

# **Business models for the road sector/TEM Network: considerations and recommendations**

Trans-European North-South Motorway (TEM)



UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

# **Business models for the road sector/ TEM Network: considerations and recommendations**



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The report is prepared by Mr. Andrzej Maciejewski (TEM Project Manager) in cooperation with the TEM Project National Coordinators.

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# United Nations Economic Commission for Europe

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The United Nations Economic Commission for Europe (UNECE) is one of the five United Nations regional commissions, administered by the Economic and Social Council (ECOSOC). It was established in 1947 with the mandate to help rebuild post-war Europe, develop economic activity and strengthen economic relations among European countries, and between Europe and the rest of the world. During the Cold War, UNECE served as a unique forum for economic dialogue and cooperation between East and West. Despite the complexity of this period, significant achievements were made, with consensus reached on numerous harmonization and standardization agreements.

In the post-Cold War era, UNECE acquired not only many new member States, but also new functions. Since the early 1990s the organization has focused on assisting the countries of Central and Eastern Europe, the Caucasus and Central Asia with their transition process and their integration into the global economy.

Today, UNECE supports its 56 member States in Europe, Central Asia and North America in the implementation of the 2030 Agenda for Sustainable Development with its Sustainable Development Goals (SDG). UNECE provides a multilateral platform for policy dialogue, the development of international legal instruments, norms and standards, the exchange of best practices, and economic and technical expertise, as well as technical cooperation for countries with economies in transition.

Offering practical tools to improve people's everyday lives in the areas of environment, transport, trade, statistics, energy, forestry, housing and land management, many of the norms, standards and conventions developed in UNECE are used worldwide, and a number of countries from outside the region participate in UNECE work.

The multisectoral approach of UNECE helps countries to tackle the interconnected challenges of sustainable development in an integrated manner, with a transboundary focus that helps devise solutions to shared challenges. With its unique convening power, UNECE fosters cooperation among all stakeholders at the country and regional levels.

# Transport in UNECE

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The UNECE Sustainable Transport Division is the secretariat of the Inland Transport Committee (ITC) and the ECOSOC Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals. The ITC and its 20 working parties, as well as the ECOSOC Committee and its sub-committees are intergovernmental decision-making bodies that work to improve the daily lives of people and businesses around the world, in measurable ways and with concrete actions, to enhance traffic safety, environmental performance, energy efficiency and the competitiveness of the transport sector.

The ECOSOC Committee was set up in 1953 by the Secretary-General of the United Nations at the request of the Economic and Social Council to elaborate recommendations on the transport of dangerous goods. Its mandate was extended to the global (multi-sectoral) harmonization of systems of classification and labelling of chemicals in 1999. It is composed of experts from countries which possess the relevant expertise and experience in the international trade and transport of dangerous goods and chemicals. Its membership is restricted in order to reflect a proper geographical balance among all regions of the world and to ensure adequate participation of developing countries. Although the Committee is a subsidiary body of ECOSOC, the Secretary-General decided in 1963 that the secretariat services would be provided by the UNECE Transport Division.

ITC is a unique intergovernmental forum that was set up in 1947 to support the reconstruction of transport connections in post-war Europe. Over the years, it has specialized in facilitating the harmonized and sustainable development of inland modes of transport. The main results of this persevering and ongoing work are reflected, among other things, (i) in 58 United Nations conventions and many more technical regulations which are updated on a regular basis and provide an international legal framework for the sustainable development of national and international road, rail, inland water and intermodal transport, including the transport of dangerous goods, as well as the construction and inspection of road motor vehicles; (ii) in the Trans-European North–South Motorway, Trans-European Railway and the Euro-Asia Transport Links projects that facilitate multi-country coordination of transport infrastructure investment programmes; (iii) in the TIR system, which is a global customs transit facilitation solution; (iv) in the tool called For Future Inland Transport Systems (ForFITS), which can assist national and local governments to monitor carbon dioxide (CO<sub>2</sub>) emissions coming from inland transport modes and to select and design climate change mitigation policies based on their impact and adapted to local conditions; (v) in transport statistics – methods and data – that are internationally agreed on; (vi) in studies and reports that help transport policy development by addressing timely issues based on cutting-edge research and analysis. ITC also devotes special attention to Intelligent Transport Services (ITS), sustainable urban mobility and city logistics, as well as to increasing the resilience of transport networks and services in response to climate change adaptation and security challenges.

In addition, the UNECE Sustainable Transport and Environment Divisions, together with the World Health Organization (WHO) – Europe, co-service the Transport Health and Environment Pan-European Programme (THE PEP).

Finally, since 2015, the UNECE Sustainable Transport Division has provided the secretariat services for the Secretary General's Special Envoy for Road Safety, Mr. Jean Todt.



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# Acronyms and Abbreviations

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<b>AASHTO</b>	American Association of State Highway and Transportation Officials
<b>ADB</b>	Asian Development Bank
<b>AM</b>	Asset Management
<b>AMS</b>	Asset Management System
<b>AMP</b>	Asset Management Plan
<b>AUSTROADS</b>	Organization of road transport and traffic agencies in Australia and New Zealand
<b>BMC</b>	Business Model Canvas
<b>CEDR</b>	Conference of European Directors of Roads
<b>CIP</b>	Capital Investments Projects
<b>IRF</b>	International Roads Federation
<b>ISO</b>	International Organization for Standardization
<b>ITS</b>	Intelligent Transport Systems
<b>NTIS</b>	National Traffic Information Service
<b>OECD</b>	Organisation for Economic Cooperation and Development
<b>O&amp;M</b>	Operation and Maintenance
<b>PIARC</b>	World Road Association
<b>PPP</b>	Public–Private Partnership
<b>PPIAF</b>	Public–Private Infrastructure Advisory Facility
<b>SAMP</b>	Strategic Asset Management Plan
<b>SOE</b>	State-Owned Enterprise
<b>TAMP</b>	Transportation Asset Management Plan
<b>TEM</b>	Trans-European North–South Motorway Project
<b>UNECE</b>	United Nations Economic Commission for Europe

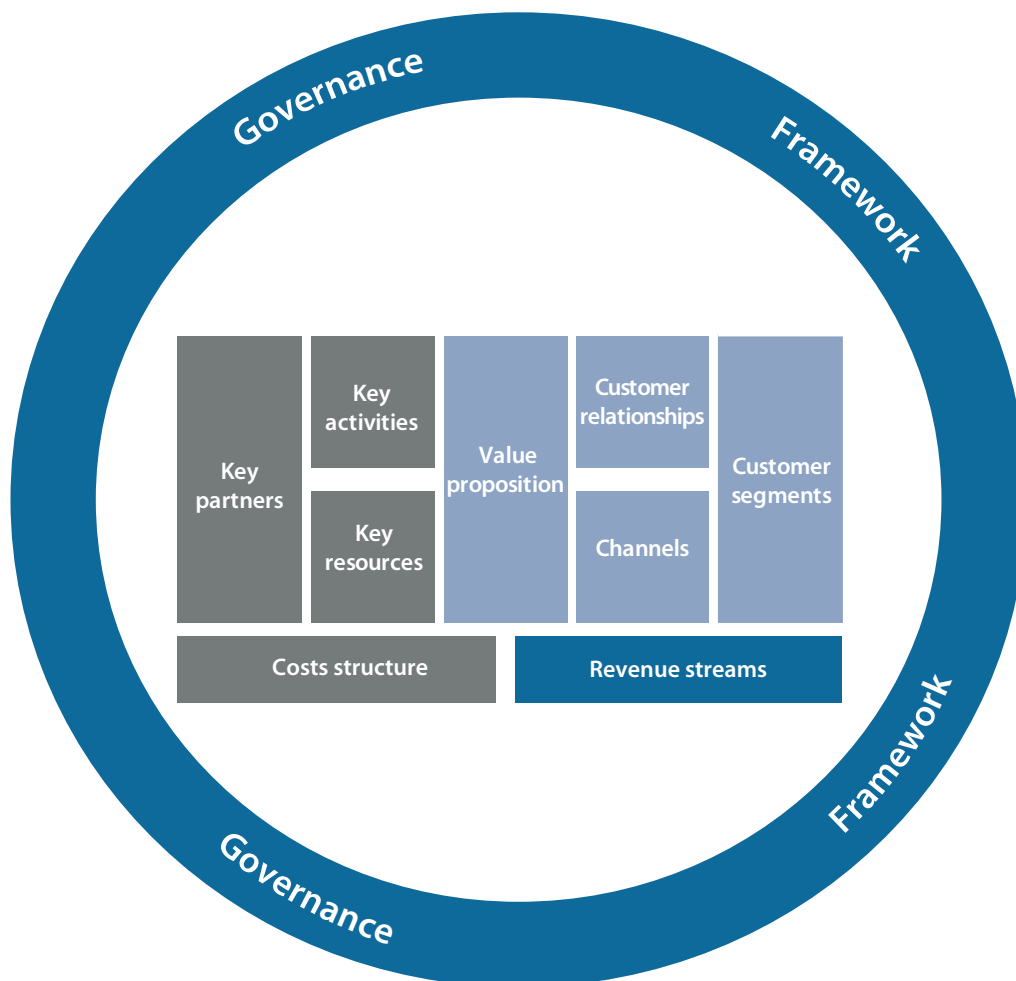
# Executive summary

Ageing infrastructure, increasing transport volumes and new investment in high-capacity roads on the Trans-European Motorway (TEM) network necessitate improved road construction and maintenance. The traditional business model for managing this infrastructure, which postpones repair activities until major deterioration occurs, is no longer sustainable. It is too expensive and has a negative impact on the value of road network assets. As the costs of operating, repairing or building increase, while available funding decreases, it has become more challenging for governments to meet public expectations and the demands of ageing infrastructure. The challenge is to provide the same or even better value for less money. There is also strong demand for transparency and accountability from road authorities, requiring justification for decisions and accountability for results.

Therefore, the TEM Project Steering Committee has prepared a dedicated report focusing on analysis of the existing business models of road authorities, funding strategies and management of expenditures (operations and investment strategies) in order to understand how the above-mentioned challenges and requirements are currently addressed within the TEM member countries.

As a common framework for further analysis (within this study and in future TEM Project studies), the Business Model Canvas (BMC) approach has been adopted. This concept distinguishes four main groups of activities which, together, provide a comprehensive perspective on an organization's internal and external context.

**Figure 1**  
Business Model Canvas and governance framework



Source: Andrzej Maciejewski (2020).

On that basis, Section One presents information about the expectations of the customers of the road sector and what is the value and value proposition that road authorities should provide to their clients and stakeholders. Additionally, the section discusses general requirements for governance, showing – based on international studies – the importance of transport and transportation infrastructure in modern public governance.

These considerations are followed by the general framework for public service delivery in the road sector and subsequently by three possible implementation strategies.

Section 2 provides information about possible general arrangements between different organizations within the road sector (ministries, road authorities) together with recommendations on how to establish formal relations between actors. Section Two also discusses the main business processes for road authorities that are common worldwide, and provides an easy-to-use tool for assessment of the level of maturity of road authorities in terms of their type or legal form, management system, management and technical skills, and private sector involvement.

Section 3 – covering the green part of the BMC diagram above – discusses how to use asset management and asset management systems to improve the management of internal processes, and how this may reduce the total cost of ownership of assets (which is the largest expenditure of road sector organizations).

Within this Section, conceptual models of asset management systems and possible implementation strategies are presented, based on international best practice.

Finally, Section 4 presents the revenues perspective of the business model. This section discusses financing sources and instruments, and provides analysis of the strengths and weaknesses of the presented methods of financing road infrastructure. It also presents information about public–private partnerships (PPP) as a possible solution for infrastructure maintenance, rehabilitation, reconstruction or construction, addressing types of contracts, requirements for sound preparation processes for PPP projects and information about risk management.

Each of sections 2, 3 and 4 are followed by a benchmarking analysis of TEM Project member countries that shared their data for the purposes of this study.

Section 2 includes benchmarking analysis on a number of organizations responsible for road networks of national importance, including concessionaires, the number of employees of public road authorities or companies (excluding concessionaires), and the legal forms of road authorities and their responsibilities and relations with supply chain organizations.

Section 3 covers benchmarking of comprehensive asset management practices with special emphasis on network and asset performance management and measurement, risk management, life cycle planning, and timeframes for multiannual planning of network maintenance and development.

Section 4 analyses the status of TEM member countries' sources of funding (i.e., taxes, road user charges, grants, loans, PPP), financing mechanisms (state budgets, earmarked lines in state budgets, independent road funds) and division of available funds between capital and operational expenditures.



# Section 1: Road sector goals and public services

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Following the Business Model Canvas methodology for analysis of current business models of road authorities within TEM Project member countries, this report starts by defining the external context for the service delivery – thus customer expectations and the road infrastructure value proposition. The necessary requirements for the sector's governance and possible implementation strategies can then be considered.

## 1.1. Customer expectations

Public sector organizations are being increasingly subjected to both legislative and competitive pressures forcing them to reconsider their relationships with users of their services – who can be defined here as customers in a business sense – to develop a more overt customer orientation (as the primary driver of organizational performance). The creation of value supports the development of a customer orientation and is a requirement to which more public sector organizations are adapting. This applies to all sectors of the economy as well as to the road sector.

In modern society, road infrastructure has become an essential part of daily life. Individual road users, logistics companies and public transportation agencies expect reliable and safe road infrastructure to carry out their transportation or wider mobility operations, moving goods and people.

Road authorities need to properly plan, build, maintain and operate the road infrastructure to create the abovementioned value for their customers.

## 1.2. Road infrastructure value proposition

Typically, road administrations engage in three generic activities – road asset management, traffic management and road safety management.

Road asset management includes all activities aimed at restoring or keeping road infrastructure in a desired condition. It delivers services to road users through road infrastructure, and road users access this service by driving on the

infrastructure. The outcome of this activity is a network with specific conditions or parameters which provide services for road users.

Road infrastructure is a resource that road users integrate into their own value-creation processes. For the users, road infrastructure becomes a means to other ends.

The extent to which road users perceive value-in-use from road infrastructure depends on their experience with the road agency's maintenance activities as manifested in the experienced road conditions. Road infrastructure contributes to the users' value creation by influencing, for example, the driving time, the costs of traveling and the stress of driving.

Traffic management – the second main activity of road agencies – denotes all activities aimed at controlling traffic parameters by changing the active use of road infrastructure. Like road maintenance, traffic management contributes to value creation for road users by influencing the performance parameters of the road infrastructure.

However, while road maintenance indirectly provides services through road infrastructure that meets certain parameters, road agencies engage directly with the users through traffic management measures which include the provision of information about the current traffic situation, possible redirection routes in case of traffic jams, lane closures or suggestions for appropriate driving behaviour. Since the road agencies adjust their traffic management measures to the current traffic patterns – which are to some extent a response to earlier road events – road agencies and road users interact with each other; they "take actions of some sort that influence the other party's process".<sup>1</sup>

Road safety is usually treated as the most important service and attribute of the road infrastructure and an outcome of road authority operations. It should therefore be the ultimate result of asset and traffic management activities.

## 1.3. Requirements for governance

The expectations of the road sector's customers should be considered in the wider context of state governance, which may be defined as "the exercise of economic, political and

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<sup>1</sup> Andreas Hartman and Florence Yeang Yng Ling, "Value creation of road infrastructure networks: A structural equation approach", *Journal of Traffic and Transportation Engineering*, vol. 3, No. 1 (February 2016).



administrative authority to manage a country's affairs at all levels, comprising the mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences."<sup>2</sup>

This definition constitutes a sound basis for responsive and accountable governance, which is a key enabler for the achievement of the Sustainable Development Goals.

According to the United Nations report on Responsive and Accountable Public Governance<sup>3</sup>, focusing on satisfying people's expectations in terms of quality, quantity and promptness of public services delivered with limited resources available is crucial to enhancing public sector responsiveness. The achievement of responsive governance depends on how policies, strategies, programmes, activities and resources are focused on people's real needs.

In parallel, establishing strong governance accountability is essential in the delivery of expected goals (i.e., the 2030 Agenda for Sustainable Development Goals). An accountable organizational culture deters waste and mismanagement of resources. Accountability for performance serves to guide, monitor and evaluate public institutions and programmes, indicating needed improvements. That is why building the capacity for financial and performance accountability shapes the trust necessary for leveraging resources and safeguarding funds.

For instance, the Office of the Auditor General of Canada<sup>4</sup> defined five principles for effective accountability that have been identified as being keys to accountable governance:

1. Clear roles and responsibilities – the decision-making roles and responsibilities of the parties in the accountability relationship should be well understood and agreed upon.
2. Clear performance expectations – the objectives pursued, the accomplishments expected and the operating constraints to action, which include the means, operating principles and procedures, human resource management issues and adequate financial control, should be explicit, understood and agreed upon.
3. Balanced expectations and capacities – performance expectations should be clearly linked to and balanced with each party's capacities (authorities, skills and resources) to deliver.
4. Credible reporting – credible and timely information should be reported to demonstrate what has been achieved, whether the means were appropriate and what

has been learned (including reporting requirements, modalities, sufficient information for Parliament, etc.).

5. Reasonable review and adjustment – fair and informed review and feedback on performance should be carried out by the parties, achievements and difficulties recognized, appropriate corrections made with appropriate consequences for the concerned individuals.

In addition, other actors (including the Australian National Audit Office) emphasize the importance of shared risk management, both in terms of delivery of services and the management of any contract.

Accountability therefore denotes responsibility for results and outcomes, and not only processes. When operating effectively, accountability serves to ensure that public governance can flourish, related institutions perform well, and services are delivered to citizens effectively and efficiently.<sup>5</sup>

Adaptation of responsiveness and accountability of governance requires addressing several challenges for the public sector and re-assessing its role in public services delivery, including the following:

1. Changes in demographic profiles
2. Increasing customer expectations
3. Awareness of the users of public services
4. Demand for greater transparency
5. Budgetary constraints
6. Global competition to attract investments

Achievement of these requirements for governance necessitates sound understanding of what public services are and how they may be provided. According to international best practice as collected in a report of the PricewaterhouseCoopers (PwC) Public Sector Research Centre<sup>6</sup>, delivering of public services may be based upon five key strategic enablers:

1. Understanding of the customer
2. Removing silos between governmental agencies
3. Building capacity
4. Service delivery
5. Continual improvement

Understanding of the customer – based on the findings of this study, customer focus is often challenged by public sector culture, hierarchical organization structures and differing public sector priorities, whereas the priorities of public agencies need to be aligned to customer requirements.

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<sup>2</sup> United Nations Department of Economic and Social Affairs, "Glossary". Available at [http://www.unpog.org/page/sub5\\_3.asp](http://www.unpog.org/page/sub5_3.asp)

<sup>3</sup> United Nations Department of Economic and Social Affairs, *World Public Sector Report 2015: Responsive and Accountable Public Governance* (New York, 2015).

<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

<sup>6</sup> Public Sector Research Centre PricewaterhouseCoopers, *The road ahead for public service delivery: delivering on the customer promise*, (n.p., 2007).

Removing silos between governmental agencies – this requires what is referred to as connected government, meaning a common vision supported by integrated objectives, outcomes or process flows. Key elements for connected government should include, inter alia, common service standards or the breaking down of intra-agency silos before starting to break down cross-agency silos.

Building capacity – in terms of capacity building, the main elements are defined as long-term planning, organizational and process design, use of technology, people’s support for the organization and culture of organizational change.

Service delivery model – to be able to define the appropriate service delivery model, the overall goals of public service delivery should be clearly articulated in terms of (a) quality of service, (b) cost of service and (c) suitability of different service delivery channels for different customer segments. That is why this report recommends clearly defining the role that the specific public agency or authority intends to play (i.e., policymaker, regulator or service provider) as a first step towards developing the right service delivery model. Understanding how technology may support the achievement of an organization’s goals, whether or not public–private

partnership can deliver targeted outcomes and how risks are managed have also been found to be vital considerations.

Continual improvement – in terms of continual improvement, it is recommended to benchmark conducted activities, finding answers for the following three questions: (a) what to innovate? (b) where to learn from? (c) how to adopt?

It is worth mentioning that according to the United Nations Global Survey for a Better World<sup>7</sup>, 1 out of 16 of the main expectations of people worldwide is better transportation and roads.

This means that public services related to transport and especially the road sector are recognized as one of the most important types of services the state should provide to its citizens and taxpayers. Moreover, relevant institutions are obliged to constantly improve their level of service through both improved strategic governance and operational excellence.

The previously presented generic approach to governance may therefore be applied for the road sector, as roads are the fundamental building blocks for the creation of wealth, economic growth, access to services and social cohesion.<sup>8</sup>

**Figure 2**  
Importance of better transportation and roads for citizens

	1,000,000	2,000,000	3,000,000	4,000,000	5,000,000	6,000,000	
A good education							6,528,295
Better healthcare							5,524,342
Better job opportunities							5,428,588
An honest and responsive government							4,422,173
Affordable and nutritious food							3,987,435
Protection against crime and violence							3,678,573
Acess to clean water and sanitation							3,582,181
Support for people who can't work							3,273,182
Better transport and roads							3,185,197
Equality between men and women							2,924,325
Reliable energy at home							2,899,844
Political freedoms							2,787,942
Freedom from discrimination and persecution							2,694,153
Protecting forests, rivers and oceans							2,504, 831
Phone and internet access							2,457,634
Action taken on climate change							1,981,549

Source: ibid., United Nations Millennium Campaign (2014).

<sup>7</sup> United Nations Millennium Campaign. *We the Peoples Celebrating 7 Million Voices* (2014). Available at <https://myworld2015.files.wordpress.com/2014/12/wethepeoples-7million.pdf>

<sup>8</sup> Nicklas Garemo, Brendan Halleman and Martin Hjerpe, *A better road to the future: Improving the delivery of road infrastructure across the world*, (n.p., McKinsey & Company, 2018).

What then should be done to govern the road sector in a responsive and accountable manner? How should current challenges be addressed? How should people's expectations be met and an appropriate value proposition be provided?

### 1.4. Frameworks for value delivery system

In this section the TEM Project analyses international best practice and the experiences of TEM member countries, considering what could be termed the road sector's delivery system.

According to a McKinsey & Company report<sup>9</sup>, the delivery system consists of:

- Sector governance
  - How decisions are made
  - How budgets and plans are structured
  - How incentives are aligned
  - How roles and responsibilities are divided
- Collaboration among stakeholders
  - Public sector
  - Private sector
  - Citizens
  - Organizations
- Enabling foundations
  - Capacity and capability
  - Data
  - Accounting principles

The delivery system, tailored in line with these recommendations, requires implementing all the indicated components due to their interrelated nature. As stated in the report:

*Improvement interventions will only reach their full potential when they are designed and implemented with the full delivery system in mind. The impact of any intervention aimed at increasing the pipeline of planned road projects will be limited if the permitting process is slow and complex due to, for example, poor stakeholder management or collaboration between institutions. Likewise, increased funding for roads will likely lead to increased cost if the supplier market is capacity-constrained and/or oligopolistic in nature.*

The main factors which impede road sector performance may be listed as follows (though not limited to):

- Ineffective project selection and prioritization
- Ineffective construction and supply market due to fragmentation across the value chain
- Oligopolistic supplier industries
- Insufficient planning and design and lack of value assurance processes
- Construction techniques and technology not fully industrialized
- Lack of innovation caused by inertia in design and engineering
- Ineffective procurement processes and contract structures
- Limited use of more advanced procurement, including negotiated tenders
- Limited use of demand management
- Ethics and integrity
- Additional sources of funds
- Future mobility

To capture the full perspective of the delivery system in the road sector, the authors of the McKinsey & Company report propose a five-dimensional approach as shown in Table 1.

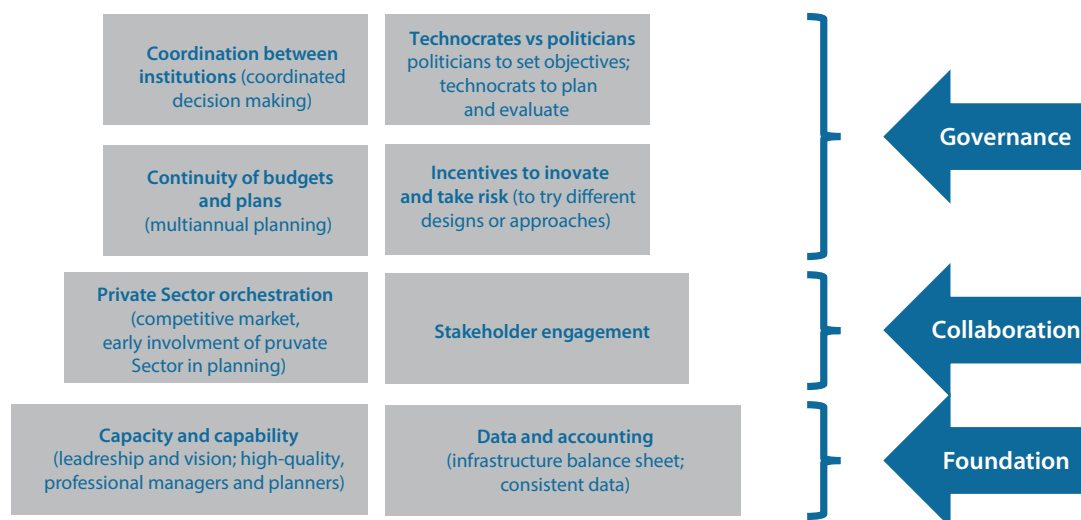
To meet these challenges, the following solutions have been proposed:

1. Improving project selection – meaning a rigorous, fact-based project evaluation and a transparent process to determine what road, what time and what treatment.
2. Streamlining delivery – meaning to boost cooperation in the sector across contracting, tendering, site management and stakeholder management.
3. Making the most of the existing network – by focusing on maintenance, reducing life cycle costs of the road and inhibiting network deterioration, but also by demand management (i.e., congestion charges) which can improve the utilization of the roads.
4. Ensuring effective sector governance – by enhancing the competence of people involved in the road sector, as well as by collaboration with different stakeholders and among different governmental organizations.
5. Enhancing funding and finance frameworks – apart from government budgets, tools ranging from tolling systems, infrastructure bonds, real estate appreciation capture, congestion charges, PPP or other methodologies can be a part of the toolbox.

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<sup>9</sup> Ibid.

**Figure 3**  
Delivery system framework for the road sector



Source: *ibid.*, Nicklas Garemo, Brendan Halleman and Martin Hjerpe (2018).

Table 1 Five-dimensional approach for the delivery system				
Fact-based project selection	Streamlined project delivery	Making the most of existing roads	Governance and capabilities	Funding and finance
Prioritized optimization of infrastructure before new build	Adequate owner team	Demand management	Strong governance and collaboration	Clear strategy for market competition and ownership
Fact-based and consistent project evaluation	Well-planned commissioning and ramp up	Increased asset utilization and loss reduction	Robust infrastructure data	Suitable regulation, pricing and value-capture investment
Master planning with coordination across assets/ jurisdictions	Rigorous execution and contract management	Robust institutions and processes for combatting corruption	Strong capabilities	Sufficient financial capacity
Strategy linked to socioeconomic objectives	Concept, design and engineering optimization	Total cost of ownership-oriented maintenance	Focus on sustainability	Suitable conditions for private finance
System-wide portfolio prioritization	Effective construction and supply market			Effective approach to PPP
	Effective procurement, tendering and contracting			Strong framework for long-term public funding
	Value-assurance process			Attractive overall investment climate
	Well-defined approach to projects in distress			
	Advanced procurement with synergies captured across projects			
	Seamless permitting and land acquisition			

Source: *ibid.*

### 1.5. Implementation strategies

The findings and diagnosis presented above correspond with the World Economic Forum’s Strategic Infrastructure Initiative report concerning the efficiency and effectiveness of infrastructure operation and maintenance<sup>10</sup>.

This study confirms the challenge for infrastructure operators when – in light of the budgetary constraints and growing customer expectations presented in the previously mentioned documents and studies – instead of applying a cost-effective approach to utilizing existing assets and improving the efficiency and longevity of existing infrastructure, many governments neglect their current assets and focus on the funding of new ones.

<sup>10</sup> World Economic Forum, *Steps to Operate and Maintain Infrastructure Efficiently and Effectively*, World Economic Forum, (REF 180314, 2014).

Three implementation strategies are proposed to infrastructure operators for parallel implementation:

1. Increasing the utility of infrastructure by maximizing asset utilization and enhancing the quality for road users
2. Decreasing the total cost of infrastructure by reducing operation and maintenance (O&M) costs and mitigating externalities
3. Increasing infrastructure value over the long term by extending the assets' lifetime and reinvesting with the entire life cycle in perspective

These strategies require appropriate enablers in managerial practices (regarding operations and maintenance as well as capital projects).

This framework and its critical success factors (presented in blue on the right side of the following table) may be outlined as shown in Figure 4.

The framework represents a highly mature approach to the challenges that road authorities face. It is also a universal proposition which can be applied not only in developed but also developing countries. For developed countries, the main concern is to optimize legacy assets to provide better services to users considering rising expectations and budgetary constraints. Therefore, priorities for developed countries may be proposed as follows:

- Introduction of new technologies into existing infrastructure systems
- Smart capacity extensions to avoid congestion
- Enhancing resilience for climate change
- Environmental sustainability
- Optimization of maintenance, replacement and upgrading strategies
- Reforming existing agencies and improving the effectiveness and efficiency of processes

For developing countries, the scope of interest should be wider as they may wish to consider not only the priorities given above, but in parallel:

- Overcoming the preference for new assets as opposed to maintenance
- Introducing sound asset management strategies, considering infrastructure life cycle analysis or resilience
- Addressing local capabilities gaps in competencies and managerial frameworks
- Setting up institutional, legal and regulatory frameworks to support long-term maintenance

**Figure 4**  
**Critical success factors for infrastructure operation and maintenance**

Increase utility	Maximize asset utilization	Enhance peak capacity and effective throughput	Apply demand management	Optimize availability/reduce downtime
	Enhance quality for users	Adopt customer-centric operating model	Enhance the end-to-end user experience	Use smart technologies to refine user performance
Decrease total cost	Reduce O&M costs	Implement lean and automated processes	Optimize procurement costs and outsourcing	Right size management and support functions
	Mitigate externalities	Arrange comprehensive sustainability: Health, Safety, Environment	Embed sustainability: Health, Safety, Environment routine	Cooperate with relevant stakeholders
Increase lifetime value	Extend asset life	Invest in preventive maintenance	Control excessive asset consumption and stress	Enhance resilience
	Reinvest with a life cycle view	Prioritize project options with whole life cycle CBA	Select contracting mode for best value for money	Prepare for efficient project delivery
Enable O&M best practice	Ensure funding	Dedicate user taxes via maintenance funds	Apply inclusive user charges	Capture ancillary business
	Build capabilities	Introduce asset management planning	Apply data benchmarks and tools	Conduct training and develop talents
	Reform governance	Corporatize and professionalize public agencies	Foster cooperation between agencies	Consider private sector participation and competition

Source: *ibid.*, World Economic Forum (2014).

## 1.6. Linking strategic and operational perspectives

The Balanced Scorecard (BSC) can be used to better illustrate customer values and expectations alongside goals, objectives or strategies for road infrastructure operators.

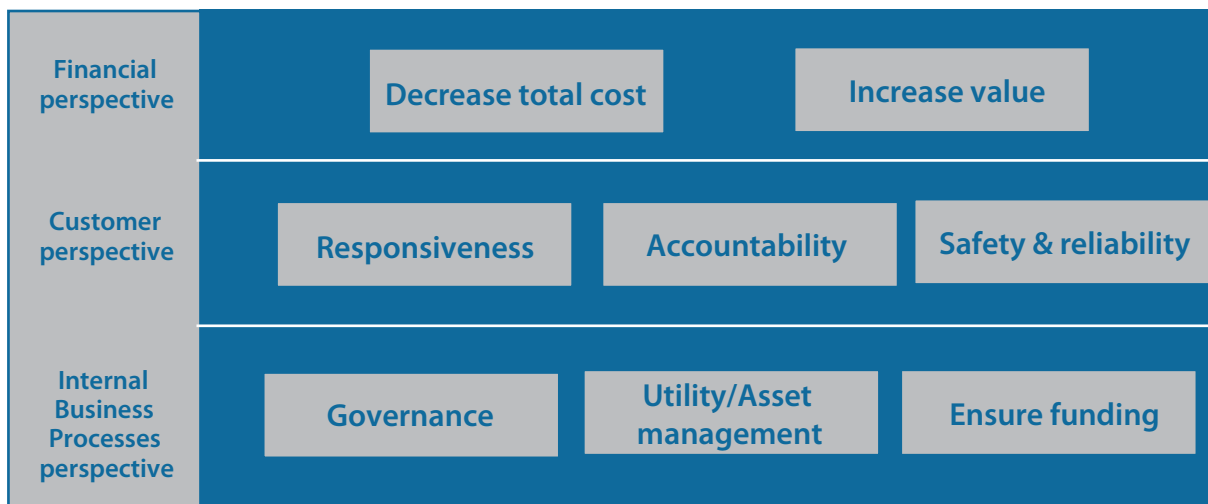
This approach should help to encapsulate the concepts presented in the following chapters of this report, but may also be used as a basis for further work by the TEM Project and by each of the member countries to improve internal business processes or particular activities. Figure 5 below presents three out of the four perspectives of a generic BSC – financial, customer and internal processes. The fourth perspective (learning and growth) will be addressed in the conclusion of this study.

Within the present report the perspective of internal business processes will be examined in depth to demonstrate international best practice and the experiences of TEM member countries in terms of:

1. Governance of the road sector
2. Asset management systems and their processes
3. Funding strategies and PPP

These three processes and their benchmarking within the TEM member countries will explain the TEM Project countries’ road sector service delivery models, network management practices and existing funding strategies, creating a basis for considering further improvements.

**Figure 5**  
Shortened balanced scorecard for road sector governance



Source: Andrzej Maciejewski (2020).



# Section 2: Governance of the road sector

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## 2.1. General arrangements

For the purposes of this study, governance within the road sector may be defined as the way in which organizations are directed, controlled and led. Governance defines the relationships and the distribution of rights and responsibilities among those who work with, and in, the organization. It determines the rules and procedures through which the organization's objectives are set and provides the means of attaining those objectives and monitoring performance.

Importantly, governance is characterized by where accountability lies throughout the organization. Where road authorities are tightly controlled by a ministry that is directly accountable to parliament, or have a limited mandate, the governance requirements are relatively straightforward. However, for agencies with a greater degree of autonomy, comprehensive governance arrangements are essential to ensure that the agency holds to its mandate, exercises probity in the expenditure of public funds, and adopts rigorous and robust processes and procedures to avoid malpractice and corruption.

In this relationship, the minister is accountable to parliament for the agency and responsible for oversight of the road authority, including key approvals of such matters as the agency's business plan, annual report and accounts. These arrangements are typically embodied in a framework document which defines a high-level governance relationship between the ministry and the agency. The typical framework document sets out the roles, accountability and key relationships between the agency and the parent ministry, and describes the supporting governance arrangements.

The ministry can be considered both sponsor and client of the road authority. As a client, the ministry sets out what it wants the road authority to deliver in the form of a strategy for the road network. As a sponsor, the ministry supports and challenges the road authority to deliver the ministry's requirements effectively and efficiently. These requirements are set out in the form of performance indicators documented in the road authority's business plan.

The minister is responsible for the policy framework in which the road authority operates, and for the design of a supporting performance specification that sets out the criteria against which the agency's performance will be measured.

The minister is accountable to parliament for the agency and will:

- approve the road authority's business plan, annual report and accounts
- agree on the level of financial resources to be made available to the road authority
- approve changes to the road authority's programmes and budgets as appropriate
- appoint the chairman of the supervisory board of the road authority
- appoint the chief executive, following a recruitment process characterized by open competition
- appoint non-executive directors
- determine which individual major road enhancement schemes will be included in the programme, reflecting the agency's recommendations, and give approvals at the relevant decision points

It is an important feature of the road authority model that the authority is held accountable for performance – in every aspect of its business – based on defined and quantified performance indicators. These will typically be set out in the business plan of the organization, and performance against them reported in an annual report that will be placed before parliament and made available in the public domain (further elaboration on this is provided in Section 3).

## 2.2. Organization of the road sector

The World Economic Forum has reported that many public infrastructure agencies have outdated governance structures and procedures. They are still subject to political influence and weighed down by bureaucracy – characteristics that affect institutional independence, efficiency and accountability. In fact, many public agencies assume both policy and implementation roles, a process that conflicts with the good governance principle – namely the separation of control and management.

In such cases, institutional public-sector reform is strongly advisable, either through corporatization or professionalization of the agencies managing infrastructure assets. Corporatization aims to capture the advantages of a privately-run company, including productivity, streamlined processes, commercial orientation and financial sustainability, while remaining



accountable to the public and serving the public interest. Professionalization likewise involves adopting many aspects of private companies but without changing the agency's legal status.

Most countries with sound and mature public management processes in the road sector have established a national road authority (NRA), operating under a variety of titles. Usually, the road authority acts as the owner of road network assets as defined in the constitution. The remit of national road authorities varies from country to country, but in general is focused on similar high-level business processes as follows:

- a) road asset management
- b) traffic management
- c) road safety management

Developed countries vary widely in the roles and associated organizational capacities of their national government road authorities. International experience shows that organizational arrangements, management skills, technical skills and systems for road administration vary greatly from country to country.

This depends largely on the stage of development of a country and on the size of the country and its government structure.

Frequently, national road authorities have a role in the deployment of intelligent transport systems (ITS) – including electronic tolling systems – and adopt ITS tools to support the delivery of standard business processes within the road authority value chain.

The role of the NRA is differentiated from that of its parent ministry to different extents in different countries. In general, however, ministries shape public policy, set outcomes and expectations for the sector, ensure provision of a sufficient and stable budget consistent with those expectations, and monitor the performance of the NRA. The NRA, for its part, is responsible for the development and delivery of a strategy to achieve the policy objectives within the budget and by providing a range of works and services for road users.

The Asian Development Bank<sup>11</sup> has classified road agencies of different kinds in terms of their structure and maturity as shown in the table below:

**Table 2**  
**Classification of road administration maturity**

Stage of development	Birth	Growth	Upgrading	Maturity
<b>Organization</b>	Large public works department	Separation of client and service deliverer	Road agency/administration/board	“Commercial” roads
<b>Management systems</b>	Maintenance management	Accounting, road inventory, traffic, and road condition	Financial management, information management, road asset, and performance management (road smoothness, capacity, safety)	Financial management, transportation modelling
<b>Management skills</b>	Resource mobilization	Management of contractual relationships and relationships with state level issues	“Commercial” management, reorganization management and management of relationships with community issues	Management of modal integration and wider issues, management of consultation and probity
<b>Technical skills</b>	Basic engineering, maintenance workforce management	Highway engineering; road asset management; planning, programming, and prioritization of road activities; contract management	Use of performance indicators, economic analysis, environmental/social analysis	Transport system performance, planning, financial analysis, information technology, traffic demand management
<b>Private sector involvement</b>	Low	Some consulting/contracting	Design, construction, maintenance, road management, and financing	Long-term performance specified maintenance and public–private partnerships

Source: *ibid.*, Asian Development Bank (2015).

<sup>11</sup> Asian Development Bank, *Reforming the financing system for the road sector in the People's Republic of China*, (Mandaluyong, 2015).

### 2.3. Road authorities: scope of activities and evolution

The scope of tasks for road authorities is changing rapidly. In mature economies, the basic infrastructure is largely complete and attention has moved to the use of technologies to increase capacity, reduce environmental impact and improve safety (i.e., decrease the total costs for the economy and increase the lifetime value of the infrastructure – see Section 1.5.) The road authority must, in turn, be able to respond to new needs and expectations in terms of electrification of road transport, growth in the sharing economy and – finally – intensive development of connected and autonomous driving. In other words, the road authority must increase the utility of the infrastructure.

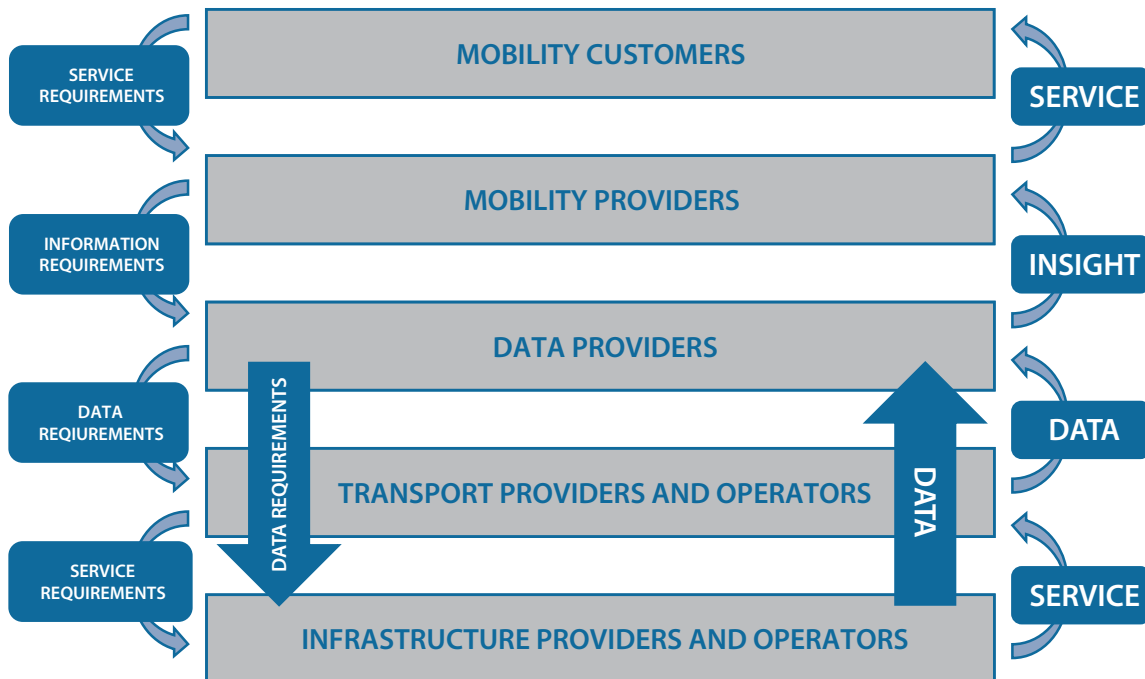
Growing mobility challenges, such as congestion, may be solved by smart mobility solutions including integrated network management (which includes both traffic management and traffic information measures integrated and managed within a transport network). These changes require new approaches to network management and demand different competencies, affecting the balance of tasks that should be retained in-house, as opposed to those that will disappear altogether or be outsourced or automated. For example, data collection, which now occupies considerable resources of people, equipment

and money, will largely be satisfied by crowd sourcing and floating car data (FCD) together with traditional sources to provide adequate and expected quality of information.

The entry of new stakeholders and contractors also requires awareness of which processes may be outsourced and when. Lessons learned from the European ITS architecture FRAME have suggested a restrained approach in which authorities should implement the minimum needed, rather than the maximum possible. Service-level agreements need to be developed and integrated at the operational level to ensure reliability and consistency in the delivery of services between national road authorities and service providers as well as for the final customer. This is illustrated by Figure 6 below.

These challenges require a road administration to be flexible and agile, focused not only on the performing of physical works, but on the managing of the effectiveness and efficiency of delivery of a growing number of public services. To prepare a strategy that responds to current needs it is necessary to consciously assess the level of maturity of the organizational framework of the road sector. Both the World Economic Forum<sup>12</sup> and the World Bank have offered clear steps to achieve expected results in terms of agility and flexibility.

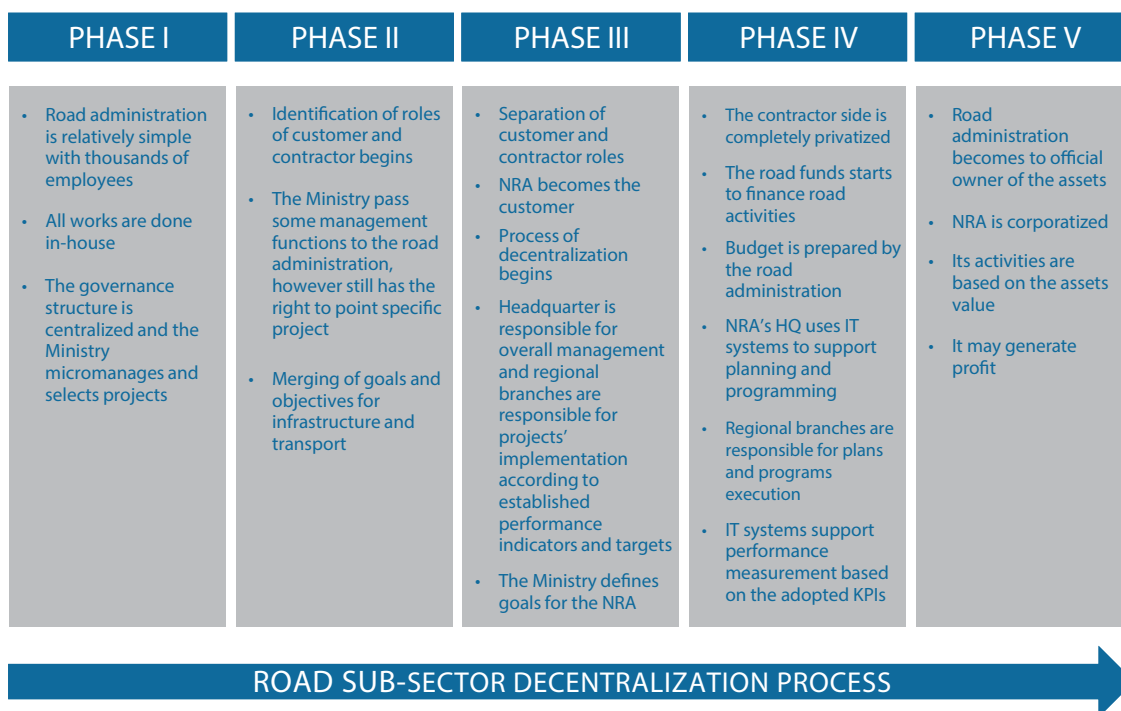
**Figure 6**  
Role of road operator within mobility-as-a-service supply chain



Source: Andrzej Maciejewski (2020).

<sup>12</sup> Ibid., World Economic Forum (2014).

Figure 7  
Phases of decentralization of road administration



Source: *ibid.*, Antti Talvitie (1998).

A five-step sequence<sup>13</sup> is identified for this evolution (Figure 7):

1. Establishment of a traditional construction and maintenance organization
2. Identification of customer and contractor functions
  - a) Customer: planning, programming, management, contracting, data collection
  - b) Contractor: execution of designs, construction, maintenance, operation
3. Separation of customer and contractor organizations and introduction of a road board
4. Corporatization or privatization of the contractor organizations
5. Corporatization of the customer road administration

roads classification). Highways England is the successor to the former Highways Agency, which was an executive agency of the Department for Transport.

The English motorway and major trunk road network totals around 7,000 kilometres, around 2 per cent of all roads in England by length. However, these roads carry a third of all traffic by mileage and two thirds of all heavy goods traffic.

The rationale behind the establishment of Highways England was to put in place an effective company with strong governance and the flexibility to run the road network responsibly, successfully and in the public interest. In conjunction with the establishment of Highways England, the government legislated a road investment strategy setting out what the company must achieve over a five-year period, with associated guaranteed funding.

## 2.4. International practices in road sector organization

### 2.4.1. Highways England<sup>14</sup>

Highways England, established in April 2015, is a government-owned company charged with operating, maintaining and improving England's core trunk road network, comprising motorways and major class A roads (according to the English

Highways England is a company limited by shares and wholly owned by the Secretary of State for Transport. The Highways England Board is the primary governance arm of the company and is accountable to the Secretary of State for Transport. The Board delegates responsibility of the day-to-day running of the company to the Chief Executive who, as the nominated Accounting Officer, is personally accountable to the Permanent Secretary of the Department for Transport<sup>15</sup> as the Principal Accounting Officer of the Department for the stewardship of

<sup>13</sup> Antti Talvitie, *International experience in restructuring road sector*, (Washington, D.C., World Bank, 1998).

<sup>14</sup> <https://highwaysengland.co.uk/about-us/>

<sup>15</sup> Each Department of State (Ministry) has a Permanent Secretary, who is the most senior civil servant in the Department and who is the Principal Accounting Officer, personally accountable for stewardship of the public funds allocated to the Department.

public funds. The Principal Accounting Officer and Secretary of State for Transport (Minister) are both ultimately accountable to Parliament for the activities and performance of Highways England.

The governance arrangements for Highways England include comprehensive independent regulation and oversight arrangements. In 2015 the Office of Rail and Roads (ORR) was appointed as the regulator for Highways England, responsible for monitoring and enforcing the performance and efficiency of the company, and for advising the Secretary of State for Transport on its compliance with the Road Investment Strategy. In addition, the Infrastructure Act of 2015 appointed the consumer watchdog Transport Focus (previously Passenger Focus) to promote and protect the interests of users of the strategic road network.

Clear key performance indicators are embodied in the framework contract between the Department for Transport and Highways England. They help Highways England and its monitoring bodies to monitor performance and identify areas where improvement is required. For example (according to the company’s annual report for 2016–2017), performance against key performance indicators were as shown in Table 3.

Target	Achievement
40 per cent reduction of killed or seriously injured by the end of 2020	6.1 per cent increase noted
90 per cent of user satisfaction by March 2017	Result of 89.1 per cent achieved
To ensure that 95 per cent of pavements require no further investigation for possible maintenance	HE achieved 94.3 per cent
To ensure 97 per cent lane availability in any one year	Result: 98.4 per cent
85 per cent of incidents on the motorways cleared within an hour	Result of 85.93 per cent achieved
To make capital expenditure savings of at least £1.212 billion by 2019–2020	£169 million savings identified against £139 million milestone for 2016–2017

Source: Highways England, *Annual Report and Accounts 2016–2017* (Crown, 2017).

Highways England has around 3,500 staff based in locations around the country, the majority of whom form a uniformed Traffic Officer Service who serve in control centres and patrol key areas of the network, relieving the traffic police of several traffic management, incident resolution and breakdown attendance duties.

Highways England is supported by the National Traffic Information Service (NTIS), which provides information to the

National Traffic Operations Centre and seven regional control centres. NTIS is operated on behalf of Highways England by private companies.

NTIS is responsible for providing accurate, historical, real-time and predictive traffic and incident information to businesses, the travelling public and Highways England’s operations. It collects real-time traffic information from over 10,000 fixed sites on the motorway and all-purpose trunk road network, including queue detection systems based on electronic induction loops in the road surface and automatic number plate recognition (ANPR) cameras in overhead gantries. Additionally, NTIS uses anonymous floating car data (FCD) from vehicles to supplement the fixed traffic monitoring sites.

NTIS also has access to nearly 2,000 CCTV cameras, 300 weather stations, 4,600 roadside electronic signs, 16,000 roadside electronic matrix signals and incident data from over 250 operational partners including the police and local authorities.

### 2.4.2. South African National Roads Agency Limited (SANRAL)<sup>16</sup>

The South African National Roads Agency Limited, generally known as SANRAL, is an independent, statutory company. The South African government, represented by the Minister of Transport, is the sole shareholder and owner of SANRAL. The purpose of the company is to maintain and develop South Africa’s expanding national road network.

SANRAL has a distinct mandate – to finance, improve, manage and maintain the national road network (the so-called economic arteries of South Africa). This organization introduced and consolidated the concept of public–private partnerships.

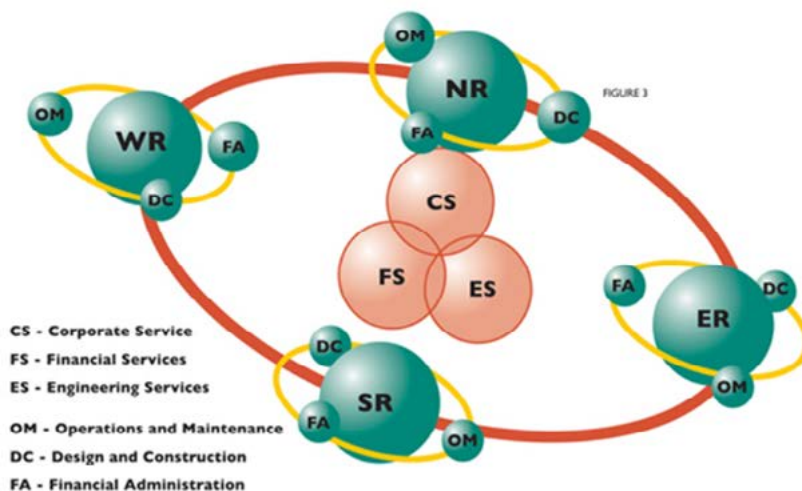
Recognizing the enormity of many demands and the advantage of constructive engagement with the private sector, SANRAL has proactively sought alternative sources of finance for road infrastructure and opportunities to reduce dependence on tax-based revenues.

The company has two primary sources of income. Non-toll roads are funded from allocations made by the National Treasury. Toll roads are funded from borrowings on the capital and money markets – bonds issued on the Bond Exchange of South Africa (BESA) in the name of the South African National Roads Agency Limited or through concessions to private sector consortia.

SANRAL is governed by a board of eight people, six of whom are appointed by the Minister of Transport; the Chief Executive Officer, who is appointed by the Board; and a representative of the Minister of Finance.

<sup>16</sup> <https://www.nra.co.za/>

Figure 8  
Organization structure of SANRAL



Source: *ibid.*

SANRAL has an interesting organization structure, illustrated by Figure 8, essentially representing a non-hierarchical, flat management system.

This matrix model emphasizes the importance of collective judgement and attempts to maximize the strengths of functional bases through the cluster system. It discourages the concept of subordinates reporting to superiors and instils a culture of collective mentorship, individual responsibility and empowerment while providing the opportunity for succession planning.

SANRAL operations are divided into two broad categories – namely toll roads, which are self-funding, and non-toll roads, which are funded by transfers from the Department of Transport. According to the Integrated Report for 2020, the total length of the national road network is 22,207 km<sup>17</sup>.

SANRAL’s principal tasks are to:

- Strategically plan, design, construct, operate, rehabilitate and maintain South Africa’s national roads to mobilize South Africa’s economy
- Generate revenues from the development and management of its assets
- Undertake research and development to enhance the quality of life of all South African citizens, with emphasis on their social and economic well-being
- Advise the Minister of Transport on matters relating to South Africa’s roads
- Finance, plan, construct, provide, operate and maintain roads in neighbouring countries upon request from the Minister of Transport and in agreement with the respective countries

These are in line with the strategic objectives of SANRAL as defined in its strategic vision as follows:

- The management of a national road network ensuring best value for money
- To continuously improve the efficiency of business practices
- To maintain market confidence
- To carry out the government’s targeted programmes to better the life of all citizens
- Safer roads for all
- To work in co-operative partnership with road users, transport providers, relevant authorities and the private sector
- To be a good employer managing SANRAL’s business efficiently and effectively and to seek continuous improvement
- To achieve international best practices
- To encourage innovation in knowledge and practice

### 2.4.3. New Zealand Transport Agency

The New Zealand Transport Agency (NZTA) was established on 1 August 2008, bringing together the functions of Land Transport New Zealand and Transit New Zealand to provide an integrated, multi-modal approach to transport planning, funding and delivery.

Land Transport New Zealand was responsible for determining standards of maintenance and construction, undertaking reviews and audits of road controlling authorities, providing advice to local authorities and developing policies for financial

<sup>17</sup> South African National Roads Agency, *SANRAL Integrated Report* (Pretoria, 2020). Available at <https://www.nra.co.za/about-us/integrated-report/>

assistance, including evaluating projects and establishing competitive pricing procedures.

Transit New Zealand was responsible for managing the state highways, and Land Transport New Zealand was responsible for providing the required funds. Transit New Zealand operated as a road authority. It prepared an annual National State Highway Programme and a 10-year Forecast, and provided these to Land Transport New Zealand for approval. Transit New Zealand maintained the state highway network, developed standards, provided assistance and advice, and liaised with the New Zealand Police, Land Transport New Zealand and the National Road Safety Committee. Transit New Zealand also developed major construction programmes for improving existing state highways and building new ones.

The government of New Zealand found that such separation of activities was not good for long term planning and decided to merge the two organizations into NZTA, which contributes to an integrated, safe, responsive and sustainable land transport system in support of the updated New Zealand Transport Strategy. NZTA works in partnership with regional and local authorities, the transport industry and communities to achieve this.

Reasons for the merger of the two agencies were stated as follows:

- to consider all transport modes and activities and ensure that appropriate trade-offs are made
- to be accountable to the Minister
- to focus on cost-effective delivery of its activities
- to facilitate more easily the transition, over time, to the fully implemented new planning and funding arrangements

The NZTA is therefore focused on delivering four key outcomes, (i) integration, (ii) safety, (iii) sustainability and (iv) value for money. The agency provides a vital link between government policymaking and the operation of the transport sector. NZTA's main tasks include:

- land transport planning
- managing the state highway system
- regulating access to, and participation in, the land transport network
- promoting land transport safety and sustainability, including driver licensing and drive safe advertising campaigns, and road signs
- allocating government funding for land transport

New Zealand set outcomes for its whole transport sector having in mind that a country thrives when the entire transport system – maritime, aviation and land transport – works together to achieve enduring sector-wide transport outcomes.

The agency works with others across the transport sector to create transport solutions and ultimately a transport system that is:

- effective – moves people and freight where they need to go in a timely manner
- efficient – delivers the right infrastructure and services to the right level at the best cost
- safe and responsible – reduces the harm from transport
- resilient – meets future needs and endures shocks

The following three strategic directions are pursued to deliver value to New Zealand. These are the three major changes the agency needs to make in the next five years to deliver what is expected and ensure customers and citizens benefit from the rapid changes happening in transport.

**Connected transport system** – aiming to transform the performance of the land transport system by integrating digital technology with physical infrastructure to create a safe, connected system that works for everyone.

**People-centred services** – aiming to simplify customers' lives and partners' work with innovative transport services and experiences that make it easy for them to do what they need to. The transport system exists to serve people. For customers, a collaborative transport-as-a-service approach starts with understanding customer needs and mining a wealth of data on the customers and their interactions to design better transport experiences.

**Partnerships for prosperity** – aiming to unlock social and economic opportunities for customers, businesses and communities through targeted partnerships. The agency is focused on transport links and services that improve social, economic and environmental outcomes for communities and for business.

To realize these strategic directions NZTA has adopted eight focus areas which describe what the agency will do in the next 3–5 years:

- Shape the land transport system
- Target rapid growth
- Connect and develop regions
- Keep people safe
- Improve customer experiences
- Deliver connected journeys
- Achieve organizational excellence
- Transform the transport agency

Transport activities will be co-designed with regions, tailored to agreed regional needs and integrated with relevant regional programmes. NZTA will transparently balance regional priorities within a nationally consistent framework.

As a steward of the land transport system, the agency takes a long-term view, ensuring road maintenance is cost-effective and making sure the system is resilient, keeps people safe and minimizes environmental harms.

To measure improvement a set of key performance indicators has been approved:

- Index of network productivity
- Index of the number of people found driving without a valid driver's license
- Index of travel time predictability
- Index of duration of observed closures on the state highway network
- Efficiency ratings
- Index of value-for-money
- Effectiveness ratings
- Index of organizational culture

### 2.4.4. Norwegian Public Roads Administration

The Norwegian Public Roads Administration (NPRA) is a government agency responsible for the state and county public roads in Norway. This includes – inter alia – planning, construction and operation of the state and county road networks, driver training and licensing, vehicle inspection and subsidies to car ferries.

The Norwegian Public Roads Administration strives to ensure that all those who walk, cycle, travel by car or use public transport should reach their destinations safely.

The NPRA has a broader mandate than most national road administrations as they are responsible for the management, planning, building, operation and maintenance of national and county roads, but also inspections of vehicles and road users. From that perspective they are in a good position to facilitate the interplay among roads, vehicles and road users – thus to become a mobility enabler and a key player in Norwegian society.

The agency is led by the Directorate of Public Roads, which is subordinate to the Ministry of Transport and Communications and is divided into 5 regions and 30 districts. The Norwegian Public Roads Administration is one of the largest government agencies of Norway in terms of budget. In matters concerning state roads, the agency is subordinate to the Ministry, and in matters concerning county roads, subordinate to the county administrations. The NPRA can respond effectively to trends in transportation and mobility because the organization implemented sound organizational change 15 years ago, including the separation of contractor and customer roles.

The NPRA is currently further restructuring its organization to prepare itself for the future. As from September 2017, there is a new Department for Road Transport in the Directorate of

Roads responsible for the development and management of future road transport systems.

The NPRA is the owner of most traffic data sources, such as the DATEX node and the Application Programming Interfaces for the National Road Database. Their ambition is to become the main provider and clearing house for important data sets to enable the analysis and management of future transport systems.

In 2003 – as a result of a demerging of the construction division of the Norwegian Public Roads Administration – the company Mesta AS was established. The company became a separate limited company (AS) owned by the Ministry of Transport and Communications, and was subjected to competitive forces.

After two years – in 2005 – the state ownership of Mesta AS was transferred from the Ministry of Transport and Communications to the Ministry of Trade and Industry. Three years later Mesta's operations were reorganized into the independent subsidiaries Mesta Drift AS, Mesta Entreprenør AS, Mesta Asfalt AS, Mesta Elektro AS, Mesta Stein AS, Mesta Verksted AS, Mesta Eiendom AS and Geo Survey AS. In 2012 Mesta Konsern AS, Mesta Drift AS and Mesta Elektro AS were merged into one company – again called Mesta AS. Mesta Verksted, Mesta Eiendom and Mesta Sverige remain independent limited (AS) companies.

These activities helped to create a competitive market in Norway based on a previously state-owned company, introducing a clear separation of the roles of contractor and customer.

### 2.4.5. Finnish Transport Agency

The Finnish Transport Agency (FTA) is a government agency responsible for the maintenance of Finland's road, rail and waterway systems. The agency's annual budget is 1.6 billion euros. The parent organization of the FTA is the Ministry of Transport and Communications. The FTA was founded on 1 January 2010. The agency took over the operations of three separate transportation agencies – the Finnish Rail Administration, the Finnish Maritime Administration and the Finnish Road Administration.

The Finnish road network consists of highways, municipal street networks and private roads. Supported by fifteen regional centres, the FTA is responsible for the maintenance and development of the state-owned road network. There are 78,000 kilometres of highways maintained by the FTA, of which about 50,000 are paved.

The Finnish Transport Agency describes itself as an expert organization responsible for Finland's roads, railways and waterways and for the overall development of Finland's transport system. The agency seeks to optimize the effectiveness of the transport system, improve traffic safety and enhance sustainable development in all regions. FTA experts develop services to facilitate travel and transport, thus promoting the development of a well-functioning society.

It is the Agency’s responsibility to maintain the high quality of Finnish infrastructure which, in turn, enables mobility services and digitalization.

The Finnish Transport Agency’s tasks include the following major areas:

- to maintain and develop the transport system in cooperation with other actors
- to answer for the state-owned road and railway network and to coordinate, guide and monitor waterways management throughout the country
- to carry the responsibility for large road projects and for the planning, maintenance and building of railways and waterways
- to manage operations in transport and infrastructure under the Regional Centres for Economic Development, Transport and the Environment (ELY Centres)
- to participate in the coordination of transport and land use
- to handle and develop traffic management in the state-owned transport infrastructure and in shipping
- to provide the operating framework for winter travel
- to develop and promote traffic services in addition to a well-functioning market for these services
- to promote productivity improvements in transport infrastructure management
- to develop the operational preconditions for public transport and to grant subsidies aimed at promoting merchant shipping and other transport modes
- to ensure a well-functioning transport system under exceptional circumstances as well as under normal circumstances

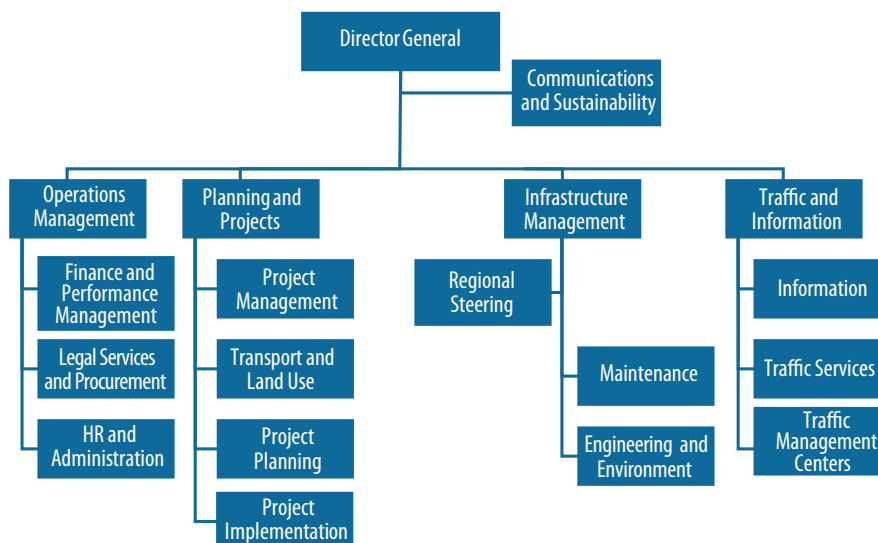
The Finnish Transport Agency is composed of four functional divisions, as well as one supporting Division of Communications and Corporate Social Responsibility, which reports directly to the Director General. The functional divisions are organized into departments and units in a conventional hierarchical structure, illustrated by Figure 9.

The Operations Management Division is responsible for managing the operations and promoting the corporate practices of the agency. This division provides services to all agency employees and, to some extent, to the employees at the Regional Centres for Economic Development, Transport and the Environment. The task of the division is to support the core operations in financial and legal issues as well as HR administration, and to coordinate the agency’s security and preparedness procedures.

The Planning and Projects Division is responsible for effective and high-quality implementation of large investment projects in the transport network, and for the development of several implementation models and quality assurance methods.

The Infrastructure Management Division is responsible for maintaining transport infrastructure, performing its duties as the public authority and for steering the area of responsibility for transport and infrastructure under the Regional Centres for Economic Development, Transport and the Environment. The Finnish Transport Agency determines the level of service based on needs and resources. The Infrastructure Management Division oversees matters concerning transport technology, infrastructure management property and materials management.

Figure 9  
Organization structure of Finnish Transport Agency



Source: Ari Huomo, presentation prepared for the UNECE Group of Experts for Benchmarking of Construction Costs of Transport Infrastructure (2016).



The Traffic and Information Division is responsible for traffic services and the operative traffic control in all modes of transport. It is also responsible for managing and developing the FTA information services, data resources and data administration. The Traffic and Information Division offers nationwide expert advice on the licensing and procurement of public transport services and on the allocation of state funds for public transport.

As with the Norwegian case, Finland took action to separate customer and contractor roles and to establish a stand-alone delivery company (Destia).

In 1925, following Finland's independence, the state established the Road and Waterway Construction Administration (RWCA) which carried on building and developing the road network. The RWCA was followed by the National Board of Public Roads and Waterways and the National Board of Public Roads.

In 1998, the official administrative and road maintenance duties of the National Board of Public Roads were separated from each other into two departments which oversaw administration and production, respectively. The administrative department's official duties nevertheless continued to include production, planning, construction and maintenance.

The years 1998–2000 were marked by preparation for entering the open market. The era of the National Board of Public Roads came to an end in 2001 with the permanent split of production and administration into two separate organizations.

The Finnish Road Administration remained in charge of public roads and continued to coordinate road maintenance. The production department was renamed the Finnish Road Enterprise, which began to compete with other earthworks contractors for road maintenance contracts.

Competition was introduced gradually until, on 1 January 2005, the Finnish Road Enterprise was fully exposed to open competition. The Destia name was instituted in 2007 when it was adopted as the marketing name for the Finnish Road Enterprise.

From the beginning of 2008, Destia became a wholly-state-owned limited liability company, established with the purpose of continuing the work of the Finnish Road Enterprise. Ahlström Capital agreed on 26 May 2014 to acquire Destia Limited's share capital from the State of Finland, with the ownership of Destia transferred to Ahlström Capital on 1 July 2014.

### 2.4.6. Benchmarking analysis among TEM Project member countries

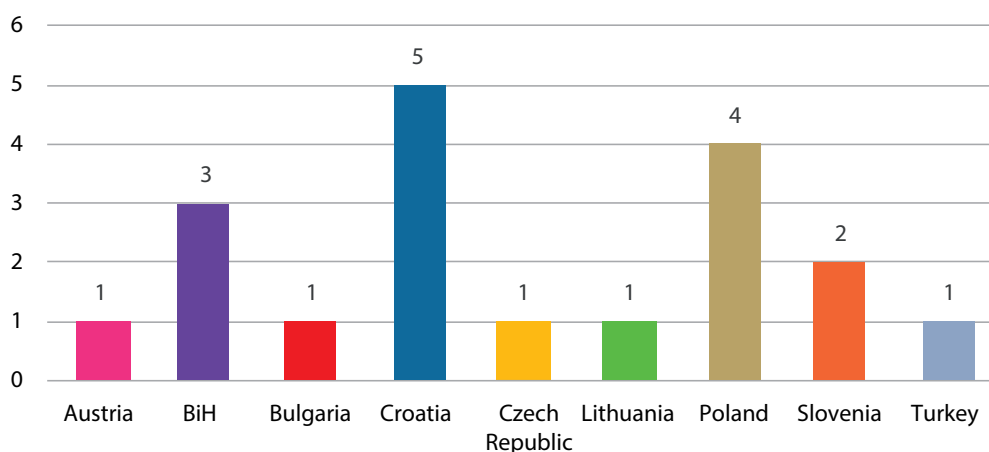
The number of road authorities responsible for the management and development of road networks of national importance varies among TEM Project member countries.

In a majority of those that responded, there is a single organization that manages the national road network, although numerous member countries also divide those responsibilities among several organizations.

In some cases, like Bosna and Herzegovina or Slovenia, there are multiple public authorities and/or state-owned enterprises performing the roles of national road network managers.

As these two examples show, in such cases public enterprises or authorities are usually responsible for different parts of the network. While some of them are responsible for the high-speed roads (e.g., DARS in Slovenia) others are responsible for secondary roads and their management.

**Figure 10**  
Number of road authorities (including concessionaires) in TEM member countries



Source: UNECE TEM Project, Survey of TEM member state road infrastructure business models (2018).

In Austria, ASFINAG is a state-owned company responsible for the motorway, while the rest of the road network is under the responsibility of local governments.

This differs from the sector governance arrangements in, for example, Croatia and Poland where apart from public authorities there also exist concessionaires who manage some parts of the network (some sections of the motorways).

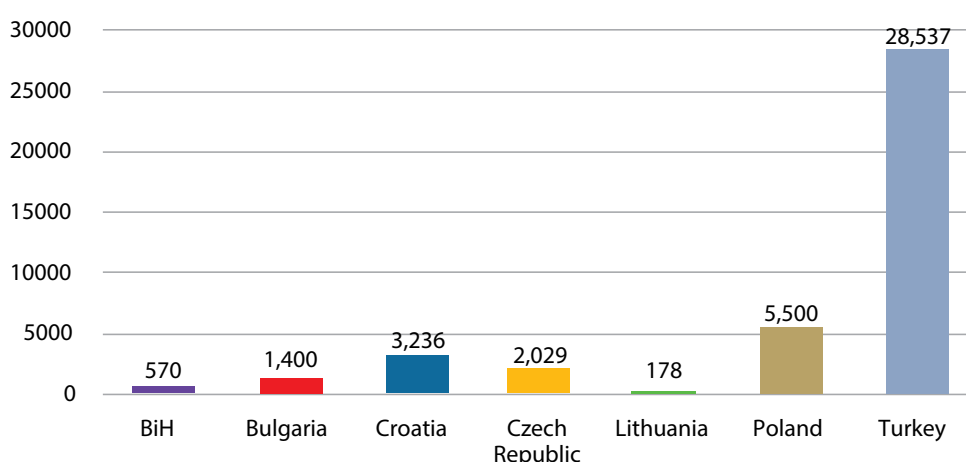
In Poland for instance, although there are in fact four organizations responsible for national road network

management, only the National Road Authority is the legally mandated body responsible for the traffic management.

This arrangement is intended to ensure road users a uniform driving experience, although the impact of possible lack of consistency in infrastructure asset management may still be substantial, as stated in sub-section 1.2. of this report.

Among member countries, differences can be observed in the number of employees of public authorities and companies responsible for national road management – from 178 in Lithuania up to more than 28,000 in Turkey.

**Figure 11**  
Number of employees (excluding concessionaires) in TEM member countries

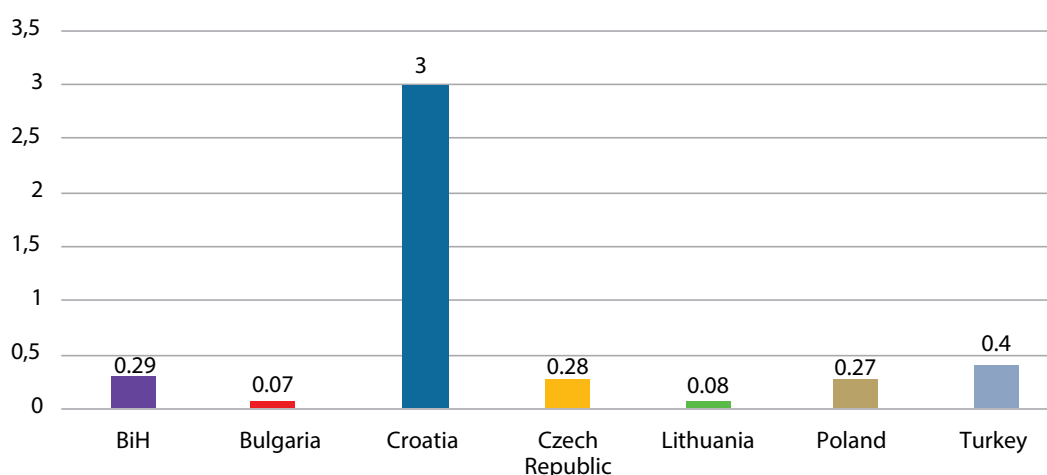


Source: *ibid.*

These differences of course are relative, as road authorities vary in regard to the length of the network for which they are responsible, and the number of tasks involved (see Figures 12 and 13 below).

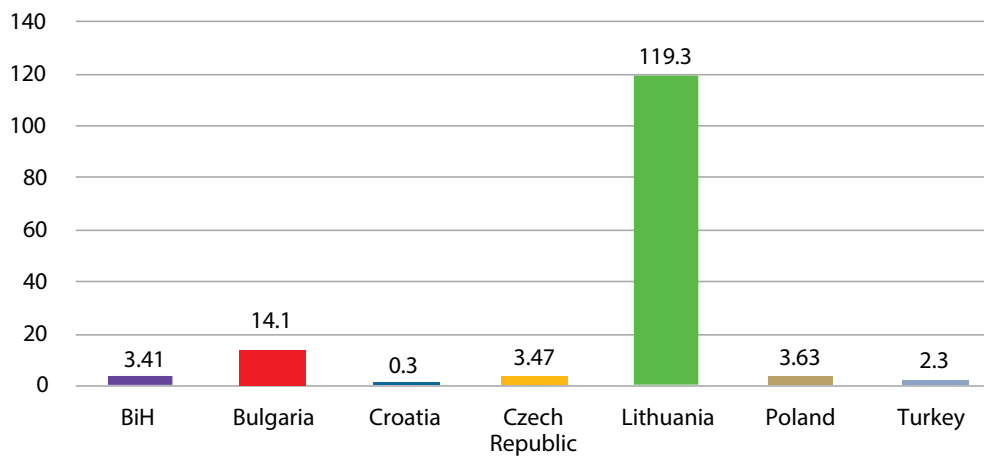
The following two charts present the relationship between the number of employees and the length of the network.

**Figure 12**  
Number of employees per kilometre (excluding concessionaires) in TEM member countries



Source: *ibid.*

**Figure 13**  
**Number of kilometres per number of employees (excluding concessionaires) in TEM member countries**

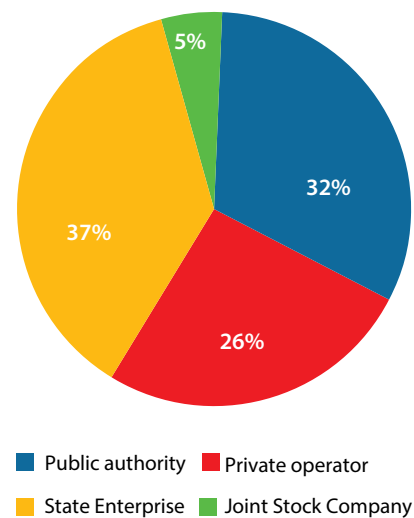


Source: ibid.

Regarding the legal form of road administrations within TEM members countries that took part in this assignment, two main organizational arrangements may be recognized – state-owned enterprises (SOE) and public authorities – with state-owned enterprises being in the majority. A change in this situation was recently carried out in Lithuania where it was decided to transfer the road administration’s legal form to that of a state-owned enterprise.

To some extent, a distinct situation may be observed in Austria where ASFINAG was initially established as an organization for financing high-speed roads (in 1982) and from the late 1990’s absorbed the full road management role.

**Figure 14**  
**Legal forms of road administrations in TEM member countries**

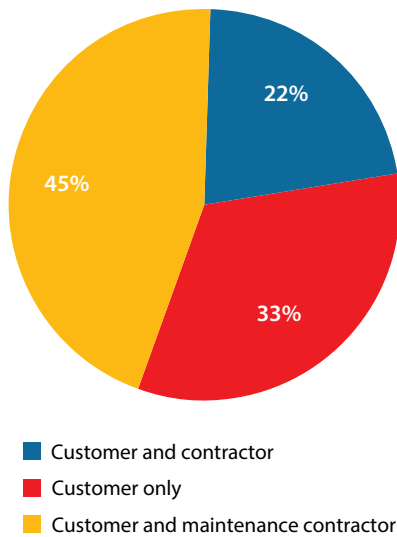


Source: ibid.

Among the surveyed TEM member countries, state road administrations are still primarily responsible for maintenance services delivery, as opposed to private sector involvement.

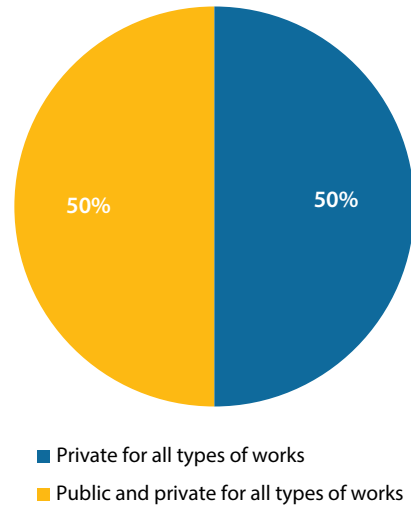
The following figure shows the dominance of private sector involvement, with road works and services delivered either by private sector organizations or a combination of public and private rather than solely public organizations; however, some works (maintenance services) are still provided in-house.

**Figure 15**  
Split of roles and responsibilities of road administration in TEM member countries

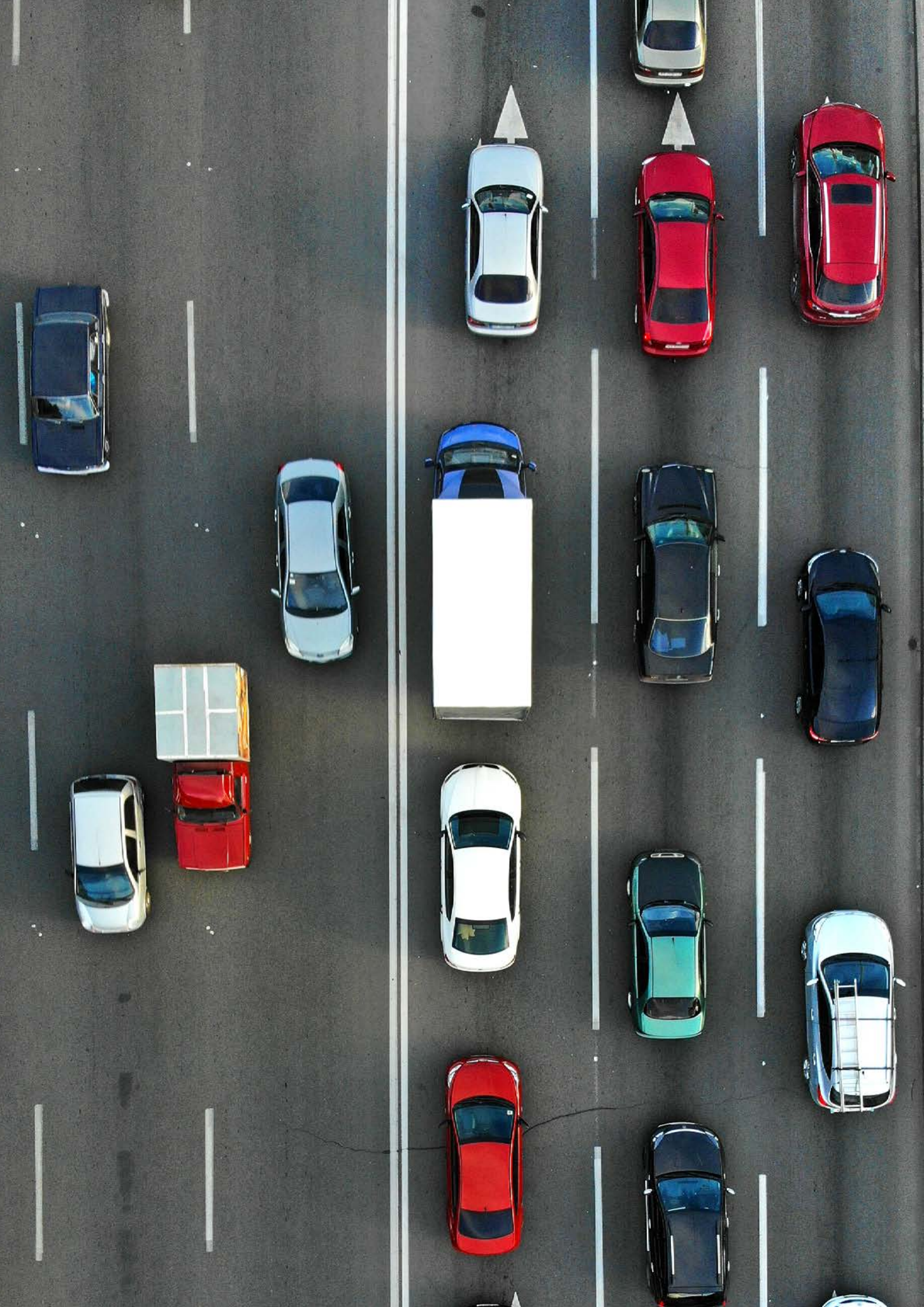


Source: *ibid.*

**Figure 16**  
Private sector involvement in the road sector in TEM member countries



Source: *ibid.*



# Section 3: Capabilities of the road authorities

## 3.1. Introduction

As the first chapter of this study highlighted, increasing the capacity and capabilities of road authorities is a key enabler for public services delivery in the road sector. Three broad categories of capabilities may be differentiated in terms of public infrastructure management:

1. Asset management planning
2. Data management, benchmarking and tools (e.g., IT systems)
3. Training and talent development

These three categories are closely linked and interrelated. Asset management may be considered an approach or even a business model of the modern road authority; however, without appropriate tools, data and training it will remain only an aspiration or ambition of the organization, not the reality experienced by customers or stakeholders.

According to the *Guide to Asset Management*, published by Austroads<sup>18</sup>, asset management is not the domain of a single department within a road authority or even a group of people that works in the field of road maintenance. From the perspective of Austroads, asset management is rather a holistic approach for the road organization which responds to both the organization's and customers' needs, and which includes decision support systems and business processes.

The Australian asset management business approach includes four key concepts as shown in Table 4.

The approach presented above is derived in part from the legacy of the British Institute of Asset Management. This British organization strongly underlines that asset management is not just about the physical assets. From their perspective, assets can be made of anything – brands, licenses, opportunities, etc. – whatever helps an organization to achieve its purposes and objectives.<sup>19</sup>

## 3.2. Core business model for a road authority

Asset management may be considered a meta-level process within an organization which enables the extraction of value for the customers and for the organization. This requires the adoption of a holistic approach, as successful asset management needs the participation of many individuals within an organization and its supply chain.

In the United States, transportation asset management (TAM) is defined as a process needed to meet the new demands of a rapidly changing transportation business environment. Traditional management methods were considered insufficient to meet twenty-first century business, social, technological or political demands.

Key concept	Depiction
The needs of customers	Asset management process must enable the organization to better understand and meet the reasonable expectations of its customers
Whole-organization approach	Asset management is a core business activity that involves most of the functions across an organization
A sequence of business processes	Asset management requires complexity and comprehensiveness of business processes
Not a one-size-fits-all approach	Having in mind how contexts, governance rules and maturity levels may vary among countries, there is no universal asset management solution

Source: *ibid.*, Austroads (July 2018).

<sup>18</sup> Austroads, *Guide to Asset Management*, 3<sup>rd</sup> ed., July 2018. Available at <https://austroads.com.au/assets/asset-management/guide-to-asset-management>

<sup>19</sup> The Institute of Asset Management, *An Anatomy of Asset Management*, ver. 3, December 2015. Available at <https://theiam.org/knowledge/asset-management-an-anatomy/>

From the perspective of the American Association of State Highway and Transportation Officials (AASHTO), TAM implementation represents good public policy and service, providing the following:

- Greater accountability in the effective use of public funds
- Improved relationship between performance and funding
- More sustainable transportation solutions

AASHTO also recommend not to look for one-size-fits-all solutions as there are many reasons why the appropriate level of asset management practices vary among organizations. These reasons may include (but are not limited to):

- Level of asset management maturity, knowledge, experience, political or physical environment, and resources
- Some aspects – such as consultation with customers about levels of service – may be new to the agency
- Agencies may wish to include other aspects such as demand forecasting, risk management, climate change resilience, asset criticality, asset valuation, cost optimization
- The characteristics of different transport networks may vary considerably

### 3.3. Asset management general requirements

#### 3.3.1. Asset management fundamentals

As stated above, asset management extracts value for the organization and its customers. It translates the organization's objectives into asset-related decisions, plans and activities, using a risk-based approach. This methodology makes it possible to achieve the desired balance of cost, risk and performance.

What constitutes value depends on the organization's objectives, the nature and purpose of the organization, and the needs and expectations of its stakeholders. The asset management process therefore supports the realization of value while balancing financial, environmental and societal costs, risk, quality of service and performance related to assets.

According to the International Organization for Standardization (ISO 55000 et al.), the benefits of implementing the asset management approach include:

1. Improved financial performance (ROI, reduced costs)
2. Optimized decision-making processes (data-driven, balancing costs, risk and performance)
3. Risk that is managed
4. Improved services and outcomes
5. Improved efficiency and effectiveness

ISO defined the assets as items, things or entities that have potential or actual value to an organization; however, this value may vary among different organizations and their stakeholders.<sup>20</sup>

This international standard proposes a set of fundamentals for the asset management process as described below:

1. Value – assets exist to provide value to the organization and its stakeholders. It does not focus on the assets as such. This requires:
  - a) A clear statement of how the asset management objectives align with the organizational objectives
  - b) The use of the life cycle management approach to realize value from assets
  - c) The establishment of decision-making processes that reflect stakeholders' and an organization's needs
2. Alignment – asset management translates the organizational objectives into technical and financial decisions, plans and activities. This requires:
  - a) The implementation of risk-based, data-driven planning and decision-making processes
  - b) The integration of the asset management process with the functional management process of the organization (including finance, human resources, IT)
  - c) The specification, design and implementation of a supporting asset management system
3. Leadership – workplace culture as a determinant of realization of value, which requires:
  - a) Clearly defined roles and responsibilities
  - b) Awareness and competency of employees
4. Assurance – asset management ensures that assets will fulfil their required purpose. This requires:
  - a) The implementation of processes ensuring the capability across all life cycle stages of assets
  - b) The implementation of monitoring and continual improvement
  - c) Human resources capacity and capability building

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<sup>20</sup> International Organization for Standardization, ISO 55000:2014 (2014).

### 3.4. Asset management system models

#### 3.4.1. ISO 55000 et al.

Organizations implement asset management systems to control, coordinate or direct asset management activities that can provide risk control and assurance that the asset management objectives will be achieved.

An asset management system is therefore a set of interrelated and interacting elements of an organization whose function is to establish the asset management policy and objectives, and – finally – the business processes needed to achieve those objectives. The elements of the asset management system should be understood as a set of tools including policies, plans, processes, procedures and IT systems.

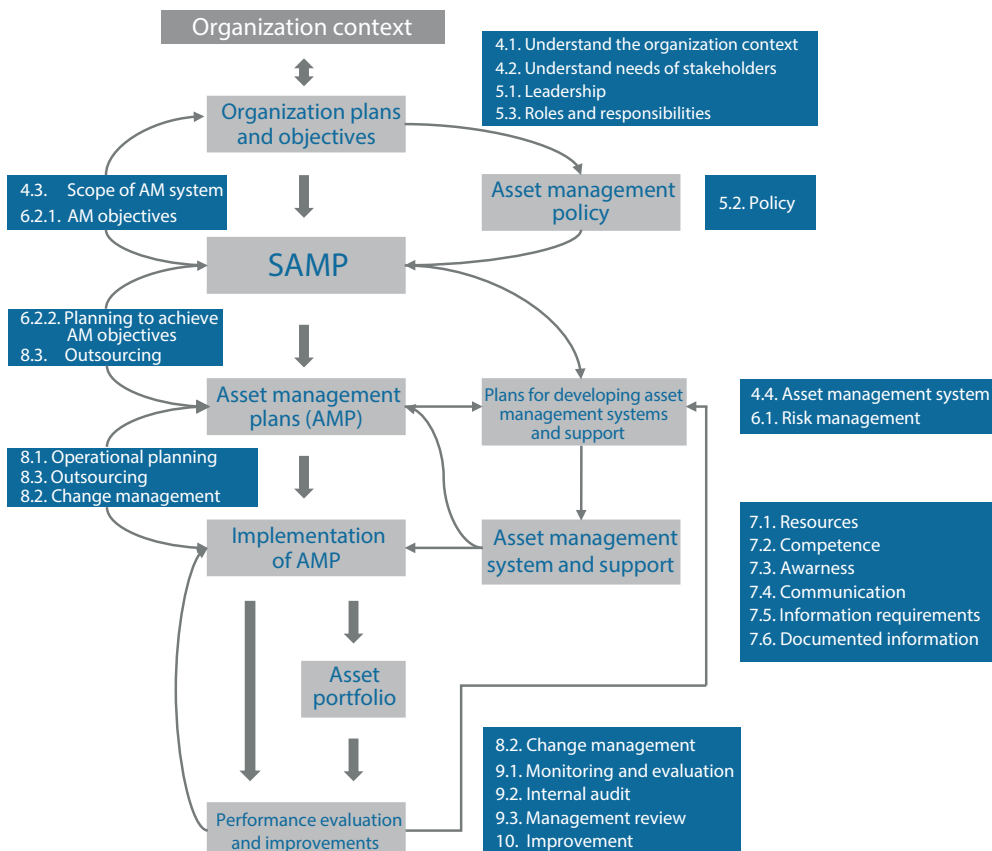
When establishing its asset management system, an organization should take into consideration its internal and external contexts. The external context includes the social, cultural, economic and physical environments as well as regulatory, financial or other constraints. The internal context includes the culture, mission, vision and values of the organization. Stakeholder inputs and expectations are also part of the context of the organization.

Another key element of an asset management system is a strategic asset management plan (SAMP), where the organization defines the principles by which it intends to apply asset management to achieve its organizational objectives. The SAMP also provides stewardship for the asset management system in the development of an organization’s operational-level asset management plans. These asset management plans should have specific and measurable objectives (timeframes and the resources to be used) and should define the activities to be undertaken on assets (how this may be done in the road sector will be presented later in this chapter).

Figure 17 depicts the relationships among the elements of an asset management system and its requirements as provided in Annex B of ISO 55002:2014.

The below depiction may be compared with other concepts and models depicted in this chapter for further analysis of respective cases from TEM member countries. However, the models presented represent the full scope of asset management systems; achieving this level of maturity requires time, engagement and a conscious deployment strategy. As asset management systems and implementation processes affect the whole organization, a step-by-step approach is strongly recommended.

**Figure 17**  
Relationships among key elements of an asset management system



Source: ISO 55002:2014.



### 3.4.2. Institute of Asset Management

An alternative model of an asset management system is provided by the Institute of Asset Management<sup>21</sup>. This conceptual model consists of 6 subject groups covering a total of 39 asset management subjects. This approach was developed to show WHAT is required to have a full asset management system; however, it does not provide an answer to the question of HOW an asset management model can be implemented. The importance of an individual subject to a specific organization will depend on its organizational purpose and context.

#### Group 1: Strategy and planning

This group aligns an organization’s activities and the outcomes from its assets with the overall objectives of the organization. This assists in day-to-day activities through the asset management plan(s). These activities also include planning to improve asset management capabilities and the management system.

The first group consists of:

- a) Asset management policy
- b) Asset management strategy and objectives
- c) Demand analysis
- d) Strategic planning
- e) Asset management planning

#### Group 2: Asset management decision-making

This group considers the challenges faced and the approaches to decision-making for the three main stages of an asset’s life, (1) acquisition/creation, (2) operation and maintenance and (3) end of life. Decisions made at each stage have an impact on subsequent stages.

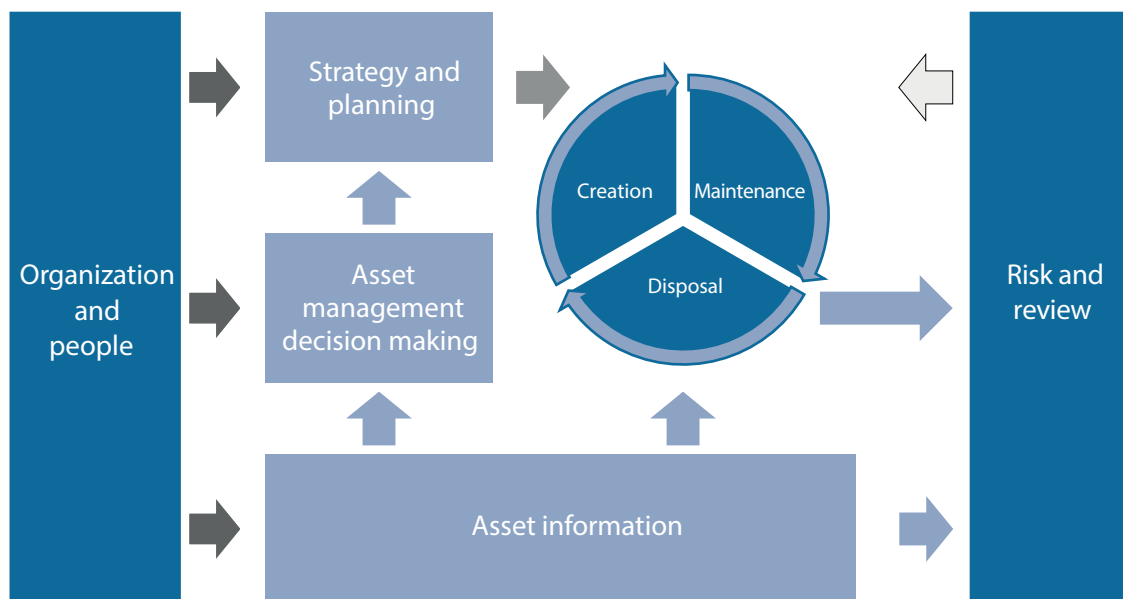
The second group consists of:

- a) Capital investment decision-making
- b) Operation and maintenance decision-making
- c) Life cycle value realization
- d) Resourcing strategy
- e) Shutdowns and outage strategy

#### Group 3: Life cycle delivery

This group considers the implementation process of the asset management plan(s) developed in the first group’s set of processes. It foresees control of the activities undertaken to acquire, operate or maintain, and dispose of the assets as essential for the successful delivery of the asset management plan(s). Focusing on integration of activities across the life cycle enables organizations to reduce avoidable costs through good designs, procurement or O&M practices.

Figure 18  
Conceptual asset management model



Source: *ibid.*

<sup>21</sup> *Ibid.*, The Institute of Asset Management (2015).

The third group consists of:

- a) Technical standards and regulations
- b) Asset creation
- c) Systems engineering (policies and processes for the requirements analysis, design and evaluation of assets)
- d) Configuration management (consistency of physical and functional attributes of an asset with its design and operational information throughout its life)
- e) Maintenance delivery
- f) Reliability engineering (ensuring that an item operates to a defined standard for a defined period in a defined environment)
- g) Asset operations
- h) Resource management
- i) Shutdown and outage management
- j) Fault and incident response
- k) Asset decommissioning and disposal

### Group 4: Asset information

This group considers requirements in terms of data and information which an organization should possess to effectively and efficiently manage its assets. Data and information requirements, including quality requirements, need to be identified and defined.

The fourth group consists of:

- a) Asset information strategy
- b) Asset information standards
- c) Asset information systems
- d) Data and information management

### Group 5: Organization and people

As implementation of an asset management business model is usually an important change for an organization, this group considers processes like reviews of organization structures, roles and responsibilities, or contractual relationships. Subjects in this group are highly interdependent and have strong influence on an organization's ability to adopt and embed asset management.

The fifth group consists of:

- a) Procurement and supply chain management
- b) Asset management leadership
- c) Organization structure
- d) Organization culture
- e) Competence management

### Group 6: Risk and review

This subject group contains core activities associated with the identification, understanding and management of risk. Moreover, it proposes to establish effective feedback and review mechanisms to provide assurance that objectives are being achieved and to support continual improvement of asset management activities.

The sixth group consists of:

- a) Risk assessment and management
- b) Contingency planning and resilience analysis
- c) Sustainable development
- d) Management of change
- e) Asset performance and condition monitoring
- f) Asset management system monitoring
- g) Management review, audit and assurance
- h) Asset costing and valuation
- i) Stakeholder engagement

As asset management system is holistic and integrative, so the number and boundaries may vary depending on the sector or industry. Nevertheless, none of the subjects proposed by IAM should be treated as stand-alone, since there are complex relationships between them.

The Institute of Asset Management's strategic planning is a process that establishes asset management objectives and strategy (as in Group 1, point b.), which may be compared to ISO SAMP. IAM asset management planning is consistent with the ISO Asset Management Plan, while IAM demand analysis is the process which an organization uses to assess and influence the demand for, and level of service from, an organization's assets (similar to knowing the context of the organization and stakeholder expectations, as proposed in ISO).

## 3.5. Road sector models

### 3.5.1. CEDR approach<sup>22</sup>

The conceptual model prepared by IAM became a basis for the approach adopted by the Conference of European Road Directors (CEDR) within their studies concerning road asset management. Building upon existing knowledge, the CEDR Task Group identified five main domains (instead of the six presented in the IAM model above) which they considered to be embracing the implementation of asset management:

- Asset knowledge and information
- Strategy and planning
- People and organization
- Stakeholders and customers (including market approach and procurement strategies)
- Risk

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<sup>22</sup> Margo Briessinck and others, *CEDR technical report 2017/06 – TG Asset Management Final Report 2017*, Conference of European Directors of Roads (Brussels, CEDR Secretariat General, 2017).

### 3.5.2. AASHTO model

The American Association of State Highway and Transportation Officials’<sup>23</sup> approach to asset management (which they call transportation asset management) is one of the most comprehensive worldwide. This is because federal regulations in the United States require every state to implement transportation asset management plans in order to receive federal funds for road infrastructure.

In general, the framework of asset management proposed in the United States consists of four main areas:

1. Service planning
2. Life cycle management and asset preservation
3. Programme planning and transportation asset management plans
4. Information systems and data

#### Area 1: Service planning

This area contains the enabling processes and tools for developing high level agency performance measures that are linked to the levels of service provided to the agency’s customers. It also consists of information about how transportation planning, growth and demand forecasting are linked to asset management. Risk management is viewed as playing a key role in service planning, while the ability to understand and respond to a variety of risks is treated as an important TAM process.

The outputs of the service planning processes described in this area are typically the identified functional improvements needed to the transportation system.

Strategic performance measurements provide information on a wide range of outcomes, such as condition, safety, mobility and risk. Typically, an agency can report on many other performance measures as well, such as output costs, action effectiveness and utilization.

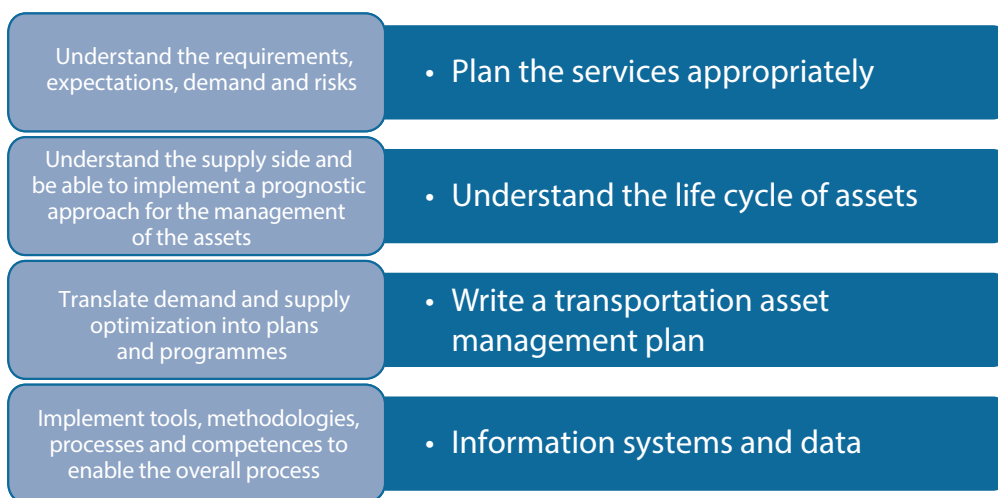
Moreover, Area 1 consists of:

- 1) The links between TAM and long-term planning, considering the effects of population growth, land use changes and other changes in the demand for transportation services
- 2) Approaches to identifying sources of risk, evaluating them, and integrating mitigation actions and strategies into the routine business functions of the agency

#### Area 2: Life cycle management and asset preservation

Area 2 presents enabling practices, processes and tools that support decision-making and prioritization for life cycle management and preservation of the agency’s asset portfolio. The outputs include operational activity, preventive maintenance, rehabilitation and ultimately reconstruction.

Figure 19  
AASHTO asset management general framework



Source: ibid.

<sup>23</sup> American Association of State Highway and Transportation Officials, *AASHTO Transportation Asset Management Guide – a Focus on Implementation* (Washington, D.C., 2011).

Within the processes and tools mentioned above, the most important are:

1. Asset inventory and its attributes
2. Condition and functional performance
3. Application of asset inventory, condition and performance data
4. Life cycle management and its links to work activities and decision-making based on condition and functional performance intervention standards
5. Life cycle cost analysis
6. Optimized decision-making and deterioration models
7. Maintenance processes

### Area 3: Programme planning and transportation asset management plans

The enabling processes and tools that support integrated, cross-function decision-making are:

1. Programme planning (from the phase of candidate projects selection, through trade-offs, up to resource allocation and budget integration)
2. Programme delivery – projects development and management as well as procurement models
3. Asset valuation and depreciation
4. Sustainability, which includes environmental, social and economic perspectives

### Area 4: Information systems and data

A transportation asset management information system (TAMIS) is a collection of hardware, software, data and processes that support asset-management business processes. A TAMIS is used to collect, process, store and analyse information about assets, to develop sound maintenance and rehabilitation strategies, and to schedule, track and manage work. A TAMIS typically includes:

1. Technical information about asset characteristics, condition and performance
2. Financial information concerning current asset value and the level of resources needed to maintain and improve assets to meet established goals and service standards
3. Planning information about recommended or scheduled work on assets
4. Historical information about work accomplished and investments made

Common functional elements of a TAMIS are:

1. **Asset inventory** – a database that identifies individual assets and their elements with the physical, operational and administrative characteristics required for

developing maintenance and rehabilitation strategies and budgets. Links to maps, photographs, video imagery or construction plans, or a combination thereof, may be included.

2. **Asset condition, performance and utilization tracking** – current and historical assessments of physical condition and operational performance. Asset management systems may store both raw observations and multiple levels of aggregated or summarized information.
3. **Asset condition and performance prediction** – the capability to predict a future asset condition based on deterministic or stochastic models. Some systems include functions to develop deterioration or performance models utilizing historical data, expert opinion or a combination of the two.
4. **Treatment selection** – identification of maintenance, rehabilitation and replacement treatments that are recommended to be applied to the asset at different points in its remaining life cycle based on maintenance cycles, asset age or different levels of condition or performance, or a combination thereof. Treatment information typically includes (1) rules for when the treatment can or should be applied, (2) unit costs which may vary by asset characteristics and condition levels, and (3) the effect on asset condition or performance when a treatment is applied.
5. **Resource allocation** – analysis capabilities that estimate the current needs backlog, the budget required to meet a given performance level, the performance that can be achieved for a given budget level or the optimal level of performance that minimizes long-term costs. Some systems address trade-offs across programme categories or alternative packages of projects.
6. **Work planning and tracking support** – automated or partially automated generation of work programmes, creation of contract documents, creation of work orders, tracking of completed work and work histories.

The technology components of a TAMIS are:

1. **Database** – providing core data storage for inventory, work plans, work history, model parameters, etc. Many commercial asset management systems support multiple database types (Oracle, SQL Server, Microsoft Access, etc.).
2. **Links to geospatial features** – providing the ability to view and analyse asset and related information based on location, either through an interface with geospatial data maintained within a separate enterprise database or a geographic information system (GIS), or through inclusion of geospatial data directly within the asset management database.

3. **Application software** – providing capabilities for uploading, exporting, viewing and editing data; running analyses; performing queries and producing reports.
4. **Interfaces** – providing linkages for sharing of data between the asset management system and other systems, which may include budgeting, project programming and scheduling, financial management, work order/maintenance management, trouble-ticket, materials management, time entry, fleet and equipment management, enterprise resource planning (ERP) systems and enterprise data repositories.
5. **Field data collection system** – providing capabilities for viewing and updating inventory and condition information in the field and synchronizing or uploading the data to the master database.

### 3.6. Asset management system implementation

#### 3.6.1. AASHTO general approach

The models presenting asset management systems above may be considered as desired scenarios for most of road authorities. Reaching such a state requires the preparation and implementation of sound deployment strategy. The AASHTO manual proposes an eight-step plan for successful implementation, grouped into three overarching processes:

- a) Setting the direction for TAM
- b) Aligning the organization
- c) Preparation of the transportation asset management plan

**Figure 20**  
General approach for asset management system implementation



Source: *ibid.*

The first group – setting the direction for TAM – consists of three steps (out of the eight-step plan mentioned above):

1. Setting agency goals and objectives for TAM (Step 1)
2. Agency self-assessment and gap analysis (Step 2)
3. Definition of the scope of TAM in the agency (Step 3)

The starting point for any agency is having a clearly defined mission and organization-wide strategic goals and objectives. This is considered a basis for quantitative, proactive decision-making which should improve the ability to achieve its mission. TAM goals and objectives should therefore be quantified by performance measures, and these measures need to have targets with a set timeframe and available resources.

To establish goals and objectives there are various approaches proposed, such as:

- a) To define the context for setting TAM objectives – thus to identify the factors that drive the objectives
- b) To determine the organization’s management framework – how the agency will manage organizational performance
- c) To integrate TAM with the organization’s business processes – meaning that every person must share a common understanding of the levels of service
- d) To obtain organizational commitment – which is critical for integration of TAM with business processes; this may be achieved by internal communication or training that will raise the awareness of the staff

The second step consists of:

- a) Strategic self-assessment to benchmark characteristics for establishing its level of maturity in terms of asset management
- b) TAM gap analysis, a tool for drilling down to the details of TAM processes – which uses the maturity model as a scale
- c) Identification of appropriate TAM practice – suggestions to consider when deciding what TAM practices to focus on

It is worth understanding what the expected outcomes of these tools are. While a self-assessment process identifies a range of other useful processes, tools and approaches for an organization to pursue, a gap analysis provides a step-by-step method of moving from a general action plan to actual implementation.

The outcome of this step should be a prioritized list of TAM practice improvements, including a time for each improvement to be completed, responsibility and required resources (i.e., people, time, money).

The third step should focus on:

- a) The definition of asset types and the needs of assets managed by the agency; it is recommended to start with just a few asset classes and then build incrementally
- b) A decision-making process, which should be seen in the context of the organization's mission and the services it delivers to road users/customers
- c) The definition of business processes and asset management capabilities
- d) Data needs
- e) Cost and benefits analysis

The second group – aligning the organization – consists of the next five steps:

1. Development of the change strategy (Step 4)
2. Integration of TAM into the organizational culture (Step 5)
3. Integration of TAM into business processes (Step 6)
4. Establishment of asset management roles (Step 7)
5. Establishment of the performance management standards (Step 8)

The change strategy is built based on the previous steps evaluating an agency's maturity. This phase depends on the extent of the changes required, and it may be necessary to develop a comprehensive approach that will contribute to the requirements given above in the first step (obtaining organizational commitment). A change strategy should also consider complex communication with all stakeholders (both internal and external). From the internal perspective this will allow the integration of TAM into the organizational culture (as defined in Step 5).

The integration of TAM with business processes will require the establishment of linkages and data flows that may not have existed before, as TAM implementation will bring new business processes or information to support performance measurement on the strategic, tactical and operational levels. This also requires establishing new roles both for the implementation and operation of the asset management system.

Finally, to monitor if the organization is making real progress in terms of achieving the established goals and objectives, performance management standards should be implemented. This may be based on the input, output or outcome measures. In line with the maturity level, it is expected that the

organization will go from more input-output measurements to an outcome-focused approach (so from the quantity of resources or quantity of works towards results in performance or condition).

Much work done internationally (i.e., by OECD<sup>24</sup> presented in Table 5) on the performance indicators for the road sector addresses (among other things) infrastructure condition; social, economic, health, and environmental outcomes; user satisfaction and road agency deliverables.

To support performance measurement, a number of IT and ITS services and applications may be used as internal clients of the organization but also to monitor improvement of the organization. Based on World Bank<sup>25</sup> experience, a comprehensive management information system normally consists of a computerized road management system (for planning, programming, budgeting and preparation of road works) and a financial accounting system. Information systems are also required, for example, for management of personnel records and equipment. Several developing or transitioning countries have had computerized pavement management systems (PMS) supplied and implemented by consultants for their road agencies. However, often the long-term sustainability of these systems has been poor.

The successful implementation of a computerized road management system (RMS) depends on the interaction of three fundamental components – processes, people and technology. If any of these components are lacking, the system will not be successful. The best technology in the world will ultimately fail if implemented in an environment where there are no people to run it or where the processes are not in place to utilize it.

The sustainability of a computerized road management system also depends on the type of management information produced, the extent and cost of data required by the system, the availability of local technical expertise on all aspects of the system and the availability of local computer expertise for the maintenance of both the software and hardware.

The extent to which the management information produced by the MIS meets the day-to-day needs of managers within the roads organization will ultimately determine whether the system is adopted as part of management procedures.

If the managers do not use the information, it will probably fail. The cost of data acquisition can be high and will often be the most expensive aspect of implementing and operating a road management system. As such, it is essential that appropriate data design is undertaken to ensure cost-effective data requirements.

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<sup>24</sup> OECD, *Performance Indicators for the Road Sector* (Paris, 2001).

<sup>25</sup> Cesar Queiroz and Henry Kerali, *A review of institutional arrangements for Road Asset Management: Lessons for the Developing World*, Transport paper series, no. TP-32 (Washington, D.C., World Bank, 2010).

Table 5 Performance indicators for the road sector		
No.	Indicator name	Purpose/description
1	Average road user cost (car and truck)	To measure the average cost of running a medium car, a light diesel truck and an articulated six-axle truck as determined from the Highway Development & Management Model of the World Bank.
2	Level of satisfaction (travel time)	To measure satisfaction regarding travel time and its reliability, and quality of road user information.
3	Number of fatalities	To measure the fatality risk for all road users from a road traffic perspective and from a health perspective.
4	Unprotected road user risk	To measure the fatality risk from a health perspective, based on the number of unprotected road user fatalities divided by the number of inhabitants.
5	Environmental policy/programme	(Yes/no). To measure the extent and use of environmental policies and programs by road agencies. The indicator is based on the requirements of ISO 14001.
6	Market research and customer feedback	(Yes/no). To measure the existence, extent, type and success of market research processes.
7	Long-term programmes	(Yes/no). To measure whether the organization responsible for managing the road system has a long-term plan or programme in place that is based on trade-off analysis among new construction, maintenance and operations of the road system and that allocates available resources at the system level among these alternative strategies for achieving the goals of the system.
8	Management systems for distribution of all resources	(Yes/no). To measure the existence of standard and robust management systems comprising: strategic planning and asset management planning, economic evaluation, implementation monitoring, review and audit procedures for the distribution of resources in the programme development and management process.
9	Quality management audit	(Yes/no). To measure the set up and use of a quality management system based on ISO 9000.
10	Forecast values of road costs versus actual costs	To serve as an indicator for the ability of an organization in operational schedule and cost management.
11	Overhead percentage	To measure the administrative (fixed) costs of the road administration in relation to the total costs of the road administration.
12	Value of assets	To establish the existence of standard and applicable methods to calculate and measure the value of assets of road infrastructure.
13	Roughness (according to road class)	To rate road networks on the basis of user comfort.
14	Condition of structures	To measure the percentage of engineering structures presenting important deteriorations.
15	Satisfaction with road system condition	To establish standard and applicable processes for market surveys and customer feedback aimed at monitoring and measuring road user satisfaction with road system condition.

Source: *ibid.*, OECD (2001), from the Summary of the field tests report.

It is important that technical staff within the roads organization understand the inner workings of the road management system. A black box system is unlikely to be sustainable as questions will arise regarding the details of how the management information has been produced – for example, about the rules used for prioritizing periodic road works. It is desirable to use an open system where all algorithms and procedures are published and accepted by those using the MIS.

Based on the eight-step process presented earlier, the organization should possess an asset management system that enables it to prepare a transportation asset management plan (TAMP) – the third overarching process.

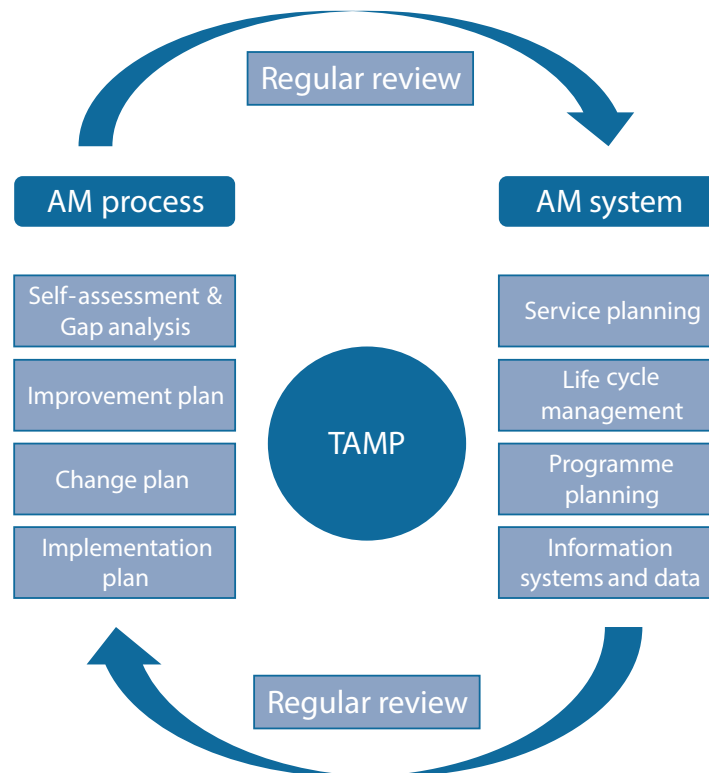
TAMP can be considered a central, tangible result of the asset management system and process. It is a focal point for:

1. information about the assets
2. management strategies
3. long-term expenditure strategies
4. business management processes

It is therefore an essential management tool that brings together the areas described in the section above. It is worth remembering that TAMP should be reviewed and updated regularly. ASHTO recommend the period between reviews should not exceed three years.

As was stated before, the journey to asset management maturity requires time and depends on the options available to different countries and organizations. That is why, in the review process, not only the TAMP may change based on new information – in terms of network condition or performance – but there may also be changes in the sophistication of analysis or systems used, or in the services that an organization provides – more customer oriented technical levels of services or the implementation of outcome measures instead of output.

**Figure 21**  
**Differentiation between asset management as a process and as a system**



Source: Andrzej Maciejewski (2020).

### 3.7. Asset management plans as a first step

According to the *International Infrastructure Management Manual* (IIMM)<sup>26</sup> preparing an initial TAMP using readily available data and information may be an alternative to a more structured (and complex) approach. This TAMP may be treated as an internal document produced to understand the strengths and weaknesses of current asset management practices and to identify priorities for future development.

This approach involves using the initial plan to record current policies, standards, life cycle tactics, levels of services, information systems, critical assets, knowledge of assets and work programmes. The focus should be on current expenditure on asset development, renewal, maintenance and operations.

This TAMP shouldn't be considered as a competitor to self-assessment and gap analysis, but it may prove complementary in defining what is the as-is situation. The self-assessment is the baseline against which the desired improvements are compared. For each dimension of maturity, the plan must establish achievable objectives, a timeframe and a step-by-step plan to reach the objectives. These steps are expressed as the improvement plan. This process may be supported by the initial asset management plan, but continuous improvement requires gap analysis to be carried out to generate an improved asset management plan in the following cycles.

IIMM strongly recommends such an approach, as from their perspective this makes it possible to recognize deficiencies and undertake necessary improvement activities. This approach may also be described as top-down followed by bottom-up. The Table 6 snapshot presents the advantages and disadvantages of both approaches, per IIMM:

<sup>26</sup> Institute of Public Works Engineering Australasia, *International Infrastructure Management Manual*, 5th ed. (n.p., 2015).



	Top-Down Analysis	Bottom-Up Analysis
<b>Advantages</b>	<ul style="list-style-type: none"> <li>■ Supports the 80/20 rule (get 80 per cent of the result from the first 20 per cent of effort)</li> <li>■ Identifies weaknesses in the plan earlier and focuses on appropriate data as opposed to perceived data needs</li> <li>■ Initially less resource intensive</li> <li>■ Better use of limited resources and quick results</li> </ul>	<ul style="list-style-type: none"> <li>■ Outputs are data driven with a high degree of confidence</li> <li>■ Data is of a high quality</li> <li>■ Ability to undertake data modelling and improve decision-making</li> <li>■ Continuous plan revision is simpler</li> </ul>
<b>Disadvantages</b>	<ul style="list-style-type: none"> <li>■ Potential for compromised quality and completeness of data</li> <li>■ Assumptions required to make decisions</li> <li>■ Potential for inappropriate decision-making</li> <li>■ Inability to undertake detailed modelling and sensitivity analysis</li> </ul>	<ul style="list-style-type: none"> <li>■ Data collection takes time</li> <li>■ Time of production can impact the ability to make urgent decisions</li> <li>■ Potential to lose focus on objectives – too focused on data issues</li> <li>■ Costly and time consuming</li> <li>■ Data rich – information poor</li> <li>■ Lack of focus on supporting AM activities</li> </ul>

Source: *ibid.*, Institute of Public Works Engineering Australasia (2015).

### 3.7.1. How to develop the asset management plan

As presented in sections 2.2. and 2.3., asset management system models and approaches to their implementation seem to be comprehensive but are not easy to implement (or at least to achieve quick results, which may be crucial to convince decision makers to put some resources towards implementation of asset management). It is convincing

then to start with preparation of an initial AMP/TAMP as the first step.

To ease this process, five core questions may be posed in order to imagine what should be considered in the AMP/TAMP. These key questions can provide a general direction in which to work and eventually arrive at solutions. Through this process both AMP and TAMP will be improved and the asset management system will become sounder.

General question	Detailed questions
1. What is the current state of my assets?	1.1. What are the owned assets? 1.2. Where are they located? 1.3. What condition are they in? 1.4. What is their performance? 1.5. What is their remaining useful life? 1.6. What is their remaining economic value?
2. What is my required level of service?	2.1. What is the demand for my services? 2.2. What is required by regulators? 2.3. What is the actual performance? 2.4. Are the regulatory requirements fulfilled?
3. Which assets are critical to sustained performance?	3.1. How do they fail? 3.2. How can they fail? 3.3. What is the likelihood of failure? 3.4. What do they cost to repair? 3.5. What are the consequences of failure?
4. What are my best O&M and CIP investment strategies? <sup>27</sup>	4.1. What alternative management options exist? 4.2. Which are the most feasible options? 4.3. What would be the optimum mix of the following?: - preservation and preventive maintenance - reactive maintenance - rehabilitation - construction/replacement
5. What is my best long-term funding strategy?	5.1. What revenues will be required? 5.2. What is the investment gap to meet asset condition goals? 5.3. What is the revenue gap to keep the asset with accepted risk tolerance?

Source: World Road Association (PIARC), Asset management manual: a guide for practitioners, (Paris, 2017).

<sup>27</sup> O&M – operation and maintenance, CIP – capital improvement plan/program

Although these questions offer perspective on the full picture of the asset management plan and, as a consequence, the asset management system, it is necessary to determine how this iterative process of writing an AMP or TAMP and establishment of an asset management system should look.

Certainly, any generic model of such a process cannot be applied without customization in every country; nevertheless, it is helpful to consider a conceptual model of this process to consciously decide on the specific sequence in a country or an organization. What do we already have, what needs to be reviewed and what needs to be prepared from scratch?

Based on international best practice as described by IIMM, PIARC, AASHTO and others, a multiple step process should be considered to develop a good asset management plan.

The AMP should be a document which explains the basis for the allocation of budgets and the development of financial plans. It should also provide evidence to justify the levels of budgets that are necessary and the likely impact that different funding scenarios may have on the performance of the assets. Through a good AMP, an asset management system may be well positioned within the wider business context. The plan should also provide information on how asset management, including work programmes, will be delivered.

The asset management plan can therefore be conceptualized as a business plan for an organization that plays a stewardship role in the road sector. Steps to develop the AMP should be as follows:

### 1. Development of asset inventory

Database of all assets within an asset group or service. At a minimum it needs to include pavement and bridge assets; inclusion of other physical assets is recommended.

### 2. Development of levels of service, performance measures and targets

- a) Levels of service – broad statements that describe the performance required, which are a balance of stakeholder expectations, corporate vision and available funding. At a proficient level of asset management, levels of service can be split into two distinct categories:
  - Customers – how the customer receives the service in terms of tangible and intangible measures or criteria
  - Technical – expressed in technical terms; some basic levels of service may be defined as performance measures
- b) Performance measures – each level of service should be supported by a set of performance measures. Two types of measures are of interest:
  - measures of physical condition (understood as its ability to provide the required level of service, not its physical state)
  - measures of organizational performance

There are four types of performance measures:

- input – shows the amount of resources needed to complete activities and includes staff, labour and materials costs, but does not necessarily demonstrate performance
  - output – typically measures completed activities such as area of surface dressing/year; provides information on the activities completed per programme of work
  - outcome – describes the results of activity provided and may include measures such as public satisfaction or the condition of various assets
  - efficiency – reflects the input/cost/activity or the total service
- c) Targets – progress in achieving asset management objectives, as described by levels of service, is quantified by target values of the selected performance measures. Therefore, each performance measure should have a performance target associated with it over a period of time (typically up to five years). Performance targets define quantitatively the performance that needs to be achieved to reach the required level of service. They should be agreed on within the organization, achievable and affordable.

### 3. Assessment of performance and failure modes

- a) Condition evaluation serves to identify maintenance and rehabilitation needs and to monitor the health of the assets
- b) Asset performance has three primary components:
  - operating cost
  - utilization
  - condition
- c) To estimate possible failure modes, it is necessary to know:
  - the likelihood of economic failure and the timing (an asset has reached a point of economic failure when it is no longer competitive with asset options that are available for delivering the same or improved function; a business case requires a life cycle cost analysis)
  - the likelihood of capacity failure and timing versus demand predictions (an asset does not have the capacity to meet its designed performance)
  - the likelihood of physical and functional failure and timing

### 4. Determination of residual life

Residual life is the time until failure and is particularly important for managing high-cost and high-risk assets. A prediction of time to failure enables an organization to initiate a planning process for renewal. It is achieved using deterioration models.

### 5. Determination of life cycle and replacement costs

- a) LCC – all costs of owning and operating the asset from planning through retirement or replacement;  $LCC = \text{capital costs} + \text{lifetime operating costs} + \text{lifetime maintenance costs} + \text{disposal costs} - \text{residual value}$
- b) This requires valuation of assets and development of a depreciation model

### 6. Determination of future demand for the network

Traffic growth analysis and stakeholders needs

### 7. Determination of business risk

- a) To identify critical assets which are high cost and significant consequences if they fail
- b) With this analysis, a better understanding can be had of where the greatest risks lie, which should help the focus of investment and maintenance strategies<sup>28</sup>

### 8. Optimization of operations and maintenance

- a) The balance between planned and unplanned maintenance that can be optimized
- b) Relying solely on either unplanned or planned maintenance would, in most cases, result in higher total costs. The task is to achieve the right mix so that total costs lie in the optimal band. This requires experience, understanding of asset behaviour, repair methods and the acquisition and use of appropriate cost data and analysis tools.
- c) This step also requires calculation of maintenance needs

### 9. Optimization of capital investments

- a) Based on the data and information collected in steps 1–8, it is possible to evaluate the best

operation, maintenance and capital investment strategy to deliver the required levels of service at the best cost and level of risk exposure

- b) This is required to carry out a cost/benefit analysis of all options (such that all factors are assessed, including risk exposure, probability of failure, life extension)
- c) Adopt the most cost-effective options in terms of the total business picture using net present value (NPV) analysis, with risk reduction to the business considered a benefit

### 10. Determination of the best funding strategy

An analysis of the expenditures for the proposed maintenance, operations and capital expenditures is required to meet the prescribed levels of service over the planning period. This information then represents the net increase (or decrease) in the cost of service associated with the plan.

On the above basis an organization is ready to prepare its asset management plan, which should have a strong financial component. The financial plan must demonstrate the funding required to meet the performance set out in the asset management strategy. The most effective financial plans cover between 5 and 15 years, and their main function is to accomplish the following:

- Identify the financial resources that will be available in the coming years
- Select the appropriate maintenance strategy (scenario)
- Determine realistic objectives that can be assigned for the asset management plan

Based on best international practice, the process to build the financial plan is as follows:

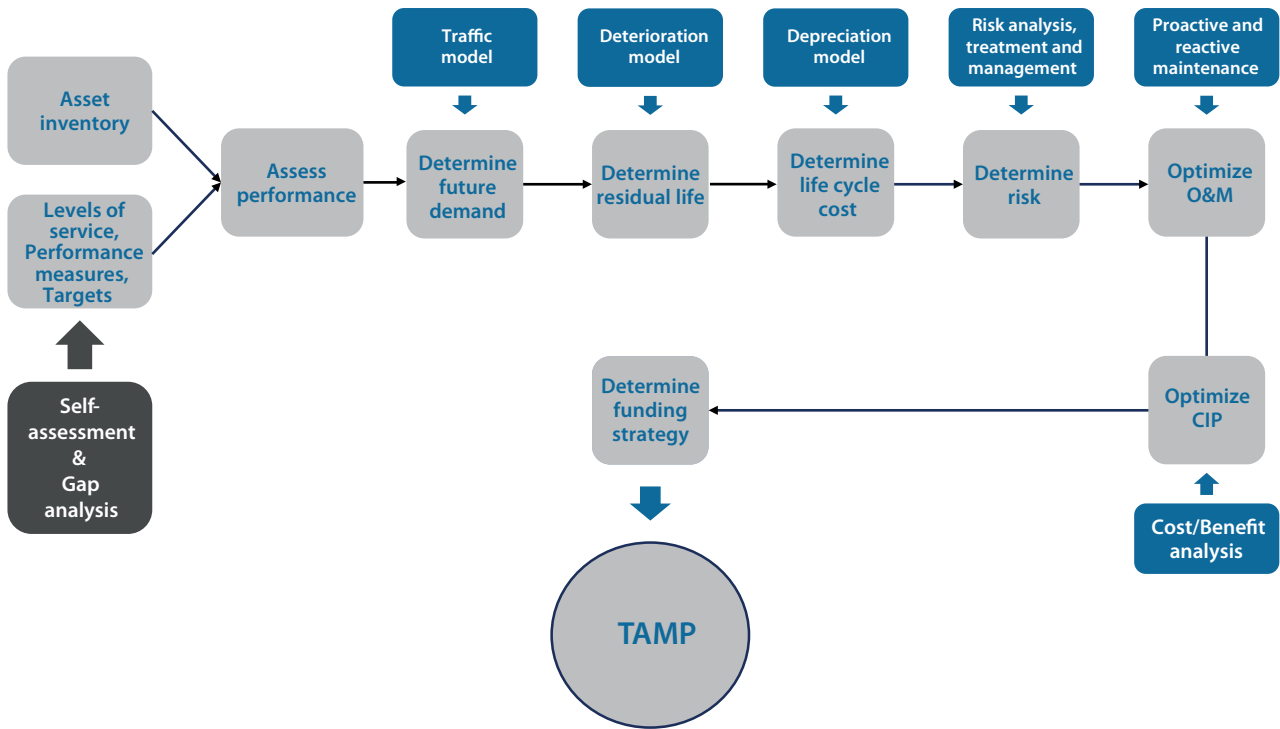
- **Step 1:** determining the cost of the proposed works. The financial plan should be built on a works plan that contains activities the organization is required to undertake; the works plan should contain the activities that have been prioritized according to the policy of the organization for at least the upcoming year, but it is better to have these priorities for the next 3–5 years; ideally each asset group should have determined the costs of its own work plan.

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<sup>28</sup> Identification of critical assets – critical assets are those that are essential for supporting the social and commercial needs of both the local and national economy. These assets will have a high consequence of failure (but not necessarily a high likelihood of failure). These assets should be assessed separately from others. By identifying critical assets, road authorities can target and refine maintenance plans or financial plans at the most crucial areas. Criticality can be assessed by applying broad assumptions about the implications of failure. Simple criteria can be defined to assess the loss of service (affecting or disconnecting specific parts of a community; affecting businesses of different sizes and significance; affecting a specific number of road users/hour). Risk exposure is calculated as follows:  $\text{risk} = \text{likelihood} \times \text{consequence}$

- Risk identification: the organization identifies the risks that could affect its objectives (i.e., legislative changes or operational failure)
- Risk analysis: evaluation of the probability with its consequence
- Risk treatment: the so-called 5 Ts – treat, tolerate, terminate, transfer, take advantage of the risk
- Risk management: the likelihood and consequences of risks can be used to inform decision makers (i.e., in case of changes in funding strategy) regarding the performance of, investment in, and implementation of works programs or achieving levels of service.

Figure 22  
Asset management planning process



Source: Andrzej Maciejewski (2020).

- **Step 2:** allocating the funds among programme areas. Advanced organizations consider prioritizing their assets to ensure those assets most in need of funding to meet levels of service and those that may be critical to the organization. A possible approach to allocate funding among different assets may be based on ensuring the optimum performance rather than the maximum performance.
- **Step 3:** assessing financial sustainability. The financial plan should preserve the value of the assets in the organization’s ownership as much as possible so financial plans may be used to make the case to senior leaders. The case should present the consequences of underfunding in terms of:
  - Impact on the transportation network
  - Impact of assets value and performance
  - Economic impact evaluated in terms of the increase in whole-life costs and vehicle operating costs

This process of AMP development may be visualized as a flow chart as presented in Figure 22.

### 3.8. Integration of approaches

Full implementation of an asset management system as shown in the conceptual models provided by ISO, IAM, IIMM, Austroads, AASHTO or PIARC requires a lot of effort, time and resources.

Nevertheless, asset management may bring to an organization new perspective on its business model, which supports organizations in understanding and responding to customers’ and stakeholders’ needs, providing stewardship to the organization’s internal business processes, helping to improve the management of assets, and thus improving cost management and enabling the organization to consciously prepare its financial plan and approach towards revenues.

A summary of the above-described models and processes is presented below in an integrated way to ease the first step in asset management plan implementation (Table 8).

Table 8 Integrated approach to asset management				
Three main outcomes	AMP business process	Five core questions	AASHTO areas	
<b>Self-assessment &amp; gap analysis</b>				
<b>PERFORMANCE ASSESSMENT</b>	Develop asset inventory Establish levels of service, performance measures and targets Assess condition and performance	What is the current state of my assets?  What is my required level of service?	SERVICE PLANNING	TRANSPORTATION ASSET MANAGEMENT INFORMATION SYSTEMS (TAMIS)
<b>OPTIMIZATION OF DECISION-MAKING</b>	Determine future demand Determine residual life Determine life cycle costs Determine risk treatment and management Optimize operations and maintenance Optimize capital investments	Which assets are critical?  What is my best O&M and CIP investment strategy?	LIFE CYCLE MANAGEMENT AND ASSET PRESERVATION	
<b>FUNDING STRATEGY</b>	Determine funding strategy Build TAMP with financial plan	What is my best long-term funding strategy?	PROGRAMME PLANNING AND TAMP	

Source: Andrzej Maciejewski (2020).

### 3.9. Benchmarking analysis for TEM Project member countries

As noted in the previous sub-section, implementing the asset management approach requires the deployment of appropriate processes, procedures, competences and supporting systems regarding:

- Performance assessment
- Optimization of decision-making
- Funding and financing

Network performance assessment should cover not only surveys focused on the technical condition of particular assets but even more on the actual ability of those assets to provide the required services. This means that some types of assets even with demanding technical conditions may provide services when, for instance, the demand for these assets is not substantial.

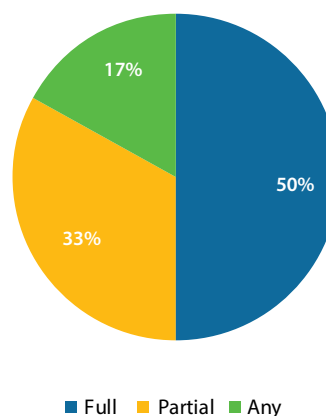
Network (and assets) performance assessment should therefore take into account utilization, the physical and functional likelihood of failure, and operating cost.

These attributes of both network and asset should be reported for adjusted performance management and the measurement framework, and be used for the process of optimization of decision-making to decide which road sections require what treatment in which year.

Currently, the majority of TEM member countries carry out the process of performance evaluation, taking either the full or sometimes partial approach. It is important to bear in mind that reporting and analysing costs, utilization or likelihood of failure sometimes requires substantial organizational and

financial effort (for instance, due to the data collection process). Therefore, it is critical to be aware of the need for network and assets performance assessment and to initiate this iterative process and ensure its continual improvement.

**Figure 23**  
Performance assessment practices in TEM member countries

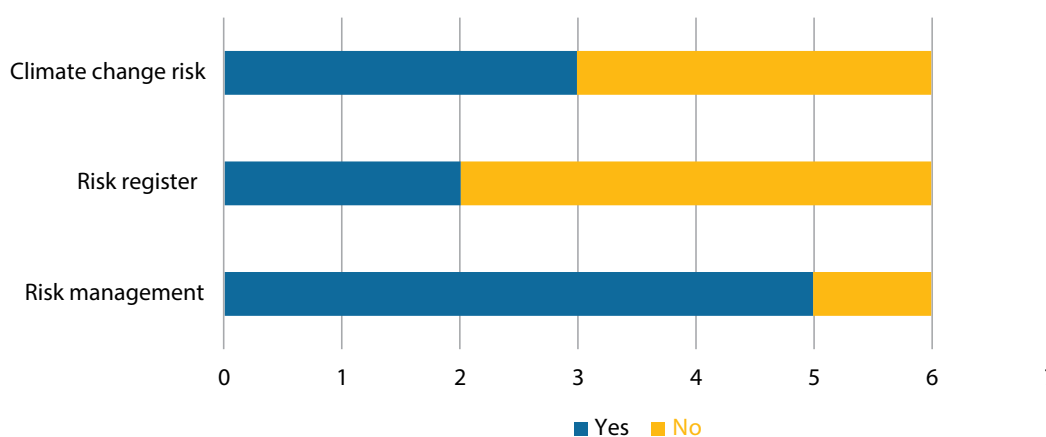


Source: *ibid.*, UNECE TEM Project (2018).

Comprehensive asset management, apart from network and assets performance assessment, also requires well designed and documented risk management.

The graph below shows that this need has been well recognized by the TEM member countries. What may be defined as a current challenge is the creation of sound risk registers or risk databases. These would contribute to the process of criticality assessment and help in prioritization of assets and grouping of assets in the further planning and programming phases.

**Figure 24**  
Risk management practices in TEM member countries



Source: *ibid.*

Both network and assets performance assessment and risk management are used by the majority of TEM member states for the process of planning of asset management activities. Planning includes the assets' entire life cycle perspective as shown in Figure 25.

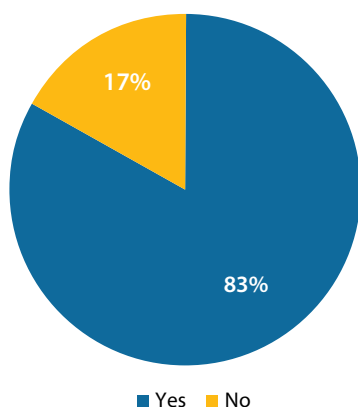
This means that the decisions concerning trade-offs between capital and investment expenditures should be preceded by appropriate optimization of decision-making<sup>29</sup>.

The same process may be observed in planning and programming of maintenance (especially in terms of periodic maintenance).

Incorporation of life cycle planning also enables road authorities and companies within TEM member countries to carry out more multiannual planning, which is crucial in asset-heavy sectors like the transport infrastructure or road sectors).

The combination of life cycle analysis and multiannual planning usually gives road managers (and their parent ministries) enough knowledge and data to convince other government officials (e.g., minister of economy and/or minister of finance) to allocate at least a sufficient level of financing to ensure delivery of services through most critical road assets. This makes it possible to eliminate or minimize backlogs in road maintenance by demonstrating the potential economic impacts of insufficient road network financing.

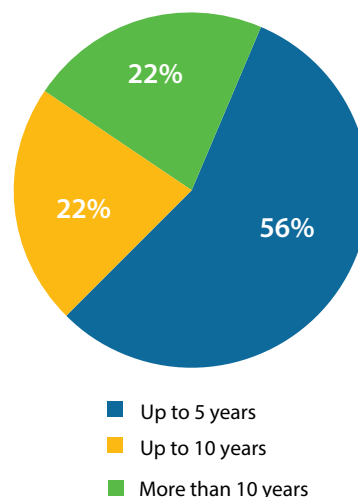
**Figure 25**  
Life cycle planning practices in TEM member countries



Source: *ibid.*, UNECE TEM Project (2018).

From another perspective, these processes assure the road authority or company stakeholders that the planning of road assets management is focused on decreasing total costs – not only for the road agency but for the whole economy.

**Figure 26**  
Planning horizon in TEM member countries



Source: *ibid.*

<sup>29</sup> Tools for optimization are not in the scope of this report and are depicted in a separate document of the TEM Project titled *Tools for asset management* (Adam Zofka and Andrzej Maciejewski, to be published).

# Section 4: Financing of road infrastructure

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## 4.1. Responsibility of road managers

A stable, sustainable and long-term funding strategy plays a fundamental role in road sector management. This aim may be achieved through a variety of institutional arrangements.

Since processes of planning, programming, design construction and maintenance of a road network are lengthy and overlapping, the process of maintaining a road network may be characterized as continuous. Instability of funding leads to ineffectiveness and inefficiency across the sector, with consequent financial penalties and economic disbenefits.

Although in many countries decision makers understand the need to provide sufficient and stable funding for sustainable infrastructure, budgetary processes make it difficult to guarantee sufficient funding year on year over the medium term. Some countries have moved to medium-term expenditure frameworks, guaranteeing funding to defined projects and programmes, but they remain prone to the needs of budgetary finance as the economy responds to uncertain events.

It is therefore the responsibility of road authority managers to put forward the case to the political leadership for increased allocation of resources for roads and to highlight the impact of planned budget allocations on network performance. The wider objective should be to demonstrate the importance of roads in underpinning economic development or the consequences of underfinancing, and thereby present the case for appropriate levels of resource allocation from public funds.

It takes several years for transport infrastructure to deteriorate to a level that would generate public pressure for more financing, yet it costs three to four times more to rehabilitate transport infrastructure than if timely maintenance had been adequately financed. This is quite a challenge for road network managers who must improve their dialogue with politicians.

Nevertheless, such dialogue has led several countries to establish specific road user charging systems to generate more funds for roads. These charges usually include not only taxes (fuel excise, vehicle registrations tax) but also distance-based tolls, vignettes (time-related charging) or a combination of both. Another development has been the establishment of statutory road funds with the objective of sequestering funds

for the road sector, protected from other uses and available year by year based on a defined source and application of the protected, or earmarked, funds.

## 4.2. Sources and instruments for road infrastructure financing

According to the report of the UNECE Working Party on Transport Trends and Economics (WP.5)<sup>30</sup>, resources available for road infrastructure financing may be categorized into primary or secondary sources.

At the most basic level there are only two primary sources of revenue for transport infrastructure – taxpayers and users. Funds from these sources may be obtained through general taxation, tolls, vehicle registration fees, driver's license fees, special truck license fees and a host of miscellaneous taxes and fees. These can, however, be politically unpopular, making it difficult to derive additional funding from these mechanisms to compensate for increased needs for transport network development.

Within the group of secondary financial resources WP.5 sees:

1. Ancillary services (renting space to service providers alongside the road network)
2. Third party contributions (landowners or commercial firms who contribute to obtain new interchanges)
3. The sale of adjacent land

In its report on infrastructure operation and maintenance, the World Economic Forum recognizes traditional funding – coming from tax revenues – as unstable, thus they propose considering more diversified funding sources. As a particular problem with traditional public budget funding, WEF mentioned vulnerability to political expediency – when politicians need to make overall budget cuts, maintenance funding suffers. Moreover, politicians have little incentive to make provisions for maintenance given the low profile of such projects relative to new construction.

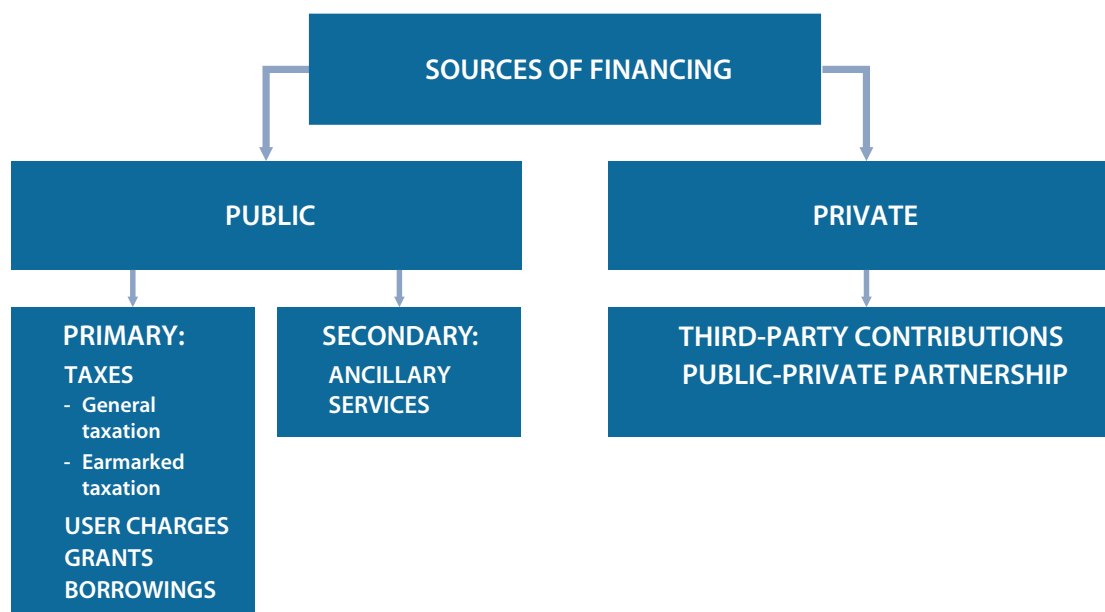
To ensure sufficient and stable funding both for maintenance and network enlargement, governments can earmark a proportion of user taxes, apply user charges or capture ancillary business opportunities.

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<sup>30</sup> Konstantinos Alexopoulos and Lukasz Wyrowski, *Innovative ways for financing transport infrastructure*, (New York and Geneva, United Nations Economic Commission, 2017).



Figure 27  
Generic groups of sources of funding



Source: *ibid.*

Hence, the instruments by which financing from the various sources presented may be channelled into road infrastructure and services for customers may be summarized as follows:

1. General and earmarked taxation
2. Grants of international organizations
3. User charges or operational revenues
4. Non-user funding (generated from ancillary services and third-party contributions)
5. Capital accumulated from financial institutions (i.e., borrowings or public-private partnerships)

In parallel with increasing and varying demands on national exchequer budgets, new means of funding are required for the development of new road construction, and for the refurbishment and maintenance of the existing ones. This needs to be achieved in an equitable and transparent manner while ensuring that the objectives are sustainable and contribute to national and international goals (safety, transport efficiency, competitiveness and economic growth).

Nevertheless, not every formula suits every situation (e.g., economic cycle or maturity of the road network).

It is important to properly select which formula to use in each situation, ensuring that the legal framework allows its usage, and that this decision will be the most efficient in terms of public budget and effectiveness for investing.

The cost of road infrastructure and society's (and road users') willingness to pay for its use should be balanced. The wider benefits of the road network may need to be better emphasized by road authorities in terms of improved safety, economic development and competitiveness, savings on journey times and efficiency.

A sound understanding of possible funding mechanisms, their characteristics, and their strengths and weaknesses is therefore required.

The below tables further summarize possible funding sources and their characteristics, while the pages that follow present the most frequent strengths and weaknesses of each source.

This analysis may be used by the TEM Project member countries for consideration when discussing with relevant ministries (responsible for transport and infrastructure, or for finance and/or the economy) the possibility of improving the level of funding or financial mechanisms.

Table 9 Catalogue of road financing sources and mechanisms		
Category	Funding mechanism	Characteristics
All-purpose taxes	General taxes	Charges applied to salaries, goods and services purchase, companies' incomes etc. Sometimes earmarked to specific road funds.
Special purpose road user taxes and fines	Vehicle taxes	Payments per vehicle depending on vehicle characteristics on a one-off and on an annual basis
	Fuel taxes	Payments applied to the oil and diesel products that are consumed by the vehicle
	Green taxes	The charge depends on the distance driven and/or the pollutant emissions features of the vehicle
	Fines	Charges from law violations
Road user charges	Distance based	Payments are applied strictly to the distance travelled
	Time based	Payments based on the amount of time that the infrastructure is available
	Road pricing	Charges applied to users within a certain area (e.g., for demand management)
	International transit fees	Transit charges taking into account distance, quantity of goods
Development cost charges	Commercial areas access contribution	Payments required for new commercial areas where the infrastructure has been developed
	Urban development contribution	Payments required from municipalities where the infrastructure has been developed
Grants		Non-repayable funds disbursed by one party
Private financing	PPP	Obtaining financing by private organizations from commercial financing institutions to be invested in public infrastructure
	Donations	Individuals or organizations who help to maintain roads

Source: Task Group S4 Optimizing the financial resources available for roads, Funding formulas for roads: inventory and assessment, (Brussels, CEDR Secretariat General, 2017).

Table 10 Strengths and weaknesses of general taxes	
Strengths	Weaknesses
High level of funds provides great possibilities for investing policies	Usually, these taxes are not exclusively aimed at funding roads
Sources of income come from various ways, so economic cycle impact may be reduced	Influenced by economic cycles, so in crisis or recession periods revenues fall
	Using general taxes for road investment avoids their usage for social expenditure or social investments, such as healthcare or education, which may be not appreciated by citizens

Source: *ibid.*

<b>Table 11 Strengths and weaknesses of vehicle taxes</b>	
<b>Strengths</b>	<b>Weaknesses</b>
Wealthier households tend to own more valuable vehicles and so contribute more in registration fees	Usually imposed as a one-off charge or fixed annual fee, so vehicle taxes are not directly related to use
Vehicle registration provides a means of identifying, confirming ownership, ensuring that insurance has been paid and enforcing traffic and roadworthiness regulations	Tax payments can be avoided by users if neighbouring countries haven't charged the appropriate vehicle registration fees
Applies to every vehicle that uses the country's roads	The sale and registration of new vehicles is related to economic activity and spending power
Offers possibilities for ecological regulation	Usually, these taxes are not exclusively aimed at funding roads, so users perceive that their taxes are being used for funding several administration needs
	Influenced by economic cycles, so in crisis or recession periods revenues fall in line with reduced vehicle sales

Source: *ibid.*

<b>Table 12 Strengths and weaknesses of fuel taxes</b>	
<b>Strengths</b>	<b>Weaknesses</b>
Costs of collection and enforcement are low because taxes are collected directly from fuel distributors	If implemented in a single state or province consumers can avoid the charge by purchasing fuel across borders
Non-road users can be exempted	Road costs are not directly determined by fuel usage or type
Instrument for environmental regulation	Imposes a larger relative burden on low-income than on high-income households
Easier to prevent fraud	Rural households at all income levels spend more on fuel than comparable urban households as rural journeys are longer and more frequent, and rural vehicles tend to be less fuel efficient
	Electric cars and new vehicles are more efficient in fuel consumption, hence they contribute less to fuel taxes

Source: *ibid.*

<b>Table 13 Strengths and weaknesses of green taxes</b>	
<b>Strengths</b>	<b>Weaknesses</b>
Encourages drivers to reduce emissions by driving less or using a lower emission vehicle	Road costs are not directly determined by emissions
Fairer than a fixed pollution charge	Implementation costs
Lower-income households usually own older and relatively high polluting vehicles	Difficult to implement for foreign vehicles
Drivers are encouraged to drive less; therefore, congestion can be reduced as well as fuel consumption and pollution	

Source: *ibid.*

<b>Table 14 Strengths and weaknesses of distance-based charges</b>	
<b>Strengths</b>	<b>Weaknesses</b>
Road user costs are directly determined by distance driven	High-mileage drivers could avoid this charge by registering their fleets outside a particular jurisdiction (if possible)
Fraud rates are low	Governments pay the capital costs for collecting the vehicle data
Drivers are encouraged to drive less or to change to other modes (including public transport), hence congestion can be reduced as well as fuel consumption and pollution	Older vehicles have to be equipped or retrofitted with the equipment used to measure distance travelled and communicate the data
	Operational costs are higher than the costs associated with current fuel taxes, and they have high start-up costs as well
	Difficult to implement/enforce in foreign vehicles

Source: *ibid.*

<b>Table 15 Strengths and weaknesses of weight-based charges</b>	
<b>Strengths</b>	<b>Weaknesses</b>
Charge related to road costs and imposed on vehicles depending on how they damage the road pavement	Negative impact on freight transport
Encourages the use of vehicles with axle configurations which do less damage to the road	Increased transport costs for all goods
Congestion could be reduced as well as fuel consumption	Implementation costs

Source: *ibid.*

<b>Table 16 Strengths and weaknesses of time-based charges</b>	
<b>Strengths</b>	<b>Weaknesses</b>
Short implementation time	Unfair for users who drive less
High flexibility possibilities	Revenues do not represent the usage of the road in terms of distance travelled
	Fraud can arise
	Enforcement costs

Source: *ibid.*

<b>Table 17 Strengths and weaknesses of commercial areas access contribution</b>	
<b>Strengths</b>	<b>Weaknesses</b>
Places the burden of costs on buyers of new business tenancies	Insufficient to cover construction costs
Allows the municipalities to optimize their road investments	Insufficient to cover maintenance costs
The infrastructure is built upon the demand	Constitutes a burden for the development of isolated rural areas

Source: *ibid.*

<b>Table 18 Strengths and weaknesses of urban development contribution</b>	
<b>Strengths</b>	<b>Weaknesses</b>
Places the burden of costs on local authorities and new home tenants	Insufficient to cover construction costs
Major public infrastructure development bodies are able to optimize road investment planning	Insufficient to cover maintenance costs
	Constitutes a burden for the development of isolated rural areas

Source: *ibid.*

<b>Table 19 Strengths and weaknesses of PPP</b>	
<b>Strengths</b>	<b>Weaknesses</b>
The government makes no payment or less payment in terms of subsidies and may spend the budget in other sectors	Traffic risks involved, underestimation of traffic volumes in the design of the project can cause financial default
Through a band-incomes design, minimum revenues can be guaranteed to the private partner and in the event of surpassing a certain income level, a percentage can be shared with the grantor	Negative consumer reaction to pay-per-use concept
Applies to every vehicle using the country's roads	Political controversy makes it difficult to implement

Source: *ibid.*

### 4.3. Organization of road financing mechanisms

The final decision about which of the financing sources, instruments and mechanisms should be used given the particular circumstances of an individual state requires internal analysis and selection by its own authorities. This decision should aim to minimize the risk of instability and unsustainability of revenues for road infrastructure purposes. Irrespectively, there should be a guarantee that the obtained funds will be spent on the needs of roads.

According to the World Bank and World Economic Forum<sup>31</sup>, one of the best approaches to sustainable road funding is to set up a dedicated road fund that receives funds related to road use and for the disbursement of the money to the road authorities. Such road funds, in various forms, have been established in many countries to provide a transparent arrangement for managing road revenues and allocating funds for road maintenance.

The term road fund can apply to an arrangement ranging from a trust account set up within the accounts of the government by administrative order, to an entity separate from the government established by legislation. One of the earliest examples of a road fund was in the United Kingdom, where a road fund was created by the Roads Act 1920 and Finance Act 1920 to pay for the building and maintenance of the road network. Its income originally came from vehicle excise duty, until that ceased to be dedicated for roads use in 1936, and then from government grants. It was wound up in an act of parliament in 1955, and since then roads have been funded from the general budget – although more recently funding has been guaranteed to provide for a strategic road programme.

The early road funds, now characterized as first-generation or 1G funds, operated based on earmarking or pledging of certain taxes and duties, generally those related to road usage. The proceeds of those taxes and duties were placed in a separately identified area of the state budget from where they were allocated to defined purposes, which included road building and improvement, but more generally road maintenance.

The drawbacks of those first-generation funds include the fact that they are generally awarded for the budgetary year, with little or no certainty that the amount will be sustained in future years. The amount raised depends on the rates of taxes and duties, and on their continued existence – which is not guaranteed as finance ministers adjust for various reasons throughout the process of macroeconomic management.

A dedicated fund can create a more stable funding base for O&M, but it is no panacea and does not guarantee the efficient use of the acquired funds. Many first-generation road funds in the 1960s and 1970s in Africa, Asia and Latin America were characterized by insufficient revenues and poor governance, resulting in poor allocation of funds and low operational efficiency.

The 1980s saw a new generation of road funds emerge which became known as second-generation or 2G funds. The differentiating principle of these 2G funds was that they were expected to operate on a commercial or user-pays basis.

Typically, their revenues are in the form of user charges that are identified separately from taxation. The most productive revenues are typically related to fuel consumption, whilst other revenues may come from road tolls, distance and weight charges, overloading fines, vehicle registration fees, etc.

These revenues are deposited into a fund managed by an independent fund management board that is responsible for determining the level of charges and the allocation of funds. To ensure that stakeholder interests are recognized, board members include representatives of the road users and the business community.

The interests of the state in the stewardship of public funds are represented by the responsible minister (normally the Minister of Finance) having step-in rights in the event of maladministration and the right to appoint a director to the board of the fund. Road funds, particularly the second-generation type, have gained support, recognizing the need for a more commercial approach to road funding and realization that significant efficiency gains can be achieved by ensuring certainty and sustainability in the level and timing of funding. In some cases, the majority of the board members are from the private sector; for example, 12 of the 27 road fund boards in Sub-Saharan Africa are constituted on these lines. In New Zealand, all board members are from the private sector (see text box on the next page).

The decision to introduce a more independent road fund must be based on a practical and systematic assessment that, among other things, takes account of the context and ability to minimize inherent distortions in the allocation of resources.

The World Bank proposed the list of questions set out in the table below<sup>32</sup>, which facilitate self-assessment by road organizations of a country's readiness to accept such a solution and the need for reforms or improvements to enable implementation.

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<sup>31</sup> Ibid., Cesar Queiroz and Henry Kerali (2010) and *ibid.*, World Economic Forum (2014).

<sup>32</sup> In the World Bank's Road Financing and Road Fund Knowledge Base.

### New Zealand case study

In New Zealand, the national road fund was created in 1953, but the arrangements have been restructured a number of times. The current fund is called the National Land Transport Fund (NLTF), which receives dedicated revenues from excise duties on motor vehicle fuel, charges on diesel-powered and heavy vehicles (road user charges), and vehicle registration and licensing fees. These revenues are paid into the central government treasury and credited to the NLTF. From 2009 to 2011, the central government also contributed from general revenues approximately 5 per cent of the total NLTF.

The NLTF is managed by the New Zealand Transport Agency (NZTA), a statutory entity with a board that makes independent decisions on allocating and investing funds from the NLTF in accordance with government policy. The NZTA also administers road user charges and vehicle registration and licensing, and monitors the road system and implementation of activities funded from the NLTF.

According to the most recent NLTF annual report, the National Land Transport Fund is a fully dedicated transport fund made up of fuel excise duty, road user charges, a portion of the annual vehicle licensing fee and income from the sale and lease of state highway property. This means that all the revenue collected from transport users is dedicated to investment in land transport. The NZTA Board has independent statutory responsibilities for the allocation and investment of the National Land Transport Fund, which occurs through the National Land Transport Program.

The National Land Transport Program is a three-year planning and investment partnership between the NZTA, local authorities, the New Zealand Police and transport sector stakeholders. It sets out the program of transport activities that the Transport Agency intends to fund in order to give effect to the Government Policy Statement on Land Transport.

The National Land Transport Program co-invests funds from the National Land Transport Fund and local and state budgets, and embraces all land transport activities that may be considered for investment during the three-year program under activity classes for public transport, road policing, road safety promotion, walking and cycling, and state highway and local road construction and maintenance.

The Government sets the strategic direction for the investment of the National Land Transport Fund through the Government Policy Statement on Land Transport and determines the funding range allocations to each activity class, thereby shaping the investment across transport modes and the transport system.

When developing the National Land Transport Program, the NZTA uses an investment assessment framework to ensure it gives effect to the Government Policy Statement and to determine which activities will receive funding within the overall funding ranges. The Investment Assessment Framework is a prioritization tool that helps to optimize the mix of investments that represent the best value for money and contribute to the Government's priorities.

**Table 20**  
**List of questions for maturity self-assessment regarding establishment of independent road fund**

Area	Question
What will the road fund finance?	<ul style="list-style-type: none"> <li>(i) Will it finance national roads and also make some contribution to local government roads?</li> <li>(ii) Will the contributions to local governments be made on a cost-share basis?</li> <li>(iii) Will it finance maintenance only (including road safety and administration of the road fund), or will it also finance minor improvements and new works and will the latter sums be subject to a cap?</li> <li>(iv) Will it have powers to borrow for investment and, if so, will there be a cap on such borrowing?</li> <li>(v) Will it be permitted to invest surplus funds and, if so, in what type of monetary instruments?</li> </ul>
Where will the revenues come from?	<ul style="list-style-type: none"> <li>(i) Will the main source of revenues be a levy added to the price of gasoline and diesel fuel (making sure that the road fund does NOT abstract revenues away from any other sectors)?</li> <li>(ii) How will non-road users be exempted from paying the diesel levy (particularly important for farmers)?</li> <li>(iii) What other revenues will be paid into the road fund (e.g., vehicle license fees, a supplementary heavy vehicle surcharge, tolls, grants from the Treasury, etc.)?</li> <li>(iv) How will the level of these charges be set?</li> <li>(v) How will the revenues be collected and deposited into the road fund to minimize delays and leakage?</li> <li>(vi) Will the road fund be an account at the Central Bank, or will the funds be deposited into one or more commercial bank accounts?</li> </ul>
How will the road fund be set up?	<ul style="list-style-type: none"> <li>(i) What sort of legal instruments will be used to set up the road fund (e.g., a budget law, decree, parliamentary resolution, or basic legislation)?</li> <li>(ii) Which ministry will be designated as the parent ministry?</li> <li>(iii) Will the minister, and any board of directors, publish the financial rules and regulations governing the way the road fund will be managed?</li> </ul>
How will you ensure good governance?	<ul style="list-style-type: none"> <li>(i) Will there be a board of directors (i.e., an oversight board) to supervise management of the road fund?</li> <li>(ii) Will it be an advisory board, or will it manage the road fund in a non-executive capacity (i.e., be a board made up of part-time board members)?</li> <li>(iii) How many persons will be appointed to sit on the oversight board?</li> <li>(iv) Which organizations will they represent (e.g., concerned central government ministries, representatives of local government, chamber of commerce, road transport associations, farming interests, etc.)?</li> <li>(v) How will board members be nominated and how will the chairman be selected?</li> <li>(vi) How will the road fund be audited and who will appoint the auditors?</li> <li>(vii) Will the audit report be tabled before parliament and published?</li> </ul>

Table 20 (con't)	
List of questions for maturity self-assessment regarding establishment of independent road fund	
Area	Question
Who will manage the road fund?	(i) Will the oversight board delegate day-to-day management of the road fund to a secretariat? (ii) Will the secretariat be independent, or will it be made up of staff from the national road agency, or equivalent? (iii) Will the head of the secretariat be appointed by the oversight board? (iv) Will the head of the secretariat appoint all other staff, subject to confirmation by the board? (v) Will the secretariat publish guidelines for dividing funds between the different road agencies, cost-share arrangements applicable to local government road agencies, and procedures for disbursing funds to all road agencies? (vi) Will there be a cap on staffing numbers (e.g., by restricting administrative expenses of specified percent of road fund revenues)?
Miscellaneous questions	(i) Will the minister be entitled to give instructions to the board and, if so, must they be in writing and will any restrictions apply? (ii) Will any special penalties apply for misappropriation of funds? (iii) Will the road fund play any role in controlling overloading? (iv) Will the road fund be required to promote contracting out and/or better procurement practices?

Source: Original text from the World Bank's Road Financing and Road Funds Knowledge Base. Available at [www.worldbank.org/transport](http://www.worldbank.org/transport).

#### 4.4. Public-private partnership as an alternative funding source and financing mechanism

According to the World Bank<sup>33</sup> there is no widely-agreed, single definition or model of a public-private partnership, though all PPP models have some common characteristics. The term public-private partnership has been used since the 1990s as a form of private sector participation (PSP) in infrastructure financing. All definitions, however, are based on the common principle that PPP is a procurement process to provide services or deliver assets through joint public and private cooperation. There are several forms of PPP, such as concessions, build-operate-transfer and leases, which are adopted based on the type of project and public sector objectives.

PPP is based on the recognition that the private sector can contribute to reducing the overall cost of delivering infrastructure services through increased efficiency and better management of some risks (such as construction). In successful PPP projects, the private sector's higher cost of financing and need for a return on its investment are offset by the benefits provided by the private participation.

There is no single recipe for the successful implementation of a PPP programme. However, the United Kingdom, the European country with the most developed PPP market, has no specific PPP law and relies on its commercial laws for the implementation of PPP projects, which is important or even essential to establish appropriate PPP framework laws and institutions.

##### 4.4.1. Constraints of private sector involvement

When a government is considering whether to launch a PPP project, several constraints should be considered. The World Bank Infrastructure and Law website provides a good

description of such constraints, which can be summarized as follows:

- a) The private sector will do what it is paid to do and no more than that – therefore incentives and performance requirements should be included in the contract.
- b) There is a cost attached to debt – while the private sector can make it easier to get financing, financing will only be available where the operating cashflows of the concessionaire are expected to provide an acceptable return on investment, that is, the cost has to be borne either by the users or the government (through, for example, subsidies, shadow tolls, annuities).
- c) Bidding and ongoing costs in PPP projects are likely to be greater than for traditional government procurement processes – the government should therefore determine whether the greater costs involved are justified.
- d) There is no unlimited risk bearing – private firms will be cautious about accepting major risks beyond their control, such as exchange rate risks or risk of existing assets. If they bear these risks, then their price for the service will reflect this. Private firms will also want to know that the rules of the game are to be respected by a government as regards undertakings to increase tariffs and fair regulation. The private sector will also expect a significant level of control over operations if it is to accept significant risks.
- e) Government responsibility continues – citizens will continue to hold government accountable for the quality of the facility and services provided. The government will also need to retain sufficient expertise, whether itself or via a regulatory body, to be able to monitor performance of the private sector and enforce its obligations.
- f) A clear legal and regulatory framework is crucial to achieving a sustainable PPP programme.

<sup>33</sup> Ibid., Cesar Queiroz and Henry Kerali (2010).

### 4.4.2. Sound preparation for PPP

It is important to carry out robust, wide-ranging preparatory work to decide on the type of contract and its requirements, contract structure, institutional and legal framework, and design project selection, procurement and contract management processes.

### Contract types

There are many alternative combinations of road project types, private sector responsibilities and private sector payment mechanisms possible within PPP contracts. Consequently, it is rare for any two PPP contracts to be identical even where they are part of an established PPP programme. Each project has unique characteristics that need to be reflected.

**Figure 28**  
Responsibility matrix for traditional and PPP contracts

Category	Work & service contract (traditional procurement)		Public–Private Partnership				Privatization
Type	Design, Build	Design & Build	Management contracts	Performance-Based Contracts (PBC)	Lease, Affermage (Brownfield)	BOT, DBFO, BOO (Greenfield)	
Design	Private by fee contract					Private by concession contract	Private
Build							
O&M	Public	Public	Private by fee contract	Private by fee contract	Private by concession contract		
Finance	Public	Public	Public	Public			
Own	Public	Public	Public	Public	Public	Public (BOT/DBFO) or Private (BOO)	
Private sector revenue options					Tolls		
					Availability payments		
					Government guarantees		
					Other support (e.g., insurance)		

Source: World Bank Group, “PPIAF Toolkit for Public–Private Partnerships in Roads and Highways” (January 2009). Available at <https://ppiaf.org/sites/ppiaf.org/files/documents/toolkits/highwaystoolkit/index.html>

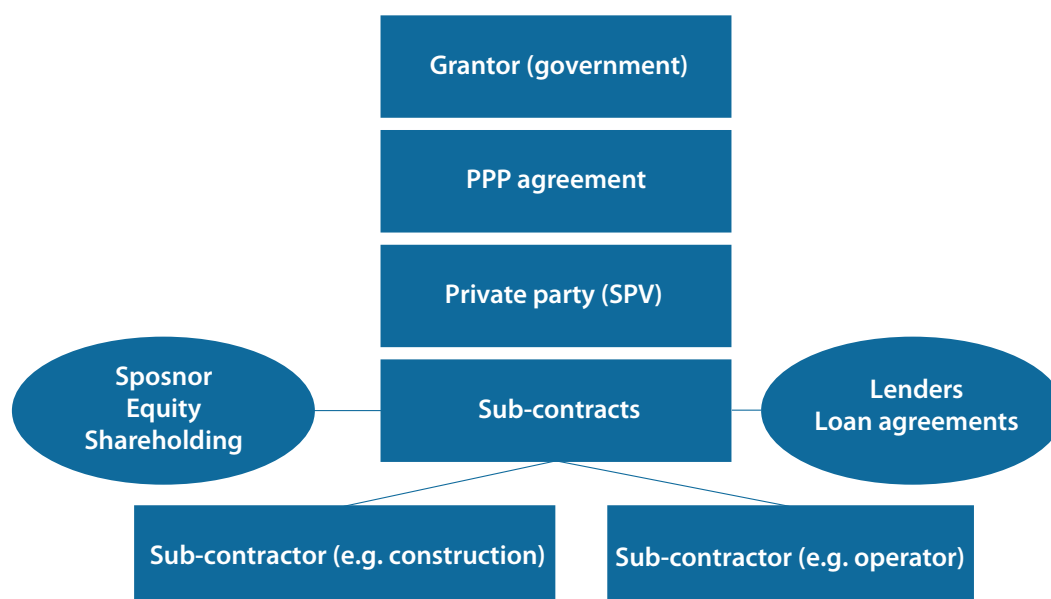
### Contractual structure

The key parties in the PPP contractual and financial structure are:

- a) Grantor – the public sector promoter of the concession project. This is typically a government entity, which may be the regional or national highway authority, or a centralized PPP unit mandated to administer the PPP procurement process and manage the concession when operational.
- b) Sponsor – a private sector consortium established to bid for the PPP concession. For new-build toll road concessions, the sponsor is typically a consortium led by one or more large construction companies, often including local partners. The sponsor may often include a toll road operating company and possibly investors (although the term sponsor is also sometimes used for the public sector promoter of a project; it refers here to private sector consortia).



Figure 29  
Legal and financial structure of PPP agreement



Source: Peter Farlam, *Working Together: Assessing Public–Private Partnerships in Africa*, (South African Institute of International Affairs, 2005).

- c) Preferred Bidder – the bidder who has been awarded the concession by the grantor, subject to the satisfactory completion of negotiations between the preferred bidder and the grantor.
- d) Concessionaire – prior to concluding negotiations, the sponsor, who has been awarded the concession by the grantor (preferred bidder), will be incorporated into a special purpose vehicle (SPV) which will be the concessionaire.
- e) Lenders – financing will typically be provided by a mix of debt (loans) and equity (funds provided by members of the consortium). Lenders are the providers of the debt element of the financing and may include commercial banks, international financial institutions, financial institutions (e.g., pension and insurance funds) and export credit agencies.

It is generally accepted that a central PPP unit is required, as a minimum, to deliver the project for the public sector. Countries differ in where the PPP unit reports to and whether PPP cells are also established within the MDA to provide a link with the central PPP unit.

Key functions of a PPP unit are to:

- a) Establish a PPP policy
- b) Promote a PPP within government
- c) Provide channels for investors
- d) Help the MDA to implement a PPP
- e) Analyse individual projects
- f) Prepare projects for procurement
- g) Coordinate MDA actions
- h) Engage government advisors
- i) Manage the procurement process
- j) Manage and monitor contracts

This structure may be conceptualized as given in Figure 29.

### **Institutional and legal framework**

PPP projects are relatively complex, requiring a range of expertise and experience that is not normally available within the public sector. Private sector participants augment their own staff capabilities by employing advisors in key transaction disciplines, such as legal, financial, taxation, environmental, technical and traffic. The minister, department or agency (MDA) often have strong expertise in technical matters but may lack skills in other areas.

A legislative framework for PPP procurement is a major advantage. Without it, each PPP project will only be based upon the concession agreement and it will be difficult to have a truly competitive bidding process. In some instances, the legislative framework has been developed in parallel with a specific PPP procurement. However, this is inefficient, creating uncertainty and extending the procurement process.

Based on international best practice, including the UNECE “Standard on PPP in Roads”<sup>34</sup>, the list of typical content of a legislative framework should envisage:

- a) Division of responsibilities between levels of government and powers of government bodies
- b) Sectors covered, details of project identification, approval, procurement and implementation arrangements
- c) Types of permitted PPP models and general conditions for these models
- d) Guidelines on risk sharing arrangements
- e) Provision of financial and other incentives by the government
- f) Provisions concerning contract management including dispute resolution
- g) The extent to which lenders can undertake security over project assets and their liabilities
- h) The administrative process involved in PPP project development and implementation
- i) Rights of the parties to a PPP contract agreement

Private sector legal requirements of a legal framework are as follows:

- a) Provide the legal coverage to enter into an enforceable contract
- b) Provide the private sector the necessary legal coverage to finance, build, operate and collect revenues or service payments
- c) Clarify regulatory control, obligations of parties, services, land acquisition, risk and profit sharing, pricing, and handover of facilities
- d) Define contract management procedures (monitoring, dispute settlement mechanisms)

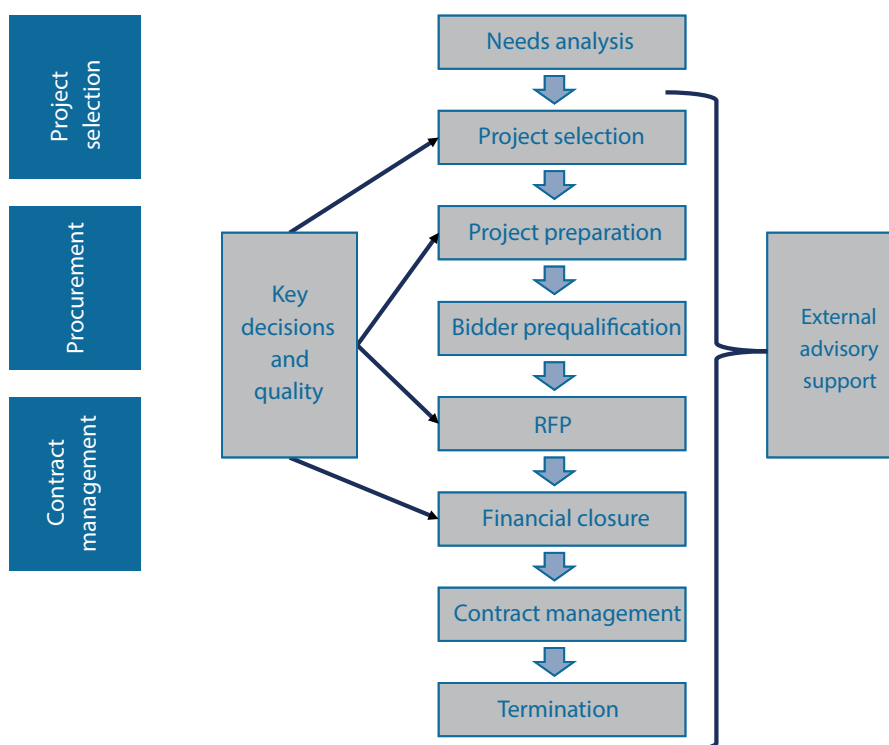
The PPP process consists of three main groups of activities as presented in Figure 30 below:

- a) Project selection
- b) Procurement
- c) Contract management

### 4.4.3. Risk management

One of the major issues within PPP contracts is risk management. Risks should be identified for each stage of a project and responsibility should be allocated for the identified risks.

Figure 30  
The PPP process



Source: Edward Farquharson and others, *How to engage with the Private Sector in Public–Private Partnerships in Emerging Markets* (Washington, D.C., World Bank, 2011).

<sup>34</sup> Available at [https://www.unece.org/fileadmin/DAM/ceci/ppp/Standards/ECE\\_CECI\\_WP\\_PPP\\_2018\\_08-en.pdf](https://www.unece.org/fileadmin/DAM/ceci/ppp/Standards/ECE_CECI_WP_PPP_2018_08-en.pdf)

As public–private partnerships are legally long-term contractual agreements, responsibilities should be clearly defined as they will determine the costs that the public and private partners will ultimately pay. For example, construction risk is usually transferred to the private sector, which means that it will be responsible (and won't be able to claim additional compensation) for delays and cost-overruns in completing the works. The best approach is not to try to transfer all risks to the private sector, as this would result in less interest (or no interest) by the private sector or a much higher cost to the public sector. As a result, risk allocation is an important component in the assessment of any PPP project.

A good practice in preparing risk matrices is to adopt the following structure for each stage of the project:

- a) Description of the risk
- b) Proposed allocation of the risk (usually two columns – Grantor and Concessionaire – and one of them gets checked for a particular risk)
- c) Comments

The general rule is that risks need to be allocated to the party that is best capable of managing them. This means that the government would need to accept some risks that it can manage better or because the costs of the private sector assuming such risks would be too high.

The private sector will price the risk of the project based on how individual risks are allocated, their likelihood of occurrence and their impact. If the private sector is transferred a risk that it cannot control (for example, inflation being higher than forecast), it will either plan a very conservative scenario (such as assuming a very high inflation rate) or simply not accept the risk (and therefore not make any proposal). The risk allocation exercise requires a solid understanding of market and project finance principles to allocate risk in a way that balances the public and private sector concerns and interests.

The preparation of a risk matrix would help the government to decide which risk should be allocated to which party. A risk framework is a useful tool that provides the basis for discussions on potential structuring of the transaction and relevant policy choices, and allows the government team preparing the project to discuss with the decision makers the proposed risk allocation and obtain approvals for moving ahead with the transaction. The risk matrix should be prepared with a legal perspective in mind because it should provide the basis for drafting the PPP legal agreement or concession agreement.

Potential bidders will carefully examine the risks and proposed risk allocation, and will prepare their bids based on their perceived risks and how comfortable they are with accepting them. In view of the volatility of the market

resulting from the current global economic crisis and the limited experience with PPP in some countries, it is likely that investors will be uncomfortable with assuming many of the risks that are usually borne by the private sector in established economies with a good track record of PPP projects.

The risk allocation matrix should be updated and refined as project preparation evolves. It is usually prepared with the support of transaction experts and in consultation with potential bidders. Ultimately the risk allocation will determine if a PPP project is financeable (that is, lenders will not finance it if they believe the risk allocation is not appropriate), so the public sector should remain flexible when designing such a matrix.

Countries with limited PPP experience may be a risky environment for private investment, and the use of risk mitigation instruments can help reduce the risk perception and facilitate private sector investment.

Several risk mitigation instruments can be used to facilitate the mobilization of private capital to finance PPP projects, particularly in those infrastructure sectors in which financing requirements substantially exceed budgetary or internal resources. Risk mitigation instruments are financial instruments that transfer certain defined risks from project financiers (lenders and equity investors) to creditworthy third parties (guarantors and insurers) that have a better capacity to accept such risks. These instruments are especially useful when the public partner is not sufficiently creditworthy or does not have a proven track record in the eyes of private financiers to be able to attract private investments without support. The advantages of such instruments are multifaceted:

- a) The public sector can mobilize domestic and international private capital for infrastructure implementation, supplementing limited public resources.
- b) Private sector lenders and investors will finance commercially viable projects when risk mitigation instruments cover those risks that they perceive as excessive or beyond their control and are not willing to accept.
- c) Governments can share the risk of infrastructure development using limited fiscal resources more efficiently by attracting private investors rather than having to finance the projects themselves, assuming the entire development, construction and operating risk.
- d) Risk mitigation instruments facilitate the flow of local and international private capital, support the creation of commercial and sustainable financing mechanisms for infrastructure development, and promote the provision thereof.

Commonly used risk mitigation instruments include guarantees and insurance products. Guarantees typically refer to financial guarantees of debt that cover the timely payment of debt service. Procedures to call on these guarantees in the event of a debt service default are usually relatively straightforward. In contrast, insurance typically requires a specified period during which claims filed by the insured are to be evaluated before payment by the insurer. Examples of risk mitigation instruments available include:

- a) Credit guarantees – these cover losses in the event of a debt service default regardless of the cause of default (that is, both political and commercial risks are covered with no differentiation of the source of risks that caused the default).
- b) Political risk guarantees or insurance – these cover losses caused by specified political risk events. They are typically termed partial risk guarantees (PRG), which may also be termed as political risk guarantees or political risk insurance (PRI) depending on the provider.

Partial risk guarantees cover commercial lenders in PPP infrastructure projects. They typically cover the full amount of debt. Payment is made only if the debt default is caused by risks specified under the guarantee. Such risks are political in nature and are defined on a case-by-case basis. A PRG is offered by multilateral development banks (such as the World Bank) and some bilateral agencies.

#### 4.5. Benchmarking analysis of TEM member countries

In TEM Project member countries one can observe the full range of possible funding sources used for both road network development and maintenance.

All six TEM member countries that shared their data for this report use taxes for the purposes of network management. The vast majority, however, supplement these sources with dedicated road user charges, grants and loans, and private funding through PPP projects.

It is worth noting the relatively low level of PPP projects in the TEM region in comparison with the predominance of public funding, especially general taxes, grants and user charges.

This shows that public funding is more attractive in the longer perspective for the road authorities and governments as it allows for a higher level of flexibility in annual and multiannual cash flows from public sources.

A majority of the TEM member countries that took part in this analysis possess or earmarked state budget lines for road network purposes or for separate road funds.

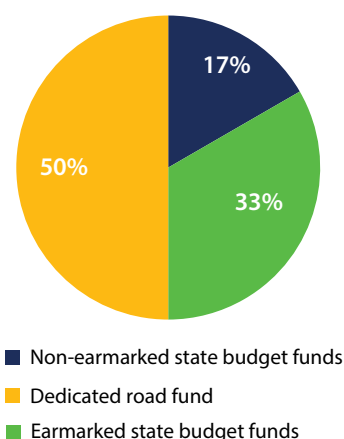
The latter financing mechanism makes it possible to generate additional funds in the capital markets similarly to how private contractors do so for PPP projects. Usually, the required additional funding obtained through public road funds is cheaper than the same amount obtained by the private partners, which has led to the growing popularity of such organizational arrangements.

Obtaining additional funds on capital markets can be achieved not only through road funds but through other instruments – for instance bond issues by the Ministry of Finance which provide money for the state budget with an earmarked line.

It is worth mentioning, however, that separate road funds – like in the Czech Republic – also play a substantial role in challenging road authorities to prove their maturity through appropriate asset management practice and evidence for cost-effective and cost-efficient road management.

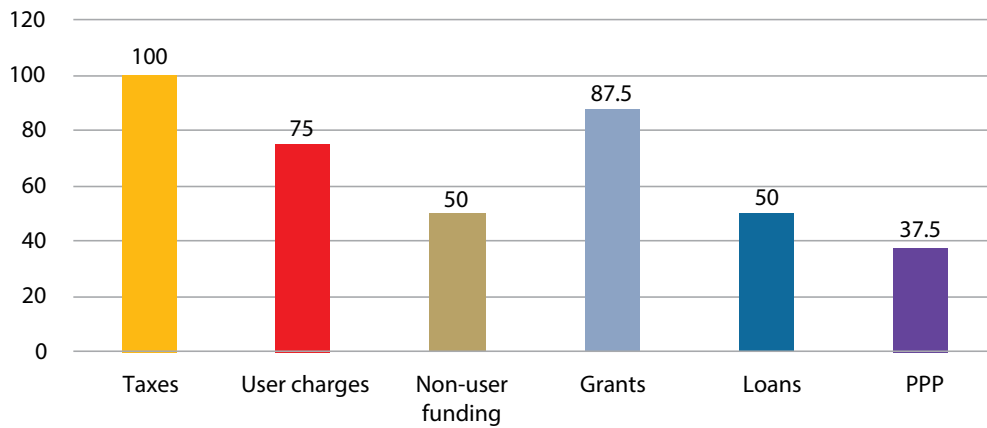
Although there are some differences with respect to funding sources or financing mechanisms, one can observe a common approach in a majority of TEM member countries in terms of trade-offs between capital and operational expenditures. The road networks in all TEM member countries still require a substantial level of new investment, which is reflected in the split of expenditures between capital expenditures (CapEx) and operating expenditures (OpEx). From the group of countries that shared their data for this study, Croatia and Bulgaria invest more in road maintenance than in road development (as of 2018).

Figure 31  
Percentage of TEM member countries using different financing mechanisms



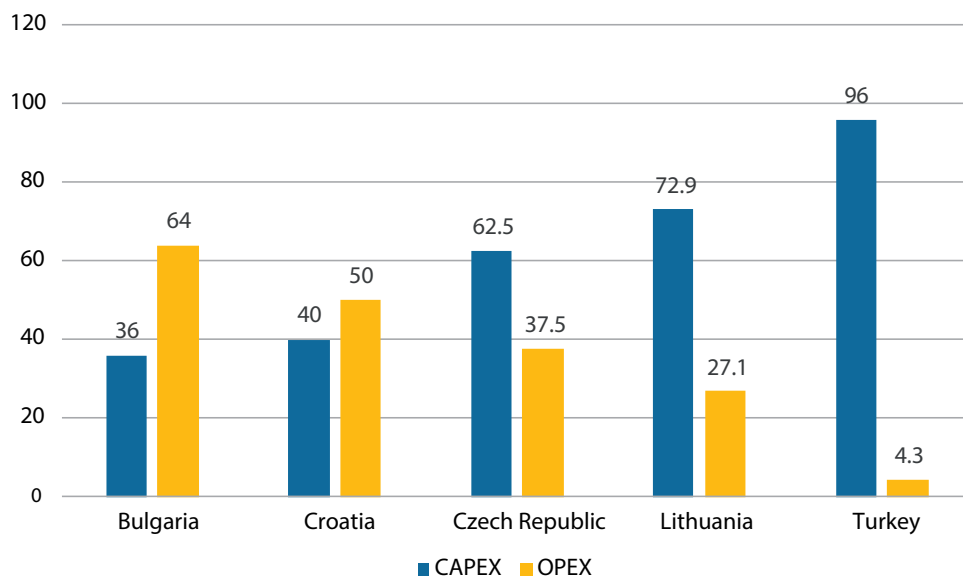
Source: *ibid.*

**Figure 32**  
Percentage of funding sources used in TEM member countries



Source: *ibid.*, UNECE TEM Project (2018).

**Figure 33**  
Percentage of expenditures for CapEx and OpEx



Source: *ibid.*





## Section 5: Conclusions

Public sector organizations are being increasingly subjected to both legislative and competitive pressures forcing them to reconsider their relationships with users and customers in order to develop a more overt customer orientation (as the primary driver of organizational performance). The creation of value supports the development of a customer orientation and is a requirement to which increasingly more public sector organizations are adapting. This applies to all sectors of the economy, including the road sector.

In modern society, road infrastructure has become an essential part of daily life. Individual road users, logistics companies and public transportation agencies expect reliable and safe road infrastructure to carry out their transportation or wider mobility operations, moving goods and people.

Road authorities need to properly plan, build, maintain and operate road infrastructure to create the required value for their customers, as presented in Section 1 of this report.

**Figure 34**  
**Public service delivery framework**



Source: *ibid.*

To achieve this aim, road sector organizations should adapt a responsive and accountable approach to governance practices that can be enabled by three main processes:

1. Governance of the road sector
2. Asset management system and its processes
3. Funding strategies and PPP

In terms of governance within TEM member countries, a few differences may be observed:

1. Some countries have more than one organization responsible for the TEM backbone network, although this is usually a concessionaire.
2. There are examples of countries which have only one public organization responsible for a network of

national importance and – in parallel – examples of countries which have divided responsibilities between two organizations responsible separately for motorways versus other national roads.

3. The variety of organization structures result in different legal forms of public road authorities.

Road sector organization is also different in terms of the private sector, as there are countries that do not use any state owned companies (SOE) and base their solutions only on private sector capabilities, though in more than 40 per cent of TEM member countries the SOE model still exists and provides services for road operators.

This is interrelated with the split of customer and contractor roles and responsibilities (see Figure 15).

It can be understood from the report that development scenarios for the road sector for the TEM Project region in terms of its decentralization and market development show an average rating of “Upgrading” (according to the Asian Development Bank classification) (see sub-section 2.2., Table 2).

Concerning asset management capabilities in TEM member countries, improvement is clearly visible.

1. Every country carries out multiannual planning for road investments
2. Most of the countries decided to do the same in terms of maintenance activities
3. Concurrently only some countries declared full performance assessment in terms of providing the required level of services
4. Not every country carried out a full risk management process

Therefore, based on the ADB classification, the TEM region may be classified as “Growing”<sup>35</sup>.

In terms of financing and funding of road maintenance and development, TEM member countries use a vast number of possible sources; however, there are countries that do not use the mechanism of a dedicated road fund, which in the majority of TEM Countries has been implemented and, based on international best practice, may be considered a very effective and efficient tool for management of revenues streams.

Moreover, TEM member countries have not neglected operational expenditures although it is clear that in the majority, expenses for new investments are greater or much greater than for maintenance and operations (Figure 33).

<sup>35</sup> *Ibid.*, Asian Development Bank (2015).



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## **Business models for the road sector/TEM Network: considerations and recommendations**

The Trans-European North-South Motorway (TEM) Project was initiated to facilitate road traffic in Central, Eastern and South-Eastern Europe and to assist with the process of integrating European transport infrastructure systems.

One of the objectives of the Project is to improve the road network's management. This report aims to provide TEM member countries with up-to-date information about how to organise service delivery models as well as benchmarking of existing and alternative business models to ensure the greater effectiveness and efficiency of the road sector.

The business models cover all relevant activities of road authorities from appropriate understanding of customer and stakeholder needs and expectations, to aligning the value proposition with key internal processes and resources (including outsourcing and partnerships in the supply chain). This approach also accounts for road authorities' costs of revenue and revenue sources and streams.

Benchmarking of existing business models in TEM member countries creates a sound basis for further detailed analytical work focused on road asset management, data management and Building Information Modelling, and sources and types of financing for funding road infrastructure development and maintenance (as defined in the TEM Project Strategy).

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