International Transport Forum

The Future of Passenger Mobility and Goods Transport in Estonia

Input Study for the Estonian Transport and Mobility Master Plan

Case-Specific Policy Analysis

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The International Transport Forum

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Case-Specific Policy Analysis Reports

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Foreword

Transport allows people and goods to move freely and offers broad access to services. It is a cornerstone of European integration and a major contributor to the European Union's economy, connecting people across different regions and countries. Demand for mobility has traditionally grown as economies and societies have become more integrated, bringing innovation and investment opportunities. Yet, crises like the Covid-19 pandemic reversed this trend and threaten connectivity, thus confronting citizens, businesses and authorities with unprecedented challenges. A fully recovered and resilient transport sector will play an important role in the climate transition and the digital transformation. Developing sustainable and smart mobility solutions will be a key part of the European Green Deal.

Estonia was one of the first countries to make use of the EU's Structural Reform Support Programme (SRSP). The SRSP provides tailor-made, demand-driven technical support to EU countries for the design and implementation of growth-enhancing reforms. Estonia requested SRSP support in 2018 to pursue, among other things, an ambitious range of preparations for a new National Transport and Mobility Master Plan. This report, prepared by the International Transport Forum at the OECD in cooperation with the European Commission's Directorate General for Structural Reform Support (DG REFORM), is a key input to the plan.

The most tangible parts of a transport plan relate to decisions to construct infrastructure. What road or rail project should be built to improve the mobility of citizens? What will make freight flows more seamless? Yet infrastructure investments represent only the tail end of transport policy-making, and an ambitious transport investment programme alone does not, in itself, signal reform. Investment programmes are based on a whole set of choices. These choices depend on the way policy decisions are made, how the transport sector is organised, and what incentives infrastructure managers and infrastructure users face.

This report focuses on each of these three aspects of strategic planning and policy making, and across all transport modes. It proposes substantive reforms in each area. It rests on rigorous and in-depth analysis, both qualitative and quantitative. The parameters were determined jointly with the Estonian Ministry of Economic Affairs and Communications, the country's line ministry for transport.

The report does not attempt a comprehensive description of Estonia's current transport and mobility system, notably those areas that work well. Rather, it focusses on existing issues and on ways to address them. To this end, it provides a simulation tool as a strategic model to help inform Estonia's transport policy decisions while a fully specified national transport model is being built.

The transport carbon footprint in Estonia can be substantially reduced, depending on how ambitious the country wants to be in the decades to come. The simulations for this study show that achieving this (and other major policy goals) will mean building fewer roads and motivating citizens to walk, cycle and use public transport more.

The vision for the future of freight transport is less clear. The greatest challenge will be to reposition Estonia as a bridge between the Baltic region and Southern Europe. Success hinges decisively on whether Estonia can align its interests with those of its neighbours; simply building more infrastructure will not suffice. At the same time, pursuing this shift should not lead Estonia to compromise transport decarbonisation or jeopardise the recovery of infrastructure costs from fee-paying transit traffic. The Rail

Baltica project, once completed, is planned to boost both regional connectivity and freight decarbonisation.

As the work for this report was being finalised, the Covid-19 pandemic swept the globe. This unprecedented health crisis has fundamentally disrupted the lives of citizens and the economy. The massive, but hopefully temporary, challenges created by the Coronavirus crisis became apparent too late to fully reflect them in the analysis. However, as robust data on the impact of the pandemic become available, the simulation tool provided together with this report will enable Estonia's government to update the scenarios for the country's transport future presented herein.

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Glossary

Term	Definition, description
Air connectivity	Ability and ease with which passengers and freight can reach destinations by air. This report defines air connectivity as the availability of flights offered by an airport, both directly and indirectly (through providing connecting flights to other airports).
Bonus-malus environmental scheme	Scheme including not only rebates but also higher rates for polluters (e.g. for the most polluting vessels in ports).
Cabotage	The transport of goods or passengers between two places in the same country by a transport operator from another country.
Community license	An EU licence to transport goods by road to or through EU and European Economic Area (EEA) countries.
ECMT licenses	Permits to carry out road freight transport operations to or through European Conference of Ministers of Transport (ECMT, predecessor to the International Transport Forum) member countries (bilateral and third country transport).
Euro class	Emission standard for vehicles defined by the EU
External costs of transport	External costs are costs generated by transport users and not paid by them but by the society as a whole such as congestion, air pollution, climate change, accidents and noise but also up- and down-stream processes, costs for nature and landscape or additional costs in urban areas.
High-capacity vehicles	High-capacity vehicles are freight trucks that are heavier or longer (or both) than vehicles currently permitted on the general road network.
Logistics Performance Index	The Logistics Performance Index is an interactive benchmarking tool created by the World Bank to help countries identify the challenges and opportunities they face in their performance on trade logistics and what they can do to improve their performance. The LPI is based on a worldwide survey of operators on the ground (global freight forwarders and express carriers),
Mobility Package	The European Commission's Mobility Package is a collection of three initiatives concerning the governance of commercial road transport in the European Union. It represents the biggest change to EU road transport rules, covering many aspects of the industry's activities.
Origin-destination market	An Origin-destination market for a particular airport is defined as passenger demand for travelling to (the destination “D”) and from (the origin “O”) that particular airport.
Polluter pays principle	A principle that holds polluters responsible for bearing the costs of managing pollution to prevent negative effects on human health or the environment.
Procurement register	A database that records key data with regard to procurement procedures and results (e.g. type of tendering procedure, number of bidders, estimated tender value, winning bid, etc.)
Rail Baltica	Rail Baltica is a greenfield rail transport infrastructure project with a goal to integrate the Baltic States in the European rail network. The project includes five European Union countries – Poland, Lithuania, Latvia, Estonia and, indirectly, Finland. It will connect Helsinki, Tallinn, Pärnu, Riga, Panevežys, Kaunas, Vilnius and Warsaw.

Surface access	Ground and water access to airports.
Tonnage tax	A tonnage tax calculates the amount of taxable income on the basis of the net tonnage of eligible vessels.
Train-kilometre	Train kilometre is a unit measuring the movement of a train over one kilometre (distance actually travelled).
Twenty-foot Equivalent Unit	Twenty-foot Equivalent Unit is a unit of cargo to measure volume/capacity. It is equivalent to the volume of a standard 20-foot container.
Unit price database	A database that records prices per unit of work or material (e.g. m^3 of steel or concrete) used in bids in infrastructure (or other) procurement).
Vignette	Vignette is a form of road pricing imposed on vehicles, based on a period of time the vehicle may use the road, instead of road tolls that are based on distance travelled.

List of abbreviations

ACI	Airport Council International
ATM	Air Traffic Movement
CAA	Civil Aviation Authority
CBA	Cost-benefit analysis
CIS	Community of Independent States
CNG	Compressed natural gas
EASA	European Aviation Safety Agency
ECA	Emission Control Area
ECAA	European Common Aviation Area
ECMT	European Conference of Ministers of Transport (predecessor to the International Transport Forum)
EEA	European Economic Area
EMS	European Modular System
ERAA	Association of Estonian International Road Carriers
EU	European Union
evkm (charge)	Electric vehicle kilometre
EVR	Estonian Railways
EVR Cargo	EVR freight train operating subsidiary
GDP	Gross Domestic Product
GHG	Greenhouse gases
HCV	High-capacity vehicle
HDM	Highway Development and Maintenance
HEATCO	Harmonised European Approaches for Transport Costing and Project Assessment
HELCOM	Helsinki Commission for Baltic Marine Environment Protection
ICAO	International Civil Aviation Organisation
IM	Infrastructure Manager
IMO	International Maritime Organisation
IRU	International Road Transport Union
ITF	International Transport Forum
LPG	Liquefied petroleum gas
LPI	Logistics Performance Index
MA	Mobility Agency (proposed)
MaaS	Mobility as a Service

MEAC	Ministry of Economy and Communications
MoF	Ministry of Finance
NO_x	Nitrogen oxide
OD	Origin-destination
OECD	Organisation for Economic Co-operation and Development
PIARC	World Road Association
PM	Particulate matter
PPP	Public-private partnership
R&D	Research and development
RB	Rail Baltica
RIA	Regulatory impact analysis
RSA	Regulatory and supervisory authority
SOE	State-owned enterprise
SOx	Sulphur oxides
SUMP	Sustainable Urban Mobility Plan
TEN-T	Trans-European Transport Network
TEU	Twenty-foot Equivalent Unit
tkm	Tonne-kilometre
TLL	Tallinn Airport
TRC	Technical Resource Centre (proposed)
TTJA	Consumer Protection and Technical Regulatory Authority
TTR	Transport Technology Roadmap (proposed)
VOCs	Volatile organic compounds
vtk	Vehicle-tonne kilometre

Executive summary

What we did

This report reviews strategic planning in Estonia's transport sector to support the development of a new National Transport and Mobility Master Plan. The executive summary provides a high-level overview of main points of the report, while Chapter 1 offers a broader overview and includes references to the relevant sections of the report.

The review comprised three elements:

- A high-level assessment of ten key aspects of transport policy, agreed with Estonia, with recommendations for reform.
- Recommendations on the level at which transport policy objectives ought to be established and how progress towards them should be measured.
- Modelling of the impact of selected proposed reforms under different scenarios.

The International Transport Forum (ITF) developed a high-level model for the country covering all modes (except aviation) to quantify the scenarios, as Estonia has not yet built a national transport model.

The review process for this study combined fact-finding missions to Estonia and a review of Estonian legislation, policy documents and data. It also took account of previous assessments of Estonia's transport policy and systems undertaken by the European Union (EU), the International Monetary Fund (IMF), the World Bank the OECD and other organisations.

What we found

Since independence, Estonia has made remarkable economic progress. This has been supported by a strong strategic planning framework across government, with a series of ten-year plans that are periodically updated and form a cohesive framework for investment in key sectors including transport.

In recent years, a process of consolidation of plans, ministries and agencies has aimed to improve cross-sectoral co-ordination and consistency. Despite this generally positive context, there is concern that the performance of the domestic transport system and limited international connectivity may impede Estonia's future economic development. The main issues identified by the review are as follows:

- Weaknesses in the processes for project identification, appraisal and selection, which significantly reduce the efficiency of infrastructure expenditure and increases costs.
- The current institutional structure contributes to these outcomes. The lack of a strong strategic policy division at the Ministry of Economic Affairs and Communications (MEAC), with high-level technical capacities, is a central concern.
- Significant policy risks exist in relation to the Rail Baltica project. There is considerable potential for cost increases, which could test Estonia's ability to fund other transport priorities.
- Systemic issues with infrastructure procurement processes significantly increase infrastructure costs. There are opportunities to use available data to prevent collusive behaviour among bidders.

- The financial sustainability of the public transport system is at risk. The adoption of a fare-free public transport policy has led to revenue losses without increasing the number of people using public transport. The policy, that aims to improve equality by making public transport more affordable for people on lower incomes, has not been effective.
- Approaches to user charging are inefficient. Road freight charges in particular rely excessively on fuel taxes. This is an obstacle to funding independence for the road infrastructure management organisation and forfeits the opportunity to unlock new road infrastructure financing approaches.
- Opportunities exist for better organising infrastructure asset management and incentivising increased efficiency.

Specific additional issues exist in road and rail freight, ports and shipping, and aviation. The most significant is underutilisation of infrastructure with the decline of Russian rail transit traffic and policies to shift the focus to the development of the north-south corridor.

What we recommend

Do the analysis before making decisions, build transport modelling capacity to support policy making, and communicate progress with easily interpreted performance indicators

Estonia should introduce a project planning and selection process in which the analysis supports the decision-making, rather than legitimising decisions already made. The use of transport models will be essential in this process. Modelling can provide essential insights into the functioning of the existing transport system, support good planning for infrastructure and operations. Presently, Estonia does not possess strategic transport modelling capability; developing the basis for such models for the country was one of the main tasks for this project. Garnering support for reforms also requires communicating the performance of the transport system in ways that speak to the experiences of users. Easily understood performance indicators will create transparency, thereby adding credibility for the government's plans and strengthening the case for future reforms.

Reform the institutional structure behind transport policy making. Concentrate strategic planning in one place, create a focus on efficiency incentives, and support independence in decision-making

Estonia's ongoing organisational reform of the transport sector should focus on three objectives: unifying the planning process, rewarding efficiency and ensuring unbiased decision-making. The strategic planning function should be concentrated in a dedicated strategic policy division within the Ministry of Economic Affairs and Communications. This unit would also be responsible for establishing methodological standards for project appraisal and providing advice on project selection to Ministers. Estonia should promote efficiency in the transport sector by introducing incentive regulation, and specifically make more use of the Regulatory Asset Base model. To this end, major transport infrastructure including roads should be managed by state-owned enterprises, rather than by an all-in-one transport authority. The proposed regulatory and supervisory agency should be charged with developing incentives for efficiency (incentive regulation) that should be applied to these companies.

Integrate the results of risk analysis into decision-making during project development

Continuous risk analysis and professional risk management are indispensable. Risk analysis should serve risk-adjusted estimates of both project cost and benefits, and these should inform decision-making about

important project variables in all stages. This will ensure decision-makers are informed of major risks while these can still be addressed.

Upgrade the infrastructure procurement system comprehensively

An improved procurement system can greatly reduce infrastructure costs. The focus of reform in Estonia should be on the ability to detect anti-competitive behaviour and on fostering innovative approaches to infrastructure delivery. This requires reforms in several areas in order to achieve a mutually reinforcing effect. The creation of a unit price database should be a priority. Other elements include moving away from the use of lump-sum contracts, co-ordinating the infrastructure procurement pipelines across the transport sector and beyond, and systematically addressing the risks arising from the Rail Baltica project. In the medium term, a major goal should be adoption of comprehensive guidelines for procurement that go beyond the bidder selection stage.

Adopt a cautious and strategic approach to the use of Public-Private Partnerships for transport projects

Public-Private Partnerships (PPP) for transport infrastructure can only deliver superior value for money under specific circumstances. Only if the infrastructure operator can strongly influence user demand through service quality (in a context where the users are not captive) is this likely. This is often the case for airports and seaports; it is not generally the case for road and rail infrastructure. This is clear from extensive ITF research. Yet PPPs often become the chosen contractual model regardless, for reasons not related to efficiency. One perverse incentive is that some accounting standards do not require payment obligations under PPPs to be recorded as public debt. Improving public procurement and institutional organisation is generally preferable for achieving better infrastructure outcomes than PPPs. Where PPPs are used, this should happen within a comprehensive, best-practice policy framework that includes strong and detailed guidance on how to prepare, procure, and manage PPPs.

Extend user charging for transport infrastructure, establishing incentives for sustainable mobility and transport system efficiency

Estonia currently makes relatively little use of user charging. Access to road infrastructure is free for passenger vehicles and light-duty trucks. Heavy trucks pay a very low rate for the road-use vignette. Urban public transport fares were recently abolished in many Estonian towns. Steering user choices toward a more efficient and sustainable transport system will require significant pricing reforms. Charges for road freight transport ought to be reformed and the taxation of private vehicles redesigned to encourage the use of more efficient, less polluting vehicles and to nudge car users towards sustainable modes. Public transport pricing should be reintroduced to secure stable funding and allow investment in improving service quality, which is essential to attracting more users. Supporting policies to give more space to walking and cycling are also essential. Only strong price signals and reallocating public space from roads to active modes can achieve a significant mode shift from private cars to public transport, cycling, and walking. This has the potential to reduce the CO_2 emissions of road passenger transport by up to 50%, according to modelling results for this study. The renewal of car and bus fleets could add a further 30% reduction.

Greater reliance on user charging in conjunction with the institutional reforms will help ensure maintenance and procurement efficiency and unlock new infrastructure financing possibilities

A state-owned road infrastructure management company funded mainly by user charges, could finance road infrastructure improvements without its liabilities adding to Estonia's public debt. A predictable

funding stream that is independent from the public budget will tend to safeguard efficient maintenance and procurement planning.

Develop rail freight on north-south links with emphasis on intermodal containers

Substantial demand shifts have prompted Estonia's freight railways to focus on serving goods transport on the north-south corridor instead of east-west bulk commodity trade. The Rail Baltica is expected to play a key role in this strategy. Much work remains to complete this transformation, not least implementing a joint governance model for Rail Baltica to ensure it operates effectively. Critically, Estonia's rail freight system should adopt to offer efficient intermodal operations so it can capture a part of the international container market.

Estonia should not pursue a strategy to become a regional transport hub

Estonia should not invest in transport infrastructure simply to attract more transit traffic. Infrastructure investments that create capacity exclusively for transit traffic are hard to justify economically. Transit traffic would need to bear the full cost of the investment and cover a significant portion of the externalities created by transit traffic. Unless these conditions are met, the Estonian taxpayer would effectively be subsidising transit traffic. Furthermore, transit traffic is by its nature volatile, representing an unstable ground on which to base long-term infrastructure decisions. Rail Baltica is an exception to this consideration, as it is likely to benefit from more than 80% co-funding from the European Union. The social value for money should always remain a key consideration, even when cost recovery requirements are relaxed, for example, to contribute to objectives of regional political cohesion.

Chapter 1. Report overview and main messages

Estonia has made remarkable economic progress since its independence in 1991, with rates of growth in recent years typically exceeding 3% per annum. There is concern, however, that the performance Estonia's domestic transport system and limited international connectivity may impede the country's future economic development (OECD, 2019). To better understand the room for improvement in the Estonian transport system. The Ministry of Economic Affairs and Communications (MEAC) collaborated with the International Transport Forum (ITF) to undertake the most comprehensive transport policy review of Estonia to date. This review was financed by the European Union's Structure Reform Support Programme, with the support of the European Commission.

The review consisted of three elements. The first was a high-level assessment of ten selected aspects of transport policy. These were co-determined with Estonia. Issues and recommendations for reform were consequently identified for each. The second was to develop a set of quantitative indicators that can be used to measure progress toward the achievement of the underlying objectives of desired transport policy. The third element of the review was to combine a quantitative analysis of the movement of people and goods in Estonia with reform propositions that could be modelled and to measure their impact on the achievement of the main policy objectives under different scenarios. Estonia has not built a national transport model yet, so a bespoke high-level model was developed for the country, covering road, rail, and sea. A lack of data prevented the inclusion of air transport. The material presented in Chapters 2 – 4 of this report included a supporting analysis, which was presented to Estonia in separate individual reports. The model developed for the country was also delivered to Estonia to inform decision-making until a full national transport model is developed.

This chapter summarises the key messages of the report. It commences with the priority reform proposals identified in the ten policy areas, then identifies and explains the relevance of the indicators chosen before setting out the scenario analysis. The recommended reforms are largely systemic in nature, rather than addressing investment priorities at the level of individual projects. This reflects the fact that project selection must be based on strong planning processes to identify priority needs and the application of robust cost-benefit analysis to determine which projects can meet those needs most effectively and efficiently.

1.1. Which policy reforms should have priority?

In each of the ten policy areas analysed, we identified first the key issues and then the reforms needed to address them. The following sets out the highest priority reforms within each policy area. A full exposition of the identified issues and proposed reforms can be found in Chapter 2.

Institutional structure should consolidate and ensure greater independence of strategic decision-making and instil efficiency incentives

Estonia was already in the process of reforming the organisation of its transport sector at the time this review commenced. These reforms broadly follow the Scandinavian model, in which most transport-sector roles are carried out by a single public agency. In the case of Estonia, this was to be the new Mobility Agency. The ITF suggested significant changes to the planned reforms. Our comprehensive proposal is

captured in Figure 1 (see Chapter 2, Section 2.1 Institutional Structure for a detailed analysis). Here, six key issues are highlighted:

- *Concentrate the strategic planning function.* The strategic planning function is currently dispersed between multiple organisations. It would benefit from being concentrated in a newly established strategic policy division within the Ministry of Economic Affairs and Communications (MEAC). The new division should be responsible for establishing methodological standards for project appraisal via a Technical Resource Centre (TRC) (see below), and for quality assurance of project proposals and appraisals received from the infrastructure management bodies. The division should also be ultimately responsible for the provision of advice on project selection to Ministers.
- *Provide technical support to bodies that dispense inputs to strategic planning and procure infrastructure.* An in-house consultancy within the strategic policy division – the Technical Resource Centre (TRC) would be of great assistance to these bodies. The TRC should provide high-level technical capabilities in key areas, thus supporting MEAC's ability to undertake high-quality strategic planning and prepare high-quality procurement strategies. One part of this reform is also an improvement in the status of the analysis/advisors working in the strategic policy division, to enable these key units to attract and retain the best people. This includes the creation of the post of the Chief Transport Economist and a Chief Procurement Officer.
- *Co-ordinate methodologies and infrastructure priorities across sectors.* The reforms above address the transport sector alone. A new agency – Infrastructure Estonia – should be established to improve the strategic allocation and co-ordination of infrastructure investment by identifying key infrastructure needs across all sectors and recommending priorities. This can help to determine the amount of infrastructure investment required to be committed over time and to allocate it appropriately between transport and other sectors and identify synergies and co-dependencies. The benefits of the independent infrastructure advisory model, which is becoming increasingly common in OECD countries, flow from its cross-sectoral remit and potential to achieve cross-party support and the continuity needed for long term planning. A result of a high level of independence from government.
- *Increase the efficiency of the transport sector by introducing incentive regulation, specifically through the Regulatory Asset Base (RAB) model.* Rather than creating an all-in-one Transport Authority similar to Trafikverket in Sweden, with a separate Regulatory and Supervisory Agency, Estonia should keep the infrastructure management function separate. All major transport infrastructure (including the roads) should be managed by state-owned enterprises. An incentive regulation function should be established at the regulatory and supervisory agency and applied to these companies. Most have natural monopoly characteristics and should, therefore, be subject to similar incentive frameworks as utilities (e.g. electricity transmission).
- *Pursue user funding of the state-owned enterprises (SOEs) managing infrastructure to maintain efficiency and unlock new infrastructure financing possibilities.* If road infrastructure were managed by an SOE and largely funded by user charges, the road company could finance new road infrastructure against its own balance sheet, with its debt excluded from the Estonian public debt. This would represent a better way to increase investment in infrastructure than bypassing the Maastricht criteria public debt limits through PPPs. Furthermore, a predictable funding stream that is independent of the general budget will tend to safeguard efficient maintenance and procurement planning. The transport taxation sections (2.5 and 2.7; covering passenger and road freight) discuss the merits of introducing electronic distance-based user charges. The railway infrastructure company is already funded through charges for infrastructure use. Cost recovery

levels have declined and currently stand at around 70%. Subsidies to train operators would be preferable to eroding revenues from infrastructure access charges in the pursuit of freight modal shift from road to rail. This would maintain funding independence from the general budget, maintain balance sheet stability and minimise the risk of debt accumulation.

- *The Mobility Agency should focus on co-ordination between public transport service providers. The* role of the proposed Mobility Agency should be more limited than previously envisaged, focusing on public transport-related functions, including ensuring co-ordination between the different public transport services, integration of pricing and ticketing and the procurement of contracts for services subject to compensation under public service obligations (PSOs).

Analysis must precede decision-making in infrastructure planning and strategic transport modelling capacity should be enhanced

Project appraisal should inform investment decisions, rather than confirm decisions that have already been made. A change in culture is required to achieve this. The analysis cannot replace political judgement (e.g. giving priority to improving infrastructure in region A over region B). Rather, it ensures that those judgements are informed by the best possible information, clarifying the nature of the costs and trade-offs involved (see Chapter 2, Section 2.2 Infrastructure Planning and Project Selection for a detailed analysis).

For analysis to assume the necessary role in supporting the decision-making process two key changes are necessary. First, the role and status of transport analysts - experts involved in transport modelling and project appraisal as part of the Transport Resource Centre – must be enhanced. Their head, the Chief Transport Economist should be appointed by, and report directly to, the Minister. Moreover, salary and benefit provisions should allow the Technical Resource Centre to attract the best people.

Second, substantial development of infrastructure planning and investment appraisal capabilities is crucial. Estonian authorities received specific recommendations such as strategic modelling tools, prioritisation and project selection, appraisal processes and methodologies, inter-urban modelling and appraisal, urban transport, audit and *ex-post* evaluation to advance these areas.

Integrate the results of risk analysis into decision-making during project development

Ongoing risk analysis and risk management are indispensable, particularly in major projects. Their results, however, should not be considered separately from the base cost estimates derived from projects' design documentation. Risk analysis should be used to prepare risk-adjusted estimates of both project cost and benefits and it is the risk-adjusted numbers that should be used in decision-making and as necessary, in providing updates to the general public (see Chapter 2, Section 2.3 Infrastructure Procurement for a detailed analysis).

Failure to do this incentivises a culture in which people will not strive to present the most likely numbers and impacts but rather those that will be accepted with least resistance. This means fewer opportunities for decision-makers to find out about risks and problems at a time they can still be addressed.

Upgrade infrastructure procurement approaches, the capabilities of staff, and supporting institutions comprehensively

Substantial opportunities exist to reduce the cost of infrastructure, improve the detection of anticompetitive behaviour, and foster innovation in infrastructure delivery. Achieving these improvements

will require a range of mutually reinforcing reforms (see Chapter 2, Section 2.3 Infrastructure Procurement for a detailed analysis). Immediate priority should be given to the following:

- *Establish a unit price database*, starting with the road sector and eventually covering all public works. A systematic database of unit prices (e.g. cost per m^3 of asphalt, gravel, concrete), is essential for informing future cost estimates and budgets, detecting abnormally low (or high) bids etc.
- *Abandon across the board use of lump-sum contracts or their derivatives*. The road administration adopted this practice to avoid adversarial relationships with bidders and/or contractors. Unfortunately, such contracts substantially increase the cost of infrastructure and should only be used for the simplest works. In addition, the Ministry of Finance should commission an in-depth analysis of infrastructure procurement contract performance and the contracting culture to more precisely identify in what other types of procurement inadequate application of contract formats is an issue.
- *Analyse the construction market and co-ordinate the infrastructure procurement pipelines across the transport sector and beyond.* A construction market analysis will identify how public sector demand affects the Estonian construction sector and its segments. Entities whose demand affects the same segments within and beyond the transport sector should co-ordinate their spending to avoid demand-driven price increases.
- *Give greater priority to implementing the mitigation plans from Rail Baltica's risk assessment.* The risk assessment for the Estonian part of Rail Baltica identified a series of risks to the project and proposed mitigation measures. Progress has been made, however many of the mitigation measures have still not been adopted.

Other reforms that will require more time include developing procurement strategy guidance that goes beyond bidder selection and the professionalisation of the procurement role. In parallel, the Technical Resource Centre, proposed as an institutional reform, should take on the role of a knowledge hub for procurement, as well as planning and investment appraisal.

Pursue comprehensive transport sector reforms before considering the limited and targeted use of public-private partnerships

Estonia has been considering the use of PPPs in road infrastructure projects. A key motivation appears to be that the European Union will not count the debt incurred through PPPs as part of the Estonian public debt. This is widely regarded as a perverse incentive arising from the European System of Accounts standard, in that it is a poor reason for pursuing PPPs. PPPs should be pursued where they can provide superior value for money to alternative types of procurement or public sector organisation.

It is unclear whether PPPs can achieve superior value for money in a wide range of infrastructure contexts. The ITF has recently concluded an international research project on private investment in infrastructure, including PPPs, and procurement more broadly (ITF, 2018). It found that PPPs could deliver superior value for money only under conditions of strongly endogenous demand. These conditions often exist in the case of airports and seaports. However, where they are not met, as in road and rail infrastructure, the use of PPPs is not recommended. Instead, Estonia is encouraged to pursue the reform of the institutional structure of the transport sector, and gradually introduce distance-based user charging. These reforms will allow Estonia to finance new investments in roads off the balance sheet without the use of PPPs. Road

corporations with the same functions already exist in many European countries (see Chapter 2, Section 2.4 Infrastructure Funding and the Role of Private Finance for a detailed analysis).

If Estonia does pursue PPPs, it should use a comprehensive, best-practice PPP policy framework that includes strong and detailed guidance. This would imply expanding the recently published Estonian PPP guidance to address several additional factors. These include properly representing what private finance in infrastructure can and cannot achieve supplier de-risking, contract management after project delivery and dealing with the renegotiations.

Reform the current transport taxation arrangements to introduce appropriate incentives to underpin efficient infrastructure provision

Estonia currently has very little user charging in place, except in the rail sector. Access to road infrastructure is free of charge for passenger vehicles, fares were recently abolished for many public transport users, and the vignette heavy goods vehicles pay to use the roads is so low as to be effectively symbolic. The negative consequences are substantial. Estonian cars have the highest specific carbon emissions in the European Union and poorest energy efficiency. The introduction of free public transport did nothing to reduce inequalities between Estonians or reduce car dependency and will ultimately lead to lower quality public transport services, further undermining the attractiveness of this mode (see Chapter 2, sections 2.5 Steering User Behaviour and Public Transport Policy, 2.6 Rail Freight and Infrastructure and 2.7 Road Freight Regulation for detailed analysis).

Estonia needs to reform taxation and user charging arrangements for both freight and passengers, and also road and rail. The overarching objective should be to achieve stable and efficient levels of infrastructure cost recovery through taxation and user charging. Generally, such user charges should be based on short-run marginal costs, with mark-ups to contribute to fixed costs based on willingness to pay. The taxation and charging system should incorporate incentives to reduce emissions through differentiation of charges in relation to vehicle emissions characteristics. Revenues from fuel excise duty will erode over time, as cars become more fuel-efficient and the share of electric vehicles grows. A vehicle-kilometre charge will be needed to compensate for this loss. In the meantime, fuel excise duty also has an important role in steering choices towards reducing CO_2[1] and other harmful emissions. The large gap between duty on diesel and petrol created by temporary Covid-19 crisis measures needs to be reversed and eliminated. In the case of roads, the objective should also be to achieve funding independence for the prospective road company through the introduction of distance-based user charges. This will also generate an appropriate contribution to costs from users of the network that are registered abroad.

- *The introduction of car ownership taxes should be considered* as an incentive to buy cleaner new and second-hand cars. This would be best achieved through a minimum emissions class limit for the first registration of second-hand car imports, together with a tax on the purchase of new vehicles that is differentiated by emissions class. This combination is preferred to a differentiated annual circulation tax to minimise any regressive impact.
- *Public transport fares should be re-introduced* where they have been abolished. Experience now shows that the introduction of free public transport in Estonia did nothing to increase ridership and made no contribution to reducing traffic on the roads. The modelling results presented below suggest that the re-introduction of user charging would similarly have no negative impact on ridership. Re-introducing fares would improve funding stability for public transport and enable greater investment to improve service quality, which is essential to retaining and increasing ridership.

- *Electronic distance-based charging for passenger cars will eventually be needed*. Electronic distance-based charging (hereafter: evkm charging) can offset the erosion of fuel tax revenues as vehicles become more fuel-efficient and electric vehicles replace fossil-fuelled cars. Simulations from other countries show that technological progress could lead to a more than 50% fuel-tax revenue erosion by 2050. In Estonia, negative population growth is likely to drive an even larger relative decline in revenue. This makes the introduction of an evkm charge a necessity. The charge could be increased gradually over time, to enhance its political acceptability, but planning for the evkm charge solution and procurement of the system to operate it should start immediately. The equity concerns of a charging system can be addressed by targeted subsidies and/or cross-subsidisation within the system. An evkm charging system can also be used to manage congestion, should this become a significant issue in the future, by differentiating charges based on location and time of day where needed.
- *For trucks, evkm charges should be introduced as soon as possible*, for several reasons. The price of the current time-based vignette required to use the Estonian network is low and is limited by EU directives. Thus, their contribution to infrastructure cost recovery and scope for use in internalising external costs is minimal. Furthermore, domestic and foreign international hauliers can avoid Estonia's relatively high rates of fuel excise by purchasing lower-cost fuel in neighbouring countries, thereby avoiding making a fair contribution to the costs they impose on the Estonian road network. Estonia should introduce an evkm charge now, channelling revenues directly to the prospective road company to help ensure its funding independence. If user charges are set at a level to cover half or more of expenditure on the roads, the company would have the freedom to raise its own debt, greatly facilitating the financing of new infrastructure and upgrading of roads. If the political acceptability of such a reform requires offsetting the user charge this could be achieved through partial rebates of fuel excise duty to commercial operators, a system that exists in some other EU member states. If road freight evkm charge revenues that are insufficient to secure funding independence for the road company, an extension of the charge to passenger cars should be accelerated.
- *Fuel taxes should remove the incentive for the use of diesel fuel.* In May 2020, Estonia temporarily cut diesel fuel taxes by 25% for a period of two years as a response to the Covid-19 crisis. This timeframe should be respected and diesel fuel taxes be set at the same level as petrol taxes upon the expiry of this measure. This is essential to remove the fiscal incentive for the use of diesel fuel, which imposes significantly higher costs, via lower taxation levels than those applied to petrol, as has historically been the case.
- *Access charges for rail infrastructure should be set to preserve rail's independence from short-term budget risks*. Rail infrastructure charges cover around 70% of annual expenditure on the system and until recently freight revenues covered 100% of costs. Parts of the system need electrification but there is generally overcapacity and, to date, no major maintenance or renewal deficit. This independence from exposure to the short-term risks associated with general budget funding and the financial equilibrium should be conserved. Policy towards modal shift for freight from road to rail, and to carry more passenger traffic, might require subsidies to train operators. This is a preferable route to supporting these services than reducing infrastructure charges. Compensating the infrastructure manager for lower charges through annual budget settlements would risk undermining the predictability of funding for infrastructure. At the same time, periodic review of charges is recommended, to ensure that mark-ups correspond with price elasticities, and the terms of conditions for access and ancillary services are non-discriminatory.

- *Specific urban transport considerations:* Estonia should develop a comprehensive and integrated set of policies to change user behaviour if the desire is to increase the use of public and active transport modes. This involves both discouraging choices that are not socially desirable and encouraging other, more desirable choices. Such policies should involve the provision of more and better services and better co-ordination of service offerings to enhance convenience and value and improve the overall customer experience. Key steps are that public transport pricing should be re-introduced and the revenues obtained used to direct more resources toward improving the service quality. An integrated tariff system is needed for public transport by all modes, together with improved co-ordination between territories. Public service obligations (PSO's) and concession contracts should also include more incentives, such as payments related to service quality. More road space should be devoted to cycling and walking. Lastly, the effectiveness of urban public transport policies will be maximised where they are integrated with land-use planning. This implies that planning rules should favour development in areas that are best served by public transport, that they should reflect an acknowledgement of the accessibility benefits of higher-density cities and that development fees should be used to support transport-related infrastructure improvements.

Focus on North-South cross-border co-operation to develop rail freight along this part of the EU corridor

Estonian freight railways have historically been heavily oriented towards former Soviet Union markets and for a period operated as a private, profit-making enterprise. This traffic has become volatile and declined. Growth in recent years has come from domestic container traffic from the ports, much on North-South lines. The Rail Baltica project is expected to expand flows along this corridor, with goods to and from Finland playing a major role for its business case. However, much remains to be done for this to happen (see Chapter 2, Section 2.6 Rail Freight and Infrastructure for a detailed analysis).

Building the Rail Baltica (RB) line is only the beginning of this initiative and numerous initiatives will be required to exploit its potential. For successful operation, Estonia should strive for the adoption of a joint governance model between the three Baltic States for the management of RB infrastructure. If achieved, centralised traffic management and operations control will facilitate seamless train movement, ease the access and enhance the attractiveness of the line for customers, improve infrastructure maintenance and avoid redundancies. Efforts to build future strategic partnerships should commence immediately in terms of operations. Poland and Finland should be closely involved in RB's deployment and operations planning. Cross-border co-operation and rail freight traffic connections should be pursued well before RB is finished. Initiatives such as the existing "Amber train" service between Lithuania to Estonia will promote co-operation between infrastructure managers (IMs), operators and other actors, favouring the development of common rules and identifying bottlenecks.

The primary role of RB is that of an international connection. RB was designed to avoid population centres and to foster international connectivity. This should remain to be the case. Upgrading the existing network that runs through population centres is a more effective way to improve regional connectivity. The international focus should not be repurposed to service regional demand.

The future of freight rail and its contribution to a carbon-neutral economy will be increasingly determined by its ability to adapt and capture part of the container market. Estonia needs to foster intermodal operations and the development of dry ports and intermodal terminals. Modernising existing infrastructure is essential to improvements national and regional connectivity.

Estonia should not pursue a strategy to become a regional transport hub

While Estonia recovers a relatively high share of direct rail infrastructure costs (about 70%) from access charges, there remains a 30% shortfall, and there is no cost recovery for externalities. For road freight, the infrastructure costs are fully recovered, and the incentives to limit CO_2 emissions created via fuel taxes are stronger than in most EU countries. However, externalities still matter. Increasing the amount of transit activity in the road freight sector would increase the need for road infrastructure expansion or the introduction of congestion charging, creating a social cost for Estonia. Similarly, if transit traffic increased on the rail network the Estonian taxpayer would effectively be subsidising transit traffic. Rail Baltica is an exception, due to its (expected) 81% co-funding from the European Union. In these circumstances, Estonia should not be pursuing a strategy in which it aims to attract more transit traffic. Social value for money should remain a key consideration, even when cost recovery requirements are relaxed, for example in the interest of contributing to objectives of regional political cohesion. Appraisal of projects, domestic or international in character, should retain this perspective.

Port policy should focus on developing maritime business clusters and contracts for ferry services should allow pricing to be used to manage demand

Estonian ports perform well but remain underutilised as the result of a sudden drop in Russian transit traffic a decade ago. Rail Baltica, the main initiative to attract additional cargo flows, is still several years from becoming operational. A valuable lesson for making infrastructure investment in the future is that transit flows are volatile and could easily lead to large investments becoming stranded. Estonia has few options to address this problem. While there may be opportunities to pursue value-adding activities in the ports, they are unlikely to yield substantial economic gains (see Chapter 2, Section 2.8 Maritime Policy for a detailed analysis).

The current state aid package to attract 200 ships to bear the Estonian flag is likely to be ineffective and should be re-evaluated. A maritime cluster strategy should be developed instead, targeting innovative maritime activities, where Estonia could develop comparative advantages.

In passenger transport, ferry tenders should be redesigned to incentivise service quality and efficient use of assets. This involves introducing a dynamic pricing scheme to reduce ferry congestion during peak times and moderate underutilisation during weekdays and the off-season. Incentives in PSO contracts for equipment and asset maintenance should also be investigated.

Aviation transport policy should focus on generating more data to support decision-making and efficiency incentives should be introduced at Tallinn airport

One of the limitations faced in trying to assess transport policy in the aviation sector and conduct basic quantitative modelling was the lack of relevant data. As a result, it is difficult to assess the impact of important developments, such as Rail Baltica on Tallinn Airport. The new rail connection will improve access to the competing Riga airport. To make informed decisions on aviation policy, the Ministry of Economic Affairs and Communications should conduct periodic air connectivity reviews as an important input to aviation project planning and project selection (see Chapter 2, Section 2.9 Aviation Policy for a detailed analysis). In line with study recommendations regarding institutional reforms, the economic efficiency of Tallinn Airport in delivering air connectivity should be subject to scrutiny from the proposed transport sector regulator.

Develop a Transport Technology Roadmap through dialogue with major innovation-focused institutions

The proposed Technical Resource Centre should lead a process of developing clear goals and priorities for transport innovation through a Transport Technology Roadmap (TTR). This should involve ongoing structured dialogue with major innovation-focused research bodies as part of a strategy to frequently update the TTR. A dedicated group within the TRC should develop and guide the work being undertaken on the future impact of technology on transport, in turn informing the new National Transport and Mobility Master Plan.

Adopt a principles-based approach to regulating new mobility services

This will enable consistent and timely responses to new mobility services, helping ensure their potential benefits are realised and costs and negative externalities are minimised. The principles should be based on those previously highlighted by the ITF and OECD and should be linked to a sustainable urban mobility plan.

Develop a nationwide climate-resilience analysis for the transport system

This will ensure that site and design decisions for major transport assets and maintenance choices for existing assets systematically address climate risks. Estonia should consider relevant EU policies and requirements and draw on the work of international organisations and other countries that have adopted analytical frameworks for this purpose.

1.2. How should reform progress be measured and communicated?

An indicator framework is an effective tool to communicate transport policy reform progress to the public. A set of indicators was developed during this project with Estonia and organised in terms of broad transport policy objectives. International practice, the research literature and the current Estonian Transport and Mobility Master Plan, were considered. There is no manual or single identified best practice approach to defining transport policy objectives or measuring progress towards them. However, one of the most common approaches is to identify objectives related to three key dimensions of sustainable development - environmental, social, and economic – and, for each, develop specific indicators or targets (see Chapter 3 for a detailed analysis).

The ITF identified over 200 indicators, proposed and currently in use. However, if an important objective of the indicator framework is to communicate transport policy progress to the public, using a large number of indicators would be self-defeating. We, therefore, defined six principles to guide the selection of the most relevant indicators. One of these is that all indicators need to be able to measure a tangible benefit or outcome obtained by users as a direct result of a transport policy. There are two aspects to why this is important. First, all indicators are not equally relevant to all users, which means at least some indicators should be linked to particular user groups. Second, the outcome measured should be as close as feasible to the user's experience of performance. For example, citing the length of road infrastructure in a particular country does not mean much to a car user. A more relevant outcome is the length of people's average daily trip (in time and in cost).

The ITF defined nine user groups, adopting the above principles (private road transport, walking/cycling, public transport, and so on). At least one indicator was selected for the nine user groups of each of the following performance dimensions: accessibility/connectivity, affordability, emissions, and efficiency. Table 1 is an excerpt from the indicator framework that relates to car and taxi users.

The progress towards EU-wide transport policy targets as laid out in the EU Transport White Paper (European Commission 2011) can be tracked through improvement in the same Indicator Framework.

Table 1. Transport Policy Indicator Framework – an excerpt

	Indicator	Description	Indicator category	Transport policy objective*
a.	**Road private passenger (car and taxi)**			
1.	Time to border by road	Average time to reach the international market by car (including depart border procedure)	**Accessibility**	3
2.	Urban accessibility	Average travel time per trip	**Accessibility**	2
3.	Inter-urban and rural accessibility	Average travel time per trip	**Accessibility**	2
4.	Fuel efficiency	Energy consumption (in kWh per vkm)	**Efficiency**	3
5.	CO_2 emissions	CO_2 emissions total and per vkm	**Emissions**	1
6.	Average fleet age	Average age of registered vehicles	**Emissions**	1
7.	Affordability of private vehicles	Expenditure on private vehicles, % of household income for the bottom quartile of the population	**Affordability**	2

* 1 = environmental objectives, 2 = social objectives, 3 = economic objectives.

1.3. How ambitious must transport policy reforms be to achieve significant progress?

The quantitative component of the policy review undertaken with Estonia modelled three scenarios, comprised of a selection of policy reforms based on the recommendations of the ten policy area reviews. These scenarios do not constitute a comprehensive policy plan, but rather estimate the likely impact of those reforms that could be modelled using the data currently available. They provide a series of "what if" scenarios that shed some light on possible reform paths and their impacts (see Chapter 4 for a detailed analysis).

The outcomes of High Ambition (HA) and Low Ambition (LA) reform scenarios for each transport sector were compared with the Business as Usual (BAU) scenario, which assumes no change to current transport policies. The HA scenario was chosen to represent what could be feasible with strong political alignment, sound prioritisation of the transport reform and sustainable growth. The LA scenario represents the likely impact of a reform programme in which some measures are not implemented fully, or have their implementation delayed significantly. The BAU scenario assumes no change in policies and only accounts for population and GDP changes.

Introducing and increasing charges for private car users is the most efficient measure to push users to other modes

Estonia has potential for a substantial modal shift from car to more sustainable modes of urban travel, i.e. public transport, walking and cycling. If the HA scenario is achieved, the proportion of total trips made by

car could fall from more than half at present to less than a third. These results are largely driven by two user charging measures: a congestion charge for Tallinn and a distance-based toll for all car trips. Coupled with this mode shift away from cars, and optimisation of the car and public transport (PT) fleets, the ambitious scenario suggests CO_2 emissions could be nearly 50% lower in the HA scenario than in the BAU scenario, in 2050.

While the user charge-driven mode shift is positive in terms of sustainable mode share and CO_2 emissions, the incidence of the increased costs should be evaluated to ensure individuals are not unfairly burdened.

Reintroducing fares for public transport does not adversely affect patronage or CO_2 emissions

Reintroducing fares for public transport would provide a revenue stream for public transport authorities to make improvements to services and provide some insulation from the risks of fluctuations in funding allocations from the general budget. The proposed restoration of fares would make a minimal difference to urban mode shares or CO_2 emissions in our model. The reintroduction of fares does not need to have adverse impacts on the equity of users and any issues could be addressed through direct income support.

Large proportionate increases in rail ridership will make only a small contribution to mitigating CO_2 emissions overall given rail's small initial share of passenger traffic

The model incorporates reforms that target user behaviour by improving rail travel, which leads to significant increases in rail travel from the current levels. However, due to the comparatively small share of rail passengers overall, the results are not transformative on a national scale.

The optimisation of private car and bus fleets would reduce CO_2 emissions by 27% of road and overall emissions

This reform is responsible for the majority of the 30% savings in carbon emissions in the HA compared to the BAU scenario. Optimisation is a combination of shifting to lower-emission vehicles and a cleaner fleet, as well as better utilisation (higher occupancy) of the vehicles in the fleet.

Electrification of rail could reduce related CO_2 emissions by 48% compared to current freight activity

The modelling suggests that electrification of the railways would result in a 48% emissions drop from freight activity if all lines are fully electrified and all traction were electric. This estimate uses the European average for the emissions factor for electric power production. This would produce an annual saving for freight of more than 25 000 tonnes of CO_2 considering well-to-wheel[2] emissions. If the highest-utilised corridor from Tallinn to Tartu is electrified, this alone leads to a 22% savings in CO_2 emissions. It would lead to significant savings to the operators, increasing efficiency, as well.

On the passenger side, the reduction of well-to-wheel CO_2 emission of rail is rather small in HA because the electrification is compensated by an increase of the rail activity (-2 000 tonnes per year from rail). More substantial benefits come from a modal shift of passenger car to rail, with -2% of overall passenger emission, e.g. about 50 000 tonnes per year in HA.

Notes

1 CO_2 equivalents were not used to accommodate for other types of emissions as well (e.g. NOx, SOx) as it would only contribute to a sense of false precision in this particular case. 1 L of Diesel is 3.07 kg CO_2 / litre for CO_2 alone, and 3.17 kg CO_2 eq, so only 3% more.

2 A well-to-wheel implies the entire (life cycle) environmental impact was considered, from the production of the energy source to the actual emission from the tail pipe. A less comprehensive approach is tank-to-wheel, which considers only direct vehicle emissions.

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Chapter 2. Assessment of key transport policy areas

This chapter consists of a high-level assessment of ten selected aspects of transport policy. These were codetermined with Estonia. For each aspect, issues were identified and recommendations developed. The findings of this analysis then informed the choice of reforms in the policy scenarios modelled in Chapter 4.

2.1. Institutional structure

The International Transport Forum reviewed the current institutional arrangements in Estonia in respect of transport policy, investment, service delivery and regulation. It considered recent institutional reforms, proposals currently under consideration by the Estonian government, and previous recommendations for institutional reform in the sector.

This chapter sets out the conclusions of this analysis. It identifies key institutional weaknesses and recommends an integrated set of institutional reforms that would support improved performance in key strategic areas, notably project identification, appraisal and selection; regulation and supervision; and cross-modal and cross-sectoral co-ordination. A key perspective is that of the need to recognise the inter-dependence between processes and institutions and, consequently, to ensure that mutually supportive arrangements are put in place to enable better outcomes.

Key issues

Sound institutional arrangements are an essential element of a well-functioning policy and regulatory system. Two key areas in which institutional quality is particularly important are:

- project identification, appraisal and selection
- regulation and supervision.

These functions must be undertaken using sound and consistent methodologies if the social returns on investments are to be maximised. A systematic approach is needed to ensure that all relevant investment options are identified at the appropriate time, that decisions reflect deliberate choices, and that those choices are based on estimates of the expected performance of investment options made using appropriate and clearly identified criteria.

Sound institutional arrangements are fundamental to ensuring that good processes are consistently followed, that high-level policy goals are achieved and that social benefits are maximised, even when there are competing political imperatives. Developing and implementing an appropriate institutional structure requires significant attention to key governance elements. Of particular importance are clearly allocated roles and responsibilities, adequate and appropriate powers, accountability and transparency, and systematic performance evaluation (OECD 2014). Second, appropriate co-ordination arrangements are needed to ensure that decisions are optimised across modes, providing sound linkages between individual projects and within-mode choices and the broader transport strategy, as well as other relevant policy fields.

Similarly, a well-functioning regulatory system for infrastructure is essential to supporting growth in a market economy. The World Bank (2015) notes that "Good regulatory practices can determine the prospects for policy success or failure. Studies show strong correlations between regulatory quality and economic growth, better governance quality and higher incomes per capita." Similarly, the OECD (2014) argues that better governance arrangements for regulators enhance their effectiveness and contribute to the achievement of key policy goals, particularly by building legitimacy, underpinning capacity development and supporting the development of necessary co-operative relationships between stakeholders.

Current institutional arrangements contribute to deficiencies in project identification, appraisal and selection

While project appraisal practices have improved, and the use of cost-benefit analysis is more widespread, there is currently no generally applicable guidance on project identification, appraisal and selection. Appraisal methods are inconsistent and appraisal is often conducted too late to influence project selection significantly. Deficiencies in the current institutional structure contribute significantly to these shortcomings and must be rectified if the ITF's proposed reforms to appraisal processes and methods are to be implemented effectively.

The International Monetary Fund (IMF) has rated the effectiveness of project selection in Estonia as low. Two of the concerns it identifies are: 1) the lack of a "comprehensive pipeline" from which projects can be selected, based on consistent, published criteria; and 2) the lack of review of nationally funded projects by an independent agency. The IMF rated these as high priority areas for reform, together with the need to adopt a standard appraisal methodology. Moreover, in contrast to European Union-funded projects, appraisals of nationally funded projects are not published (IMF, 2019), impeding scrutiny by stakeholders and thus reducing accountability.

The OECD has also raised the issue of inconsistent approaches to project appraisal, noting that cost-benefit analysis had not been systematically applied to the infrastructure projects planned for 2018-20 and that "given the already considerable levels of investment in road and rail transport, it is unlikely that such additional projects will have high positive economic returns" (OECD, 2017: 24). The absence of a "coherent framework" to assess the value for money and socio-economic impacts of investments was identified as a fundamental challenge in identifying the most productive investment projects and it was noted that the National Transport Development Plan 2014-20 did not set priorities among the specific initiatives identified (OECD, 2017).[3] The significance of these issues is demonstrated by previous research on the importance of sound public investment management, which concludes that good co-ordination in investment planning and a clear system for project selection can close up to two-thirds of the public expenditure efficiency gap (IMF, 2019: 20).

Discussions with Estonian officials indicate that the issue of differing approaches to project appraisal, including inadequate and inconsistent use of cost-benefit analysis (CBA), remains despite a more widespread use of formal project appraisal methodologies in recent years. The results of CBA are not typically used to compare possible projects, within or across modes; still less cross-sectorally. Of particular concern, as noted in Section 2.2 Infrastructure Planning and Project Selection, is that CBA is often undertaken too late in the process to influence project selection. Instead, the results of project appraisals are seen as frequently serving in practice to provide *post hoc* rationalisation for choices made on other grounds.

Estonian officials also identified the division of strategic planning functions between numerous organisations – including municipalities, ministries, the Roads Administration and transport operators –as a contributor to the problem of investments not being compared on a consistent basis, particularly across

modes. The OECD (2017) has previously recommended that Estonia establish an independent infrastructure advisory body with responsibilities across all infrastructure sectors. This reform would contribute significantly to the adoption of consistent approaches to project appraisal and selection. It would facilitate the development of project appraisal methodologies and process standards that could be endorsed by the government for use across both the transport sectors and in other key infrastructure sectors. Such a body would also have responsibility for conducting broad infrastructure audits and recommending investment priorities, thus facilitating the development of a major project "pipeline", from which strategic choices could be made. However, officials have indicated that the government has not actively considered this proposed reform to date.

Fragmented institutional responsibilities impede co-ordination between project appraisals and strategic policy

Estonia has a well-established Transport and Mobility Master Plan, which identifies some individual transport investment projects. However, officials note that there is limited co-ordination between project selection and the high-level objectives and orientations established in the Master Plan. As an example, the Roads Administration faces an increasingly large gap between budget allocations and the list of projects it must complete, with tensions between the need to address maintenance backlogs on existing assets and to meet political commitments to developing new infrastructure. This is consistent with previous OECD findings, which point to a lack of strategic co-ordination as an important factor limiting the effectiveness of transport infrastructure investments in Estonia (OECD, 2017). More broadly, Section 2.2 notes that there is no process for moving between project-based decisions and the development of a larger choice set in the context of budget constraints and the need to use identified criteria to determine priorities.

In addition, officials describe a gap between national-level planning and municipal and regional priorities. This second dimension of the strategic co-ordination issue is particularly relevant given the increasing focus in OECD countries on accessibility perspectives in transport planning. Greater priority is being given to the concept of minimum acceptable levels of access to be provided to all members of the population. The recent centralisation of some regional transport functions in the context of the January 2020 abolition of the county level of government (*Maavalitsus)* may heighten concerns that regional priorities are not well understood and not taken into account by decision-makers.

Institutional capacities are limited by issues of scale

A key implication of the current mode-specific institutional structure in the transport sector in the context of a small country is that the small scale of some institutions is likely to prevent some institutions from attaining a critical mass. That is, they may be unable to develop and maintain an adequate core of expertise to underpin the development of strategic approaches to their roles, such as the adoption of best practice regulatory policies and practices. For example, the Civil Aviation Authority has a staff of approximately 32 people, and officials indicated that capacity problems within the organisation have been identified in a number of external audits. The small scale of a number of entities also means that scale economies in the provision of support services cannot be achieved, exacerbating resourcing issues.

Conversely, officials expressed concerns regarding a perceived imbalance in size and influence in the policy process between the Roads Administration and the bodies exercising equivalent responsibilities in respect of other modes. Such dynamics can undermine the development of balanced strategic plans that incorporate appropriate and integrated transport solutions.

The small scale of several institutions in the transport sector also implies that available potential economies of scale are not being exploited. The broader context is one in which the Estonian government has adopted a programme of mergers and consolidation of institutions. For example, it recently created

the Consumer Protection and Technical Regulatory Authority (TTJA) by merging the former Consumer Protection Board and Technical Regulatory Authority. However, there is scope for significant further consolidation.

Key institutions exhibit significant governance deficiencies

Estonia makes significant use of the "arms-length agency" model in the transport sector, with bodies including the Roads Administration, the TTJA and the Civil Aviation Authority being governed by their own statutes. However, these statutes constitute secondary, rather than primary, legislation and are approved by the Minister, rather than the parliament. The governing legislation requires these statutes to set out the scope and functions of the agency, organisational and management arrangements (including the rights and obligations of directors), the structure of the agency and functions of its constituent units, among other governance matters.[4] In practice, however, these statutes contain relatively little detail on these issues and the requirements established have a limited degree of consistency, with the best practice principles for the governance of regulators identified by the OECD (2014).

For example, the statute of the Roads Administration states, in relation to the organisation's strategic role, only that it has the function of "participating in the development of policies, strategies, development plans and legislation relevant to its area of activity and in the preparation and implementation of international projects".[5] This provides little clarity as to the Roads Administration's specific role or relationship to other bodies in the context of such policies, legislation, etc.

The statutes of independent agencies should clearly and explicitly identify and detail their responsibilities in respect of key functions and the processes to be followed in carrying them out. They should provide the agencies with distinct identities and adequate degrees of independence, consistent with the nature of the roles they are required to perform. Good governance arrangements form a fundamental component of a well-functioning institutional structure which, in turn, is essential to ensuring that sound processes are consistently followed and decision-making is robust and resistant to political and/or stakeholder pressure. It is essential that key organisations be able to give frank and independent advice and assessments to support better policy discussion and decision-making.

The organisation and funding of road asset management limits financing options and imposes efficiency costs

Estonia collects almost twice as much money through fuel taxes as is allocated to the Road Administration through the general budget. Until 2015, the funding of the Road Administration was secured through earmarking a portion of fuel taxes. However, that policy was abandoned in favour of increased fiscal flexibility. So far, this change has not significantly affected the funding stability of the Road Administration, However, a common experience in many countries is that, when the fiscal situation deteriorates during downturns in economic cycles, spending priorities change, and the provision of adequate levels of infrastructure funding through the general budget is likely to be compromised. This has negative impacts on maintenance planning and life-cycle cost optimisation of new investment difficult. Among the consequences are maintenance backlogs and, ultimately, costlier maintenance or a sustained reduction in the quality of the infrastructure. The current funding arrangement and the fact that the Road Administration is organised as a public agency rather than a state-owned company also limit Estonia's strategic options in infrastructure financing. If a state-owned company were managing road infrastructure and recovered more than 50% of its cost through user charges (alongside other conditions), the company could borrow against its own balance sheet and the debt would not count against Estonia's public debt limits.

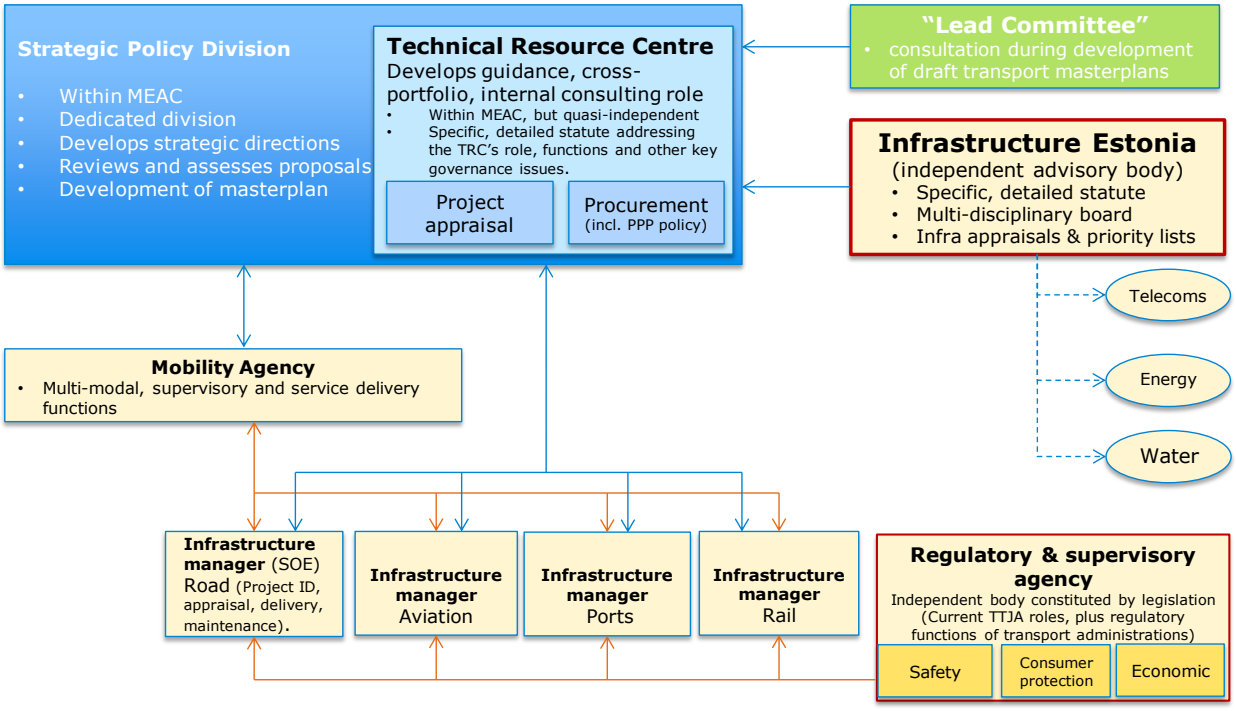
Avenues for institutional reform

The above discussion highlights issues in respect of transport planning and delivery in Estonia that have significant institutional elements. The recommendations for reform made in Section 2.2. can also be expected to be more effectively implemented if they are supported by appropriate institutional reform. Institutional reforms should be adopted in respect of agencies with responsibilities for project appraisal, project selection, procurement, operations and maintenance, as well as regulation and supervision. Two key objectives of these reforms should be to:

- improve links between the strategic directions of the transport policy and individual project selections
- enable and support the change in the status of analysts, as recommended in Section 2.2., and reduce the tendency for decisions to be taken on political, rather than technical, grounds.

Figure 1 outlines the proposed structure of the major organisations in the sector, while the subsequent discussion provides more detail on the proposed changes, the rationale for them and the expected benefits.

Figure 1. Proposed institutional structure for the Estonian Transport Sector



Note: MEAC = Ministry of Economic Affairs and Communications.

Establish a strategic policy division within Ministry of Economic Affairs and Communications, supported by a Technical Resource Centre

In line with the Ministry of Economic Affairs and Communications' (MEAC) lead role in developing the National Transport and Mobility Master Plan, a well-resourced strategic policy division should be established within the Ministry. Its primary responsibilities should be to develop strategic policy directions, ensure cross-modal co-ordination, and establish standardised project identification, appraisal and

selection processes and methodological requirements. The strategic policy division should also be responsible for the development of the high-level transport model, recommended in Section 2.2.

The individual infrastructure management bodies should have primary responsibility for initial project identification and assessment, within the parameters set by the strategic policy established by MEAC. However, the strategic policy division of MEAC should be responsible for both quality assurance of the appraisals of individual projects and for advising ministers on project selection, both in the context of the National Transport and Mobility Master Plan and more broadly.

Section 2.2 highlights the need to change administrative processes to ensure that project selection becomes a formalised and systemic process, whereby decision-makers choose between lists of options which have been subject to an initial, co-ordinated assessment, rather than making piecemeal decisions. Similarly, Section 2.3 Infrastructure Procurement argues for a systematic and evidence-based approach to infrastructure procurement decisions. The relevant division of MEAC should be responsible for implementing these reforms and should be supported by a dedicated technical resource centre (TRC), located within the division. The TRC should provide high-level technical capabilities in key areas, thus supporting MEAC's ability to undertake high-quality strategic planning and prepare high-quality procurement strategies. TRC staff should also be out-posted to modal agencies to share their expertise during project identification and initial development.

The TRC should be headed by a Chief Transport Economist, as recommended in Section 2.2. A core responsibility of the TRC would be to develop detailed methodological and process requirements for project appraisal and procurement of significant infrastructure assets. In the case of procurement, simplified requirements and guidance materials would also be required at a portfolio level for smaller projects. This role should include developing and disseminating implementation manuals and providing training and technical support to analysts in relevant agencies. A core staff of around 12-15 people should be sufficient to enable the TRC to perform these functions, although the provision of out-posted officers would necessarily require some additional resources.

The Minister should endorse the methodological guidelines produced by the TRC and require their use across the transport sector. This could subsequently form the basis for the endorsement by the government of a standardised methodology and processes for use across all areas of public sector infrastructure investment and procurement, thus helping to ensure the consistent adoption of best-practice approaches across all portfolio areas. Should the Estonian government adopt a policy encouraging the use of public-private partnerships (PPPs)[6], the procurement guidance should specifically address this topic, providing clear rules for determining the appropriateness of their use in specific contexts, preferably within the context of a robust legal framework that is applied across the public sector. The TRC could also provide an appropriate institutional base for the development of a Nordic-Baltic expert network on transport modelling and appraisal, as recommended in Section 2.2.

A key function of the TRC would be to provide technical advice and assistance to the infrastructure management bodies in the areas of project identification and appraisal, as well as procurement. The ability of the TRC to contribute to improved practices and outcomes in these areas would be dependent on its ability to forge close and co-operative links between itself and the infrastructure managers. The development of these links would be promoted by co-locating TRC staff in those organisations on an "internal consultancy" basis. This would enable them to work closely and in a sustained manner with these bodies from the early stages of project development. The need to have one TRC specialist for planning and another for procurement permanently co-located with an infrastructure management body would depend on the scale of its planning and procurement operations. For example, there may be a need for two full-

time specialists at the road and rail infrastructure managers, whereas support could be organised on a shared basis for aviation and maritime.

The TRC would ultimately be required to determine the adequacy of project appraisals and procurement processes, assessing them against the published and government-endorsed methodological and process requirements. A sound project selection process requires a body independent of the project proponent to systematically assess the quality of project appraisals. The Chief Transport Economist could be given this function. Project appraisals could be evaluated according to their compliance with the approved requirements before being considered for approval to ensure the robustness of the process. The Chief Procurement Officer would adopt an analogous process.

This key role of the TRC would, therefore, contribute substantially to the effective implementation of the OECD's previous recommendation that Estonia carry out *ex-ante* cost-benefit analysis on all major infrastructure projects, based on a uniform methodology. This is a key means of working toward the development of a "coherent framework to assess the value for money and socio-economic impacts of planned investment" that would ensure the most productive infrastructure projects were correctly identified and prioritised. (OECD, 2017)

The TRC would also be an appropriate body to undertake the more systematic and consistent programme of *ex-post* assessment of past investments recommended in Section 2.2. As noted, *ex-post* assessments provide a key means of improving *ex-ante* analytical methods. Thus, assigning this function to the TRC, as the body with responsibility for developing detailed project appraisal methods and guidance, would provide an effective feedback mechanism. TRC responsibility for this function would also ensure that it was undertaken independently of the initial project proponents, thus supporting the quality and credibility of the analyses. On the procurement side, an illustration of the role of *ex-post* analysis is available in ITF's "Motorway Cost Estimation Review: The Case of Slovakia" (ITF, 2018).

The TRC should have a distinct organisational existence. Its independence should be guaranteed through its own separate statute so that it can carry out its technical functions effectively. Consideration could be given to the potential need to at least partially exempt the TRC from civil service standards in relation to salary and conditions to ensure its ability to recruit and retain high-quality technical experts.

Corporatise major infrastructure asset management

The Mobility Agency Proposal currently being developed by the Estonian government would see the establishment of two institutions with cross-modal responsibilities: a national transport agency, broadly equivalent to the Swedish *Trafikverket*; and a separate regulatory and supervisory agency (RSA), based on the TTJA. Estonia should indeed establish an RSA for the transport sector, adapting the existing TTJA to such ends, as proposed. Key aspects of the RSA proposal are discussed in further detail below. Estonia should also establish a multimodal Mobility Agency. However, the management of major transport infrastructure assets should be undertaken by separate, corporatised entities, structured as state-owned enterprises, rather than being a function of the Mobility Agency.

The corporatisation of asset management will enable significant improvement in the efficiency and effectiveness of infrastructure procurement, maintenance and operational functions. These functions should be undertaken on a corporatised basis, adopting a Regulatory Asset Base (RAB) model. Adopting this approach to major transport investments can ensure that the asset manager has appropriate incentives to ensure the efficient delivery and management of the assets, taking a "whole lifecycle" approach (e.g. by ensuring that maintenance programmes are optimally scheduled and implemented). This model can yield significant efficiency gains if it is supported by an effective regime of incentive regulation (Makovsek and Veryard, 2016; Makovšek, 2019; Alchin, 2019). The achievement of these

potential gains in practice is reliant on the independence of the regulator, provision of clear incentives to infrastructure managers, and clear accountability for performance outcomes. The latter condition is most likely to be achieved if the infrastructure managers are organised on a mode-specific basis, facilitating the assessment of the performance of specific asset types. Some of the elements required for incentive regulation, such as an advanced regulatory accounting system, are probably already in place at the dominant Estonian telecoms operator or in the energy distributions sector, both regulated by an independent agency. This would have been a requirement by the European Union directives in the respective sectors. Other tools, such as performance benchmarking, have yet to be developed (an example is included in Smith et al., 2019).

The appropriate accountability and transparency mechanisms for the mode-specific infrastructure management bodies would be most readily achieved by establishing them as state-owned enterprises (SOEs). This ensures that clear financial accounting and reporting requirements exist and that other key governance requirements are met. The SOE model is already in use in the transport sector in Estonia (e.g. Estonian Railways Ltd., Tallinn Airport) and should be extended to other modes. In particular, adopting the SOE model in the road network would ensure a clearer performance management framework for major road assets. The adoption of this approach to infrastructure management implies the adoption of complementary institutional reforms that provide sound strategic direction to the responsible entities, as well as effective regulation and supervision. The institutions involved are addressed further below and each covers all modes. This will help to ensure a more strategic approach to project selection, as well as enhancing regulatory capacities and effectiveness. The following recommendations address the role and status of these institutions.

The RAB model can be adopted, and provides similar incentive benefits, even when the functions of the operator or the infrastructure manager need to be subsidised. Here, the key requirement is to ensure that the public service obligations that have partly underpinned the decision to invest in the assets are explicitly identified and their extent quantified. This process of explicit identification provides transparency and accountability benefits in terms of the initial investment choices and enables performance management disciplines to be applied, notwithstanding that the asset investment does not fully respond to commercial logic.

Ensure that the state-owned enterprises managing infrastructure assets are user-funded

If the companies responsible for infrastructure management can fund their functions through user charges they effectively become independent from the annual budget allocation process. Even when that is not fully possible (because subsidies are necessary), a higher level of independence is still desirable. Particularly in the case of the Road Administration, Estonia should both prepare to transform this entity into a state-owned enterprise and increase its funding independence by introducing distance-based user charges. In the long term, the availability of stable funding will contribute to the efficiency of the maintenance and procurement functions. The new road company would also be able to borrow against its own balance sheet and finance new infrastructure without increasing Estonia's official public debt, provided sufficient funding independence is achieved. The PPP option, Estonia is currently considering, is a less desirable option, as set out in Section 2.4 Infrastructure Funding and the Role of Private Finance.

Estonian officials made it clear that the introduction of tolling in Estonia is not currently considered politically desirable. However, Estonian road users are already paying for road infrastructure through fuel taxes. Measures exist to limit the equity impacts of user pricing, such as cross-subsidisation within the network. Furthermore, the political acceptability of user charging could be improved by partially refunding fuel taxes for commercial traffic in the short to medium term. A longer discussion of these issues and

options is included in sections 2.7 Road Freight Regulation and 2.5 Steering User Behaviour and Public Transport Policy.

Establish a regulatory and supervisory agency with responsibility for all modes

The proposals currently under development by MEAC envisage the establishment of an RSA. Officials indicated that the recently established TTJA is expected to form the core of the proposed RSA, and that it would take over the regulatory and supervisory functions currently exercised by the mode-specific transport agencies in addition to its current functions. This reflects the fact the TTJA is a key regulatory institution within Estonia, with responsibilities covering several sectors.

Moving these functions to the TTJA should improve regulatory administration and enforcement in several ways. First, the consolidation of transport regulatory responsibilities into a pre-existing multi-sectoral regulatory authority will support the adoption of best practices, favour the development of regulatory expertise and better leverage that expertise by allowing to be more easily deployed across sectors. Second, Estonian officials note that the formation of the TTJA has already led to the achievement of economies of scale and scope. Further consolidation of regulatory activities should lead to additional gains in this area. Third, having a single regulator responsible for numerous sectors favours consistency in regulatory approaches, enhancing regulatory credibility and reducing the risks of economic distortion due to unwarranted differences in regulatory approach between sectors. Multi-sectoral regulators are also generally considered to be more resistant to capture by business or political interests. They are comparatively widely used within Europe, particularly in smaller countries, indicating the importance of scale economies and of the related need to ensure that regulatory agencies have a critical mass and make optimal use of scarce expertise. Research shows a clear trend toward multi-sectoral agencies expanding their regulatory scope over time (Jordana and Levi-Faur, 2010).

While the TTJA currently exercises regulatory and supervisory functions in relation to both safety regulation and consumer protection, the scope of the RSA should be expanded to include a third, broad area of regulation: that of economic regulation. It should exercise these functions, in particular, in relation to the mode-specific infrastructure agencies recommended above, which should be established as state-owned enterprises. The benefits of adopting the corporatised asset management model, based on the RAB model, will only be obtained if infrastructure managers are subject to an effective regulatory system that establishes appropriate incentives and disciplines. An additional division of perhaps 20 staff members would be required to enable the development of these functions. The key staff of this Division should be highly trained industrial economists, well versed in the economics of incentive regulation, and headed by a chief economist. The division could develop its role over time and be staffed as required.

Ensure agencies have adequate independence from the government

The model of the arms-length regulatory agency has become widely used in recent decades, as governments seek to enhance the credibility of regulatory structures and reduce transaction costs by minimising political intervention in day-to-day decision-making. The objective is not to undermine ministers' power to take decisions but to maintain a stable, consistent economic direction between the junctures at which they take course-altering political decisions. Estonia's transport sector currently includes a number of agencies which broadly follow this model (e.g. the TTJA and the Roads Administration). However, deficiencies in the statutes establishing these organisations limit their independence in practice and governance arrangements fall short of best practice principles.

The proposed RSA would be a larger organisation with a wider mandate than the current TTJA. Careful consideration should be given to the governance arrangements adopted for this body in particular. There should be a presumption in favour of establishing the RSA as a fully independent body with its own primary

legislation. The statute should provide adequate detail in relation to the agency's specific role, functions, powers, governance arrangements, accountabilities and funding, with these provisions being consistent with relevant best practice principles (OECD, 2014; World Bank, 2019).

Care should be taken to avoid creating conflicts between the RSA's functions. For example, some existing functions of the TTJA related to project implementation would appear to be appropriately reallocated.[7] In addition to the functions identified above, the RSA should report on the effectiveness and efficiency of the operations of the infrastructure management agencies.

Establish an independent infrastructure advisory body

The OECD has previously recommended that Estonia establish an independent infrastructure advisory body (OECD, 2017). The IMF has also identified project selection as a high priority area for reform and, in particular, highlighted the fact that nationally funded projects are not reviewed by a body independent of the proponent ministry before inclusion in the budget (IMF, 2019). The institutional reforms proposed above, together with the process reforms identified in Section 2.2, would significantly improve project identification, appraisal and selection practices. However, there is a clear case for establishing an independent infrastructure advisory body as a complementary measure. The benefits of the independent infrastructure advisory model flow from their cross-sectoral remit and high level of independence from the government. While adopting the reforms recommended above would improve investment allocation within the transport sector, optimising national infrastructure investment also involves determining the required amount of infrastructure investment to be committed over time and allocating it between sectors. Only a multi-sectoral agency can perform this role.

There is a clear trend toward establishing such bodies, which are increasingly seen as necessary tools to ensure infrastructure spending is well-directed. Infrastructure's long life span and high cost mean investment decisions should be based on a comprehensive, long-term vision, independent of short-term political considerations. Robust institutions are fundamental to achieving this. Independent advisory bodies can also improve stakeholder engagement, enhance transparency and provide authoritative advice based on detailed analysis. All of these factors help to reduce the influence of short-term political considerations on infrastructure decision-making.

Establishing an independent infrastructure advisory body would also help to address the need, identified in Section 2.2, for Estonia to better analyse the implications of international projects, in which it is only one participant, in the light of national transport priorities and objectives.

A recently established body of this type is the United Kingdom's National Infrastructure Commission (NIC). In contrast to some equivalent bodies, its remit focuses on a small number of key functions: it conducts detailed studies of infrastructure needs and produces a National Infrastructure Assessment once per Parliament, which assesses long-term infrastructure priorities and makes recommendations to government.[8] Such a focus on core functions is appropriate to the Estonian context of a small country with limited resources, particularly in the organisation's establishment phase. The NIC currently carries out its functions with a staff of approximately 40 officials. Given the significantly smaller quantity of infrastructure needs in the Estonian context, an equivalent body could carry out its role with far fewer staff than this.

In the medium term, consideration should be given to broadening its role by transferring the Technical Resource Centre to it, from its proposed initial location within the strategic policy division of MEAC. This change would be, in effect, the vehicle for applying the best practice project appraisals processes and methodologies that the ITF recommends the TRC should develop across all major infrastructure sectors. It would also mean that Infrastructure Estonia would take on the function of providing independent quality

assurance of business cases for large infrastructure projects as is done, for example, by Infrastructure Australia.[9]

While independent infrastructure advisory bodies commonly develop priority lists of proposed infrastructure projects, these are rarely, if ever, binding on governments. However, they enjoy a high level of credibility if developed via high-quality processes and methods. Independent advisory bodies are not intended to remove decision-making responsibility from politicians; rather, they provide political decision-makers with better information, enabling them to make the right decisions in a timely manner.

If the potential benefits of an independent infrastructure advisory body are to be achieved in practice, close attention must be paid to its design. Its remit should cover all major infrastructure sectors, including transport, energy, telecommunications and water. Its organisational status, governance, roles, responsibilities and accountabilities should be designed to ensure its ability to provide high-quality, independent advice that is regarded as credible and authoritative by key stakeholders. Established models, such as those governing the United Kingdom's National Infrastructure Commission and Infrastructure Australia, provide useful starting points for the development of an appropriate model.

The demands of establishing the proposed TRC, including the need to ensure that it is adequately resourced with staff with appropriate technical skills, may suggest the need to take a staged approach to the establishment of an independent infrastructure advisory body. However, the nature of these bodies also tends to increase their ability to attract appropriately qualified people from various sectors outside government. Their independent status can contribute to their attractiveness, as can their ability to recruit staff on market-based remuneration arrangements, rather than being bound by civil service rules.

2.2. Infrastructure planning and project selection

This section sets out the conclusions found in a review of the methodologies and processes currently underpinning infrastructure planning, project appraisal and selection in the transport sector in Estonia. It offers recommendations for how to improve transport investment appraisal and selection to the Estonian government. All transport modes were considered.

Review of the methodologies and processes focused on how the needs of infrastructure investment in the transport sector are being assessed in Estonia. It asked whether they are derived from strategic priorities and how this is being done. Whether the Estonian assessment of transport needs take into account risk and uncertainty or the interdependencies with other economic sectors. It also reviewed how stakeholder engagement is managed.

To develop the recommended avenues for reform, the International Transport Forum (ITF) researched just how developed project appraisal is in Estonia. Core questions to determine this were: is guidance on when to choose between a cost-benefit analysis, wider economic benefit analysis, multi-criteria or another method available to the government? Is *ex-post* analysis systematically performed, and does it help improve future assessments and decisions?

A range of other related subjects touching on the organisation of the planning and appraisal functions was also explored.

Key Issues

Estonia has ambitious goals its economy, society and the environment, to which the transport sector will make a vital contribution. Some of these goals relate to aspirations for the people, others to international commitments, for example on climate change.

Constraints posed by individual sector budgets, projects and policies at ground level have the potential to challenge the country's current ambitious goals. Further analysis is required to demonstrate whether continuing on a business as usual assumption at project level will allow for this.

An approach should be developed to better communicate linkages that exist between goals, programmes and projects. Some of the elements of this approach exist already. Development of a simple national transport model using forecasts of population, GDP per capita, car ownership and transport costs to generate aggregate traffic forecasts, fuel consumption, carbon emissions and other impacts would be a useful tool. Much of the methodology will need to be qualitative in nature based on a logic structure linking goals, programmes and expected outcomes. This will be a means by which all parties, political, civil service and agencies can engage and share ownership of policy and programme formulation.

Three themes are identified here as a means of unpacking these high-level issues and providing a framework for recommended reform:

- The culture of decision-making and development of the process – the analysis should precede not follow a decision but precede and inform it
- People and Analytical capability -the status of capable analytical teams should be boosted and further development of this role is needed
- Tools of the Trade – a systematic approach to modelling and appraisal methods is needed

These are explored, in turn, below.

The analysis follows a decision rather than precedes and informs it

In Estonia, decisions are often made on political grounds and the analytical work, if carried out, is undertaken for the purpose of supporting that decision rather than as a means of presenting decision-makers with a set of options for consideration within the wider policy framework. The analysis tends to follow the decision rather than to inform it. While such practice is not uncommon elsewhere, it places a great deal of weight on the quality of the initial decision if it is taken without the benefit of a strong analysis to inform the political decision at the point at which it is made.

Such a process raises challenges for the status of the analyst. It introduces the risk of the analyst losing their independence and being "captured" by politicians and other supporters of the scheme who seek a favourable verdict from the analysis.

It could not be determined whether a systematic process of identifying existing and potential problems on the Estonian transport networks exists. The current absence of information about where and when intervention might be needed means there was no means of moving from high-level objectives to a programme of possible projects for investment and for maintenance, with the aim of establishing priorities within that programme in the context of a budget and other constraints on delivery. The absence of such a process could explain the limited role of appraisal in the current decision-making process.

Some of the most demanding problems described during this research related to international projects in which Estonia is just one participant. Linking the expected outcomes of these projects to the objectives and priorities of the Estonian government's national transport programme does not seem a priority.

The analyst team is capable but it needs its status boosting and role developing

Estonia has a relatively good base of human resources in transport planning, modelling and appraisal. Professional resources are limited and should be considered when reviewing the balance of demands on professionals against available supply.

The following observations were noted:

- There is knowledge of cost-benefit analysis as a methodology and experience in applying it, although usually as a tool to justify a prior decision.
- Awareness was amply demonstrated of the gap between high-level policy goals and project appraisal methods and of the possibility that bottom-up decisions at the project level would not meet top-down policy objectives.
- There was familiarity with useful tools such as highway development and maintenance (HDM) management system models for road maintenance prioritisation.
- There was some familiarity with urban mobility modelling and appraisal of public transport schemes, relevant to decision-making in Tallinn City.

This led to the conclusion that there is a strong base on which to build in the transport analysis area, although capacity may be a problem. The main issue identified, is the lack of status and recognition accorded to the analyst team. A significant cause of this is the limited role of analysis and evidence in the decision-making process.

A further question is how Estonia should develop its professional capacity in transport analysis. As a small country, the market for such expertise will inevitably be thin. While local private sector transport consultancy firms exist and play a valuable role, working with Tallinn local authority analysts, major cross-boundary projects are dominated by analysts from international companies.

A systematic approach to modelling and appraisal methods is needed

Some useful modelling and appraisal tools exist and are well used by analysts. However, there is no formal guidance or systematic approach to help decision-makers appreciate problems and priorities. This lack of method is more apparent at the strategic level. At the scheme-based level, methods exist and we gained the view that these methods provided a framework for the development of more comprehensive quantification and valuation methods and for the formalisation and documentation of these methods.

Strategic modelling tools: Decision-makers require a more evidence-based method for assessing how the evolution of the transport sector is expected to impact the effectiveness of the policies of other government ministries. Examples of this are transport's influence on the achievement of carbon targets and its impact on land-use policy.

Prioritisation and scheme selection: Officials require a process that will allow them to better identify and shortlist potential interventions that are the best value in terms of delivering the high-level objectives while meeting the budget and other constraints. This is the place where cost-benefit analysis excels; informing decisions about priorities.

Appraisal guidance: It is possible that methods and values used in the appraisals carried out for rail, public transport and highway schemes have been developed in a somewhat unsystematic way. For example, while the analysts interviewed were all aware of the use of a wage-related value for travel time savings, no references to documentation of these or other appraisal values were provided. While an informal knowledge sharing system might be adequate for the needs of a small country, the conflicts that emerged

when external consultants are involved in undertaking appraisals of externally-funded projects was evident. A well-documented method and set of values will demonstrate the Estonian government's commitment to the use of analysis and enable officials to challenge the case they are presented with by external funders.

The impression that current appraisal methods may be unsystematic was further supported by the analysts interviewed signalling gaps in their data. These included data and projections for vehicle occupancy rates and journey purpose splits, which are needed to convert values of time savings per person into an average value for each vehicle on the road.

The resilience of the transport system to various global risks is an issue being addressed in many countries. Most obviously a rise in sea level, an increased incidence of storms and flooding, and scarcity of key raw materials. There was no suggestion that these issues were being addressed yet within the appraisal process in Estonia.

Inter-urban modelling and appraisal: Tools already exist for understanding the performance of the options most commonly considered for reducing travel times and evaluating the risk of accidents for users of the inter-urban road network. The adequacy of these models in their coverage of such features as junctions and their interactions with the urban road network were not investigated. While re-assignment was not a significant response in many cases, travellers between cities in the hinterland did in some cases face a choice of routes.

As in many countries, the level of maintenance of roads and in particular of local roads is a problem. Officials lacked a strong case for demonstrating the adverse effects of the current neglect or the benefits of an increased level of spending. Poor quality local roads reinforces a perception of mobility poverty and isolation in outlying rural areas.

Urban transport: Tallinn city and its consultants have taken an effective approach in developing a model for urban mobility for planning the tram network. It should be feasible to extend this model to incorporate bus services. It was clear how the model could map potential housing and commercial developments on to the tram network and hence demonstrate the links between the capacity of the tram and future demand. However, the model lacked a full transport/land-use interaction assessment process. Given the pace and scale of development in Tallinn, such a tool could prove invaluable both in decisions about planning consent and possibly in capturing increases in land values as a potential means for funding new lines. The ability to provide the data required for establishing such a model would need to be considered.

Ex-post evaluation: It was evident that analysts had monitored the performance of some recent projects. One example of findings is that the rail upgrades had resulted in passenger growth well in excess of expectations. There was, however, no evidence of a systematic process for monitoring and evaluating past investment as a means of auditing performance or learning about the potential for improving analytical methods.

Avenues for reform

In this section, a series of recommendations for reform are organised under the three headings. These relate to the role analysis can play in contributing to well-judged decisions, the human resources needed to deliver, and the methods to be used.

Doing the analysis ahead of the decisions

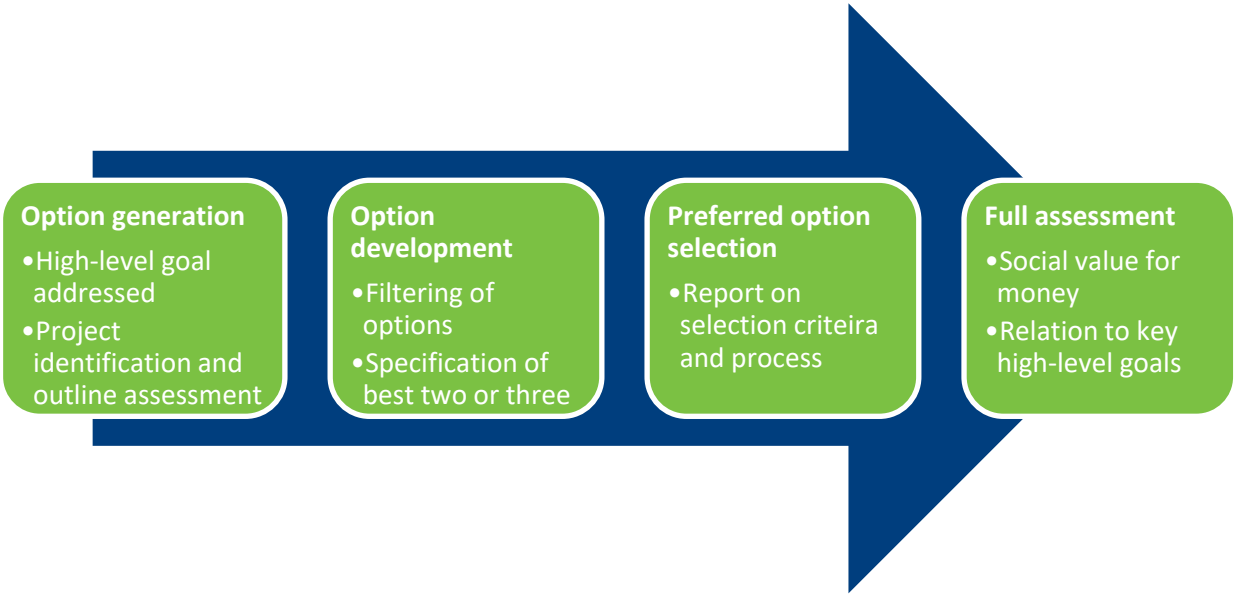
Reform of decision-making requires putting in place changes to the administrative process. Importantly, moving from what would appear to be a piecemeal selection of projects as they come to the attention of

policy makers to a formalised and systematic process. The objective of this reform would be to present decision-makers with a list of options, a broad indication of the likely performance of each and the budget and other constraints against which a programme can be delivered. Such a reform will help decision-makers to select schemes and draw up a programme which best delivers their strategic objectives. New tools are needed to give decision-makers an overview of the problems and high-level potential options that can be sifted, assessed for further analysis and then carried forward as options to be prioritised in the Estonian transport investment and maintenance programme. Responsibility for delivering the programme would continue to be split between the modal agencies, with a cross-modal programme for Tallinn City.

Such analysis should not replace political judgement, since in the public sphere government Ministers must be accountable for decisions. It would, however, be preferable to work towards a process in which evidence and analysis precede and inform decision-making. Greater acceptance of this at political level would be the single most important step on the path to a more mature process. It would also help to avoid a situation in which decisions are taken one by one and questions of prioritisation and making difficult choices over resource allocation are not faced head-on.

Projects included in the major scheme programme should go through a number of clearly defined stages with codified analytical requirements at each stage (Figure 2). There should be an option generation point at which each scheme is identified and assessed in outline. Some form of early-stage assessment technique should be used to provide some indication of the scope and content of the programme. Then there should be a stage of option development for each individual scheme where the range of possible options are filtered to the best two or three. There should be a further analysis report at the point where the preferred option is chosen. Finally, there should be a full analysis of the social value for money of the scheme prior to final decision.

Figure 2. Major project assessment



Each stage of this process needs to be informed by the budget and other constraints on delivery of each option and of the programme. The aim is to encourage decision-makers to adopt the discipline of prioritisation and of weighing up the competing claims of the problems and solutions that make up the programme.

At the final full assessment stage, it is important that a holistic case is developed which relates back to the high-level goals set for the transport sector. A combination of cost-benefit analysis, quantitative and more qualitative methods are used to build the case.

Many European countries follow this four-step approach. Variants are developed according to the focus of national policy. The United Kingdom, for example, has developed a more elaborate five-case model (HM Treasury, 2018) that assesses schemes according to their strategic importance, economic case, financial case, management case, and commercial case. The last two go beyond the process outlined above and consider how the project will be delivered and the potential role of the private sector, for example, involving private finance.

The Estonian model will need to account for national policy priorities and for projects funded by the European Union and other external parties; identifying Estonia's interests and separating these from objectives that have an international focus.

A one or two-page assessment summary presenting the results of the analysis should adequately reflect both the economic and broader policy issues at stake to the decision-maker. For this, it is not sufficient to compute a single monetary indicator of net value of the project. The gains, losses and trade-offs entailed need to be highlighted. The process should be designed with proportionality in mind; if it is too heavy or burdensome it will fail.

The process of moving from high-level problem identification through to a set of possible solutions and narrowing these down to a set of preferred options, ranked in the context of budget and other constraints on delivery, will only be effective if it is linked to a formal approval framework. At each stage, there should be a gateway at which policy makers and officials reach an agreement about the next stage of the development of the programme.

Enhancing the influence of the analyst team

Analysts in Estonia have very little exposure to decision-makers. This does not help to promote how well-conducted economic analysis can assist policy making. Closer integration between analysts and the more senior policy officials would be one way of gaining wider acceptance of the role of analysis. Officials should be encouraged to ensure that the role of economic analysis forms part of their discussions with ministers.

Enhancing the importance of analysis so it becomes an essential input to decisions has implications for the status and capacity of the economic and modelling analysts within government and its agencies. Without being prescriptive, the questions of who does what and where within the government structure would need to be reviewed internally. In the United Kingdom, the status of analysis changed fundamentally many years ago with the establishment of a senior-level post and the appointment of a Chief Transport Economist in the Transport Ministry with a direct line to Ministers, clear responsibilities and the freedom to build a team.

The first essential requirement for the chief transport analyst is to concentrate on developing in-house capability and expertise at government and agency level. The reform of decision-making processes and augmenting the tools used by analysts will require an increase in the resources allocated to modelling and appraisal. This is needed both for policy work done at government level and for acting as an intelligent customer for work undertaken by consultants and other agents in the supply pipeline. Therefore, outsourcing the expertise is not advised.

Estonia is a small country and, as in the case of other small countries, faces the challenge of ensuring that its professionals are up to speed and maintain cutting-edge industry knowledge. New Zealand, for example, is a small country that participates as an "honorary state" in training networks at official

practitioner level in Australia. Knowledge sharing networks for civil engineering exist in the Nordic region and this could be extended to transport modelling and appraisal. The ITF would be well placed to foster the development of such an idea. Consideration could be given to branching out into academic links. This could help to bring the Estonian professional transport community into closer contact with similar problems being confronted elsewhere in Scandinavia and with the methods being used for analysis and policy formulation.

One purpose of such a network would be to give Estonian officials access to a pool of experts whose knowledge could complement an in-house team in particular transport fields as and when specialist knowledge and experience is required. The aim should be to provide more continuity of collaboration than would be achieved through one-off consulting projects.

It is neither efficient nor credible for all economic analysis and modelling to be done in-house. Consultants with special expertise are required. Another relevant scenario from New Zealand is that they have succeeded in developing and maintaining a number of quite small local consultants with world-class expertise in particular areas. One local consultant interviewed during this research was working on the model for the Tallinn tram extensions. We would definitely want to encourage the creation of a local/regional supply chain. However, for international projects such as Rail Baltica, international consultants are bound to be involved and here the requirement is to develop the evidence base and the in-house analytical capability to a point where Estonia is a fully competent client for the work and is contributing to it in the most integrated way possible. Some of the suggestions in the next section might be helpful in that regard.

Developing a systematic approach to modelling and appraisal

This section contains suggestions for taking the analytical toolkit forward. These are not in priority order but sequenced from the more strategic to the more tactical. A hierarchy of modelling and appraisal tools is useful; one size does not fit all problems. The process of moving through a series of stages from the assessment of policy options to the design and specification of the preferred option should be defined through the formal decision-making framework proposed above.

High-level policy option generation and assessment: The development of a high-level tool that provides national-level transport forecasts that inform the design of policies and demonstrate necessary trade-offs between different projects can close the gap between strategic policy formulation and the project level. This could be a relatively simple elasticity model calibrated on historic evidence and use available exogenous variables such as population, GDP per capita, car ownership, and fuel costs together with best evidence on relevant elasticities. This would need to be populated by agreed assumptions about trends in the exogenous variables with a facility for sensitivity testing. The initial work could be done at the national level or with a simple typology of area types such as city, town, rural. The tool should not be overly sophisticated in computing terms and should be appropriate for use by spreadsheet literate people. It should also be capable of progressive development. The main use initially would be to provide a picture of trends in transport demand and to enable assessment of their consistency with carbon and other targets. A second use would be to provide growth factors for use at the project level. In the absence of local data, values used by analysts in comparable countries should be adopted.

A second stage would involve a greater use of geography so as to begin to link congestion and land-use feedbacks into the model. This would require a zoning system and a skeletal network with representation of capacity and speed/flow relationships. The two stages together would resemble a national model.

A more fully developed project cycle - project option generation: A second recommendation is for the development of a more formalised project cycle, with analysis embedded at key stages. This is to ensure

that analysis and evidence gathering precedes and provides an input to political commitment. For capital schemes, the development of an early-stage screening and sifting tool using available indicators such as volume to capacity ratios, evidence on speeds, accident history and so on to create a set of criteria for entry into a pool of projects which merit more detailed assessment. A well-designed tool will encourage discussion between officials and decision-makers about priorities, likely outcomes, interdependencies and constraints.

This tool would contribute to changing the role of analysis from justifying a decision already made to informing decision-makers about the choices of schemes within a programme. Such a tool is likely to be more effective if the information it generates is well presented. Policy makers need to be able to see why it helps them to make decisions. A formal requirement to adopt such a process and to specify the gateways at which decisions are made in the formulation of projects, in the narrowing down of the options, in the allocation of indicative funding and in the more detailed economic case is called for.

Informing the choices that decision-makers face: An output of the economic appraisal is the ratio of benefits to costs. While this ratio should be a leading indicator for decision-makers, it is not in itself a decision. It should not be taken to imply that all projects with benefits in excess of their costs should be approved. It is likely that there will be more projects with benefits equal to or in excess of their costs that can be afforded from the budget or can be procured within the planning timeframe. In such cases, some indicative minimum cut-off ratio might need to be set, in order to eliminate the lower value proposals.

Secondly, the schemes in the list of viable options will not all be strictly comparable. For example, a cost-benefit analysis of a rail scheme might omit certain benefits such as those of improved passenger comfort delivered by new trains if evidence on passengers' willingness to pay for those quality improvements is unavailable. Not all environmental impacts will be capable of valuation in financial terms.

Considerations of social and spatial equity might also be relevant to achieving policy objectives. For example, for reasons of regional regeneration decision-makers may wish to consider prioritising a highway scheme serving a deprived part of the country even if the appraisal shows that greater benefits could be achieved for road users by investing in a more prosperous region. Cost-benefit analysis can inform decision-making and demonstrate the value of the unmeasured benefits that a decision-maker's willingness to consider a scheme with a lower benefit to cost ratio implies. For example, imagine a minister was considering approving a highway scheme in a deprived part of the country where benefits were only 20% higher than the scheme costs (a benefit/cost ratio of 1.20:1) over a scheme in a more prosperous region with comparable costs and benefits 50% higher (a benefit-cost ratio of 1.50:1). The decision to do so would imply that decision-makers are willing to spend 25% more (1.5/1.2) to buy road user benefits in a deprived part of the country than they would spend elsewhere. In such a situation, analysts might provide further guidance for decision-makers by referring to evidence on alternative and perhaps more effective ways of meeting the objectives, such as reducing regional inequality by other means.

Similar techniques apply to deriving implicit values for benefits, such as rail passenger comfort, which might not form part of the quantified economic appraisal. The assessment summary referred to above will be a key source of the information that decision-makers will need to consider.

It is recommended that the Chief Transport Economist in the Transport Ministry is responsible for ensuring that decision-makers are made aware of the trade-offs they are making when considering which schemes they should approve. In addition, the Chief Transport Economist should build up a record of decisions and rationale so that, over time, greater consistency between decisions might be achieved.

Ministers and their officials should decide whether the analytical case in support of each of these decisions is made public. There are certain sensitivities in the publication of each individual business case before the

process has, after a number of years, become a well-established method. However, the government should annually publish an indicator of the value for money of the projects they have approved in terms of the benefit/cost ratio of that year's programme of projects, aggregating the results of the individual projects. Such an indicator should be accompanied by a short note explaining the process through which the choices have been made by decision-makers (as outlined in *Doing the analysis ahead of the decisions* above*)*. This will help build the credibility of government decision-making.

Final approval stage — modelling: On the main inter-urban highway network, there is not a great detail of route choice. If that is correct, the principal problem is representation and modelling of scheme alternatives including their junctions. Possibly the skeletal network described above might be developed to a level at which alternative capacities and layouts could be represented within that model. Or alternatively, local models might be required. In either case, basic data quality would be crucial for robust analysis.

A common experience is that the best tools for modelling analysis, such as aggregate assignment models, are not always the best for communication and presentation to stakeholders and decision-makers. For choices such as 2 by 2 on sections of the main network versus single carriageway or 2 plus 1, microsimulation models can be a very useful way of illustrating the difference in the performance of alternative network specifications. Tools and methods should be adopted which help decision-makers to understand what an option might deliver and facilitate the conversation about priorities and value for money within a programme.

Road maintenance: Consistent use of modelling tools such as highway development and maintenance models (HDM) can inform decisions about road maintenance. This would ensure that decision-makers are informed about the outcomes of decisions on the allocation of funding between the capital and maintenance budgets. The use of such tools should form part of the systematic approach the ITF recommends.

Ex-post evaluation: The evaluation of project delivery and its performance after opening should be carried out frequently. Following on from the staged process of modelling, appraisal and decision-making set out above, the authority responsible for the scheme is required to undertake some minimum level of data collection after completion and within a few years of opening. The requirements should include data on capital costs and completion dates to inform future decisions about delivery risks. In addition, the authority should be responsible for collecting data on the key outputs from the appraisal, such as traffic flows, accident rates and service levels. Comparisons of actual and forecast performance should be used to help to improve modelling and appraisal methods. Examples of relevant reference points through the project's lifetime, relevant for *ex-post* analysis can also be found in past ITF work (ITF, 2017; ITF, 2018).

Auditing analysis: In several countries, the independence of the analysis is strengthened by an audit of the methods, assumptions and results of the cost-benefit appraisal for either all schemes above a certain cost threshold or of a sample of them. In the United Kingdom, the audit is carried out within the transport department, but by a team whose role it is to provide an internal challenge prior to seeking HM Treasury's approval for funding. In Norway, the Institute of Transport Economics at the University of Oslo fulfils this role. In some other countries, the Ministry of Finance is responsible for the review process, which requires an independent audit of all major schemes above a certain threshold. Slovakia is one such example. We did not reach a view about how the function of internal audit prior to approval of the scheme might best be undertaken in a small country. An option for Estonia would be for the audit to be budgeted as part of the project but for it to be procured and administrated by the Ministry of Finance so as to ensure appropriate independence. Another option is to give that role to Infrastructure Estonia, a new cross-sectoral body, proposed in our review of the Institution Structure of the transport sector.

Consistent appraisal framework, methods and values: It is recommended that Estonia establishes a common framework of appraisal at project level, initially covering economic, environmental and financial considerations. This framework should be comprised of elements that can be valued in financial terms, quantified in physical terms, and that are qualitative in nature, such as impacts on biodiversity or on national heritage. The framework should be flexible and used proportionately and consistently across all cases of investment appraisal.

A workbook should be developed which codifies the framework approach itself and the treatment of the usual issues within such a framework. These range from national issues such as the appraisal period and discount rate, treatment of uncertainty, unit of account across to sector-specific problems such as the treatment of induced traffic, and indirect taxation on fuel etc. The Estonian government should consider inviting an external independent review of this workbook to ensure that it represents current best practice.

For the foreseeable future, it will be sufficient to rely on the benefit transfer method so as to take advantage of research work elsewhere to import values adjusted for the income levels of Estonia. This will require assumptions about key variables, for example, about the time series income elasticity of the values of travel time savings. However, for a country of this size, the priority is first to develop a set of credible values from elsewhere. These can be refined later with local studies if they are highly controversial or policy sensitive. A prime source in this area is the HEATCO study (IER Stuttgart, 2005) and the associated article by Shires and de Jong (2006).

Urban transport assessment: Schemes in and around Tallinn City require a different approach to assessments where it is reasonable to take a uni-modal approach and to use what is essentially a fixed demand with exogenous growth approach because:

- walking, cycling, tram, bus and possibly rail commuting still need to be modelled
- policies like parking need to be represented
- induced traffic from both wide-area reassignment and from trip redistribution are likely to be relevant
- land-use change, and its two-way relationship with transport change, is important.

Investigation showed that there are some strong drivers of dispersion of both residence and employment location in the city region with implications for city planning as a whole. It is unlikely that a national model of the form recommended above (*Developing a systematic approach to modelling and appraisal* subsection) could include these features. A model of the city region is required. An impressive presentation was received on the modelling work relating to tram extensions in Tallinn is an example where development of the existing model with better representation of linkages between transport and land use is worth exploring as a way forward.

Large externally driven projects – international, private sector: Project examples of this category include the Rail Baltica and the mooted Helsinki—Tallinn tunnel. Whether the requirement is for planning consent or for public funding, the Estonian government should act on behalf of the people to assess what is in the national interest. This goes beyond issues of cost-benefit appraisal to much broader issues relating to regional politics and the planning system. From an appraisal perspective, however, such projects should be considered on the same basis as a domestic transport project, i.e. in terms of their social value for money to Estonia.

2.3. Infrastructure procurement

Every year, Estonia's Road Administration and other transport infrastructure managers procure hundreds of millions of euros in infrastructure and related services from the private sector. In 2019, this amounted to around EUR 300 million, disregarding co-funding from the European Union[10] (MEAC, 2020). The effectiveness of the procurement process importantly determines, whether best value for money can be secured.

The International Transport Forum's (ITF) task was to investigate 1) how the infrastructure procurement function in Estonia is organised, 2) how the Estonian infrastructure managers in the transport sector approach key procurement choices in delivering projects, and 3) how Estonia approaches the development of in-house procurement capacity and competences. This section is to be considered in conjunction with sections 2.1 Institutional Structure and 2.4 Infrastructure Funding and the Role of Private Finance. The recent International Monetary Funds's (IMF) Public Investment Management Assessment (PIMA) review could be seen as a high-level companion on issues with regard to procurement. Private investment in infrastructure is addressed in Section 2.4 Infrastructure Funding and the Role of Private Finance.

This section looks at what other bodies or roles support the execution of the procurement function in an infrastructure manager. It investigates how Estonian infrastructure managers approach key decisions in the procurement of projects, such as bidder selection process, contract scoping and delivery models, and payment mechanism choice. This also includes how the procuring entity engages the market to inform or be informed. Finally, the effective execution of the procurement function requires competent staff. Hence, this section also investigates Estonia's progress towards the professionalisation of the procurement function.

Key issues

Estonia has established solid foundations for procuring transport infrastructure and related services. The EU directives have been fully adopted: an e-procurement system was set up; an appeals body was established to handle bidders' complaints and; a procurement department hosted by the Ministry of Finance acts as a technical resource centre to advise the public sector on how to procure. The IMF's PIMA gave Estonia a relatively good mark on project delivery. The same is true for the European Commission's performance indicators, though these are less useful for this analysis, as they treat public procurement as a whole and do not offer a breakdown for infrastructure and transport.

A more detailed review of how public clients in Estonia inform their procurement decisions nevertheless revealed a number of areas for substantial improvement.

An infrastructure unit price database is missing

Cost estimates play an important role throughout the development of a project – from inception to delivery. In the early phases, a cost estimate based on the outline design becomes an input in the cost-benefit analysis (CBA). Later, cost estimates based on the more mature project design inform the reserve price (the internal budget cap) and the tender estimate, which can be revealed to the bidders.

A unit price database collects information (the price of a m^3 of concrete, steel, etc.) from bids submitted in tenders. It has a variety of uses at different project stages. It directly informs cost estimates when the design is mature enough to allow an estimation of quantities.[11]

At present, Estonian infrastructure managers (the Road Administration, the Estonian Railways, etc.) rely on ad-hoc information and partial databases that the project designers themselves have at their disposal.

The absence of a unit price database can make the initial cost estimates less reliable, the CBA outcomes will be biased, as will the reserve price and the tender estimate. These biases can influence not only the CBA but also procurement outcomes. Kennedy et al. (2018), for example, show that the tender estimate can be an important pricing signal to the market, leading to bids that are up to 10% lower. Without a unit price database, procuring entities also face a serious challenge in trying to determine whether infrastructure prices are elevated and effective competition could be challenged, or when a bid is abnormally low.

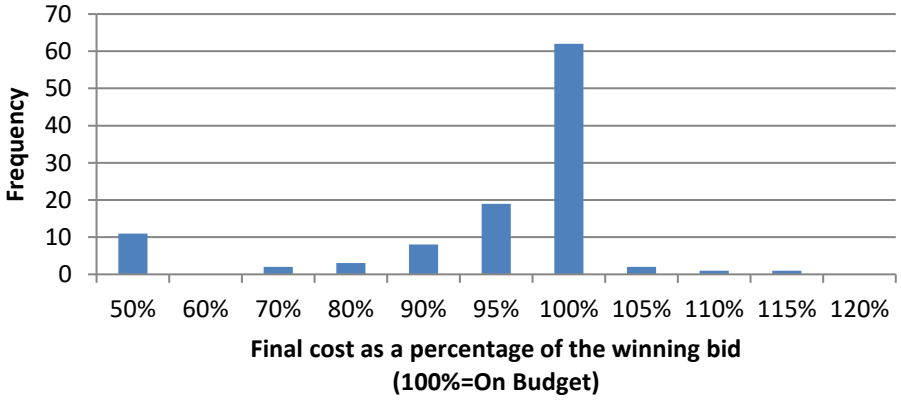
Estonia has negative cost overruns in infrastructure procurement - this is not a sign of efficiency

The ITF's snapshot analysis of the contract cost performance in the road sector finds Estonia to be an outlier compared to international empirical evidence. The analysis considered only completed projects, no framework contracts, and assumed the data was accurately entered in the procurement register. It is important to note that some vital pieces of information were, in large part, missing; for example, the estimated tender value. Two results of this analysis raise concern.

First, for projects above EUR 1 million where the estimated tender value[12] was available, in 13 out of 25 projects the contract award value was the same as the estimated tender value, even though only four of those cases had a single bidder. This is a warning flag for anti-competitive behaviour. Had there been any competition, the price would have been anything *but* exactly the same.

Second, in terms of cost performance after the contracts were signed, the entire contract portfolio exhibits a systematic cost underrun. On average, the final contract cost for projects valued above EUR 1 million is 13% lower than the contract award value. Figure 3 shows the contract cost performance, clearly showing that cost overruns are very limited or "cut off")

Figure 3. Final value versus contract award price for road contracts for the period 2007-17



Note: Only contracts larger than EUR 1 million are included.

Source: Raw data was derived from the Estonian public procurement register.[13]

ITF, 2018a found that roads experience a systematic cost overrun of up to 9%. The majority of contracts behind this performance are procured based on the lowest price competition, use a design-bid-build method and are priced via a bill of quantities. The bill of quantities is an estimate, so, naturally, the quantities related to the execution of projects cannot be accurate. On an individual project basis, sometimes these will be overestimated and in other cases underestimated. Globally, however, the

quantities are systematically underestimated, due to the inability of the public clients and designers to fully foresee all the tasks necessary or identify the needs of the public client. The root causes are still a subject of discussion among researchers (Flyvbjerg et al., 2019).

What is evident in the Estonian case, though, is that an enormous share of contracts is delivered exactly on the budget or are substantially below it. The primary reason for this seems to be the Estonian approach to contracting. The contracts are design-bid-build contracts based on the bill of quantities, however, a 5% contingency has been put in place for unforeseen works, with conditions for its use defined in the contract. Its purpose seems to have been to limit cost escalation and annexes to the works contract.

This cap gives the contractors some room for risk-sharing. However, it essentially moves the contract closer to the lump-sum contract format. Unless the works in question are extremely simple and there is little question about the actual quantities or scope that needs to be delivered, lump-sum contracts are excessively expensive (e.g. Bolotnyy and Vasserman, 2019). A potential concern is also a substantial share of overestimated contracts, which is at least partly explained by the fact that the contract award value in the procurement register includes the 5% contingency.

The precise reasons driving these results require an in-depth analysis. Nevertheless, in conjunction with the extremely low level of contested tenders and practically non-existent appeals, the above results suggest an inefficiency of competitive tendering in Estonia and, with that, deficient value for money of public spending.

Ex-post analysis and the procurement register are valuable but underutilised tools

The PIMA reports that *ex-post* reviews are done for European Union-funded projects and some major nationally funded projects. ITF's discussions with the Estonian entities procuring transport infrastructure revealed that *ex-post* analysis is rarely done on the procurement outcomes.

The procurement register includes a range of information on individual tenders but omits essential data points that would allow for a more effective analysis of tender or contract performance. The focus is entirely on the bidder selection procedure and provides no information with regard to other aspects of the contracts. For example, there is no information on the delivery model the project is using or the payment mechanism. Granted, most projects in Estonia rely on a single format (design-bid-build, with a bill of quantities payment mechanism), but this should change over time, following the trends in more advanced countries. Although an ad-hoc description of the contract is available in the database, this does not allow straightforward pooling of different types of works, which have different risk profiles. A current maintenance contract is not the same as rehabilitation and a brownfield construction project is not comparable to a greenfield project.

There is no real co-ordination of procurement pipelines across modes

Government procurement can be an important driver of demand on the market. If the suppliers cannot effectively plan their capacity or are subject to demand shocks induced by exogenous factors, the state or both, the prices will go up. Estonian entities procuring transport infrastructure maintain a forward-looking plan of procurement, which is said to be reasonably accurate up to one year in advance. There is no structured process or platform over which the authorities co-ordinate their procurement plans. The upcoming procurement cycle of Rail Baltica may substantially affect the Estonian market situation.

Although Rail Baltica contracts are expected to be bigger than infrastructure contract sizes procured in Estonia so far, Estonian companies may be involved as subcontractors and the supply of relevant materials may be local as well.

There was no evidence of procurement co-ordination between transport and other infrastructure sectors.

There is no procurement guidance beyond the issues of bidder selection

EU directives focus primarily on the bidder selection process. They offer no guidance on other important dimensions of a procurement strategy, including a make-or-buy decision, a contract scoping[14] and delivery model[15] decision for larger projects, and the choice of the payment mechanism and other incentives in the contract. Most EU countries do not yet have guidance that concerns procurement strategy decisions beyond those stipulated in the EU directives. However, Estonia need not wait.

The absence of such guidance leaves all other elements of a procurement strategy to expert judgement, which cannot be a good basis for systematically maximising value for money, especially if more advanced tools or insights are available.

Current Estonian infrastructure procurement practice rarely ventures outside the traditional low bid, design-bid-build contract procured through a bill of quantities. That said, about 46% of contracts procured by the Road Administration are larger than EUR 5 million and a few larger than EUR 20 million. Such contracts might already qualify for a more detailed analysis to devise a comprehensive procurement strategy to maximise value for money. For projects like Rail Baltica, the use of such methods is critical.

Consequently, the current in-house technical support - the procurement department hosted by the Ministry of Finance – does not offer holistic support on procurement-related questions, but focuses on compliance with legislation only.

The professionalisation of the procurement function in Estonia has yet to materialise

Estonia has not yet developed a matrix of procurement specialist roles or their required competences. Many within the government are aware of this issue but no operational measures have been introduced.

The literature (e.g. DeCarolis et al., 2018; Saussier and Tirole, 2015) acknowledges the importance of the roles, capabilities and appropriate staff capacity to execute infrastructure procurement efficiently. A lack of capabilities and capacity in the procurement function contributes to inferior procurement outcomes, with significant impact on public budgets.

The mitigation measures from Rail Baltica's risk assessment are not yet fully implemented

A risk assessment of the Estonian part of the Rail Baltica project (EY, 2017), undertaken when the project was at the outline design stage, identified multiple risks. These were all of part of or related to procurement: project management, budget/cost estimates and procurement strategy. The two highest ranked risks in the EY analysis (ranked average impact and high probability) and still relevant today implied a potential cost overrun of up to 20% (EUR 260 million) and a delay of up to three years. The Estonian Court of Audit report noted that the risk management system has been set up in the Estonian implementing body Rail Baltic Estonia (NAO, 2019b; Annex D). The mitigating measures for high-level risks that were recommended in the EY (2017) report are not yet fully deployed, with work still underway.

With regard to project management, compliance with international best practice and a single project management organisation were recommended. It also stated the importance of a full procurement strategy, among other things. These issues have not yet been fully addressed, though progress is underway.

Crucially, the Estonian Court of Audit report (NAO, 2019a and 2019b) recently stated that a "higher-cost" scenario for the project is missing, due to a lack of political will. The Ministry of Finance elaborated that the current Estonian budget could absorb up to a 19% increase of the Estonian contribution, which is about EUR 60 million or 4% of the 2017 project cost estimate for the Estonian section. Though the 2017 risk assessment never produced a risk-adjusted estimate, the top two risks identified by EY alone suggest a much higher budget contingency would be prudent. Greater than 40% cost overruns over initial outline

design estimates have been identified as typical for projects of this type and scale (Flyvbjerg, Skamris Holm and Buhl, 2002).

As noted above, progress in the implementation of mitigation measures has been underway in Rail Baltica and, with the development of the detailed design, the risk of cost overruns will be smaller. That said, projects do face cost overruns even after the detailed design has been developed. For the moment, though, the Estonian budget has no satisfactory contingency plan for significant cost overruns. Such contingency plans should extend beyond a budget plan period; the Estonian budget strategy covers four-year periods, but the Rail Baltica project will last longer.

Avenues for reform

The above revealed a broad spectrum of issues that range from personnel capabilities and organisation to culture and methods. A comprehensive set of reforms is proposed below to improve procurement outcomes.

Create a database for transport infrastructure unit prices

There are different ways to arrive at a cost estimate for an infrastructure project, depending on the accuracy desired. A common approach used by many large infrastructure projects is to source unit price information from bids and process it in a database.

There is no systematic overview of which authorities maintain such a database, but it is commonly operated by road administrations or companies and other sectors (e.g. US road agencies, Highways England, DARS in Slovenia, NDS in Slovakia, etc.). Ideally, a unit price database is maintained for all public works, going well beyond transport infrastructure, as is the case in Belgium.[16]

The unit prices in the infrastructure sub-segment can differ considerably from the price developments in the residential construction sector, hence the use of commercial software products from the private sector using unvetted data is inadequate. The ITF's (2018a) *Motorway Cost Review of Slovakia* provides other examples of the role of cost estimation.

Introduce systematic ex-post analysis of infrastructure projects with additional data points captured in the procurement register

Ex-post analysis should be strengthened and become systematic in the procurement process.

Ideally, all projects over a certain, rather significant, threshold should be subject to *ex-post* analysis.[17] The procurement *ex-post* performance should be addressed in the same report as the cost-benefit *ex-post* analysis. There could be random procurement performance tests and an analysis of the causes of particular problems that may have arisen for smaller projects. To assist the procurement aspect, the procurement register should record several additional data points on project characteristics and procurement outcomes. ITF (2018) recommends that cost estimates be recorded at several critical points through the project's development.

At a minimum, a classification of contracts should be developed in the register itself to separate broad types of works (maintenance, renewal, brownfield/greenfield construction). A qualification of terrain difficulty and complexity of works should be established and recorded[18] as well. Further expansion would depend on the Estonian ambition to pursue benchmarking of cost per physical unit of infrastructure, which is highly desirable, but which very few countries have pursued to date (e.g. in the United Kingdom and Australia). Ultimately, though, the benchmarking data would be extremely valuable for the economic and incentive regulation function of the economic regulator for the infrastructure asset managers as envisaged in Section 2.1 Institutional Structure.

The role of the procurement register must be respected by its users if any of these upgrades are to make sense. The Estonian authorities must ensure that the entry of data into the register is mandatory, with real consequences for lack of compliance. In the current register, missing data is abundant: the estimated values for most tenders were missing in most cases.

Analyse the construction market and co-ordinate the infrastructure procurement pipelines across the transport sector and beyond

Currently, the Estonian public clients – which are procuring infrastructure, construction or related services – plan pipelines to allow their dedicated market segment – the suppliers – to plan ahead and adjust capacity as necessary. There is no cross-sector co-ordination. This approach assumes that each public client is served by a market segment of the construction market that is completely separate from the rest and a demand increase in one sector will have no spillover effects on the others. This assumption is unrealistic. Many construction firms try to diversify to other sectors so not to depend on a single source of revenue. In addition, they depend on a single pool of construction workers and engineers. A mega project such as Rail Baltica would also affect the supply of construction materials. The Risk Analysis of the Rail Baltica project (EY, 2017) itself identifies, for example, a significant risk for the project due to input price hikes. The average demand for sand and gravel due to the project's construction is to double on average between 2020 and 2025. Obviously, this will affect not only Rail Baltica, but all other infrastructure construction in the same time span.

A construction market analysis should be performed, identifying how public sector demand impacts the Estonian construction sector and its segments. Entities, whose demand affects the same segments within and beyond the transport sector should co-ordinate their spending to avoid demand-driven price hikes.

For major projects like Rail Baltica, or considerable initiatives in other sectors, the analysis should capture to what extent the Estonian companies, their construction material suppliers and their workforce will be affected. Multiple scenarios of the involvement of Estonian firms and impacts on other local markets (worker supply, construction materials) should be investigated.

Pursue an in-depth analysis into the causes of the contract performance in Estonian transport infrastructure procurement

The ITF's high-level analysis of infrastructure procurement outcomes in Estonia showed a substantial presence of projects where the tender estimate was the same as the contract award value. Furthermore, it discovered a substantial systematic cost underrun of over 10% on ten years of road procurement data. One explanation for this is that the contract award value recorded in the procurement register included a 5% contingency, which should not be the case. That said, the snapshot review was performed on road procurements, as this sector is usually the most developed around the world in terms of procurement practices. This suggests the likely existence of systemic failings in one or more aspects of the procurement process. Given the importance of this issue – which necessarily significantly reduces the effectiveness of Estonia's infrastructure expenditure – the Ministry of Finance should commission an in-depth analysis of the infrastructure procurement process. This review should assess process quality; contract structures; content, management and works supervision; and anything else deemed important. Further, to ensure the credibility of the review and its conclusions, the government should seek the services of expert auditors (with legal and civil engineering expertise) in the international market.

Professionalise the infrastructure procurement role

Estonia is aware of this challenge, but significant operational measures have yet to follow. The European Union has recently put forward recommendations on the professionalisation of the procurement function (EU, 2017). The United Kingdom and other countries developed standards on the

roles and competences of people involved in procurement, project management and related functions. An example is the Project Delivery Capability Framework for Project Delivery Professionals in Government by IPA (2018b).

Infrastructure procurement guidance should go beyond the issues of bidder selection

Beyond the requirements set forth by the EU directives, Estonian decision-makers in procurement currently do not consider other important procurement dimensions or base their choices on expert judgement.

The make-or-buy decision reflects a long-term strategy of the state in terms of where it strikes the balance between in-house capabilities. For example, activities which are consistently needed but for which no real competition has formed in the market need to be insourced. As an extreme example, the Tallinn City Authorities recently entered a third consecutive seven-year contract with a private company who handles the cities' infrastructure design and procurement. This is a core function and should be insourced.

The contract scoping and delivery model selection concern the questions: Should the project be broken down into several contracts? If so, what should the nature of these contracts be? Should they remain competition-based or should they involve approaches that rely more on negotiations and collaboration? The latter may better handle uncertainty due to the project's complexity or give greater scope for innovation, but can lead to higher cost if applied on inadequate projects or parts of them.

The payment mechanism and other incentive power elements determine the contractor's motivation to deliver on time and on budget. As already noted, lump-sum contracts or requesting on-time/on-budget delivery should be used sparingly, as any uncertainty at the time the contract needs to be priced will lead to excessive contingencies on average and in some cases contractor failure (referred to as the "winner's curse"). Either contracts need to involve extremely simple works (e.g. moving grass) or a particular project's on-time and on-budget delivery is of such extreme importance that the public client is willing to pay an exorbitant premium for such a result.

Preparing and introducing a new procurement strategy to Estonia is a comprehensive project. It requires progressive stages and should be subject to an official strategy adopted by the government (similar to the DfT's Infrastructure Efficiency Strategy initiative[19]).

A first stage in that strategy could be the establishment of a sector-wide unit price database. In the second stage, Estonia could pursue the adoption of recently developed tools to support make-or-buy, contract scoping and delivery model decisions. A pilot tool has been in the testing phase in Australia for several years already (ITF, 2018b). Recent ITF work on major projects also complements the Australian tool (Kennedy et al., 2018). The third phase would be the introduction of project management standards. The United Kingdom appears to be a leader in this area, having just released a new set of project delivery standards (IPA, 2018b). A fourth stage would be an investigation of the preconditions that would be necessary for the introduction of new contracting and delivery models in Estonia (e.g. early contractor involvement, alliancing, etc.). And lastly, a fifth stage would be the pursuit of the procurement function job professionalisation.

An in-house procurement consultancy should advise on all aspects of a full procurement strategy

Section 2.1 Institutional Structure proposes the establishment of a technical resource centre within the Ministry of Economy and Communications. Procurement of infrastructure can have sector- or mode-specific aspects and it is important that the experts are close to "where the action is". For this reason, the technical resource centre's staff should be co-located with agencies with procurement responsibilities,

and only as necessary. This implies at least one procurement expert from the technical resource centre would be located in each agency where there is a continuous need to provide procurement advice or guidance (e.g. the Road Administration or the future road corporation, as laid out in Section 2.1 Institutional Structure). When not providing on-going advice, these experts should research current procurement developments and help to devise procurement-related guidance, i.e. support the other main functions of the technical resource centre.

As noted in Section 2.1 Institutional Structure, guidance on investment appraisal and procurement produced by different sectors going beyond transport should be aligned throughout Infrastructure Estonia, the body proposed in the same section.

What role, if any, should the existing procurement department at the Ministry of Finance play? This will need to be determined by the Estonian authorities. Currently, the department checks for compliance with European Union directives.

Give greater priority to implementation of the risk mitigation measures identified in Rail Baltica's risk assessment and adopt the most likely cost estimate of the project in decision-making

The EY (2017) risk analysis included multiple critical points that should be addressed before the project procurement begins. The elaboration of a procurement strategy is currently underway. Among other things, an analysis into the unit cost this project might yield is a critical element that will support procurement and related processes, such as ensuring that an adequate budget is available.

Furthermore, it is essential that Estonia start operating with the most likely cost estimate. Arriving at a risk-adjusted cost estimate involves taking the base estimate produced by the engineers (derived from the design) and adding a mark-up derived from a Monte Carlo analysis of impacts and probabilities of risks in the risk assessment. As the detail of the design advances, the baseline estimate will change (the current estimate is EUR 1.59 billion, up from the initial EUR 1.35 billion) and needs to be adjusted accordingly. The mark-up for risks can increase – if new risks are identified – or be reduced, depending on the confidence in the risk mitigation measures executed. Internally, the government should operate with the most up-to-date estimates. The public should be periodically updated, at least at the key points of the project development, to maintain buy-in to the project and the credibility of the government. Not finding the political will to operate with the most likely number, even if they impinge negatively on the project's CBA, could have multiple adverse implications.

For example, were the project significantly delayed, part of the funding may be deferred to a subsequent financial planning period, making the final share of the EU co-funding uncertain. Using a lower official cost estimate clearly would not play into Estonia's best interest. Furthermore, operating with numbers and deadlines that are unlikely to be realistic does not incentivise a culture in which people strive to present numbers and impacts as they truly are. This means fewer opportunities for decision-makers to find out about risks and problems before they actually occur and at which point they could still do something about them.

The public clients procuring infrastructure should pilot alternative procurement approaches to stimulate innovation

The traditional lowest price design-bid-build delivery model delivers very good performance in most infrastructure projects and should remain the backbone of procurement. That said, the same approach also stifles the information exchange between the bidding contractors and the public client and involves the contractors only after the detailed design is already complete. In the last decades, approaches have emerged that involve contractors earlier in the process and are based on the principle of negotiation rather

than competition (e.g. early contractor involvement). Best value rather than the lowest price is the focus of these projects. In elements of larger projects, where there is high uncertainty or many alternative solutions may exist, it may make sense to pursue approaches where the contractor can start working with the designer and the client early on to identify alternative solutions or propose innovations. The work on the performance of these alternative contracting approaches and their ultimate impact on value, cost, and time of delivery is still in its infancy, despite a few decades having passed since their emergence. Estonia should take a cautious approach and pursue alternative contracting formats, at first on a pilot basis, ensuring a large dissemination and analysis of outcomes. One way to identify appropriate projects would be to introduce the procurement strategy decision model piloted in Australia (ITF, 2018b), as pointed out above, to best identify where alternative contracting approaches could fit best.

2.4. Infrastructure funding and the role of private finance

Estonia has only just begun introducing public-private partnerships (PPPs) and is considering their use on road infrastructure projects, using an availability-based model. Given that this procurement option is only now being considered, there is no key issues analysis to a large extent this section aims to highlight the policy risks and opportunities of this option, based on the state-of-the-art. It builds on ITF (2018), where the evidence and propositions around private finance in infrastructure were comprehensively reviewed. This section also draws substantially on the work conducted under several other topics, notably the approach to project selection and the share of road funding available from user charges.

This section investigates: 1) the views toward PPPs held by Estonian officials at the time of meeting; 2) the role of private finance in infrastructure procurement; 3) challenges related to PPPs and points of attention, should Estonia choose to pursue them; and 4) the options Estonia has, if it chooses not to pursue PPPs.

Avenues for reform

Estonia requires further clarity on PPP outcomes concerning policy implications, potential execution challenges and the nature and merits of available public-sector alternatives. Estonian officials are aware of the perverse incentive arising from the European system of accounts standard ESA10. This standard does not require debt incurred as a result of using PPPs to be included in the public debt statement.. In addition, (such as those discussed in the institutional structure section of this report). What follows here are suggested areas for reform.

Communicate the difference between funding and financing and the role of private finance in infrastructure and beyond

Public-private partnerships (PPPs) are surrounded by a range of propositions regarding their benefits over traditional public procurement. Makovšek (2019) analysed the central propositions in detail, including the following three roles, where PPPs can:

- yield productive efficiency gains over traditional public procurement and management
- improve allocative efficiency by preventing the state from building projects that are not financially justified, i.e. the roads to nowhere
- alleviate public borrowing constraints, implying PPPs could help solve funding problems.

The evidence of the productive efficiency of PPPs does not show a uniform picture

A firm or a project achieves productive efficiency when it produces a given quantity of output at minimum cost. The measurement of efficiency changes can be done by comparing the performance of a system before a change that would improve performance was made and after. Alternatively, a system could also be compared to others to see whether these perform better or worse. Despite the use of sophisticated quantitative techniques, it is challenging to achieve like for like comparisons, when comparing different forms of governance (and ownership). Makovšek (2019) reviewed evidence for the road, rail, aviation, maritime sectors and concluded that there is no conclusive evidence that PPPs lead to superior productive efficiency outcomes in road and rail projects. Most of the studied PPPs were road projects. However, a lack of systematic performance data collection by the governments to-date inhibited investigations into the value-for-money of projects.

The use of PPPs on port and airport projects do show performance improvements, but robust conclusions are difficult to draw because the introduction of PPPs is frequently accompanied by other institutional or regulatory reforms. Another particular challenge is ensuring randomisation, i.e. if governments do not choose projects to be procured as PPPs randomly, then some underlying characteristics may drive their choice and comparisons with traditional counterfactuals will be biased.

PPPs cannot improve project selection or prevent the building of "roads to nowhere"

One of the benefits ascribed to PPPs is that they could improve project selection. Engel, Fischer and Galetovic (2020) argue that user-funded PPPs could prevent the pursuit of white elephant projects, as the prospective private partners would reject projects that could not recover their cost. While this proposition goes back to Adam Smith (1776) and his Wealth of Nations[20] it does not take full account of the nature of current project selection processes today. Makovšek (2019) explained the challenges if the government retains the power to choose the procurement mechanism and what happens if the government is relieved of that power.

If the government retains the power to choose the procurement mechanism a PPP cannot improve project selection. Before the start of procurement, a cost-benefit analysis is generally undertaken, and this requires a traffic forecast. Governments generally do not do traffic forecasts themselves, but buy the service on the market. If a government wants to pursue a project but knows *ex-ante* that the project is unlikely to be able to recover its cost through tolling in a reasonable amount of time, it would not pursue a PPP test in the first place.

Alternatively, if a government decides to build a motorway programme by requiring that all projects first be submitted to a PPP test (or all those that scored a positive CBA result), only those projects that achieve required capital market rates of return would proceed. Assuming PPPs would be more cost-efficient than public sector models, the proposition above is problematic because:

- the capital markets' appetite for risk is not stable and required rates of return may not necessarily reflect or be correlated to the social desirability of the project (see fluctuation in demand risk appetite in Makovšek (2019)), i.e. the risk sensitivity of capital markets may be elevated due to reasons pertaining to the markets themselves and not to the demand and tolling potential of a particular project.
- there may be a substantial number of motorway sections that are desirable in terms of their cost-benefit evaluation, but cannot satisfy the return requirements of the private sector. If these are left to be executed by the government, then the PPP filter would achieve nothing. If the government does not pursue them a substantial social welfare gain would be lost. If the execution of the cost-benefit analysis would be transferred to the private sector then a perverse incentive

would be introduced to approve as many projects as possible, replacing one moral hazard with another.

Further to the above, there are other ways the government could side-line the PPP filter. For example, many governments have established motorway companies which handle the entire national network and are funded by tolls (e.g. DARS in Slovenia, AsFinAg in Austria). Within these networks, there may be sections that were not economically justified but are cross-subsidised by others. A government could do the same when designing the scope of a PPP – selecting sections that would cross-subsidise those that cannot recover their cost, while still achieving the required private-sector return overall. These issues could potentially be addressed only if the private sector would also be responsible for infrastructure planning. As this would open a range of new issues difficult issues no advanced economy to date relinquished its role as a central infrastructure planner to the private sector.

In summary, project selection is endogenous to the government and, for the time being, no mechanism has been invented that could successfully take that responsibility away. Therefore, PPPs cannot contribute to an improved selection of projects.

PPPs do not give the state more money to spend

A common misconception of PPPs reflects confusion between the concepts of financing and funding. It has been widely assumed that, by marshalling private capital investment, the government can expand its pool of investment funding. However, this view ignores the fact that this additional capital investment be repaid with a return, in the same way as if governments were to fund the project directly by issuing bonds. PPPs are both a procurement tool and at the same time a different means by which a government can borrow. Regardless of the form of the borrowing, repayment requires the use of either general or dedicated taxation or user charging.

A further false impression is that PPPs can extend the public borrowing constraint, i.e. that the state, through the PPPs, can actually borrow more than it could otherwise. This issue arises from the application of inadequate accounting standards which do not properly recognise the assets and the liabilities related to PPPs in the public sector balance-sheet. In consequence, the liabilities related to the PPPs, be it availability based or funded by user charges, generally do not have to appear in the statements of public debt as reported to the European Union. The European system of accounts (ESA10), despite past reform attempts, still allows off-balance sheet treatment of PPPs, thereby creating a perverse incentive for their use.

These accounting deficiencies create the impression of lower than otherwise public debt, but they do not, in fact, increase borrowing capacities. If PPP funding is availability based (i.e. they are funded from the general budget) the government needs to pay an annual charge, usually for decades. This will allow the current government to spend more but limit investment opportunities for future governments. If many PPPs are pursued, a substantial portion of government expenditure will be fixed in advance, limiting budgetary flexibility. The latter dynamic explains why Estonia in 2012 abandoned the ring-fencing of tax revenues for roads and other purposes: that is, this change allowed it to better manage large changes in the fiscal situation, such as during the last Global Financial Crisis. The International Monetary Fund (IMF) has developed a tool for monitoring fiscal exposure to PPPs (PFRAM – PPP Fiscal Risk Assessment Model), which enables this challenge to be managed.

A more serious issue is that the incentive to pursue PPPs for accounting purposes can lead to new projects being pursued on a value-for-money basis, being watered down or ignored. This risk is exacerbated by the weaknesses in Estonian project identification, appraisal and selection processes identified and analysed in Section 2.2. Infrastructure Planning and Project Selection.

In countries with substantial experience in the use of PPPs, such as the United Kingdom, a persistent criticism has been that governments have been unable to secure an unbiased selection of procurement options. Despite various measures to ensure a balanced selection, in practice ministries often faced a situation in which a project could only be funded if it was a PPP or not at all (NAO, 2018). Ultimately, criticism from the National Audit Office and the academic community, together with several prominent failures of PPP initiatives, led to the loss of political support for privately-financed infrastructure projects in 2018.[21]

Given that Estonia is obliged to use the ESA10 standard as a member of the European Union, its options on how to address a bias towards PPP will be limited, but some proposals are included below in "The use of PPPs in Estonia: Critical Success Factors for PPPs".

Other proposed benefits of PPPs

PPPs tend to get associated also to other benefits (see e.g. Engel, Fischer and Galetovic, 2020), which depend on the public sector alternative – the counterfactual we choose to compare PPPs with. Commonly, when citing PPP benefits, the weakest or the legacy public sector alternative is used.

The public sector legacy approach to infrastructure governance involves a public agency, which is funded through the general budget and contracts construction and maintenance activities from the private market. This is how the road sector is managed in Estonia and the same model can still be found in many other countries around the world.

Funding through the general budget has two implications. First, raising money through taxation gives rise to a deadweight loss that economists call the marginal cost of public funds (MCF), because taxes disincentivise people from working. Every Euro raised through general taxation, therefore, has an extra cost to the society. A short explanation of this concept is available in Makovšek (2019). Second, countries have found it difficult to maintain consistency in infrastructure spending over time, leading to large maintenance backlogs in some cases (see data for Europe in Makovšek (2018)). The consequences of insufficient infrastructure maintenance are not immediately visible. The annual political negotiations around the general budget can affect the predictability of maintenance budgets and thereby impair the efficiency of maintenance planning. Any infrastructure organisation with a predictable and sufficient maintenance budget will perform better in terms of maintenance performance than one that faces an uncertain budget position over the next several years.

Availability-based PPPs include a contractual obligation for the state to pay an annual charge, which supports the predictability of maintenance budgets. That said, no country manages all roads as PPPs. If tolling is not introduced; procuring a few projects as PPPs will provide a better maintenance standard, but the rest of the network will suffer in comparison.

Introducing tolls to fund PPP projects is a political challenge. But if a country is able to introduce tolling, it can do so regardless of the procurement model chosen. Many countries (e.g. Austria, Slovenia, Slovak Republic) have established toll-funded motorway companies, which are independent from the annual general budget political cycle. These companies can also disperse traffic demand risk through their entire network, as well as over time, by adjusting the tenure of their lending portfolios, by refinancing to secure the best interest rates.[22] The same company can use modern infrastructure procurement contracts such as Design-Build or Early Contractor Involvement if they want to put greater stress on innovation to lower the cost of infrastructure.

The counterfactual to a user-funded PPP is a user-funded, state-owned infrastructure manager of a network or in larger countries a part of a network. This issue and the efficiency incentives associated with it are further explored below.

Consider systematic reforms of public infrastructure governance rather than piecemeal PPP interventions

What is the core issue with PPPs?

In the absence of hard evidence, support for PPPs has relied on theoretical propositions, such as the high-powered incentives within PPP contracts (e.g. high penalties to contractors if they fail to deliver on time, fixed budget) and the bundling of project phases. So far, the very drivers of efficiency in PPPs have received insufficient attention, which also has an offsetting impact, increasing uncertainty for the bidders, when they need to price the contracts (ITF 2018). For example, if the bidder needs to commit to a fixed price and date of delivery, taking full responsibility of the design and construction of a project, it is expected they have a reasonably precise view of the resources and time needed for project completion. If the bidder cannot estimate these quantities precisely, a very high contingency allowance will be introduced.

Risk-averse behaviour implies that, on average, these contingencies will be too large. The PPP model lacks any *ex-post* mechanism to control for exorbitant economic rents. This issue exists in all availability-based PPP contracts and contracts, which are user funded, but the users are captive and have a limited opportunity to respond to something like service quality issues. All road PPPs, for example, demonstrate these characteristics, since PPPs on new sections are not accepted by the market unless exclusivity is guaranteed and users have no comparable travel options.

Conversely, ITF (2018) suggested that the use of PPPs is recommended in cases where users can strongly respond to changes in service-level quality (demand is strongly endogenous). Marine port or airport PPPs competing for the same catchment area meet these criteria. In this case, the PPP consortium will be under continuous pressure from other competing service providers; providing a continuous efficiency incentive and eroding abnormal rents.

What are the public alternatives to public-private partnerships?

One of the main alternatives to PPPs relevant to Estonia is the corporatisation of the management function of infrastructure (Section 4.1.). This would imply, in particular, the transformation of the road agency into a road company.

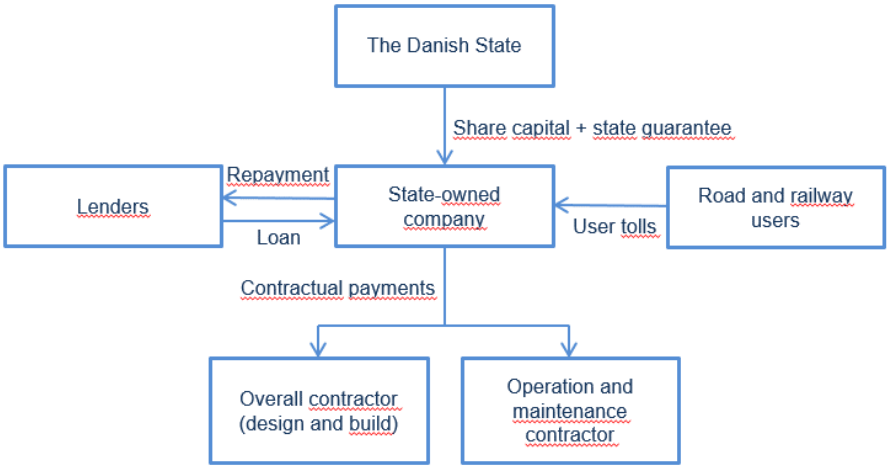
Another alternative is that the management of infrastructure assets includes a form of incentive regulation known as the Regulatory Asset Base (RAB) model, commonly used in the regulation of utilities. The United Kingdom is one of the first countries to have applied this approach to its motorway company. If this were to be done in Estonia it would involve the current regulator (Consumer Protection and Technical Regulatory Authority - TTJA) taking on an additional role. This would be the function of incentive regulation; monitoring and stimulating the efficiency of road infrastructure management, as well as that of other infrastructure managers where competitive pressure is lacking, such as the national airport and the railway infrastructure.

To maximise the efficiency potential of the state-owned infrastructure managers, their funding should be independent from the general budget, where possible. In the road sector in particular, Estonia should, therefore, introduce tolling on roads and reintroduce fares in public transport, as proposed in Section 2.5 Steering User Behaviour and Public Transport Policy. Since the Estonian citizens are already paying for the infrastructure, effectively through fuel taxes, it should be achievable to introduce tolling by offsetting a portion of the fuel taxes.

As an example, in Denmark, the Sund&Belt holding owns several State-owned companies, which fund themselves. The holding also benefits from a state guarantee, financing itself at a cost premium on 0.50%

higher than the risk-free rate of the state. Despite this, the Eurostat rules still allow the company to be off the balance sheet (Figure 4).

Figure 4. The state-owned infrastructure manager



Source: Holm and Horstmann-Nielsen (2018).

If a newly created Estonian road company can manage to recover more than 50% of its cost through tolls (alongside other less demanding conditions), it would be possible to treat the company and its financial obligations as off the balance sheet, as is done with PPPs. This is done at present in several countries. In Slovenia for example, DARS is responsible for the entire national motorway programme, which was built over a period of 20 years. The company is funded through tolls for heavy-goods vehicles and vignettes for private cars. As the company is responsible for several billion euros of debt related to the national motorway programme, governments have been careful not to endanger its capacity to service the debt. A failure to reach 50% cost recovery could lead to the re-categorisation of its obligations and an instant substantial increase in public debt. This political disincentive to interfere in the funding flows of the company has promoted the predictability of funding. This is an essential element of an effective maintenance strategy.

A key aspect of the structure above is that it represents a comprehensive approach to the management of network industries and the execution of transport policy. By contrast, applying PPPs on occasional sections of the road network, together with a public governance approach would make the execution of transport policy changes, network-wide, more difficult. Any network-wide reforms would likely require renegotiations of the PPP contracts.

The use of public-private partnerships in Estonia: Critical factors for success

If the Estonian government decides to pursue PPPs, it should do so within the context of a detailed policy framework that reflects international best practices, in order to maximise the likelihood that projects are executed successfully and improve value-for-money. There is an abundance of guidance available from intergovernmental organisations, which promote the use of PPPs, such as the European Investment Bank's The European PPP Expertise Centre (EPEC)[23], the World Bank[24] or the Global Infrastructure Hub.[25]

This extensive guidance concerns:

- the legal/regulatory framework
- institutional arrangements
- PPP project selection and preparation
- contract management

Estonia has prepared draft guidance materials on PPPs (TGS Baltic, 2019a; TGS Baltic, 2019b) which covers much of this material, but leaves room for improvement.

Several of the misconceptions with regard to the proposed benefits of PPPs have found their way into the draft guidance on PPP application in Estonia (e.g. the ability to improve project selection, the ability to spread cost over time. This should be amended to represent not only the probable benefits but also the risks of using PPPs. Useful starting points are in the analysis further above.

Below are some caveats that concern the last three bullet points; separating the third into two separate areas of discussion.

Institutional arrangements

The execution of a PPP programme will require the establishment of a PPP knowledge centre. This should be absorbed by the proposed Technical Resource Centre, where the procurement expertise would be concentrated and in line with the recommendations of Section 2.1 Institutional Structure. If eventually technical resource centres are also established by other sectors (power, water, housing), these could co-ordinate the creation of PPP guidance and technical support beyond their own sector with oversight by Infrastructure Estonia, a cross-sectoral body, also proposed in Institutional Structure.

Project selection

A key element in supporting the adoption of an unbiased approach to PPPs would be the introduction of the IPSAS32 public accounting standard, which Estonia has already done. The use of this standard was recommended by the IMF (Funke, Irwin, and Rial, 2013) for financial reporting to citizens and the market. IPSAS32 is based on accounting principles (specifically, that of economic control), which ensure that obligations related to PPPs are recorded on the public balance sheet, contributing to greater transparency.[26] The bias towards PPPs caused by the accounting treatment of PPPs in the European Union can not be fully neutralised as long the European System of Accounts is not reformed. That said, Estonia could still take steps to try to ameliorate the bias.

The first step is to increase transparency. This can be done by summarising obligations and contingent liabilities related to PPPs and making this available to the public via the government budget and discussed in fiscal policy (IMF, 2019).

Secondly, Estonia should seek to neutralise imposing a choice on the decision-makers of specific projects. This is particularly relevant where a project can only go ahead as a PPP or there will be no project.

In the past, countries used the Public Sector Comparator to assess which PPPs might be better value for money, in terms of project selection. This tool suffered from a lack of empirical data, relied on unproven strong assumptions, was biased in the favour of PPPs, and was ultimately abandoned in the country that was the first to advocate its use – the United Kingdom (see the *PPP's do not give the state more money to spend* section above). Elsewhere, qualitative reviews have been developed to decide whether a project is appropriate to be executed as a PPP and not as an assessment and whether the PPP is better than the public sector alternative.[27] However, unless the project is very small, most can be structured in such a way

as to be procured as a PPP. If Estonia decides to pursue PPPs it should not develop a Public Sector Comparator as no country collected sufficient data to make such an analysis meaningful. Instead, Estonia should adopt a simple assessment to determine, which projects might be more or less appropriate to be deployed as PPPs.[28]

One consideration is that of the appropriate project size. Reducing project size (for example by breaking a road project into several separate contracts) creates disproportionate transaction costs and leads to the introduction of many interfaces between contracts, giving rise to additional risks and costs. Smaller projects also have difficulties in attracting sufficient interest from international capital markets, leading to higher financing costs. Estonia should, therefore, avoid atomising PPP contracts to ensure local participation. On the other hand, letting contracts above a few hundred million (EUR) in value will reduce the number of international contractors that could bid (e.g. see Roumboutsos, 2020).

Project preparation

One issue that the project preparation guidance published by international organisations in relation to PPPs does not yet accommodate is the recent recommendation by the ITF Working Group on Private Investment held in 2018, which concerns the targeted de-risking of PPP projects.

The objective of the de-risking is directly related to the challenge laid out in the *What is the core issue with the PPPs* section above. The bundling of project phases and the requirement to deliver on-time and on-budget increases the uncertainties faced by contractors in the PPP consortium. As laid out in Kennedy et al. (2018) a range of actions can be taken by the public client to reduce the uncertainty bidders face during the tendering process.

A precondition to the effective reduction of uncertainty *ex-ante* is also to apply a tendering process that is best suited to facilitate an information exchange between the client and the bidders – this is the competitive dialogue process. Here we cite just two examples.

One example concerns the level or project design. Currently in PPPs at best an outline design is made available to the bidders, which implies that about 15% of the engineering is done. During the bidding process, the bidders have to develop the rest of design in a very short time period and with a possibility that they might lose the bid. It is recommended that the public client makes a fully-costed reference design available, with degrees of freedom in cases where it is expected the PPP bidders might do better/provide alternative solutions and a detailed design with full permits acquired, where this is not expected or desirable.

Another example is to pursue joint risk-management with the PPP bidders during the competitive dialogue. This will help the client identify who is able to mitigate or manage which risk at the lowest possible price, ultimately reducing the cost of risk across the project. The public client could then also make informed decisions regarding what cost will the transfer of particular risks entail and whether certain risks are best managed within the public sector.

Undertaking such measures will reduce the cost of the PPP without adversely affecting the efficiency incentives in the model, i.e. value-for-money will be improved.

Contract management

The operational phase of the contract brings a different set of challenges. While compendia of good practice are available (https://managingppp.gihub.org/), a fundamental challenge with regard to PPPs is contract renegotiation.

This is the case especially in emerging economies or where there is a lack of experience with PPP delivery and management.

PPPs contracts typically last for several decades. During such extended periods, unforeseeable events are likely to arise which will require contract renegotiation. A policy framework should be developed *ex-ante* to address such renegotiations and ensure that their outcome is not a significant reduction in the value-for-money of the PPP over time. The ITF (2017) published a comprehensive review and recommendations with regard to these renegotiations and we recommend this document be used as a basis to frame a PPP renegotiation policy. Among other things, the establishment of a PPP arbiter or regulatory body is recommended.

Two key points were that renegotiations should only be allowed in exceptional cases and that an independent body should be tasked with determining when renegotiation of a PPP is legitimate.

A further issue that concerns the operational phase is information sharing. One important aspect, for example, the sharing of information on traffic flows, which may be needed to inform the national transport model, assess the viability of adjacent road projects etc. As the private partner is not required to service any information requests other than those specified in the contract, it is vital that Estonia considers what information should be reported to inform policy decisions. This will also help to create a more level playing field in case the need for renegotiations will arise during the operational phase of the project. The World Bank guidance on PPP contractual provisions, particularly on disclosure and confidentiality, should be a useful reference point to start with to address this issue (WBG, 2019).

2.5. Steering user behaviour and public transport policy

The International Transport Forum (ITF) reviewed the current state of urban passenger transport and the main mobility trends in Estonia. It analysed the current fuel and vehicle taxation regimes, the organisation and pricing of public transport, and urban planning. This section highlights key issues in Estonia and presents the conclusions of ITF's analysis. It recommends an integrated set of reforms that would support a shift to sustainable and low-emission transport systems in line with Estonia's ambitious national and global climate change mitigation goals.

Key issues

Transport planning and investment decisions have largely sought to cater to the growing number of private cars by adding road capacity and providing sufficient parking space. However, it is well established that car-centred planning leads to additional traffic (i.e. induced demand[29]), does not ease congestion nor reduce environmental externalities (Standing Advisory Committee for Trunk Road Assessment [SACTRA, 1994]). On the contrary, this approach has encouraged dispersed patterns of development and resulted in longer journey distances. There are also harmful consequences in terms of quality of life, health, distributional issues and climate change.

Estonia is one of the most transport- and energy-intensive economies in the European Union. To a large extent, this is the result of the unmanaged growth in private vehicle use. Prioritising private vehicles in urban planning has also led to the underdevelopment of public transport options, which has, in turn, accentuated spatial inequalities. Unplanned urban sprawl resulting from the lack of integration of land-use and transport planning and weak planning control have also contributed to increasing accessibility issues.

Estonian policy makers need to re-examine the rationale behind Estonian mobility policy and transport infrastructure investment in order to underpin a move toward a more sustainable transport system. Rather

than accommodating traffic growth, the emphasis should be on reversing car dependency and encouraging less damaging forms of mobility. This shift in approach implies providing adequate and equitable access to opportunities through public transport, walking and cycling. These changes would contribute significantly to efforts towards mitigating climate change, as well as reducing air pollution and its associated health impacts. However, the transition of the transport sector will give rise to conflicts between environmental and social objectives. It is necessary to identify groups that require targeted compensation to ensure that individuals, particularly the most vulnerable, do not bear excessive costs.

The following sections set out key obstacles to reducing car dependency and promoting more sustainable modes of travel. The analysis covers fuel and vehicle taxation, public transport organisation, and pricing and urban planning.

The inconsistent tax treatment of different modes encourages the use of cars and fails to provide incentives to choose less polluting cars

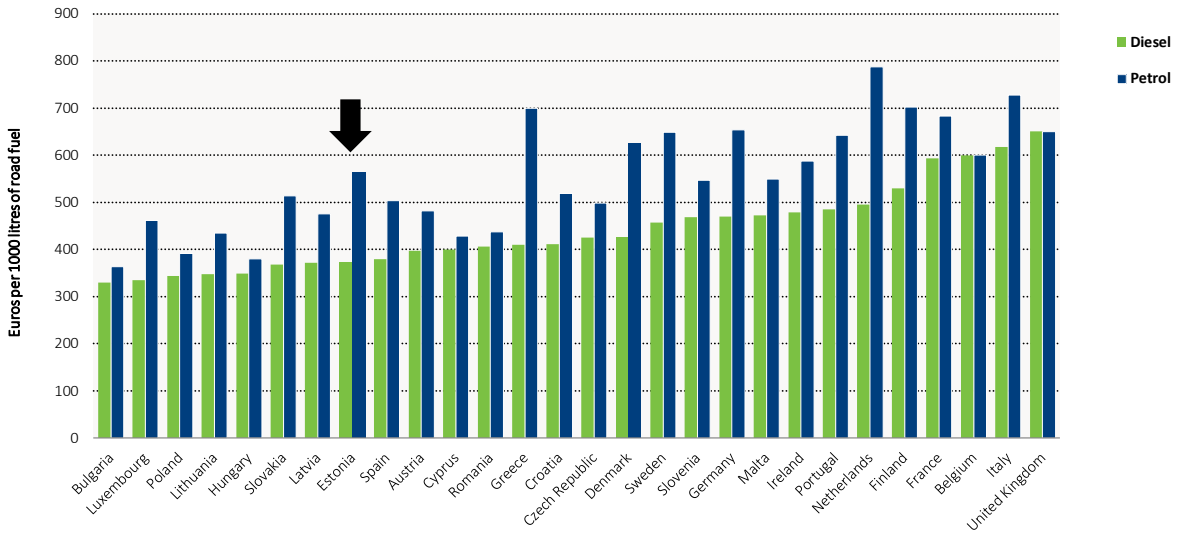
Road transport accounts for a large and rising source of greenhouse gas (GHG) emissions in Estonia. Passenger cars have the highest average CO_2 emission levels in the European Union and worst fuel economy (European Commission, 2016). New vehicles purchased in Estonia have the highest average CO_2 emissions in the European Union, at 132 grams per kilometre, compared to the 2017 EU average of 118.5 grams per kilometre (EEA, 2018). Ownership of passenger cars is higher than the EU average, and cars are older and larger than the EU average.

This is largely the result of low and inconsistent vehicle taxation levels. Estonia does not have any vehicle taxation apart from a circulation tax for heavy goods vehicles and a low, flat vehicle registration fee. Taxation of motor vehicles accounts for only 2.5% of environmental tax revenues, well below the OECD average of 24.5% (OECD, 2017). Estonia does not levy any user charges on private vehicles, neither at the national nor at the city level.

Estonia levies an excise duty on transport fuels, other than biofuels. Despite a number of increases in the excise duty, emissions from cars have not decreased noticeably (EEA, 2017). As in most OECD member countries, petrol is taxed at a higher rate than diesel, despite the fact that the use of diesel yields more CO_2 than an equivalent volume of petrol and its use in even the most recent engines produces more local air pollutants, including nitrogen oxide (NOx) and particulate matter (PM). In the first quarter of 2020, the excise tax for petrol was EUR 0.563 per litre, while the tax for diesel stood at EUR 0.493 per litre. On 1 May 2020, however, as part of measures aimed at combating the Covid-19 crisis and its economic effects, Estonia opted to cut diesel fuel excise duty by 25% to EUR 0.372 per litre for two years.

When the external environmental costs are taken into account, there is no good basis for taxing road diesel favourably relative to petrol (Van Dender, 2019). The reason for lower rates is to reduce tax on commercial transport, which is an intermediate service; in principle, it is more efficient to tax end products. A system of partial diesel excise tax rebates, as practised in some EU member states, is a more suitable approach that avoids distorting the passenger car market.

Figure 5. Diesel and petrol excise duties in EU member states, May 2020



Source: European Environment Agency, https://www.eea.europa.eu/data-and-maps/daviz/road-fuel-excise-duties-6#tab-chart_1.

Fare-free public transport is not financially sustainable and has not encouraged modal shift

Fare-free public transport (FFPT) was introduced in the city of Tallinn in 2013 (Box 1). In July 2018, it was extended throughout the whole country. Eleven out of fifteen counties have agreed to offer free public transport for all. Those municipalities that opted out of the scheme must still provide free public bus services to all persons aged under 19 and over 63. The Estonian government established public bodies Public Transport Centres (commonly referred to as PTAs) to run bus services in the regions. The State also provides support to consolidate bus lines, order new vehicles and improve services.

Fare-free travel is not provided on some lines, in particular those that cross county boundaries. This is because some PTAs – West-Viru, Harju, Rapla and Parnu – have chosen not to implement fare-free bus transport for all. When a county opts out of the fare-free system, it not only misses out on additional funding from the national budget allocated for county public transport, it must also pay for additional transport concessions. For instance, Harju County's transport centre (North PTA) reported that ridership on some lines increased by as much as 60% after the requirement to provide free public transport to all persons aged 0-19 and 63+ was introduced. This was partially due to the shift from commercial lines previously run in parallel. However, additional services put in place have not been sufficient to meet increasing demand.

Commercial bus operators providing service on long-distance and international routes have also been required to provide free service to preschool children and some groups of people with disabilities. These operators provide high-quality bus services that are self-financed via ticket sales. Commercial operators also maintain the bus stations and the ticket selling system. However, commercial carriers do not receive any compensation from the national government for providing this social service. Providing free services to preschool children and people with disabilities is an appropriate policy intervention. However, there is no sound basis for obliging commercial carriers to provide these services without compensation in a situation where the state is extensively subsidising bus and train services.

Box 1. Fare-free public transport in Tallinn

In 2013, Tallinn made all public transport free for registered, taxpaying residents of the municipality. The objectives of the policy were to alleviate congestion and pollution, reduce inequality and promote more sustainable travel patterns. The increased net cost of operating Tallinn public transport (rising from EUR 50 million to EUR 70 million) was covered by additional local tax revenues, derived in part from an increase in the number of residents registered in the city. In 2019, Tallinn had 441 000 registered citizens compared to 416 000 in 2012 (Tallinn, 2019). The migration came from surrounding municipalities, which lost those tax revenues.

Since fare-free public transport (FFPT) only applies to registered Tallinn residents, it does not address the problems experienced by suburban commuters. Its measured effects on modal split are marginal with a persistent shift towards private car use over the past seven years across all income groups. Cats, Susilo and Reimal (2016) found that the number of people in Tallinn using public transport instead of cars had risen by 8% but, at the same time, the average length of a car journey had increased by 31%, suggesting increased car use. Flaws in the design of FFPT in Tallinn limit its potential benefits: fewer than 50% of riders regularly validate their ticket. This means that ridership data from ticket validations considerably underestimates boardings.

The future financial viability of fare-free public transport in Tallinn is questionable. Increases in resident numbers initially yielded additional revenue to offset the increased net cost of operating the system. However, significant increases in resident numbers are unlikely in a small country with a declining population. Tax revenue for public transport, therefore, will remain at relatively constant levels, limiting the capacity for future investment in public transport.

It has been reported that the fare-free public transport policy has increased the mobility levels of rural Estonians, who comprise one-third of the country's total population and are generally older and less affluent. However, not all residents have access to public transport and overall, the scheme has failed to reduce car dependency. Increases in ridership have often been the result of an undesired modal shift from walking or cycling, or the result of induced demand from residents who were already public transport users. Proost (2017) argues that, by increasing operating deficits and reducing capacity to invest in public transport networks, low public transport prices may result, paradoxically, in a modal shift away from public transport as quality declines with underinvestment. In this view, keeping the prices high enough for stable investing in capacity and service quality improvements is a better strategy than fare-free public transport. If the system is maintained, it will be increasingly difficult to fund as needs for additional capacity and improved quality will also increase. The system is also extremely vulnerable to budget cuts if political priorities change. Therefore, developing a strategy for re-introducing pricing is essential to ensuring that the system is financially viable in the long term and that quality of service will not deteriorate over time.

A lack of integration between modes is undermining the achievement of modal shift objectives and efficient service delivery

Co-ordination between public transport routes and service providers is usually based on informal negotiation between PTAs, municipalities and Elron - the main rail operator in Estonia. Some PTAs take rail schedules into account when setting timetables for local bus services, but in the majority of cases, inter-modal co-ordination is absent. Connections between lines are often inconvenient and long distances between stops frequent.

The absence of integrated ticketing reflects the lack of inter-modal co-ordination. This is particularly problematic in the capital region, where almost 120 000 commuters travel daily between Tallinn and Harjumaa county and require separate tickets. There are also differences between the tariff systems of the different counties, with some areas providing fare-free public transport, and others not. Among counties that continue to charge fares, some set tariffs on a zonal basis, while in others the price depends on the distance travelled. Moving towards a more co-ordinated approach and eventually integrated public transport ticketing across the country will be essential to making public transport more convenient for users and thereby more competitive vis-à-vis car travel. It will be also help to address the needs of residents of rural areas.

A lack of investment means the full potential of existing rail-based services is not exploited

Since 2014, rail passenger numbers have been growing. According to Elron's figures, passenger numbers rose by as much as 50% between 2014 and 2018.[30] On certain lines during certain periods, there are too few trains to cater to the increased demand. This has led to measures such as the restrictions on taking bicycles on passenger trains since summer 2019.

Speed is another challenge: trains can travel at 160 km/h, but infrastructure factors limit actual speeds to 135 km/h. On some lines – between Tartu and Tallinn, for instance – train travel remains faster than car or bus travel. However, current plans to expand road capacity on the parallel road route may significantly change this, reducing competitiveness of rail services.

Most of Estonia's rail network runs on diesel, with electrification limited to suburban trains around the capital. Currently, only 132 of the 1 219 kilometres of the rail system are powered with electricity. Diesel locomotive engines are an important contributor to air pollution and noise emissions.

The construction of regional stations on the Rail Baltica route is an ineffective way to improve local accessibility

Estonia is planning to build 11 regional stations along a 213 km stretch of the Rail Baltica Route by 2030. This means that in addition to carrying high-speed trains with maximum design speed of up to 249 kilometres per hour, Rail Baltica will enable regional trains to travel at a speed of up to 200 kilometres per hour. Given the alignment of Rail Baltica corridor, the proposed stations risk being located far from areas that can generate sufficient demand. Even with the creation of feeder bus services and the proposed decommissioning of the existing 1 520 mm rail connection, this will not be an effective way of improving local accessibility.

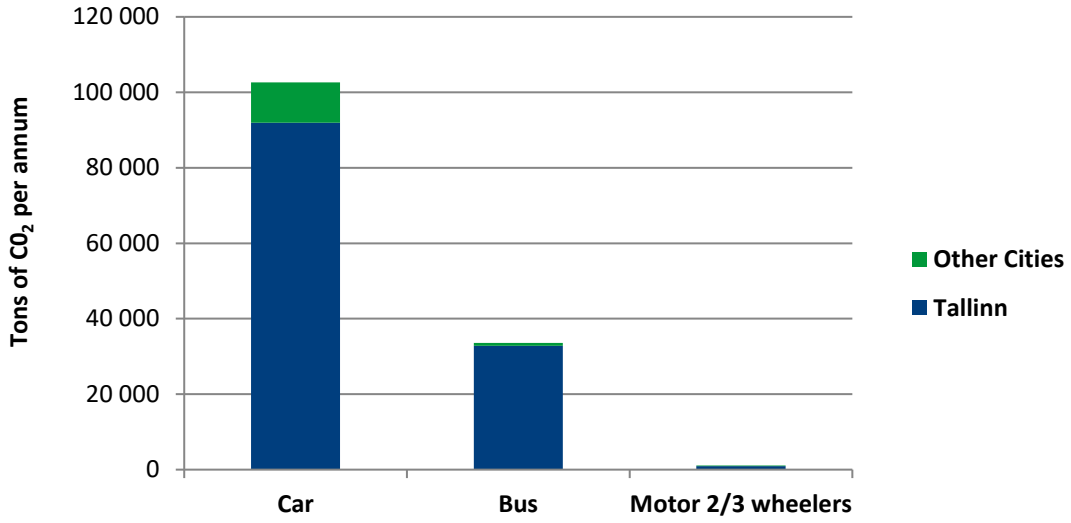
The cost of the new stations, which is currently estimated at EUR 2 million each, would not be financed via the RB project funding currently in place. Estonia could apply for EU co-funding, however Estonian participation will still be required. It is currently anticipated that funding will come from the sale of carbon emission credits, with European Union support, or the state budget. However, these funds could be directed towards other, more cost-efficient, investments. Estonia should re-evaluate the need for regional stops along the Rail Baltica route and conduct an additional in-depth assessment of costs and benefits for the location of any proposed stations.

Urban transport policies remain car-oriented

Current Estonian urban and transport planning practices remain car-oriented and the mode share of private cars continues to grow. Tallinn dominates in terms of commuting volumes: around 80 000 people travel to the city daily and a majority of these trips are made by car. In Tallinn and Harju, the total annual circulation of vehicles (million vkm) has increased by approximately 2.5 times in 18 years (SUMP, 2019). As a result, Tallinn and its neighbouring regions account for around 50% of all Estonia's transport

emissions. Policy reform is essential if the negative externalities associated with excessive car use are to be reduced. Figure 6 illustrates CO_2 emissions of passenger transport in Estonia.

Figure 6. Total tonnes of CO_2 emitted by mode of passenger transport in Estonia



Note: The numbers are broad estimates made using the ITF global urban model (2019).

Source: ITF (2019).

On-street and off-street parking pricing: The cost of parking in urban areas is an important determinant of whether citizens choose to drive to a particular destination. Some Estonian cities (notably Tallinn and Tartu) apply reasonably high parking charges to areas in their centres. However, cities control only a limited proportion of the stock of parking spaces. Tallinn, for instance, has a three-zonal system with only about 5 800 parking spaces in paid parking lots and paid on-street parking spaces managed by the city. But there are thousands of private off-street parking spaces that are usually cheaper. To date, no attempts have been made to control the price of these private parking spaces, as is done in numerous other cities, for example, by taxing them.

Revenues from on-street parking go directly into the general budget, with no indications to redirect toward transport or urban realm improvements. Whereas, in many other cities worldwide, revenue from increased parking prices is allocated to improving the attractiveness of other transport modes.

Parking regulations: The large number of privately owned parking facilities and the planning requirements to provide additional parking for all new developments weaken the impact of policies of charging high prices for publicly owned parking spaces. All cities in Estonia have requirements that developers provide minimum numbers of parking spaces in new developments. These local building regulations usually are derived from (non-mandatory) national design standards and the general guidance provisions of the building code.

Regulations that set minimum requirements for the provision of parking encourage an over-supply of parking and bundle the cost of unnecessary new parking with new housing. This leads to over-consumption of valuable land, while added parking-related costs can make it financially unviable to develop more

affordable housing units. Tallinn has already announced its intention to abolish minimum parking requirements in the city centre in its Sustainable Urban Mobility Plan. This trend, however, needs to be reinforced by other urban areas in the country.

Road space allocation in urban areas favours private vehicles: Due to the rising modal share of private cars more and more green areas and public spaces have been converted into parking lots. This has a negative effect on liveability, health and quality of life. At the national level, goals for increasing the share of walking and cycling are already included in several strategies. However, the main responsibility for achieving higher shares for sustainable modes lies with local municipalities. In particular, provision of cycling infrastructure and improvements to the urban realm largely falls under the responsibility of local governments. However, in most cities and towns bicycle planning is poorly institutionalised and even where a cycling strategy exists, there is a mismatch between developed strategies and follow-through. Similar observations can be made in relation to policies favouring pedestrians.

Tallinn was the first Estonian city to adopt a cycling strategy, in autumn 2017. Tartu completed its first cycling strategy in January 2019 and began the implementation of a bike-sharing system in June 2019, which has reportedly been very successful. These interventions, however, were adopted at the same time as contradictory policies of providing new and wider roads to cars and, in Tartu, the continued provision of free parking, including the opening of a new free parking facility in the centre of the city in 2019. In sum, the efforts to increase the mode share of sustainable modes have been undermined by other interventions that make car use more convenient and attractive.

Pedestrians and cyclists are highly vulnerable in urban traffic. The fatality risk of pedestrians is much higher in Estonia than in countries with good safety performance: Estonian pedestrian fatality rates are three times higher than in Finland (Pratelli, 2013). In road maintenance, limited attention is paid to the situation of pedestrians, and pavements are frequently in a deteriorated state, particularly in winter. There is no integrated approach to street maintenance: the owner of each adjacent lot is responsible for footpath maintenance. As a result, the maintenance of pavements in winter is often uneven, and pedestrians find themselves vulnerable to falls and obstacles.

The lack of land-use and transport planning integration contributes to urban sprawl: Urban sprawl has increased sharply since the early and mid-2000s, in parallel with the rapid increase in the use of private cars. The privatisation of land following Estonia's independence has led to unplanned low-density development, as the reform process did not include the specification of density requirements. Numerous industries relocated outside Tallinn's city centre, where property prices were low. Commercial malls built on the outskirts of Tallinn became a common sight and led to increased reliance on private car use.

These developments were not part of a spatial planning strategy and were not integrated with any transport plans or policies. In many cities, development controls continue to be weak. As a result, many people live far from jobs and are not well connected to them by public transport. The lack of public transport provisions and basic services (such as schools or medical centres) in suburbs has contributed to car-dependent transport patterns for trips between Tallinn and its suburbs.

The main issue is that there are no clear links between urban planning and transport policy in Estonia. The Ministry of Finance is the main body responsible for designing and co-ordinating regional and urban development at the national level, yet there are no regional rules that make the provision of public transport links a compulsory requirement for the developers of new developments within or outside urban areas. Many municipalities in the country lack a comprehensive development plan and do not have a comprehensive overview of ongoing developments (e.g., in the form of electronic database). They also lack the capacity to enforce specific rules regarding density or proximity to public transport on developers.

Avenues for reform

The following identifies policy tools that national and local governments in Estonia can use to facilitate a transition to more sustainable transport systems. It also provides insights into the likely effectiveness of these policies and the key ways in which policy design will affect effectiveness and efficiency. Finally, it highlights potential synergies between these policies as well as potential negative interactions.

Adopt a differentiated vehicle purchase or ownership tax to encourage improved fuel efficiency

Incentives to purchase clean and energy efficient cars should be adopted as a priority to reverse current trends of increasing emissions from passenger transport. This could be achieved by a differentiated purchase of registration tax or a differentiated circulation tax. Both forms of tax can have significant impacts in encouraging the purchase of more fuel-efficient, lower-emission vehicles. A purchase tax for new vehicles would probably have the strongest influence on the shape of the fleet, as consumers are more sensitive to the purchase price.

The efficiency of such taxes depends critically on their design. Experience to date shows that tax systems based on a linear and continuous relationship between the tax rate and CO_2 emissions are the most efficient. The main alternative, of classifying vehicles into different emission rate bands, with lower tax rates applied to lower emission bands, suffers from the disadvantage that its incentive effects are discontinuous. That is, a manufacturer has no incentive to seek further emissions reductions unless the result is a move in the vehicle's classification to a lower tax band. The result of this defect is frequently seen as a "bunching" of vehicle emissions at levels just below the ceiling levels for each tax band.

An alternative is to combine purchase tax with a rebate/subsidy for more fuel-efficient vehicles. This is referred to as a "feebate program". The example of France shows that the way the feebate system is designed has an important impact on both its performance and budget. In particular, the rate at which the so-called pivot point (the point that marks the level of efficiency beyond which performance is incentivised) is set is a critical component.

Whichever system is chosen, tax bands (if used) and rates should be updated regularly in order to maintain the incentive effects of the tax as average emissions performance improves.

Applying a differentiated tax based on CO_2 emissions on used cars brought to Estonia from abroad could discourage the large-scale import of older cars (around 30 000 such cars are currently imported each year). However, this could be a less effective alternative, as it may limit capacity of low-income residents to buy a more fuel-efficient car at a price they could afford. Such reform could also be criticised as being regressive in nature, in that it would heavily tax more affordable (i.e. used) vehicles. In addition, in the case of second hand vehicles, fuel costs constitute a large proportion of overall ownership costs, and the existing high fuel taxes already provide a fairly strong incentive to favour more fuel-efficient vehicles. Old, poorly maintained vehicles contribute disproportionately to emissions and a minimum emissions class limit for first registration of all vehicles, including second hand imports, could help discourage the import of older cars.

Consider introducing electronic distance-based charges on passenger vehicles in the long run

Moving from an energy-oriented approach based on fuel taxation to distance-based transport taxes will be essential for sustaining a stable tax base in the road transport sector in the long run. Along with the decarbonisation of road transport, the increasing penetration of alternative fuel vehicles and improved fuel efficiency will erode the traditional tax base, which is already under stress in many European countries. For example, In Slovenia, a joint analysis of the OECD and ITF projects a 56% decline of fuel tax revenues

derived from passenger cars by 2050 compared to 2017 levels[31] (OECD/ITF 2019). With revenues from excise duties levied on fuels in road transport representing 15% of total tax revenue in Estonia, comprehensive transport tax reform to protect revenues should be considered. This means finding the right mix of taxing distances driven, vehicles and fuel.

Distance-based charges should ideally be set based on short-run marginal infrastructure costs. There is also a case for differentiating distance-based charges according to vehicle emissions class. If distance charges were to depend on vehicle characteristics, they would help internalise environmental costs and address air pollution in particular. Fuel taxes can play an important role for internalising environmental costs if they are set at least at the shadow price of CO_2 emissions. The High-Level Commission on Carbon Prices recommended shadow prices in the range of EUR 37 to EUR 74 for 2020, rising to EUR 72 to EUR 144 by 2050, all in constant 2017 prices (High-Level Commission on Carbon Prices, 2017). Petrol excise duty, currently at EUR 0.563 per litre corresponds to a shadow price of EUR 244 per tonne of CO_2. Diesel excise duty, EUR 0.493 per litre until cut to EUR 0.372 per litre on 1 May 2020 as part of the response to the Covid-19 crisis, corresponds to a shadow price of EUR 184 per tonne of CO_2.

In the long run, road congestion could become an acute issue, especially in urban areas. In this case, distance-based charges provide an opportunity for managing congestion. Differentiation by location and time of day in relation to congestion allows drivers to adapt travel according to the hour of the day rather than being priced off the road. In urban areas, the additional revenues should be used to support investment in public transport and infrastructure for non-motorised traffic, helping to improve the efficiency of urban transport systems overall.

Tax diesel fuel at the same rate as petrol, if not more

Diesel fuel should be taxed at a rate at least as high as petrol, as its use entails larger negative externalities. According to Transport and Environment, the gap between petrol and diesel in Estonia, until cut to EUR 0.372 per litre on 1 May 2020 as part of the response to the Covid-19 crisis, was EUR 0.07 per litre, which translates into EUR 41 million lost revenues for under-taxed diesel. The decision to temporarily reduce diesel tax will substantially further reduce government revenue, while potentially distorting the passenger car market, and needs to be reversed as soon as the economic situation allows. Estonia should increase diesel taxes to at least the level now applied to petrol. Targeted tax rebates for vulnerable groups should be used to ensure the social acceptability of this reform and minimise any negative distributional consequences. However, these should be time-limited, in recognition of the finite lifespan of motor vehicles.

Re-introduce public transport pricing

Estonia should develop a strategy for re-introducing pricing in public transport. This reform is needed to reduce operating deficits and increase the capacity to invest in public transport networks. Such action will require a strategic approach and strong political leadership. Fares should be calculated to cover operating costs, while fare structures should be designed in ways that support the objectives of maintaining and increasing market share and service levels.

Ideally, future transit pricing policies should move towards fine-grained, distance-based pricing. Adopting a refined time- and distance-based pricing model for both public transport and roads would greatly enhance system efficiency and fairness. With distance-based public transport pricing, each route is divided into fare stages, with a clear boundary point for each stage. This is considered the most equitable basis for fare-setting because it most accurately reflects the cost of providing the service. Given that individuals have a higher willingness to pay for longer trips, distance-based pricing allows more of the consumer

surplus from each trip to be captured via the fare. It is, therefore, generally possible to achieve a higher revenue stream than with a flat fare (Lipscombe, 2016).

However, distance-based fares can give rise to uncertainty over the price among users prior to riding. This uncertainty can create a barrier to using public transport as well as equity implications for low-income riders. It is also complex to administer, as it requires sophisticated technology. The alternative of a zonal fare (whether network-based or route-based) is often favoured on the grounds that it is simpler and cheaper to implement and easier to communicate. With a zonal system, the network is divided into zones, with a flat fare applied within each zone. The price is then determined according to the number of zones crossed by the passenger. The trade-off is that passengers travelling short distances across two zones pay relatively high fares, as they have to pay for two zones. Thus, this model, too, presents some equity problems.

An effective ticket validation system is an essential element of any fare regime and must be accompanied by an enforcement system, including fines or other penalties for rides that are not validated. These elements are essential to obtaining high levels of fare compliance and achieving the revenue objectives of the fare system. In addition, the data yielded by a robust validation mechanism can be invaluable to transport planners, enabling them to monitor demand levels and patterns, thus informing decisions on changes to service provision.

Provide targeted subsidies to minimise the negative equity impacts of reintroducing public transport fares and electronic distance-based charging for car users

Almost all public transport fare systems include discounted fares for specific groups. The goal of these concessions is to prevent public transport pricing from forming a barrier to the use of the system by low-income groups. In practice, most concession regimes determine eligibility in terms of membership of broad grouping, notably students and the elderly. However, membership of such groups generally correlates only loosely with financial need. A theoretically preferable approach is to set eligibility criteria that are more direct indicators of financial need, such as income or household status. However, the potential benefits of the better targeting of subsidies must be balanced with the implementation costs involved.

Governments that already have a system in place that identifies groups with the relevant characteristics can easily adapt it to a fare system for public transport at little or no cost. The city of Bogota, for example, uses data from the well-established System for Selecting Beneficiaries of Social Spending (SISBEN) to determine eligibility for concession fares on public transport. The SISBEN is a stratification instrument used by Colombia's national and local governments for programmes related to water, electricity and healthcare subsidies (ITF, 2017). Estonia seems to have a good basis for understanding residents' income and other characteristics to identify groups that should benefit from a targeted subsidy system and may be in a position to adopt this approach.

However, if the approach adopted to determining eligibility for fare concessions is too rigorous, some could potentially perceive it as running counter to broader modal shift objectives.

With regard to road user charges, as with any fiscal instrument, these too have implications for social equity and equality. They have a proportionately greater impact on those with lower incomes (are somewhat regressive) but no more so than alternatives such as fuel tax. The majority of vulnerable low-income households in Estonia rely on old vehicles with poor fuel economy, therefore substituting an evkm charge for fuel tax will benefit them if the revenue extracted remains constant. Should the government want to do more, cross-subsidization within the system or targeted subsidies represent additional options.

Congestion charges have perhaps the most potential for regressive effects because, depending on scheme design, impacts can vary by location of households and because they are usually levied in addition to

existing taxes and charges rather than substituting for existing taxes on transport. Car-dependent low-income households can be vulnerable to loss of income from a congestion charge (Cain and Jones, 2008), but given their small numbers, targeted subsidies would be a much more efficient way of addressing the problem than foregoing the overall benefits of charging reform. In European cities, the majority of vulnerable low-income households have no access to a car, and if charging revenues are recycled into public transport most benefit from congestion charges. Overall congestion charges have been found to be no more problematic than other transport sector taxes and charges (Eliasson, 2016; ITF, 2018).

Develop a clear and sustained communication plan to support the introduction of public transport and electronic distance based road pricing for cars

Both the motivation for fare policy changes and the changes themselves need to be clearly communicated to the public. It will be important that the public understands that the funds currently used to cover operating costs will be redeployed towards quality improvements and needed expansion of the network. This will allow for revenue from ticket sales to be used to cover operating costs.[32] This is how the Estonian government can put enhanced reliability, regularity, travel time and frequency at the centre of the conversation. Focusing on the role of increased fare revenues in supporting and enabling the expansion of the system's coverage and improved service quality will help increase the acceptability of the fare reforms. The same logic should be followed when introducing electronic distance-based charges for cars, explaining that users with lower incomes with actually benefit (if fuel tax revenues are offset as proposed) and that the new system will ensure road infrastructure quality is maintained or improved.

The communications strategy should be a sustained one, starting early and continuing during and after the fare changes. As an example for public transport, in 2010, Singapore began transitioning from non-integrated bus and rail fares to an integrated distance-based system. The information campaigns that accompanied the adoption of the new system were considered essential to its successful implementation. The campaign included radio broadcasts, road shows at bus interchanges, advertisements in newspapers, posters and brochures (Lipscombe, 2016). The campaign helped people to understand the new fare structure, and increased public acceptance.

Adopt an integrated tariff system and improve co-ordination between Public Transport Centres

A common ticketing scheme covering all modes of public transport (train, urban transport, rural bus lines) would yield significant benefits for both urban and rural users. A key strategy to encourage the use of public transport is to ensure the ticketing system is attractive and easy to understand for all users. This includes ensuring that the pricing system is coherent and simple, with a reasonable number of tickets that takes users' needs into account. Adopting integrated ticketing and tariff policies that make tickets valid for all public transport modes across a whole region is the preferred means of achieving these outcomes. (Civitas, 2020)

Progress is already being made toward the implementation of this reform, with the Ministry of Economic Affairs and the city of Tallinn discussing the creation of an integrated public transport ticketing system. Implementation is planned to fall under the responsibility of the Tallinn Region Mobility Council, which was created pursuant to the memorandum of co-operation signed by the Minister of Economic Affairs and Infrastructure and the Mayor of Tallinn in October 2019. The council will also be responsible for establishing the principles for future mobility planning in the urban area.

A simple and user-friendly integrated ticketing system is likely to be most successful. Adopting standard architecture (such as the Integrated Transport Smartcard Organisation) for the introduction of smart card systems can significantly reduce both cost and implementation times, while also greatly reducing delivery

risks. A further key to success is obtaining early agreement among operators on the division of ticket income. This can be particularly challenging if the ticketing system covers both urban and regional areas. (Civitas, 2020)

The Mobility Council provides a sound institutional architecture to support the implementation of integrated ticketing. The successful implementation of this reform in the Tallinn region can be expected to provide a sound basis for the adoption of integrated ticketing across the other regions of Estonia over time.

Improve concession design to run the system more efficiently

Efficient procurement of services yields better cost control. Competitive tendering for bus services is well established in most regions, but changes to the design of the concession system could significantly improve service quality and value for money.

A key step would be to estimate carefully the price at which service should be provided before launching the tender process in order to provide appropriate price signals for operators. Currently, operators provide services under gross costs contracts, which stipulate that the operator be paid a fixed sum for running a service for a set period, regardless of patronage. Under such contracts, operators have little incentive to perform well, as they do not receive benefits from increasing patronage. Estonia should consider introducing positive quality incentives in the form of bonuses to encourage better performance from operators. These would come in addition to the penalties for not meeting minimum performance requirements, which are currently set out in the contracts. Examples of the successful use of this mechanism include Oslo-Akershus and London (Transport for London). These quality incentives could be based on different parameters: waiting time for high-frequency routes, punctuality for low-frequency services, wait time, cleanness of vehicles and overall user satisfaction. Transport for London has a well-elaborated and efficient system of penalties and bonuses (TfL, n.d.1).

Improving monitoring practice could also be a way to ensure that operators meet quality requirements. Currently, PTAs monitor operators' performance, while the Road Administration conducts regular checks on the mechanical conditions of the vehicles used. Entities organising public transport should also consider conducting "mystery shopping" survey techniques – wherein independent contractors mirror consumer behaviour - to objectively monitor driver and vehicle quality. To ensure that operators comply with the conditions set out in the contract and that they are reporting mileage correctly, it is also important to undertake regular contract compliance audits. Obliging operators to report data on any accidents that occur while a bus is in service is also essential for monitoring service safety.

Focus on improving existing rail services

Estonia should focus on the reconstruction of existing rail infrastructure and increasing the frequency of trains between larger Estonian towns and cities (Tallinn, Tartu, Pärnu and Narva). Increasing travel speed requires eliminating level crossings and investing in existing infrastructure and signalling systems. In particular, some points in the network near Tallinn constrain capacity. Addressing this could allow operators to offer express commuter trains in addition to the current fleet.

Another important investment is acquiring additional rolling stock in order to increase the service offer and the level of comfort for intercity trips, thus better competing with coach services that offer a high level of comfort.

Electrification of high-demand lines will significantly reduce CO_2 emissions, noise and fuel costs while increasing train speed. Other measures, such as planning new developments close to railway stations and improving inter-modality, should also be adopted as part of a broad service improvement strategy.

Conduct additional assessments to determine the economic feasibility of regional stops along Rail Baltica and integration with local transport services

Estonia should undertake further detailed analysis of the expected benefits and costs of including some or all of these stations in the scope of the Rail Baltica project. This should include consideration of the relative merits of this investment compared with alternative investments in existing rail lines. Additional assessment should include: origin-destination matrixes, mode choice models, land-use planning and co-ordinated integration with other modes. It should also consider the likely extent to which real-estate development near the stations will have enough scale to generate demand for their services. In addition, it will be important to assess the feasibility of establishing interfaces between Rail Baltica and the existing network.

Reform urban parking policy

Parking tariffs should vary according to the availability of public transport, with higher prices and shorter maximum stays in well-served areas. Efficient parking tariffs prevent capacity saturation and cruising, while ensuring high occupancy rates. Achieving such rates requires dynamic pricing, with tariffs varying over space and time using information on occupancy in surrounding areas. Cities should avoid discounts for long-term parking: Litman (2018) recommends setting daily rates at least six times the hourly rates, and monthly rates at least 20 times daily rates.

Revenues should be used, at least partly, to improve and promote alternatives, as such links can be expected to increase public support for the policy reforms and contribute to modal shift. Vulnerable groups should be compensated through targeted complementary measures. Exemptions for employer-paid parking from employees' taxable income should be eliminated to remove incentives for commuting by car. Another way to make parking costs more visible and discourage commuting by car is to encourage employers who rent parking spaces for their employees to offer them parking cash-outs instead – i.e. the cash equivalent of the parking subsidy.

Parking reform should also extend to the planning system. In many jurisdictions, developers are required to provide minimum numbers of parking spaces. However, such requirements are at odds with both inclusion and environmental sustainability objectives. Minimum parking space regulations can lead to excessive land use (Brueckner and Franco, 2017), drive up the cost of housing – since they add costs for developers (Litman, 2020) – and also incentivise car use. Thus, establishing maximum parking space requirements, rather than minimum ones, should be a preferred approach, as they will tend to support the creation of developments that are sustainable and equitable. Tallinn is already moving towards abolishing minimum parking requirements, as outlined in SUMP (2019). This practice needs to be applied in all urban areas across Estonia.

Reallocate road space and develop cycling and walking infrastructure

Decisions regarding the design and use of the city's limited public street space should prioritise space following a "pedestrian first" hierarchy of users. This means that street use should be ranked in the following order: pedestrians, cyclists, transit users, freight transporters, taxi drivers and private-vehicle drivers (ITDP, 2018). The reallocation of road space according to this hierarchy, along with investment in more and better infrastructure for these modes, is central to changing their relative competitiveness with the car, in the key dimensions of comfort, safety and journey time.

Enhancing walking and cycling conditions is also essential and recent developments in Paris provide a relevant example. Paris has been implementing its "Paris Express Bike Network" plan since 2014 and has re-allocated a large proportion of its road and parking space to more sustainable uses. Since 2014, the city

has expanded its cycling infrastructure by 43%, achieving a total of 1 000 km of bike lanes in 2020. Many cycling lanes are physically separated from motorised traffic, improving convenience and safety for cyclists.

Lisbon has been extremely successful in improving walking conditions. The city adopted a Pedestrian Accessibility Plan to address the poor quality of pedestrian crossings and footpaths, which represented a significant barrier for senior citizens to access various types of services. The plan incorporated a diagnosis of the situation, identified opportunities for change, included general guidelines (for day-to-day decisions) and listed 100 actions to be taken by the end of 2017. To support this financially, the city council made a simple decision: every year, 3% of the budget for public works would be invested in pedestrian accessibility (ITF, 2019).

Integrate land-use and transport planning

Land-use planning should give priority to locations with good public transport networks when determining where to locate new residential and office developments. This will improve the efficiency of existing public transport and help reduce car dependency. Accessibility indicators should be used to help identify locations suitable for new developments. One of the best-known examples is the Public Transport Accessibility Level (PTAL) Indicator used by Transport for London (TfL) (TfL, n.d.2). PTAL ratings reflect how close a location is to a public transport stop. PTAL is used across London to provide clear guidance on appropriate ranges of density for future development: the better the public transport access, the higher the density level at which the area is encouraged to be developed.

The use of value-capture mechanisms and development fees should be investigated as a means of financing transport infrastructure for newly developed areas. The United Kingdom, for instance, has a system that requires developers to pay for the necessary transport-related infrastructure improvements. The amount of the levy is determined through negotiations with local authorities and based in part on an assessment of how a new development is going to affect the existing public transport and road networks.

A second approach involves levying existing businesses that will benefit from a major infrastructure project to wholly or partially fund its construction. This approach is also used in the United Kingdom. For example, Transport for London raised GBP 4.1 billion of the GBP 14.5 billion cost of the Crossrail project, a major expansion of the London Underground, through Business Rate Supplements, a levy applied to existing commercial developments (Mayor of London, n.d.).

2.6. Rail freight and infrastructure

This section examines how rail freight operations and infrastructure management function in Estonia. The analysis focuses on the current state and recent evolution of the rail sector, plus existing objectives and plans moving forward. The market structure and institutional set-up are also addressed in this context. Core challenges the sector faces are identified, followed by several recommendations.

Estonian railways are going through a major transition that involves changes in the origins of demand, the types of commodities being moved and the railway system itself. Rail Baltica, a sizable project, is the largest ongoing transportation and infrastructure-related project in Estonia. It has far-reaching implications beyond rail freight operations and infrastructure management. Thus it is also addressed in other sections of the report. Rail passenger services will mostly be covered in Section 2.5. Reforms in other sectors that will condition rail freight activity will be mentioned here (e.g. road freight, ports or procurement), but reviewed more in-depth in their respective sections.

Key issues

The characteristics of Estonian railways make them different from other EU rail systems. Railways are mostly focused on freight services, with trains much longer and heavier than in the rest of Europe, and run on broad gauge track. Rail has a considerably higher modal share of freight than other European countries (see Table 2). These are features they have in common with the other Baltic States. The railway system was vertically integrated and profitable until recently, with the cost of maintaining and renewing infrastructure fully covered. Estonian ports, namely Muuga, acted as a gateway to Russia, which is still the main origin and destination of rail freight traffic. Key characteristics of the rail system, namely gauge, infrastructure, rolling stock and their respective technical standards are shared with other countries of the former Soviet Union. Hence, this region has been the natural market for Estonian freight rail, both for transport activity and rolling stock maintenance, renewals or rental.

Table 2. Key rail freight indicators, comparison with other EU countries

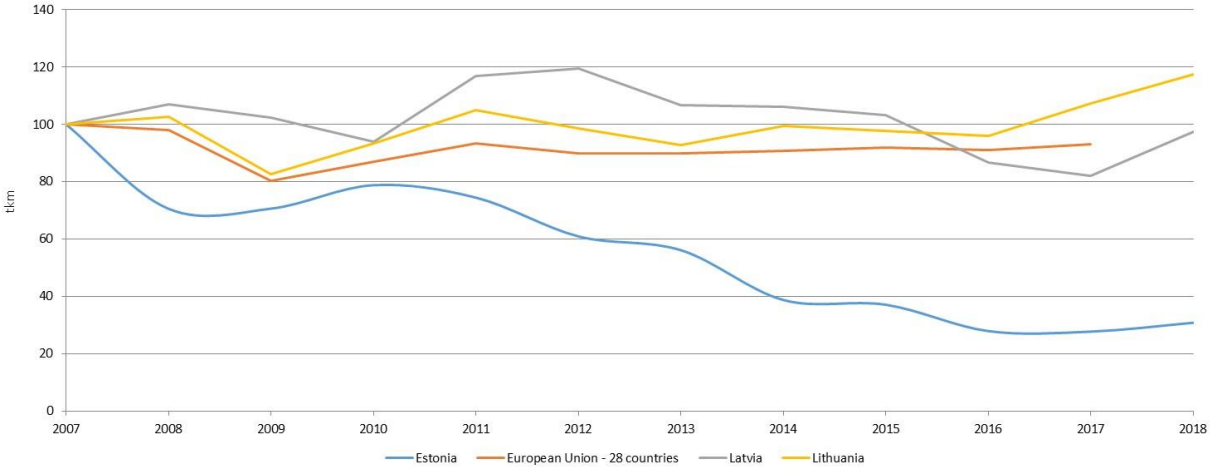
Countries	Rail modal share (% of tkm 2018 data)	Average load (tkm/train km 2017 data)
European Union - 28 countries	17.3	-
Bulgaria	18.5	357
Czech Republic	26.9	502
Denmark	11.5	713
Germany	17.8	417
Estonia	**44.4**	**1508**
France	10.5	432
Croatia	20.1	549
Italy	13.6	484
Latvia	74	1862
Lithuania	66.7	1721
Hungary	32.4	-
Netherlands	5.9	824
Austria	31.8	527
Poland	23.9	769
Romania	30.2	909
Slovenia	35.5	554

Slovakia	32.9	684
Finland	27.3	720
Sweden	30.2	659
Norway	15.2	511
Switzerland	34.7	416

Source: adapted from Eurostat (2019).

This railway model has been under stress for the past decade (see Figure 7). Political decisions have substantially reduced the volume of Russian traffic, so that from 2006 to 2018 Estonia saw the sharpest fall in activity (tkm) of any EU country, with a reduction in volume of three quarters. Part of this traffic was diverted to other Baltic countries, but Russia is also developing its own Port gateways. Moreover, EU regulation and policies are largely incompatible with the former Estonian model of a profit maximising vertically integrated railway oriented towards Russian cargos. The EU seeks a liberalised, open access, common European (EU) rail market. Infrastructure managers are required by EU legislation to be financially sound, but most do not seek profit, pursuing broader objectives of economic efficiency. This reflects the priority accorded passenger traffic across the European Union, whilst fostering the potential of rail to carry freight sustainably, making it a key element in the European Green Deal.

Figure 7. Rail freight activity trends in Estonia, 2007-18



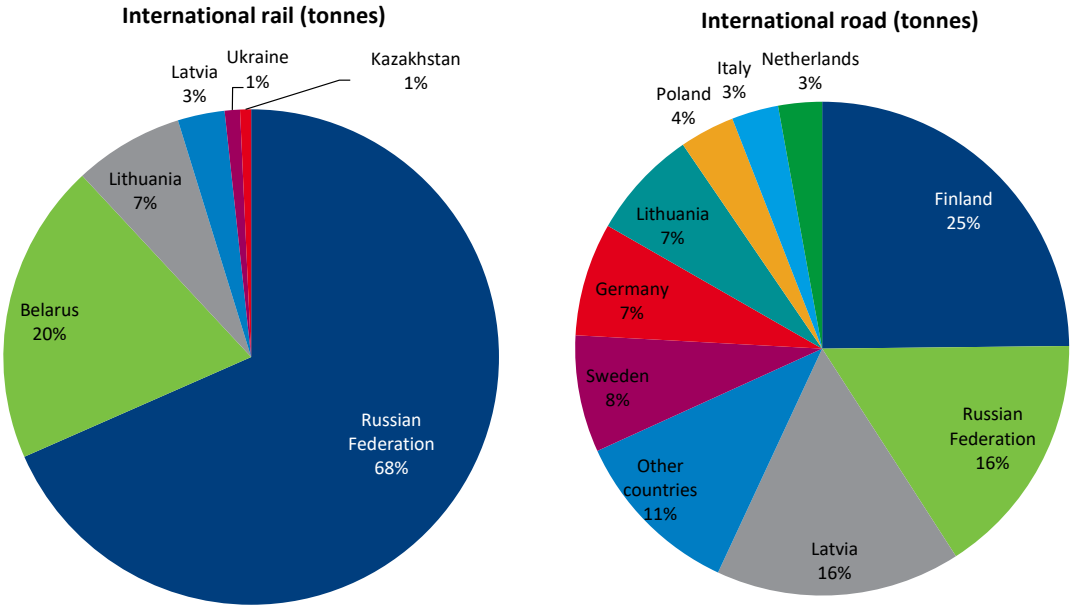
Source: Adapted from Eurostat (2018).

The transition from East-West movement of bulk commodities to North-South intermodal traffic

North and South rail flows between Estonia and other EU countries (except the other Baltic States) do not exist. Freight movements to and from Europe are carried by truck or sea (see Figure 8). With this starting point, the development of North-South intermodal traffic strongly depends on flows to and from Finland, and intra-Baltic co-operation and co-ordination, which has been weak. Traditionally, Estonia has competed with Latvia and Lithuania for East-West traffic.

In consequence, cross-border hurdles between Baltic countries cannot be explained by technical differences alone (though these also exist, namely the signalling system and maximum axle loads). Competing economic interests are an important cause. Furthermore, gauge and other differences between the current rail system in the Baltics and Central Europe represent a major challenge to fostering rail connections between these two regions, hence the Rail Baltica project.

Figure 8. International freight exchange relationship by country for Estonian rail and road sectors, 2018



Source: Adapted from Statistics Estonia (2019).

Countries of the Commonwealth of Independent States (CIS) will remain an important market for freight transport and related services for Estonia, even if volumes never return to former levels achieved prior to 2007 (Figure 7). The drastic drop in traffic since 2007 was partially offset by the development of the wagon rental and renewal business serving Russian customers. Even after Rail Baltica is completed, most of the network and equipment in Estonia, and the other Baltic countries, will remain geared towards this region. Given Estonia's geography, potential flows to and from the CIS region will continue to be relevant, including as a feeder to the North-South European connection. This will be the case for traditional connections to Central Asian countries and the Black Sea and also for new traffic from the Far East related to the New Silk Road.

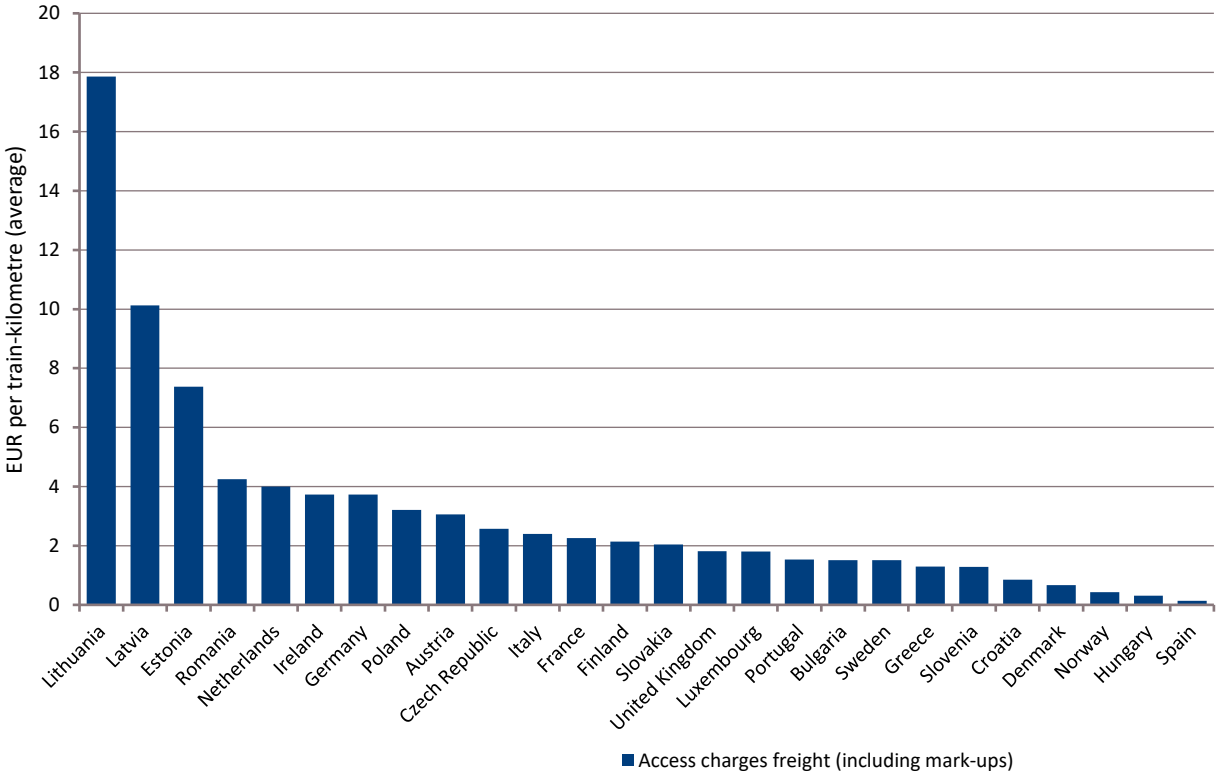
Rail charging policy has not yet adapted to the new market conditions

All rail infrastructure management in Estonia was privately owned and managed accordingly, under a profitable, vertically integrated railway until recently. The network became public again in 2007. In 2020, a small part of the public open-access network is privately owned. Separately, about half of the tonnes moved by rail are on a non-public access line owned by Enefit Kaevandused railways, a subsidiary of Eesti Energia that produces shale oil in Estonia for electricity production at two domestic power stations.

The state-owned infrastructure manager Estonian Railways (EVR) has balanced accounts, with one of the lower state subsidy levels in the European Union (DG MOVE, 2019a) and amongst the highest average access charges for freight (see Figure 9). Access and other infrastructure service charges account for a higher share of Estonian operator costs (for both freight and passengers) than in most EU countries. This

high average reflects the predominant, if reduced, share of heavy haul traffic. Whereas infrastructure costs are 18% of freight rail undertakings revenues in Germany (Bundesnetzagentur, 2018), they range between 30% and 40% in Estonia. In Germany, passenger fares generate a much larger share of revenues than in Estonia. Infrastructure cost recovery levels overall are similar between the two countries.

Figure 9. Rail Freight access charges by European Union country, 2016



Source: Adapted from the European Commission Rail Market Monitoring Report (DG MOVE, 2019a).

Estonia differentiates charges among different commodity types. For example, domestic or EU container trains pay a mark-up of 0.57 EUR on top of short-run marginal costs, whereas other goods trains pay a mark-up of up to 10.83 EUR. Determining whether the access charging policy could be optimised is not possible without a full rail-pricing review.

In addition, the way in which access charging is executed matters. Stakeholders complain that the terms and conditions to supply new routes or services are not sufficiently standardised or predictable. Ad-hoc negotiations, despite the published charges, would certainly be counterproductive to attracting more container traffic.

Disparity between available rail network capacity and future requirements

The drastic drop in rail (and road) traffic has led to overcapacity in the system, but adjustments to the rail network and rolling stock are needed to meet the emergence of new routes, commodities and strengthening of passenger services. The European Commission country review (European Commission, 2019) and transport current issues report (DG MOVE, 2019b) underline the lack of development of the Trans-European Transport network and overall transport infrastructure gaps. Furthermore, infrastructure is Estonia's lowest-scoring sub-indicator in the World Bank Logistic Performance Index (LPI).

The business, operational, institutional and local components of the Rail Baltica project are important

The models of governance and infrastructure management will be crucial to Rail Baltica's success once operations start. These models will affect the design and provision of numerous elements of the project, including maintenance services and respective depots, traffic control systems and command centres, slot allocation and seamless rail movements across the three Baltic countries. A clearer definition on the number and characteristics of freight terminals associated with this project, besides the major terminal in Muuga Port, is also missing, though several feasibility studies have been already concluded on other options (e.g.Parnu or Soodevahe Dry Port). Decisions on operations and rail services provision can have an important impact on the number, characteristics and location of maintenance facilities. Maintenance facilities are already planned near Tallinn and in Parnu, however, an overall pan-Baltic plan for infrastructure maintenance facilities is lacking. Rolling stock acquisition, or procurement of services and materials for the management and maintenance of Rail Baltica, is another area in which crucial decisions are yet to be made. This is an important milestone, as the costs associated with the rolling stock are significant (RB et al., 2018) and could affect RB's financial sustainability and overall viability.

Co-operation between all the countries involved in Rail Baltica, the three Baltic nations, but also Finland and Poland, will be critical for its success in both construction and operation

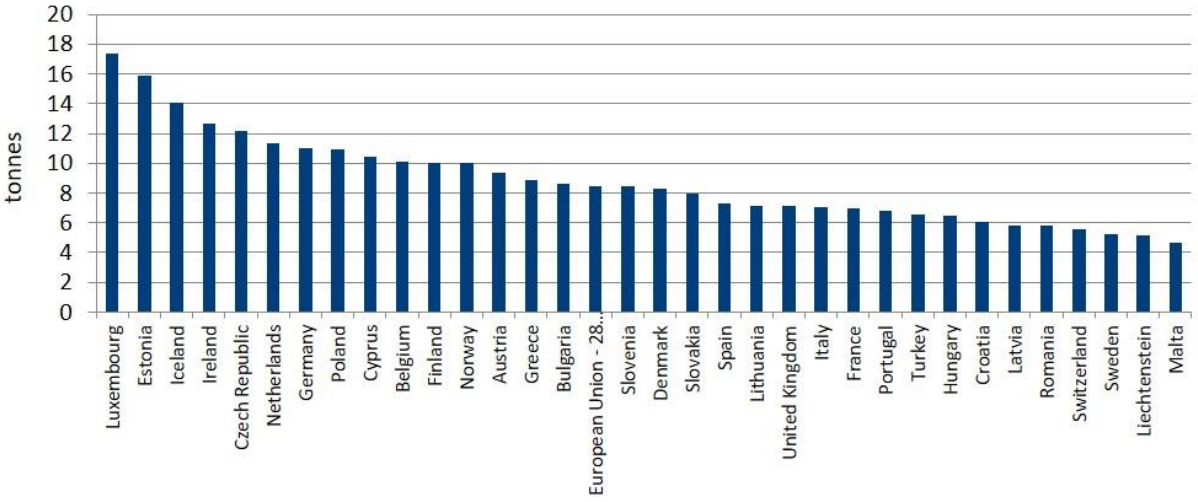
Achieving seamless rail traffic to Central Europe has more barriers than the gauge difference. Poland has a different signalling and traffic control system, electrification system and train length limits than Lithuania. Investments required to foster rail freight and overcome these other barriers will go on after the main corridor along the Baltics is completed. Minimising cross-border problems will require close alignment of the infrastructure managers on capacity allocation, plus data exchange between them and with rail operators and terminal managers. Such a vast infrastructure project can be a lever to foster this alignment, but all stakeholders, countries and railway companies must be involved in this effort. Infrastructure per se is not enough.

The strategic importance of this project goes beyond its balance sheet. It will also generate greater European integration, strengthening of economic, social and cultural exchanges between the Baltic countries, shared commitment to be the first climate-neutral continent by 2050, and commercial, technical and operational alignment of railway systems in Europe. It will integrate a key sector of the economy in the European common market. These are long-term ambitions that constitute the backdrop for Rail Baltica.

Estonia's greenhouse gas emissions are among the highest per capita in Europe

The transport system is a relatively minor contributor to the high level of Estonian GHG emissions (see Figure 10), accounting for only 11.7% of the total. However, the European Commission concluded, in its 2019 country report, that "*Estonia's transport system remains environmentally unfriendly"*, due to its fast growth and relatively high level of emissions per unit of GDP. Estonia is a transit country for trucks moving from Finland to other destinations in Europe. More than half a million trucks and trailers passed through Estonian Ports in 2018 on route to and from foreign countries, a number that has been growing since then. Moving part of these North-South freight flows from road to rail would help to reduce the transport system's contribution to GHG emissions. In addition, only 11% of the rail network is electrified, the lowest figure in the European Union ahead of only Lithuania and Ireland. Increased electrification of the rail network could also contribute significantly to this outcome.

Figure 10. Greenhouse gas emissions per capita, 2017



Source: Adapted from Eurostat and EEA (2019).

Avenues for reform

Adopt a joint governance model for Rail Baltica infrastructure management

Having common operating rules and employing the same language across Rail Baltica will be important to reduce cross-border friction and optimise operations in this corridor, taking maximum advantage of the possibilities this new infrastructure offers. Similarly, centralising traffic management and operations control will facilitate the seamless movement of trains on the corridor and avoid redundancies. The same applies to infrastructure maintenance and associated equipment and depots. Local teams and satellite centres will still be needed for these tasks, but greater integration and economies of scale can be achieved if there is a common governance framework.

Other aspects that require strict co-ordination are the allocation of train slots, or line capacity, and infrastructure charging principles. This will increase the commercial attractiveness of the infrastructure offer and ease operational requirements. The international consortium of government agencies that constitutes Rail Baltica should also assess and develop potential freight (and passenger) markets to make use of the infrastructure when it is built.

The required co-ordination in respect of the above issues will be most readily be achieved via the creation of a single management body representing Rail Baltica, which operates across all the Baltic countries. Should this prove infeasible in practice, it will be imperative to establish and maintain robust co-ordination arrangements that will enable key issues to be addressed effectively.

Foster co-operation and cross-border rail freight traffic before and beyond Rail Baltica

The “Amber train” project of an intermodal freight train from Lithuania to Estonia is one example. Setting up these types of services before Rail Baltica is implemented can provide valuable experience in running cross-border services and promote co-operation between infrastructure managers (IMs), operators and other rail/logistics actors in the Baltic States. This service can be a test for establishing common rules, identifying bottlenecks for cross border traffic and fostering the market for intermodal rail traffic across the Baltic States. Such initiatives could extend to include developing cross border traffic with Poland, which is currently non-existent from or to Estonia.

Existing cross-border barriers between Estonia and Latvia owe more to a lack of data exchange and operational co-ordination than technical differences. Trains moving between Latvia and Estonia spend between two and seven hours at the border, including time to change locomotives (around 1 hour 20 minutes), shunting wagons (if wagons are going to different destinations) and on paperwork. Information on the timing of incoming cross border trains is incomplete and unreliable in many instances, implying added uncertainty and allocation of resources to deal with these manoeuvres including personnel and tracks in the stations.

Changing this requires more of a cultural, managerial and business model shift, than assuring perfect technical interoperability between the rail networks per se.

Closely involve Poland and Finland in Rail Baltica's deployment and operations to ensure seamless border interfaces

The interfaces between Rail Baltica and both Finland and Poland, from an infrastructure, operational and service perspective are critical to attract demand and ensure the competitiveness of the project. The Rail Baltica Task Force already steers and co-ordinates between the ministries of Estonia, Latvia, Lithuania, Poland and Finland regarding the project implementation (European Commission, 2018). Furthermore, Finland and Poland have been observers on the RB Rail AS governance structure. But co-ordination is also required once the main corridor is operational.

Most freight traffic on Rail Baltica will be transit, i.e. shipments will not originate or finish in Estonia – but pass through (Ernst & Young, 2017). The connection between Finland and Estonia will play a major role with 29% of freight movements (tkm) on Rail Baltica coming from or going to Finland. Measured in tonnes, the most important flows will be from CIS countries to central Europe (37.8% of the total). The rail freight corridor North Sea-Baltic provides a co-ordination platform that should be used to the fullest to strengthen co-operation between IMs in the current context on core issues such as capacity allocation, deployment of interoperable systems and infrastructure development (CORRIDOR, 2016; Council of the European Union, 2010).

Leverage Estonia's position as the Rail Baltica line terminal to enhance growth opportunities in rolling stock rental and associated services

For Estonia to become a main location for rolling stock related services, additional clarity on the business model of Rail Baltica, related operations and rail services is required. For example, will operations be undertaken mostly by a joint venture that has its own depots, or will maintenance and other services be supplied by a third party to different operators? The market structure of Rail Baltica will necessarily affect how these type of services are offered and for companies to prepare they require a clearer picture of how this market will look.

Strengthen intermodal rail operations and the development of dry ports and intermodal terminals for the rest of the network

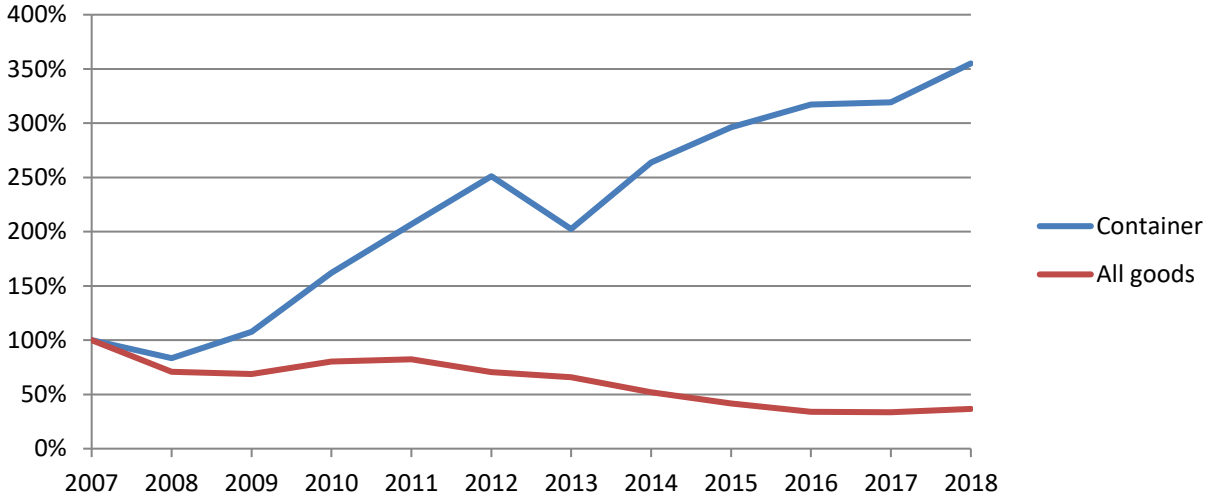
Intermodal and container transport accounts for 3% of total rail freight activity volume in Estonia. But Intermodal, or container, transport has been growing while other cargo has been decreasing (see Figure 11). In addition, worldwide demand for rail transport of some bulk commodities traditionally transported by rail (e.g. coal and other fossil fuels) is declining. In contrast, there is a continuing trend towards increased containerisation, along with the employment of other modular packaging systems. The future of freight rail and its contribution to a carbon-neutral economy will largely be determined by how well it can adapt and capture part of the intermodal market.

Improving connections within the ports and from the ports to the hinterland is critical to foster this traffic. The creation and development of intermodal terminals, both in the ports, but especially inland is essential

to be able to accommodate this type of transport. Until 2018 the domestic transport of containers by rail was almost non-existent in Estonia, but since then it has increased. Given the country's geography and scale this will always be a limited market, but there is room for growth.

Such infrastructure is relatively low cost in general and can be deployed in phases. It is generally developed by the ports themselves, railway operators, logistics companies or as joint ventures. One example is the ongoing project of Operail to develop a dry port in Tartu (which would replace the current terminal in the city centre), while there are also numerous proposals for private terminals associated with Rail Baltica. The latter will increase access to this corridor for local and national actors. They are a requirement if value-adding activities are to take place associated with the transit traffic that is estimated to constitute the majority of Rail Baltica freight movements. The main role of the government should be to deploy these terminals by co-ordinating the response of the multiple public agencies involved in their approval and easing administrative hurdles, rather than the provision of direct financial support.

Figure 11. Percentage change in tonnes moved by rail, containers vs all goods



Note: Goods moved in the public network.

Source: Adapted from Statistics Estonia (2019).

Execute periodic reviews of rail infrastructure charges for consistency with strategic policy goals

Estonia historically fully covered the costs of the railway system from freight tariffs. The relatively high-value bulk freight from Russia, carried efficiently on long heavy trains, generated the majority of revenues. The traffic mix in Estonia has changed but carriage of bulk products continues to enable a high-level cost coverage, currently 70% (90% in 2016). The figure now is similar to levels in Germany or France where, in contrast, high-speed passenger services generate the bulk of revenue. The structure of charges for infrastructure use was revised in 2017 to increase differentiation and lower charges in some markets subject to strong competition from road haulage, including domestic containers. Many stakeholders would like to see further development in this direction and eliminate some of the differences. Care must be taken simultaneously to maintain the integrity of the rail infrastructure balance sheet (in line with recommendations to make funding for roads less dependent on the general budget). To inform decisions on further reform of infrastructure charges, price elasticities should be estimated for the traffic carried and the traffic government aims to attract to rail from road haulage. The importance of price versus other

characteristics of transport by road and rail should also be evaluated. Subsidies would be required to implement policy if this analysis suggests that the modal shift targeted by the government would require train operators to charge rates below the short-run marginal costs of using the infrastructure. It would be more transparent and less risky to provide any such subsidy to train operators rather than through an annual budget settlement with the infrastructure manager. The same logic applies to passenger services.

Establish a single Infrastructure Manager for the open-access network, to facilitate integrated system management and reduce redundancies and transaction costs for the operators and taxpayers

There are two IMs in Estonia with responsibility for different parts of the public-open access network due to historical developments in the sector from the 1990s onwards. Most of the network (87%) is managed by the state-owned Estonian Railways (EE), but the remaining 13% is managed by the private Edelaraudtee (Southwestern railway). Transitioning to a single IM would simplify the system and benefit its overall performance.

Integrate rail planning into the broader transport planning to maximise the efficiency and effectiveness of the transport system

Rail is a system with multiple components and different service types with disparate needs and characteristics. An integrated rail strategy must take into account multiple fields: infrastructure, rolling stock, operations and interfaces with other sectors and modes. While the Ministry of Economic Affairs and Communications currently includes a railways division, its remit is limited. For example, it is not directly involved in the Rail Baltica project. Section 2.1 Institutional Structure recommends that an enhanced Strategic Policy Division, incorporating a Technical Resource Centre should be established within the Ministry. Care should be taken to ensure that this division has the capacity to formulate integrated, strategic policy for the rail sector, in co-operation with the rail division.

Modernise the existing rail infrastructure to achieve better national and regional connectivity

A joint vision of Rail Baltica (RB) and the modernisation of the existing network can avoid redundancies, maximising the benefits of both these investments and the associated public spending. Rail Baltica was deliberately designed not to go through population centres. Its goal is to qualitatively enhance intra-Baltic connectivity and the integration of the Baltic States with the rest of Europe. There is a fundamental contradiction between this original objective and currently proposed plans to repurpose it to offer regional services.

Upgrading the existing network that runs through the centre of cities and towns is the most effective way to improve regional connectivity, accessibility and cohesion. Such plans exist and include interventions such as improving the signalling system, removing level crossings, duplicating lines at congested choke points, line electrification and acquisition of new rolling stock. All of these can contribute to increasing the energy efficiency, speeds, comfort and frequency of rail services throughout Estonia. These improvements to the service levels are required if rail is to increase its modal share and contribute to the goal of achieving a more sustainable transport system.

Adding one or two additional stations to Rail Baltica (e.g. in Rapla) would allow for a direct interface between this new corridor and existing networks; generating synergies between them. Consistency between strategic goals and the instruments designed to achieve them should be maintained.

2.7. Road freight regulation

This section contains an analysis of the Estonian road freight transport sector. The aim of findings here is to support the Estonian government with the preparation of a new transport and mobility plan.

The analysis was supported by input from interviews with representatives of the Ministry of Economic Affairs and Communication and associations of transport firms, shippers and freight forwarders, and a stakeholder workshop.

The study focused on four areas – the regulation of the road freight sector and future developments, road freight transport taxation and charges, the potential for the introduction of high-capacity vehicles and how road freight measures can improve road asset management.

Key issues

An efficient road freight transport sector is an essential driver of economic development for Estonia. Its efficiency is an important issue for the development of transport policies. Eurostat figures indicate that in 2017 road freight transport accounted for 77% of the total inland freight transport in the European Union. In Estonia, the sector accounted for almost 58% of total domestic freight transport, demonstrating the important role it plays in the Estonian economy.

External costs of road freight transport in Estonia are imposed on the community at large as they are not fully covered by road freight taxation. Against this baseline, the main challenges for road freight transport policy revolve around the overall efficiency of the road freight transport sector, road freight transport taxation and the degree of coverage of infrastructure and external costs.

Light vehicles carry an increasing share of the road freight

A licence is needed for the carriage of goods for hire and reward in Estonia with vehicles exceeding a permissible gross laden mass of 3.5 tonnes. Regulations on access to the profession of road transport operator apply to these, but not to vehicles below this gross weight. Since 2012 no distinction has been made between domestic and international transport drivers. Therefore, the 3 500 tonne limit applies for both domestic and international transport, though EU regulations permit lower limits for national transport.

Eurostat statistics do not give enough information to assess the development of the share in total road freight transport of vehicles with a gross weight of less than 3.5 tonnes. However, the road freight transport association *Eesti Rahvusvaheliste Autovedajate Assotsiatsioon* (ERAA) indicates that this share is rising. This is in line with developments in other EU countries. The new EU Mobility Package (European Parliament, 2020), not yet approved by the European Parliament and the European Council, considers this rise in lighter vehicles to ensure a level playing field between operators using different vehicles. Rules on access to the European road haulage market, as well as driving and rest-time rules, will be extended to cover vans used in international transport (light commercial vehicles of over 2.5 tonnes), with a transition period of 21 months for market supervision, and until the middle of 2026 for tachograph and rest-time rules. Member states are still allowed to set different weight levels for national transport.

The competitive position of Estonian road freight transport companies is under pressure

The overall market share in road freight transport to and from Estonia is only 43%, according to Eurostat statistics. Its main competitors are Latvian, Lithuanian and Polish firms. The ERAA confirms that Estonia's relatively-high fuel tax and regulatory restrictions on using less-expensive drivers from other countries are

important factors that lower its competitive position. Concerns were also raised about an allegedly limited ability on the part of Estonian authorities to enforce compliant behaviour with respect to foreign firms.

Estonian officials, however, cast doubt on a number of these assertions. They note, for example, that Estonian firms operating internationally can readily buy cheaper fuel outside Estonia. They also note that a majority of speeding and other fines levied on drivers from foreign firms are paid without enforcement action being taken. Conversely, they suggest that lower rates of tax compliance among firms in competing countries may be a more significant source of competitive advantage. The structure of the Estonian road freight industry may also be a factor limiting its competitiveness. In particular, it has a relatively large number of medium-sized firms, in a context in which competing industries have moved toward a combination of larger firms which can reap scale economies and small firms that are highly flexible and able to operate in niche markets.

The new EU Mobility Package (European Parliament, 2020) may present a problem for Estonian transport firms by reducing the efficiency of their operations and increasing costs. The new Mobility Package further restricts cabotage, sets additional rules on the payment of drivers and requires drivers and vehicles to return to their home country after a certain period of operation in other countries.

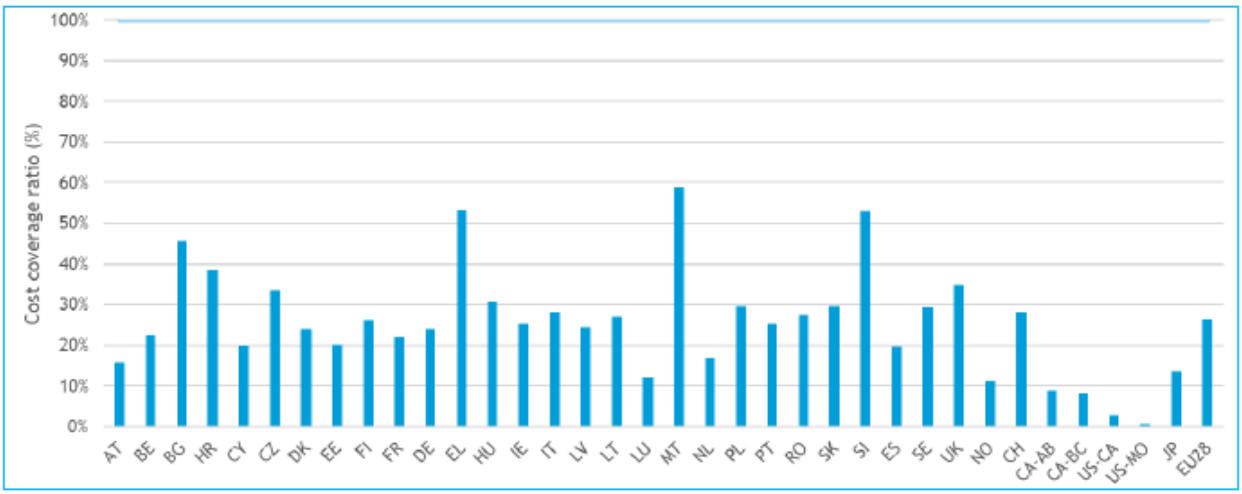
Driver shortages will become a major problem

Driver shortage is becoming a serious problem in Estonia, as in most other EU countries. ERAA indicates that a large proportion of the current Estonian drivers is over 50 years of age. The sector has difficulties attracting young people to the occupation, and Estonian law makes hiring drivers from other countries relatively costly. Initiatives to train young people as professional drivers run the risk that such drivers go abroad after training.

The current road freight transport taxation system is over-reliant on fuel excise duty

A study carried out by CE Delft (2019a) for the European Commission that uses 2016 data suggests that revenues from road freight transport in Estonia represented around 20% of the total direct and indirect cost caused by road freight (i.e. estimated road infrastructure cost and estimated external costs of crashes and congestion and the environmental costs of air pollutant emissions, greenhouse gas emissions and noise (Figure 12). This is significantly below the EU average of 27% and the fifth-lowest among EU countries. Nevertheless, fuel taxes raised more than enough revenue to cover road expenditure, approximately double average expenditure on a system that is in stable condition. Fuel tax levels were among the top ten highest in the European Union so the steering effect of the road taxation system for mitigation of CO_2 emissions is well above average. At the beginning of 2020 excise duty on diesel corresponded to a shadow price of EUR 184 per tonne of CO_2 (Figure 13 and Figure 14).[33] Diesel excise duty was cut by a quarter on 1 May 2020 as part of Covid-19 response measures, corresponding to a shadow price of EUR 139 per tonne of CO_2. This temporary measure is scheduled to be in place for two years and puts Estonia among the ten lowest rates of diesel excise duty in the European Union.

Figure 12. Overall revenue-to-cost ratio for road freight transport in the European Union, Norway, Switzerland, the United States, Canada and Japan in 2016



Note: Next to the EU28 acronyms, CA-AB stands for Canadian province Alberta, CA-BC for Canadian province British Columbia, US-CA is California in the US, US-MO is Missouri, and JP is Japan.

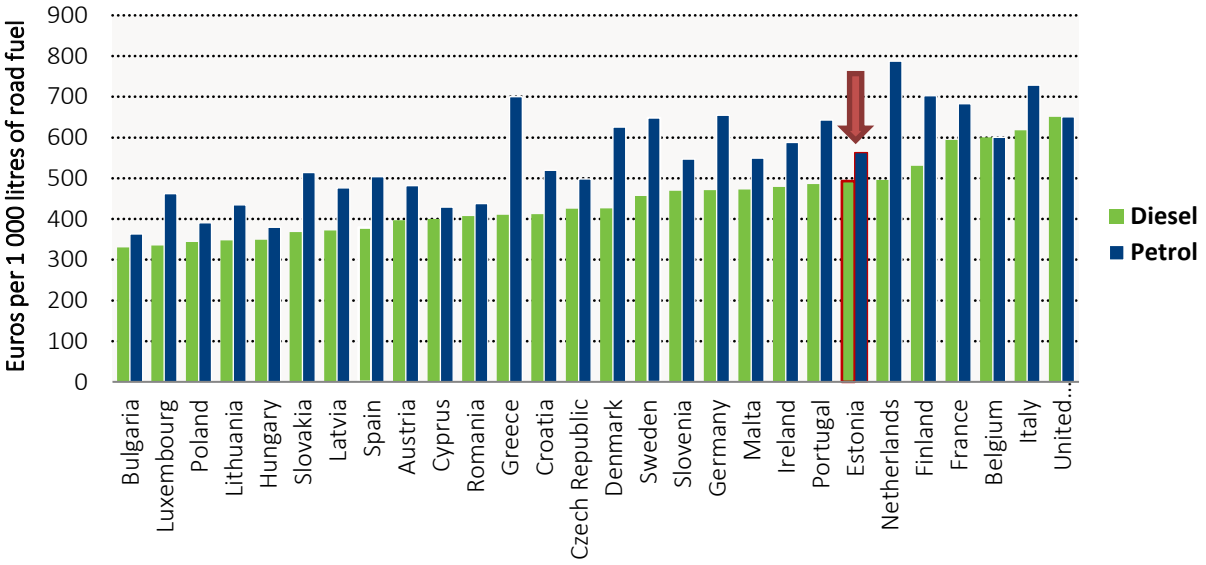
Source: CE Delft (2019a).

Data from another study based on the same dataset (CE Delft 2019b) shows that, while average revenues from light commercial vehicles (LCVs) are approximately equal to the EU average, those for heavy goods vehicles (HGVs) were around 25% below average in 2016. Estonia subsequently introduced a time-based user charging system for HGVs. While this implies that the revenues collected from HGVs have increased since these comparisons were made, the size of this impact is limited in practice. Estonia's vignette system yielded a modest EUR 20 million in 2019.

Road user charging schemes in Estonia differ in two additional ways from those most commonly used in other EU countries. First, while Estonia levies an ownership (or circulation) tax, in common with most or all other EU countries, it differs from usual practice in applying the tax only to heavy goods vehicles of over 12 tonnes gross vehicle mass.

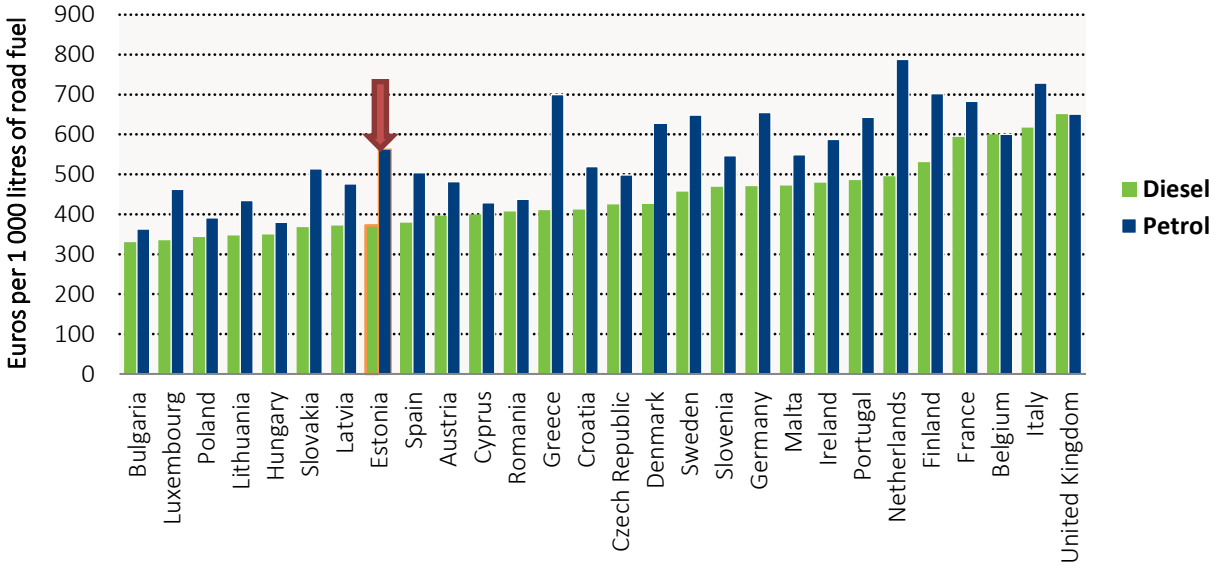
Second, Estonia relies unusually heavily on fuel tax as an instrument of road user charging. Unlike the two taxes cited above, all road users (other than those with non-fossil fuelled vehicles) pay fuel tax, albeit that diesel is taxed at a preferential rate. The disadvantage of the Estonian reliance on fuel tax is that foreign and where possible domestic transport operators using the Estonian road network are able to avoid paying the tax by refuelling at lower prices in adjacent countries and thus hardly contribute to the costs of it. These operators in effect only pay for the low-priced vignette. The loss of potential revenue is considerable, thus reducing the contribution of international domestic and foreign hauliers to the costs they impose on the Estonian road network. Fuel tax tourism will be reduced by the temporary excise duty reduction introduced as part of the response to the Covid-19 crisis. It is unclear what the net impact will be on fuel tax revenues.

Figure 13. Fuel excise duties in European Union member states, July 2019



Source: European Environment Agency data - https://www.eea.europa.eu/data-and-maps/indicators/fuel-prices-and-taxes/assessment-4; Ministry of Finance - https://www.rahandusministeerium.ee/en/news/supplementary-budget-includes-lower-excise-duties-and-temporary-suspension-funded-pension.

Figure 14. Fuel excise duties in European Union member states, May 2020



Source: European Environment Agency data - https://www.eea.europa.eu/data-and-maps/indicators/fuel-prices-and-taxes/assessment-4; Ministry of Finance - https://www.rahandusministeerium.ee/en/news/supplementary-budget-includes-lower-excise-duties-and-temporary-suspension-funded-pension.

In 2018, the European Parliament voted in favour of new rules on road-use charges in the European Union to guarantee equal treatment of road users and to help member states reach CO_2 emission reduction targets in the transport sector (European Parliament, 2018). If the draft regulation is approved, all light and heavy vehicles in the European Union will be charged depending on their actual road use and the

pollution generated. To this end, EU countries using time-based charges (vignettes) will need to switch to distance-based charges (tolls) from 2023 in the case of trucks and buses, and from 2027 for vans (over 2.4 tonnes) and minibuses. This change would provide an opportunity to increase the charging level on HGVs to levels more consistent with the EU average and, similarly, improve overall cost recovery.

Longer road freight vehicles are currently not allowed but could contribute to a safer, cleaner and more efficient road freight sector

HCVs are freight trucks that are heavier or longer (or both) than vehicles currently permitted on the general road network. Within the European Modular System (EMS) they are typically 25.25 metres long with a gross weight of 50-60 tonnes. These vehicles have been authorised for use in a range of countries in recent years in recognition of their safety, efficiency and environmental benefits (ITF, 2019). Currently, longer vehicles up to 25.25 metres are allowed in countries such as the Netherlands, Finland, Denmark, Sweden, Spain and Germany, but not in Estonia. Authorising HCVs to operate on selected roads could contribute to the overall efficiency of the road freight transport sector in Estonia.

Avenues for reform

Reform the current transport taxation system

Taxation and user charging arrangements for both freight and passengers in Estonia should be reviewed. The overarching objective should be to achieve an efficient level of cost recovery, incentives to reduce environmental costs, an efficient taxation and user charging structure with low administration costs, and an appropriate contribution from users of the network that are registered abroad. In the case of roads specifically, the objective should also be to achieve funding independence of the prospective road company, as laid out in Section 2.1 Institutional Structure.

It is recommended that the transport taxation review take into account all transport modes, and both passenger and freight transport.

Although the European Commission's proposals for new rules on road-use charges are still under discussion and may not ultimately require this change, Estonia should explore approaches for moving from a time-based road charging system to a distance-based system. This would be an opportunity to substantially increase revenues from road-use charges, reduce losses due to cross-border fuel tax arbitrage opportunities and make progress with the internalisation of external costs. It would also provide a strong incentive for efficiency through higher load factors and the consolidation of freight logistics.

Co-operation with other countries to find the best solutions for the introduction of a distance-based taxation system is necessary. Experiences could be shared with countries that are currently planning to shift from time-based to distance-based systems, such as the Netherlands, where the government has started the programme "Vrachtwagenheffing".[34] Lessons could also be taken from the success of the German Maut, which applies distance charges beyond the motorway network[35] and similar charges introduced in other EU states.

The move towards distance-based charging is fundamental for long-term strategy. It expands Estonia's options of how road infrastructure is financed and at the same time safeguards the efficiency of road infrastructure maintenance and delivery through predictable funding. ITF's recommendations regarding the institutional structure in Estonia (Section 2.1) suggest the Road Administration be transformed into a State-owned company. If the road company were to recover more than 50% of its cost through user charging it would be free to raise finance for investment. Debt would be assigned to its own balance sheet and would not count against the public debt of Estonia for the purposes of the Maastricht criteria. This

would remove the incentive to pursue expensive public-private partnerships (PPPs) for road investment projects in order to bypass public debt limits.

If an increase in the total tax burden on road freight operators is seen as undesirable, there would be a case to offset distance-based charges with a reduction in other taxes. This would achieve funding independence for the road company. The practical instrument to achieve this would be a partial diesel excise tax reimbursement for commercial uses and could be applied to phase-in the tax reform over the short to medium term. The Ministry of Finance could also change the rate of the rebate to adapt to potential fluctuations in revenues. If sufficient funding independence for the road company were not achieved by distance-based charges for road freight alone than an extension to car users should be considered.

Develop a policy framework for the introduction of high-capacity vehicles on Estonian roads

HCVs have the potential to yield substantial efficiency, safety and environmental benefits. This has been the case in an increasingly wide range of ITF countries, such as Germany, Denmark, and Sweden. However, large parts of the Estonian road network might not be suitable for use by these vehicles, while other facilitative measures may be needed for an effective introduction. This means that an integrated policy framework will need to be developed, including specification of a network of suitable roads.

The ITF (2019) report on high-capacity vehicles could be used to guide the process, specifically the section entitled “Package for policy makers: Toolbox and performance metrics”. In addition to advice on how to introduce HCV’s in a balanced way, the Package also includes a discussion on how to estimate the costs and benefits of HCV introduction to help policy makers understand the merits of these vehicles and explain them to politicians and the public.

Improve the competitive position of the road freight transport sector and develop initiatives to address the driver shortage

The Estonian government should create a more level playing field for competition between Estonian and foreign hauliers in the international freight market. Moving from time-based to distance-based road user charging would be a key initiative in this regard, while a relaxation of restrictions on the recruitment of foreign drivers could also be a significant step. The government should also ensure appropriate enforcement of key regulatory requirements in relation to the operations of foreign hauliers in the country.

The Mobility Package discussions held by the European Union (European Parliament, 2020) could be used by the Ministry to discuss the effects that national policies on the recruitment of drivers from other countries have on the relative competitiveness of trucking industries across the European Union and pave the way for EU-wide reforms of these policies.

The Estonian government, who is already financing the training of bus drivers and unemployed persons, is encouraged to discuss the shortage of drivers with the sector and stakeholders (shippers, freight forwarders, road freight operators and organisation active in education and training) and assess the available instruments to attract and retain more young people (both men and women) to the occupation.

Solutions for the shortage problem could be found in upgrading road-side facilities for truck drivers, acceleration of driving tests and driver medical assessments, measures to close the gap between the age young people finish their secondary education and the age limit for driving heavy trucks, stimulate developments in autonomous vehicles, advanced driver assistance systems and truck platooning, and improving working conditions and promotion campaigns on employment prospects in road transport.

Include the operation of road freight vehicles under 3.5 tonnes in the transport licensing system

The discussions about the upcoming new EU Mobility Package (European Parliament, 2020) could be used to review the current system regulating access to the profession of road transport operator. Given the increasing use of vehicles just below 3.5 tonnes (especially vans), it might be advisable to include such vehicles in the system to have better control of their operations. For instance, transport licenses can be withdrawn in case of repeated serious offences against traffic laws or causing a high number of accidents.

The new EU Mobility Package sets a limit of 2.5 tonnes for international transport coming and going through Estonia, but EU member states are allowed to lower the limit for domestic transport. The recommended review, therefore, should assess whether it would be beneficial in terms of a level playing field and/or traffic safety to lower the limit even more for domestic transport

Start a sector-wide programme to decarbonise road freight transport and logistics

Given the increasing attention for the environment and the recent ambitions presented by the European Commission, a sector-wide programme of decarbonisation is important. The cornerstone would be the adoption of an electronic kilometre charge for heavy vehicles, as outlined in the previous section. Programmes such as in the United Kingdom (Box 2), the Netherlands and Sweden focused on decarbonising transport and logistics might also be an inspiration for Estonia to start a similar initiative.

Box 2. Decarbonisation of road freight services in the United Kingdom

The United Kingdom government has commissioned an investigation into the possible measures and scenarios to achieve the decarbonisation of its road freight services. Possible measures of example include:

- Electrification of road freight vehicles using a decarbonised electricity supply.
- Standardisation and sharing of logistics data to accelerate collaboration between organisations, thereby improving logistics efficiency and consequently reducing CO_2 emissions.
- Telematics-informed driver-training will continue to play an important role in reducing carbon emissions from road freight.
- ICT-based solutions such as dynamic-vehicle routing and congestion predication will reduce the negative impact of congestion.
- The relaxation of time constraints may go against current trends in service-based competition but have been shown to offer significant efficiency improvements.
- Changes to weight and dimension regulations would permit the use of higher-capacity vehicles and increase logistics efficiency.
- Despite the widespread adoption of over-cab fairings, aerodynamic improvements continue to offer significant opportunities to improve fuel efficiency.

Source: GOfS (2019).

Consider further road freight incentives that can reduce the cost of the maintenance and management of road assets

Further measures to lower the costs of infrastructure maintenance are possible than areas of taxation of road freight transport, HCV's, and decarbonisation. These are more fully worked out in ITF's (2018) dedicated report on "Policies to Extend the Life of Road Assets".

Examples of such policy measures include:

- Base the planning of maintenance of road assets on traffic projections.
- Explore opportunities to reduce pavement wear through the tax and regulatory frameworks. This could include stimulating the use of dual tyres and/or multi-axle groups. Incentives to use dual tyres and/or multi-axle groups could include increased mass limits or reduced road user charges.
- Use regulatory and financial incentives to encourage transport operators to use vehicle designs and configurations with lower road asset wear characteristics.

2.8. Maritime policy

ITF reviewed the current challenges for maritime freight and passenger transport in Estonia, assessed recent reforms in the shipping sector, and considered relevant policies to reduce the environmental impact of shipping in Estonia.

This section sets out the conclusions of this analysis. It identifies four key issues and proposes avenues for reform in the Estonian maritime transport context in the areas of ports, maritime policy, ferry transport and the environmental impacts of shipping.

Key issues

Ports: Towards more transit traffic after a decade of decline?

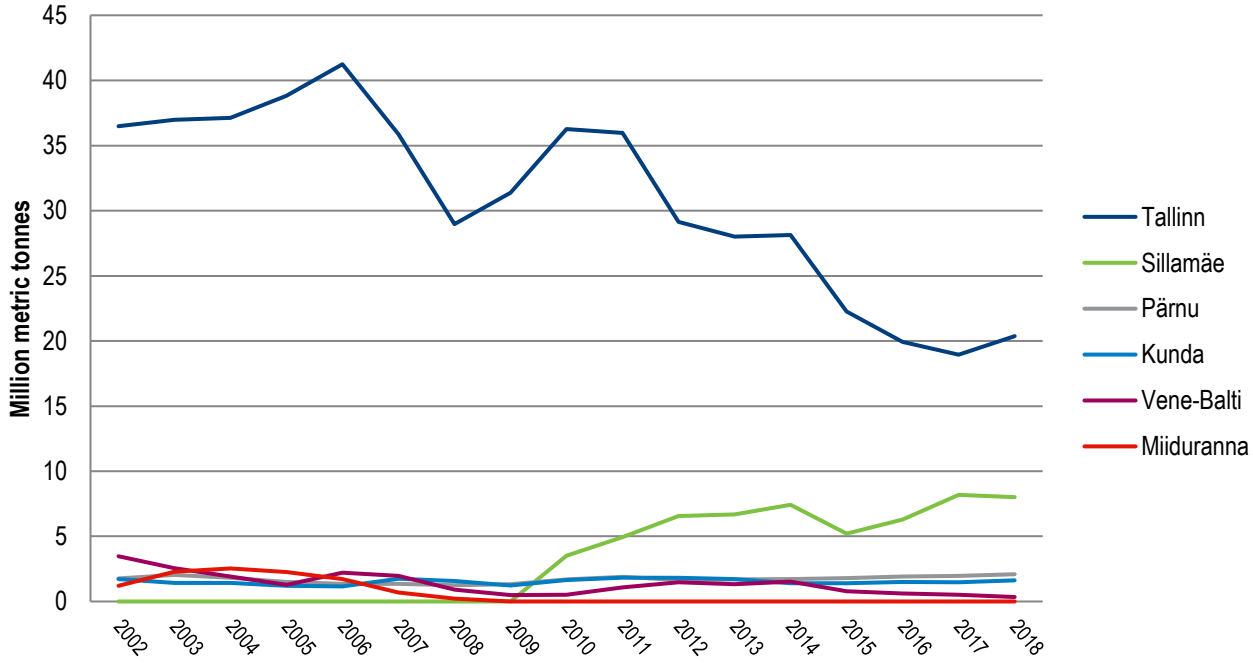
Estonia has 222 inland and seaports, most of which are small craft harbours. The most important ports group by far is the Port of Tallinn, handling 63% of Estonian port cargo and the large majority of ship passengers in Estonia. The Port of Tallinn consists of five different port sites, the largest of which are the Old City Harbour and Muuga Port.[36] The Old City Harbour, near the historic centre, is essentially used for passenger ferries and cruise ships, whereas Muuga Port, on the outskirts of the city, handles primarily cargo ships.

Estonian ports perform well if average ship turnaround time is taken as an indicator. For containerships, this turnaround time in 2018 was slightly over half a day in Estonian ports, the best score among the Baltic Sea countries. Estonia also has relatively favourable (low) turnaround times for tankers, but scores relatively less well on turnaround times of bulk carriers. Muuga Port has managed to attract one of the leading global terminal operators, HHLA, to operate its container terminal, but this is not unique in the Baltic Sea Area. In Klaipeda, Lithuania, for example, the container carrier MSC operates a terminal.

Despite good performance metrics, port volumes in Estonia have dropped from 48 million tonnes in 2006 to 38 million tonnes in 2019, largely driven by the halving of the volume of the Port of Tallinn (Figure 15). The cargo type with the largest decline over that period was liquid bulk. Container volumes in Estonian ports have grown since 2009, from 0.13 million TEUs to 0.24 million TEUs in 2018. The declining port volumes can largely be explained by a drop in Russian transit traffic, for which Muuga Port functioned as

a gateway. Underlying this drop is Russia's strategy to divert its traffic towards its own newly developed ports, such as Ust-Luga and Primorsk.

Figure 15. Cargo volumes in Estonian ports, 2002-18



Source: Eurostat (2020).

Consequently, Estonian ports are not faced with capacity constraints. Even in the container sector, which has seen growth, there is still enough capacity. For instance, the utilisation rate of the HHLA terminal in Muuga is less than one-third of its planned capacity. Ports, thus, have large spare capacity that could be exploited.

Maritime stakeholders expect a slight increase in freight in the coming years, albeit not to previous levels.[37] Due to the small internal consumer market and limited exports by sea, the growth potential of Estonian ports is dependent on transit cargo. A return to pre-2006 levels is not projected, considering Russia's new transit ports. The importance of Estonian ports for the People's Republic of China's Belt and Road Initiative currently appears limited, as Russian railways restrict cargo flows towards Baltic states. But alternative transit flows have been explored that could generate new port traffic:

- North-South transit cargo from Finland to Tallinn (by ship) and then over land to the Black Sea (Odessa) or the Adriatic Sea (Koper). This might be an attractive option for cargo to Turkey, as it would halve travel times. These flows could potentially bring a few million tonnes of new cargo to the port of Tallinn.
- The construction of Rail Baltica, which is expected to be completed in 2027, is assumed to have a strong potential to attract additional cargo flows for the Port of Muuga, which will be connected to Rail Baltica infrastructure through a new rail port. In the meantime, logistics companies have developed a train project connecting the three Baltic States (the Amber train project) that might generate some additional cargo for Estonian ports.

Development of such corridors could indeed help to capture new transit cargo flows. However, the challenge for many ports is to keep this transit traffic. Shipping companies have alternative options for loading and unloading, they have mobile assets and the buying power (in many shipping sub-sectors) to play ports off against each other. When it comes to transit cargo, the Estonian ports have various formidable competitors, such as the port of Klaipeida. A way to capture transit cargo is by the provision of value-added activities in Estonian ports that are not provided elsewhere. This would increase the switching costs for shipping companies.

A complication in developing such long-term corridor projects is the simultaneous corporatisation of the Port of Tallinn and the arms-length involvement of the central government. The Port of Tallinn is listed on the stock exchange, which has introduced the need to satisfy shareholders with often short-term objectives. A majority of the shares (67%) is held by the central government, but it does not seem to use this position as leverage to develop a ports strategy focused on the public interest. This public interest includes economic development, environmental sustainability and connectivity. The Estonian government could pursue such public objectives via its ownership or position as a shareholder in various Estonian ports.

Shipping: Preferential tax treatment adopted, but unlikely to be effective

Estonia counts several ship owners, but their cargo vessels hardly ever fly the Estonian flag or deploy Estonian seafarers. In order to address this, the Estonian government has proposed a shipping support package, adopted by Parliament in 2019[38], that will come into force on 1 July 2020. This package consists of two measures: the introduction of a shipping-specific tax – the tonnage tax – as an alternative to regular corporate income tax, and a special seafarer labour tax regime.

Tonnage tax allows shipping companies to apply for taxation based on the tonnage they operate, instead of being taxed under the normal corporate tax system. Such schemes can reduce the overall level of taxes paid and, as such, are treated as state aid that requires approval from the European Commission. The European Commission approved the Estonian tonnage tax scheme in December 2019. Under seafarer schemes, labour costs (i.e. income tax and social security contributions) for seafarers employed on board vessels flying the flag of the European Union or a European Economic Area (EEA) member state may be partly or entirely reduced. Amendments to the Income Tax Act (Riigi Teataja, 2019) impose new rules for the taxation of wages of seafarers on vessels meeting specific conditions.[39]

By introducing both schemes in a support package, Estonia hopes to generate incentives for shipping companies to register their vessels, notably cargo vessels, under the Estonian flag. The last large cargo vessel left the Estonian shipping register in 2014. The objective declared by the government is to bring 300 large cargo ships to the Estonian ship register in the next seven years.[40] In an explanatory note to the support package, the Estonian Maritime Administration expects to have about 200 ships flying the Estonian flag by 2024. The vessels are expected to bring income to Estonia through the collection of registry fees and tonnage tax. The reform has also been justified by a need to attract and develop maritime know-how in Estonia and to increase seafarer and shore-based maritime employment (legal, management and administrative functions).

Attracting Estonian seafarers?

It is unclear to which extent the reform will be able to attract Estonian seafarers to work under the Estonian flag, as data on current employment locations and labour conditions do not exist. Compared to Northern European states, such as Norway and Finland, employment conditions under the new scheme do not seem sufficiently advantageous to attract new seafarers or seafarers currently working under different jurisdictions. While the scheme may help attract seafarers working on third-party registered vessels and, while labour conditions become comparatively better for this target group, the new scheme does not

provide employment and social security standards in line with conditions on passenger vessels flying the Estonian flag or in other sectors in Estonia.

For example, amendments of the Income and Social Tax Acts (Government of the Republic of Estonia, 2019a) introduce a fixed income tax base on the basis of which social contributions are calculated. Because the fixed tax base (EUR 750) is lower than the gross wage in most cases, contributions are lower and hence reduce seafarers' pension rights. Workers are usually covered under a solidarity health insurance scheme within up to two months after termination of a work contract, including for Estonian seafarers that might have worked on Estonian-flagged cargo vessels in the past. While this insurance will not be available under the new scheme, seafarers working under the Estonian flag will be given the opportunity to receive health insurance through a voluntary agreement. This voluntary opt-in is seen as complicated and inflexible, allowing only for yearly subscriptions. However, seafarers often switch contracts – and hence flag jurisdictions – multiple times a year, which would usually require subscriptions only for short periods of inactivity.

When the employer is not an Estonian resident and the employment contract is concluded elsewhere, there is no obligation to pay social security contributions even if the seafarer is working aboard a vessel flying the Estonian flag, according to the Seafarers' Employment Act (Government of the Republic of Estonia, 2019b).

Reviving the Estonian flag?

Fiscal conditions in Estonia are already very favourable. Corporate taxes in Estonia are currently paid only on dividends, but not on corporate income, so the tonnage tax is not likely to be attractive to Estonian owners. Moreover, as Estonian companies currently operate around 50-60 ships, the objective of attracting 200 cargo vessels to fly the Estonian flag is clearly aiming to attract non-Estonian ship-owners.

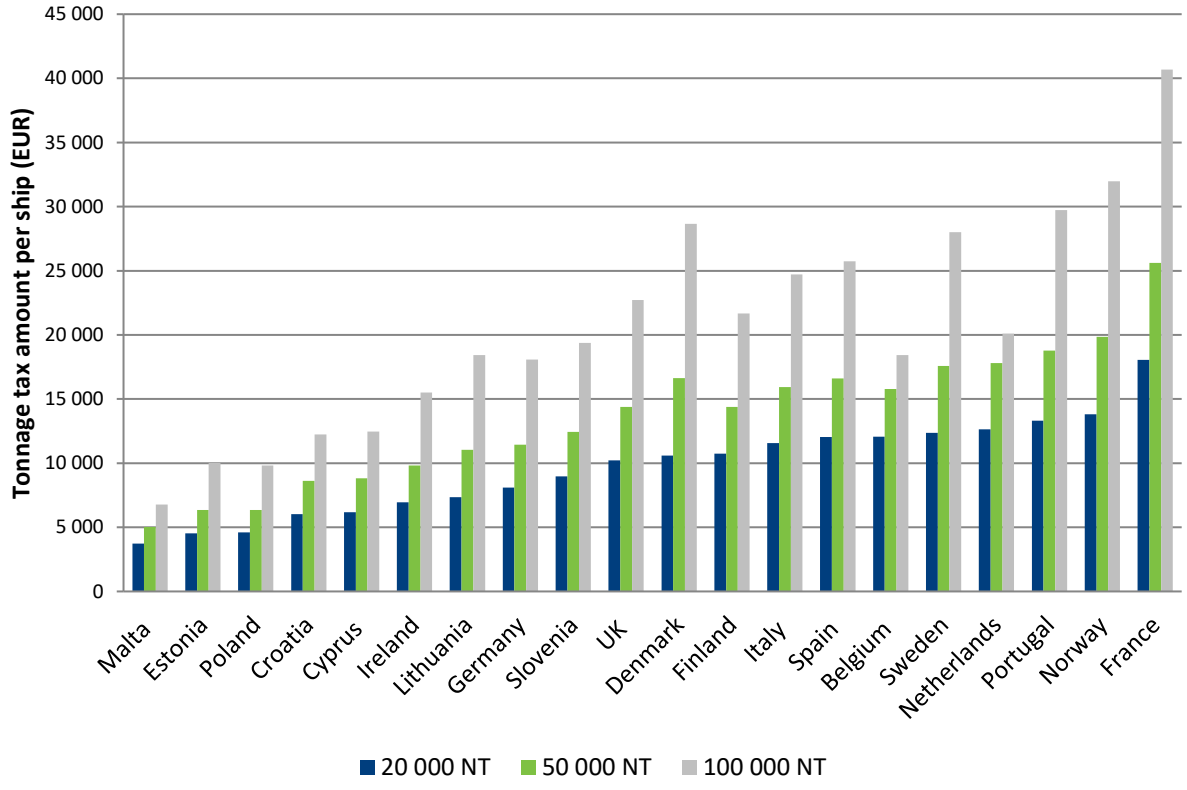
The ITF's assessment of the Estonian scheme found it to be very competitive compared to other tonnage tax schemes in Europe. For companies that deploy new ships, the Estonian scheme could be considered as one of the most attractive of all schemes of EU countries: it provides a reduction of the tonnage tax rate of 50% for vessels that are younger than five years and a 25% reduction for ships between five and ten years of age. Only Malta seems to have a more generous tonnage tax scheme (Figure 16). As these ship-owners are likely to come from EU member states, one could argue that the Estonian tonnage tax scheme encourages tax competition within the European Union, which is what the EU Maritime State Aid Guidelines (European Commission, 2004) aim to avoid.

However, use of the Estonian tonnage tax will not necessarily translate into more Estonian-flagged vessels, as cargo vessels can benefit from tonnage tax as long as they fly the flag of an EU or EEA member state. In order to solve this, the Estonian government has initiated the creation of a second registry for bareboat vessels: an electronic registry in line with the concept of e-residency that Estonia applies to the business sector. This second shipping registry is aimed at attracting foreign ship management companies and comes with very limited strings attached: there is no need to relocate commercial or management activities to Estonia, as long as there is a local contact in the form of a maritime lawyer. As these ship-owners are likely to come from EU member states, one could argue that the Estonian tonnage tax scheme encourages tax competition within the European Union, which is what the EU Maritime State Aid Guidelines aim to avoid. The registries of bareboat vessels will be maintained by the Maritime administration. The reform took effect on 1 July 2020.

The shipping support package and the shipping registry reform have been framed by shipping industry stakeholders as measures to generate shore-based employment and added value: it would help create a maritime cluster in Estonia. One wonders how this works. Even in countries with the world's largest

shipping registries, like Panama, registries only generate very limited economic value-added and cluster effects (ITF, 2019). This is arguably even more the case in Estonia where the second registry would require no actual physical presence of shipping companies. Developing the Estonian onshore maritime sector should nevertheless be a priority to generate employment in the sector. It is recommended that this be pursued through the planning process, with both a strategic development plan for the sector and alignment of local zoning regulations to accommodate investment in value-added activities. Estonia has the potential and assets that could help transform it into a maritime cluster, including advanced shipping companies, maritime institutes and maritime innovation programmes.

Figure 16. Tonnage tax due per ship according to the ship's net tonnage



Note: values in EUR by category of net tonnage (NT, measure of the internal volume of the ship's cargo spaces).

Source: based on analysis of tonnage tax schemes of European Union member states.

Passenger ferries: Sub-optimal service quality due to ferry tender design

With 16 permanently inhabited bigger islands and hundreds of small islands in the Baltic Sea, Estonia is dependent on maritime passenger transport. Given otherwise high ticket costs, the state has subsidised and put in place public transport service contracts for ferry connections which connect:

- the Estonian mainland with the bigger inhabited islands and small islands of Harju, Lääne and Pärnu counties
- the island of Saaremaa with the island of Hiiumaa

- the island of Saaremaa with the small islands located within the administrative boundaries of Saare county.

These lines may benefit from central state subsidies and subsidies from the budget of a local authority. If the revenue base of a local authority budget is insufficient to cover support to public regular services, the state covers the deficit of the subsidies to public regular services wholly or partly from the state budget.

Public transport by sea to islands provides regular connectivity but only limited incentives for operators to provide better and more efficient services. The maximum tariff per kilometre and the maximum ticket price in public regular services is established by the Ministry for county and long-distance travel. Maximum prices for intra-municipality carriage of passengers by ferry are established by the local municipality. While general satisfaction with island ferry services has increased[41], there are issues related to ferry capacity during peak times, notably during the three summer months and on weekends. However, incentives for customers to use ferries outside peak hours or days do not seem strong enough.

Island connectivity objectives (access to employment and key services on the mainland) support the case for stable prices for residents and commuters. However, different pricing strategies, such as higher price differentiation between tourists and residents, may reduce pressure on services during peak times and reduce under-utilisation of assets in low-demand periods.

In previous calls for tenders, Estonian authorities observed low levels of competition in bidding for public service contracts, mainly related to the small local market[42], tender conditions, and regulations and standards that operators are expected to adhere to (e.g. service quality and safety[43]). In 2011-12, only one company submitted a bid to provide services to the main islands Saaremaa and Hiiumaa. The Port of Tallinn was fully state-owned at that time and created a subsidiary ferry company to bid for these operations. In 2014, the Ministry tendered out the Rohuküla-Heltermaa and Virtsu-Kuivastu ferry lines starting from 1 October 2016. Väinamere Liinid OÜ (100% privately owned) and joint tenderers TS Laevad and OÜ TS Shipping (100% subsidiaries of the Port of Tallinn) participated in the public procurement. A new contract with TS Laevad was signed in 2014, which will expire in October 2026.

A reason for limited competition may be the sunk costs faced by operators in an ordinary franchise in which the operators acquire capital equipment and assets at their own risk. In such an ordinary franchise, high asset investments – or sunk costs[44] – possibly deter companies from making bids. An operator who is uncertain about the prospects for renewal of the contract or the market value of the assets in case of non-renewal will be reluctant to submit a bid and make such investments if contract periods are short and no favourable treatment of incumbents is foreseen in the following tender process (Hervik and Sunde, 2002). Currently, this applies to the Virtsu-Kuivastu and Rohuküla-Heltermaa lines. The use of state-owned vessels (possibly electric ferries) is being discussed for subsequent contracts. State-owned vessels are already used for public transport services between the mainland and smaller islands.

Shipping emissions: Promising projects, but upscaling is warranted

The maritime transport sector contributes significantly to air pollution, especially along coastal areas and port cities, exposing the population to adverse health effects. In Estonia, the Old City Harbour of Tallinn has become a significant source of local pollution and greenhouse gas (GHG) emissions, especially with the rise in maritime passenger traffic in Estonian ports, which has more than doubled in the last 15 years. Major air pollutants from shipping activities that can affect human health and the environment include particulate matter (PM), nitrogen oxides (NO_x), sulphur oxides (SO_x), volatile organic compounds (VOCs) and ozone (O_3). With shipping activity expected to rise, these emissions risk increasing as well in the coming years. A significant part of these emissions come from passenger ships, such as ferries and cruise ships

that are berthed close to urban concentrations. The ITF's calculations over 2019 show that three-quarters of the shipping emissions within the Port of Tallinn come from ferries and cruise ships.

Various national and local measures have been initiated that go beyond international and supra-national measures:

- Electric ferries. The ferry company TS Laevad (100% subsidiary of the 67% state-owned Port of Tallinn) has engaged the Estonian shipbuilding company Baltic Workboats AS to rebuild the ferry Tõll, which operates the Virtsu-Kuivastu line, into a hybrid ship. A battery bank will be installed on the vessel to reduce the consumption of diesel fuel and reduce the resulting exhaust gas by replacing fossil fuel with electricity stored in battery banks. TS Laevad expects to replace about 20% of the diesel fuel consumption with electricity.[45]
- Port equipment. The Port of Tallinn will also install shore power systems on five of its piers in the Old City Harbour as part of the first shore power project in Estonia, the aim of which is to supply the vessels that visit the port with shore electricity and thus reduce emissions and noise created by the ships' engines. By the end of 2020, the port will install automated mooring systems in order to increase the speed and safety of mooring, which is expected to reduce the use of ship fuel and the need for human resources to manually moor the ship.[46]
- Green port due rebates. In January 2019, the Port of Tallinn Group put in place environmentally differentiated port fees.[47] The rebate scheme is applied in all Port of Tallinn's ports (Old City Harbour, Muuga, Paldiski South, Paljassaare and Saaremaa). Rebates are based on the international Environmental Ship Index (ESI)[48], which evaluates the amount of air pollution emitted by a ship, the vessel's energy savings measures, as well as readiness to connect the ship to an onshore power supply. Vessels with an ESI score of 80 and above may apply for a discount of 8% on tonnage fees. For ships with an ESI score between 65 and 79.9, the applicable discount is 3%.[49]

Additional measures have been announced. New tenders for ferry services will include either the purchase of electric ferries by the state or a requirement for vessels to be zero-emission or electric. The Port of Tallinn announced public procurement for construction of a new state-of-the-art environmentally friendly cruise terminal in the Old City Harbour.

It is not clear that these initiatives will be enough. The green port due rebates likely suffer from the same problems that were identified in a 2018 ITF study: not enough focus, not enough coverage and minimal differences between clean and non-clean ships (ITF, 2018). Electrification will only yield environmental benefits if the electricity used is generated sustainably. In 2018, oil shale accounted for 76% of Estonia's electricity generation (IEA, 2019). Plans to build wind energy parks on the biggest islands could support ferry electrification efforts in Estonia and complement the use of sustainable electricity, but potential issues of grid integration would need to be solved.[50] Sustainable electricity can also be purchased through the common energy market. Estonia is part of the integrated electricity market of the Nordic countries, Nord Pool.

Avenues for reform

Ports: Stimulate value-added activities

More value-added activities in port areas could help to attract and keep new transit cargo flows. This could potentially improve the utilisation of port assets, currently underutilised. Such value added could differ per port and cargo type, but could include light assembly, recycling, waste management, painting, repair,

conditioning and other services. Location of value added economic activities in ports could be stimulated via port master plans, zoning and possibly other instruments. A more pro-active role of the national government in port planning would be required to achieve this, via its role as owner or shareholder in various Estonian ports, but also by addressing the lack of integration of land-use and transport planning, highlighted earlier in this report. This more pro-active role could take the form of the development of a national port master plan, including a sector study of the types of value-added activities that could be carried out in or close to ports, which should be translated in national guidance on land-use and zoning in and around port areas. In addition, the State could develop a more proactive role in decisions taken by the Port of Tallinn, notably by leveraging its majority ownership rights. The government should exclude the possibility of ports listed on the stock exchange unless a convincing case could be made that doing so would be best for public interest.

Shipping: Develop a comprehensive maritime cluster strategy

The shipping registry reform and the state aid package benefit a small number of maritime stakeholders in Estonia, particularly in the supply of legal services. The government should consider developing a maritime cluster strategy that targets value creation across a much larger number of sub-sectors. The cluster strategy should mainly target innovative maritime activities in which Estonia could develop a comparative advantage, e.g. related to maritime innovation and technologies. The creation of a maritime stakeholder platform in Estonia would be the first step to developing a cluster strategy that benefits job growth in the sector.

The state aid package for the shipping sector should be evaluated as soon as possible. The scheme will expire in June 2026, but the government should consider withdrawing the scheme much earlier if it is found not to have created added value, or if it negatively impacts the level playing field within Europe. Data collection should start as soon as possible in order to ensure a rigorous evaluation process over the years. Estonia could follow the example of Sweden, where the government agency Trafik Analys provides a yearly evaluation of the effects of Sweden's subsidies to the shipping sector.[51]

Passenger ferries: Re-design ferry tenders to improve service quality

Dynamic pricing is at the core of achieving a more balanced and efficient use of ferry assets throughout the year. Although currently not allowed by the provisions of the Public Transport Act, the possibility of introducing more efficient pricing strategies should be discussed and considered in order to avoid congestion in peak times and underutilisation of assets during the off-season and during weekdays. One way would be to introduce summer and weekend peak hour surcharges for non-island residents. Conditions for benefitting from residency rebates could become stricter by revising the minimum conditions to count as a resident and close current legal loopholes to benefit from rebates.[52]

Reducing risks for operators due to high initial capital requirements could be considered in future tenders by making the public purchase of vessels common practice on all routes. The Ministry is considering an operating franchise for its main island routes so that potential bidders would not face the sunk costs of acquiring capital assets, as is the case in some of the current contracts. In that case, provisions for maintenance might be required, as state ownership of vessels might disincentivise operators to properly maintain vessels. Assessment of the need of potential reconfigurations of routes could also be part of future tenders and might help to improve service for passengers. In addition, analysis of key performance indicators on all routes and regular satisfaction surveys would help identify bottlenecks.

Potential fixed links such as a bridge between Muhu (Saare County) and the mainland have the advantage of providing permanent connectivity to islands. The government needs to make sure the costs and benefits of such projects are thoroughly assessed. If implemented, accessibility must not be compromised by

excessively higher prices for crossings. Strengthening existing ferry connections might be a more viable option.

Shipping emissions: Accelerate maritime emission reduction policies

Scaling up shipping emission reduction policies could be achieved by the use of electric ferries, shore power and electric charging facilities, and environmentally differentiated port pricing. The Estonian government has the position via its public service obligations to make the local ferry fleet more ecologically sound, most likely by electrification. In parallel, the government would need to provide the necessary pre-conditions for this to work, namely to invest in electric charging systems and – more widely – to provide clean energy. The use of shore-power and electric charging in main Estonian ports should be supported by national legislation, comparable to the efforts made in the state of California in the United States. Estonia's main ports should also transition towards full environmentally differentiated port pricing. This requires a more proactive role of the state in implementing port schemes, via its role as owner or shareholder in various Estonian ports. A port pricing system not only includes a bonus for best performing vessels, but also a malus for worst performing vessels. An interesting example of such a system is applied in Bergen, Norway, where the cleanest ships get a 17.5% rebate and the dirtiest ships a 150% surcharge on the general port tariff. While there is a centralised airborne emissions monitoring system in place, this system needs to integrate the measurement of air pollutants from shipping, such as NO_x, SO_x and particulate matter in order to verify the effectiveness of environmental measures in ports.

2.9. Aviation policy

This section identifies key challenges with respect to aviation policy making in Estonia. It assesses the current state of the evidence base and the governance framework used to underpin policy and investment decisions for the sector. It then provides recommendations on how the decision-making could be improved, through implementing the systematic collection of aviation data and the use of newly proposed methodological and governance frameworks to guide transport project planning and selection. The ultimate objective of this section is to help design better decision-making tools for aviation policy makers in Estonia.

Key issues

There are few alternatives to aviation on many routes, as the only transport mode that can feasibly connect passengers and cargo over large distances in a short period of time. As such, aviation provides a very important role in a country's development by facilitating tourism, investment, and trade in goods and services. The potential of air connectivity to deliver socio-economic benefits increases as air travel becomes less expensive and more accessible to passengers and freight forwarders.

At the same time, aviation is responsible for large environmental costs. Residents who live around airports suffer from aircraft noise as well as air pollution and congestion on the roads - by-products of passenger, cargo, and airport staff travel from and to the airport. Moreover, aviation is one of the most carbon-intensive industries in the world and few opportunities are currently available to change that. The industry has made significant progress with respect to becoming more fuel efficient, but these improvements will not be able to offset the rapid increase in demand for air travel. Although aviation's share of total carbon emissions stands at around 2.5%, the future poses significant climate-change challenges (ITF, 2019).

To ensure that the benefits of air connectivity are maximised and the environmental challenges posed by the sector are mitigated, policy makers need to base their decisions on comprehensive air connectivity

reviews and assessments of all positive and negative impacts of the aviation sector on the economy and the society.

This section outlines what evidence base the Ministry of Economic Affairs and Communications (MEAC) should collect to better inform its aviation policy-making. It also summarises the aviation policy-making findings of sections 2.1 Institutional Structure and 2.2 Infrastructure Planning and Project Selection.

Policy makers rely on a limited evidence base to make decisions

To get a comprehensive picture of air connectivity available to Estonians, policy makers need to be able to answer the following questions:

- What flights are available directly from Tallinn Airport? What flights are available indirectly through connections at other airports?
- How accessible is Tallinn Airport to passengers, cargo and airport staff? How much time does it take to get to the airport and what transport modes are available?
- How happy are customers with the services provided?
- Are there any hurdles to air connectivity provision? How can they be removed?

Tallinn Airport, the owner and operator of all five airports in Estonia, collects the statistics answering the above questions. These statistics could be useful to the Ministry of Economic Affairs and Communications, in delivering periodic air connectivity reviews. Such reviews could then be used to track the progress of air connectivity available to Estonians and to better understand the connectivity impacts of prospective aviation policies or investments.

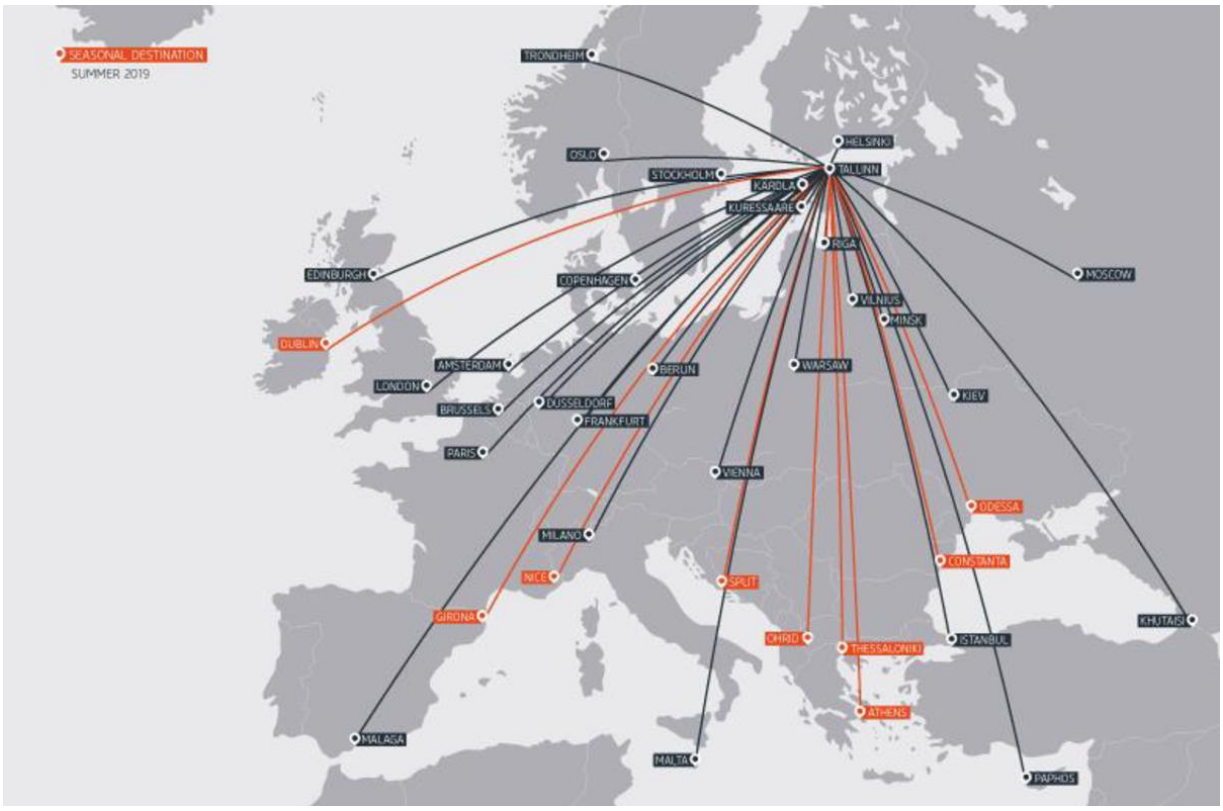
Indirect connectivity is an important part of overall connectivity. In Estonia, Tallinn Airport (TLL) provides almost all air connectivity. The airport offers around 30 destinations (Figure 17) and handles 98% of all passengers in the country (Tallinn Airport, 2020). Tallinn Airport offers fewer destinations than Lithuania's Vilnius Airport, which proposes 50 destinations in the winter and 57 in the summer (Vilnius Airport, 2020), and far fewer than Latvia's Riga Airport with its 80 winter and 105 summer destinations (Routes Online, 2019).

Although no transcontinental destinations are available from the airport directly, Tallinn Airport provides travellers with numerous connections to hub airports that offer long-haul connections. Over 50 connections are available every week, connecting passengers from Tallinn to regional aviation hubs in Helsinki and Stockholm.

A high-level review of Tallinn Airport's air connectivity indicates that the airport provides direct and indirect connectivity levels well above the average for similarly sized airports in Europe (ACI Europe, 2019).[53] In the ACI Europe review of connectivity for European airports, Tallinn Airport's connectivity fares better than that of Vilnius Airport: the direct connectivity scores for the two airports are comparable, but Tallinn offers around 30% more indirect connectivity than Vilnius. Riga Airport handles more than double the traffic numbers of TLL, which explains its direct connectivity score being roughly twice that of TLL. On indirect connectivity, the airports have very similar scores, reflecting Tallinn's excellent indirect connections to several European hubs that offer long-haul connectivity.

Both direct and indirect connectivity considerations need to be taken into account to paint the full air connectivity picture in Estonia. Periodic reviews of direct and indirect connectivity would enable the policy maker to track evolution and to identify possible connectivity bottlenecks and challenges.

Figure 17. Destinations available from Tallinn Airport, summer 2019 schedule



Source: Graphic of Estonia provided by the Ministry of Economic Affairs and Communications.

Accessibility to Tallinn Airport needs to be included in connectivity reviews by the Ministry of Economic Affairs and Communications

In Estonia, the MEAC currently does not systematically collect data on airport accessibility and surface access mode share for the Tallinn Airport.

Airport accessibility is an important dimension of air connectivity and should be taken into account by air connectivity reviews. The systematic review of Tallinn Airport's catchment area would provide an indication of the level of accessibility of air connectivity to Estonians. It would also allow for the identification of gaps in coverage, to ensure adequate access to air connectivity across the country. Such considerations should include access to international airports outside of Estonia. Riga Airport is the closest such airport, but at about five hours by car from Tallinn, it lies too far to be a viable option. However, when services on Rail Baltica begin, travel time to Riga could be significantly shorter. Connectivity and accessibility of the hub to Estonians may then be included in the air connectivity assessments for Estonia.

Data on surface access mode share is another important consideration. The majority of passengers arrive or depart Tallinn Airport by car. According to the available data, about a quarter of passengers used public transport in 2019.[54] A 2014 environmental impact assessment stated that Tallinn Airport had "no significant adverse effect on air quality in its vicinity, particularly given that aircraft emissions are discharged under higher pressure and at higher elevations" (Tallinn Airport, 2019). Tracking data on the sustainability of surface access over time would provide a useful supplement to the environmental sustainability considerations for TLL and allow policy makers to assess the extent to which airport traffic contributes to congestion and air pollution on the roads around the airport.

Passengers and aviation stakeholders need to continue to be heard

In 2019, Tallinn Airport placed among airports receiving between two and five million passengers. One of the explicit objectives set by the Estonian Governments for Tallinn Airport is to be "beneficial for its owners, internal and external clients as well as for the society as a whole" (Tallinn Airport, 2019). The airport conducts annual opinion surveys of travellers in an effort to track the airport owner and operator's performance on this objective, as well as to understand how government policy may be influencing passenger satisfaction. Tallinn Airport has enjoyed consistently high customer satisfaction rates over the past few years. The average overall satisfaction score for 2019 was 4.5 out of 5 in the ACI's Airport Quality Survey, ranking Tallinn one of the top three airports in the category of European airports with up to five million passengers. Such reviews should become part of regular air connectivity assessments by the MEAC. They should complement the extensive consultations with aviation stakeholders – airports, airlines, air navigation service providers, education providers, local residents and businesses – already in practice.

Lack of a systemic approach to modelling and appraisal in the transport sector contributes to suboptimal policy and investment decision-making

There currently is no generally applicable guidance for policy makers on cost-benefit analysis of projects and appraisal methods remain inconsistent. Moreover, project appraisal is often conducted too late in the process to significantly influence project selection. In the aviation sector, like in other transport sectors, this can lead to suboptimal policy and investment decisions.

Governance of the aviation sector is fragmented

The governance of the aviation sector is fragmented. Civil aviation policy making is the responsibility of the MEAC. Consumer protection, including air passenger rights, is the responsibility of the Consumer Protection and Technical Regulatory Authority. The environmental issues in aviation fall within the jurisdiction of the Ministry of the Environment. The Estonian Civil Aviation Authority (CAA) is responsible for the implementation of international aviation safety. It also co-ordinates aviation security. The organisation focuses on ensuring compliance with guidelines and guidance set out by the International Civil Aviation Organization (ICAO), the European Union and the European Aviation Safety Agency (EASA).[55] Some important public policy objectives are given to Tallinn Airport to execute, without supervision from an independent regulator.

The mode-specific organisation of transport administrations combined with the small-country context also means that the CAA's ability to develop sufficient technical capacities to expand on its functions is limited. The CAA currently employs around 30 staff members. It follows Estonia's use of the "arms-length agency" model in the transport sector (OECD, 2014). As recommended by Section 2.1 Institutional Structure, the regulatory powers for aviation should be given to the newly created regulatory entity in Estonia.

Avenues for reform

The above discussion highlights issues in conducting aviation policy in Estonia. The recommendations that follow summarise specific avenues for reform in terms of data collection and analysis. They also summarise the recommendations from sections 2.1 Institutional Structure and 2.2 Infrastructure Planning and Project Selection that are applicable to the aviation sector.

The recommendations are based on the following ITF documents and interviews:

- ITF's report on how to define, measure and improve air connectivity (ITF, 2018a)
- ITF's report on best practice with respect to project appraisal and selection in the air transport sector (ITF, 2017a)

- interviews with aviation and government stakeholders by ITF staff during a mission to Estonia in the autumn of 2019.

Conduct periodic air connectivity reviews to support the decision-making framework

The Ministry of Economic Affairs and Communications should conduct periodic air connectivity reviews to track the progress of air connectivity available to Estonians and to better understand the connectivity impacts of any prospective aviation policies or investments. Such reviews can be based on the data and statistics that are already collected by Tallinn Airport.

Ideally, an air connectivity review should include:

- direct and indirect air connectivity assessments
- airport quality indicators
- airport catchment area assessments
- data on surface access mode shares.

Direct and indirect air connectivity assessments: To assess the air connectivity levels available in Estonia, the MEAC needs to collect and assess both direct and indirect connectivity metrics. The use of indirect connectivity metrics is particularly important for a small aviation market, like Estonia, as intercontinental connectivity is typically only available indirectly – in the case of Estonia, by connecting passengers from Tallinn Airport with the long-haul route networks available at other European hub airports.

Air connectivity statistics collected by ACI Europe (2019) provide a comprehensive overview of direct and indirect connectivity at European airports. The figures are publically available and can be sourced directly from the ACI Airport Industry Connectivity Reports[56].

The following connectivity metrics are included as part of the Industry Connectivity Reports by ACI:

- Direct connectivity: assesses direct air services available from the airport, measured in terms of destinations and frequency (for example, an airport with five daily flights to another airport, will register a higher score than one with only four).
- Indirect connectivity: measures the number of destinations available through connecting flights at hub airports from a particular airport. For example, if there is a flight to Amsterdam-Schiphol, Istanbul or Dubai, the large number of available onward connections from these airports expands the range of destinations available from the airport of origin. Indirect connections are weighted according to their quality, based on connecting time and detour with the indirect routing. For example, a flight from Manchester to Johannesburg via Paris-Charles de Gaulle in France will register a higher score than an alternative routing via Doha in Qatar.
- Airport connectivity: takes into account both direct and indirect connectivity from the airport in question. Airport connectivity is defined as the sum of direct and indirect connectivity. It measures the overall level at which an airport is connected to the rest of the world, either by direct flights or indirect connections via other airports.

The metrics provided by ACI Europe could be used by the MEAC for the purpose of national air connectivity assessments in Estonia. Should the Ministry decide to follow its own direct and indirect connectivity assessments, more information on how to measure direct and indirect connectivity is available in the ITF Report *Defining, Measuring, and Improving Air Connectivity* (ITF, 2018a).

Airport quality indicators: The air connectivity assessments should be complemented by assessments of airport quality. Tallinn Airport currently collects these data through ACI's Airport Service Quality Surveys. Tracking passenger experience at Estonian airports is crucial to ensuring that airports deliver excellent products to their customers.

Airport catchment area assessments: To ensure that air connectivity is accessible to all citizens of Estonia, it is important that air connectivity assessments include metrics that reveal the time that is needed to reach Tallinn Airport from every region of the country. Such assessments can help identify gaps in airport access for specific areas. As previously mentioned, future assessments should also consider the proximity of Estonians to other international airports – in Riga, Latvia and Helsinki, Finland – provided the surface access to these airports improves to the extent to which they become viable substitutes for TLL.

Data on surface access mode shares: Tracking data on the sustainability of surface access over time would provide a useful supplement to the environmental sustainability considerations with regards to TLL. This would allow for the assessment of the extent to which airport traffic contributes to congestion and air pollution on the roads around the airport. TLL already collects such information and MEAC should incorporate it in its air connectivity assessments.

Finally, the air connectivity assessment efforts should be complemented by consultations with aviation stakeholders – airports, airlines, air navigation service providers, education providers, local residents, and businesses – on what they perceive to be the greatest challenges to connectivity and how they can be overcome. More information about the scope of such consultations, as well as how they can be run in practice, can be found in an ITF report that reviews decision-making in the aviation sector across several different ITF countries (ITF, 2017a). Estonia has a well-established process of stakeholder consultation in the aviation sector, which could be used to feed important industry, expert, consumer and community considerations into the Ministry's air connectivity reviews.

Rely on a systematic transport modelling and appraisal practice to underpin policy and decision-making

Section 2.2 Infrastructure Planning and Project Selection provides recommendations on how to build a systematic transport modelling and appraisal practice in the MEAC to support better policy and investment decision-making.

The analysis provided in the section reveals that useful modelling and appraisal tools exist. However, there is currently no formal guidance or approach to ensure that these tools are used to support the decision-making in the Ministry. This also appears to be the case in the aviation sector. Tallinn Airport collects and actively uses important air connectivity data and other data for decision-making. The air connectivity metrics (as suggested previously) should be used in support of aviation policy making in the MEAC.

In the context of the aviation sector, a systematic transport modelling and appraisal practice should ideally make provisions on how to consider any possible wider impacts of transformative aviation projects, beyond the costs and benefits that form part of standard cost-benefit analysis, such as increased labour productivity or investment (ITF, 2017b).

Identify air connectivity bottlenecks by taking a cross-sectoral perspective on mobility

Section 2.1 Institutional Structure provides the details on how institutional reforms will enable a cross-sector perspective on mobility challenges in Estonia. It also explains the benefits of such a cross-sectoral approach.

The ongoing and proposed institutional reforms in the transport sector will provide an opportunity for policy makers to determine how the aviation sector can best support transport connectivity across modes.

Conversely, a cross-modal perspective will inform policy makers whether improvements to surface access could help improve the overall air connectivity.

Assessing connectivity and accessibility across modes will enable a more cost-effective (and cross-modal) allocation of resources to improve mobility in Estonia. Such cross-modal considerations also are crucial to identifying the level of subsidies that may be needed to support otherwise commercially unviable remote connectivity (ITF, 2018b). Public service obligations (PSOs) currently provided to air carriers to preserve year-round connectivity between the two largest Estonian islands and the mainland should be revised with a cross-modal perspective. The procurement of PSOs across all transport modes has recently become the responsibility of the Road Administration, which has indeed created opportunities for cross-modal connectivity considerations.

Help the aviation sector deliver national and regional policy objectives through improved governance

Tallinn Airport's delivery of national and regional policy objectives needs to be scrutinised by the newly proposed regulator to ensure that aviation in Estonia maximises the benefits to consumers and the wider economy, and that the environmental impacts of aviation are mitigated to the extent possible. This should be considered vis-à-vis institutional reform proposals to establish a regulatory and supervisory agency with responsibility for all modes and ensuring that regulatory functions have an adequate degree of independence from the government. More details behind this proposal can be found in Section 2.1 Institutional Structure.

2.10. Future mobility: Adapting to technological and climate changes

This report reviews the approaches and processes currently used by national and municipal transport governance institutions in Estonia to underpin the identification, research and development (R&D), testing, procurement, governance and regulation of new and emerging transport technologies. It also assesses strategies to future-proof infrastructure design, particularly vis-a-vis climate change impacts. It offers recommendations for planning, procuring and regulating new and emerging transport technologies and services that are aligned with the policy proposals for institutional and procurement reform made elsewhere in this report.

Key issues

The key perspective underlying this section is that the world is on the cusp of a transport technological revolution. The combination of electric vehicles, micromobility, mobility as a service and autonomous transport will transform the way we live and work. The broad scope of these changes presents challenges for public authorities in understanding how to ensure the outcomes meet societal objectives, and for private organizations, whose business models are being disrupted and need to be remade.

A considered and strategic approach toward the adoption of new technologies in the transport sector is needed if the opportunities and benefits provided by them are to be maximized and the costs of adoption are to be minimised. Developing such an approach requires policy-makers to clarify the goals and priorities that they believe innovation should support, and to develop a detailed and explicit plan of action for achieving them. Establishing a structured dialogue with a range of stakeholders will facilitate both of these tasks. The section thus identifies key impediments to the achievement of these outcomes and means by which they can be addressed.

Fragmentation of innovation-related knowledge and research contributes to a lack of co-ordination of transport innovation policy

Both the Estonian Parliament and the Government have established significant bodies to address innovation and research policy. The Estonian Parliament's Foresight Centre is a think tank that conducts foresight projects on various topics with the aim of analysing long-term developments in the society and identifying new trends and developments. The study teams include Estonian and foreign experts.

The Research and Development Council is a government-led body, chaired by the Prime Minister and having a membership comprising three other government ministers (including the Minister of Foreign Trade and Information Technology) and eight government appointees. Two permanent committees, each chaired by a minister, support its work.[57] the Innovation Policy Committee, chaired by the Minister of Economy and Communications; and the Research Policy Committee, chaired by the Minister for Education and Research. The committees report annually to the Research and Development Council on the results of their work and their agendas for the year to come.[58]

An example of a significant non-government entity operating in the field is the long-established Estonian Institute for Future Studies at Tallinn University. The department includes a focus on innovation policies as part of its work programme and has previously completed a review of Estonian innovation policy for the European Union.[59] Estonian officials reported that numerous other initiatives, both governmental and non-governmental, address specific topics that may be of direct or indirect relevance to the transport sector. These include numerous overlapping working groups, initiatives, labs, research projects, test beds and industry platforms. These initiatives draw on the services of officials from EU institutions and the Estonian government, private sector employees, including those of industry associations and companies from both established and emerging industries, and the international and national research and development community.

The extent of this institutional architecture suggests that innovation and its policy implications are a high priority in Estonia. However, interviewees stressed that there is a high degree of fragmentation, with a lack of formal arrangements for co-ordination or knowledge sharing between the various players in the field. To the extent knowledge sharing occurs, it is highly reliant on informal mechanisms, particularly personal relationships between members of different bodies. As well, a lack of clarity regarding the relative roles and areas of engagement of the various bodies leads to uncertainty as to which should be invited to participate in different initiatives. Overall, the system is opaque, causing much difficulty for public and private actors wishing to plan and implement investments in innovative future transport infrastructure and service initiatives.

For government, this lack of effective co-ordination leads to two contrary problems. First, decisions regarding technology investments, which potentially have a large impact on transport services (e.g. the implementation of a future 5G network), are often made without adequate consultation and co-ordination between the Ministry of Economy and Communications (MEAC) and the relevant Ministries and agencies.[60] Conversely, similar technology assessment projects are sometimes undertaken multiple times by different entities, due either to a lack of clarity as to areas of responsibility or to inadequate transparency and communication. Both government officials and private actors argued that the lack of a co-ordinated process to identify, assess and test new and emerging transport technologies and services is a significant issue.

Officials noted that these weaknesses in addressing technology and innovation issues contrast sharply with the internationally recognised, best practice "e-governance in Estonia" programme providing IT infrastructure and services to citizens and e-residents and enhancing the quality of their online interaction with the public administration. If Estonia is to become a leader in future mobility services, the current

Transport and Mobility Master Plan needs a similarly coherent strategy, incorporating a planning and co-ordination process and funding structures.[61]

Staff capacity and resources are limited

Officials argued that ministries and government agencies have limited numbers of staff with the expertise to analyse new technologies and services and advise on their future role in, and implications for, the transport system. The level of expertise in this field within ministries was said to be largely dependent on the personal background, interest and networks of government officials, rather than the result of strategically directed recruitment and retention programmes.

This lack of capacity within government agencies is exacerbated by the fragmentation of responsibilities and lack of co-ordination identified above: the limited expertise available is unlikely to be put to its best use. This is due to both the restricted scope within which the relevant experts can operate in many cases, and the fact that institutional fragmentation reduces opportunities for capacity development via formal training and on-the-job learning.

A significant capacity imbalance exists between government and the private sector. This raises concerns regarding ministries' ability to engage effectively with private providers in a range of contexts. In particular, these include the development of appropriate contract specifications for the provision of transport-related services and the assessment of the quality of services delivered. This implies large problems in making judgements on value for money issues, leading to a tendency for government to overpay for privately provided services and/or face under-delivery in terms of quality and timeliness.

MEAC officials are aware of the potential benefits of implementing innovation procurement strategies in the transport sector, both in terms of effectiveness and value for money, and are undertaking some initiatives that address this objective. For example, MEAC is participating in an EU-funded project that seeks to use Pre-Commercial Procurement (PCP) strategies. These aim to "challenge industry from the demand side to develop innovative solutions for public sector needs", effectively enabling public sector purchasers to specify their requirements in terms of desired outcomes, rather than specific technological inputs (European Commission 2020).[62] However, full integration into the regular procurement process is lacking, mostly due to a lack of specialised staff. Staff capacity and capability issues were also cited as a key reason for the lack of a transport innovation strategy in the proposed National Transport and Mobility Master Plan.

Ad-hoc regulatory responses to new mobility services do not maximise their benefits in support of long-term transport policy goals

Estonia is home to Bolt (formerly Taxify), a long-established and successful ridesourcing operator that has more recently expanded its operations into the micromobility field, as well as other services including food delivery. However, while Taxify commenced operations in Tallinn in autumn 2013, an amended Public Transport Act, which enabled Taxify and other ridesourcing competitors to operate on a level playing field with the taxi sector, did not come into effect until over four years later, on 1 November 2017. This very long delay in developing and implementing an appropriate regulatory response occurred despite parliamentarians first announcing support for legalising ridesharing almost three years before the commencement of the new legislation, in February 2015, and the announcement of specific plans to amend the Act in December of that year.

The delay in legislating to accommodate the market entry of ridesourcing can be attributed to a number of factors, several of which have been replicated in other countries' responses to disruptive new mobility services. For example, as in many countries, policy makers faced strong lobbying from highly regulated incumbent taxi industries, arguing that they should prohibit, or tightly restrict, ridesourcing operations. In

addition, during the development of legislation to regulate the sector, there were significant shifts over time in the policy approach proposed. These included a range of specific issues that had potentially major implications for the development of the sector, such as whether there should be geographical limits on ridesourcing operations and whether they should be required to use electronic hire systems.

Underlying these policy shifts were differing perspectives as to whether ridesourcing should be seen as part of the public transport system – i.e. as equivalent to taxis – for most or all purposes. This can be seen as part of a broader problem: lack of a strategic, principles-based approach to guide policy responses to new mobility services. Similarly, as of June 2020, no further amendments to the Traffic Act to provide a regulatory framework for e-scooters have yet been adopted in Estonia. Indeed, it was reported in May 2020 that the Tallinn government had yet to decide on the threshold issue of whether scooters would be officially authorised for use.[63] This, despite the fact that Bolt became the first urban mobility provider to offer both ridesourcing and e-scooters on the same platform, over two years ago, and that e-scooters were introduced to Tallinn in the early summer of 2019.

The development of a clear, principles-based approach to new mobility services is, to a large degree, dependent on the existence of a wider policy framework, in the form of a Sustainable Urban Mobility Strategy (SUMP). A SUMP should set out a clear medium- to long-term view of what forms urban mobility should take, what modal shifts are required in order to achieve this and how to achieve them. This issue is discussed in more detail in Section 2.5 Steering User Behaviour and Public Transport Policy.

No climate change risk assessment plan has been developed for transport infrastructure and service issues

Several international organisations have highlighted the challenges of protecting transport infrastructure assets and maintaining their functionality in the face of the increasingly frequent and extreme weather events resulting from climate change. For example, PIARC (the World Road Association) argues that

> Coastal roads and bridges may need to be elevated. New design features to cope with increased coastal storm intensity will need to be developed. Drainage capacity will have to be enlarged to address heavy downpours and reduce flooding. New, heat-resistant materials and equipment will need to be put into place as the number of extreme temperature days are predicted to increase. (PIARC, 2016)

The ITF (2016) has previously noted that addressing these issues at the level of individual infrastructure assets is complicated by both the degree of uncertainty inherent in most climate modelling and the fact that these models rarely provide specific insights regarding impacts at individual locations. However, climate impacts should be considered in relation to both the siting and the design specification of new infrastructure assets, to manage these risks as far as possible. In relation to existing assets, there are implications for both the extent and scheduling of maintenance and in terms of potential asset design modifications. As most of the transport infrastructure that will be in use in 30 years has already been built, the implications of climate change for existing assets constitute a large part of this issue.

At a macro-level, governments must address questions of ensuring overall system resilience in the presence of increased risks of individual assets going out of service. Resilience, in this context, implies minimising the impact of an asset failure on the performance of the wider system. The importance of system resilience will necessarily increase over time because climate change is expected to increase the incidence of asset failure, particularly in relation to “legacy” assets.

Discussions with Estonian officials indicate that they are aware of the need to take climate change risks into account in planning transport investments and services, in order to future proof the overall transport system. Officials also highlighted the existence of the Climate Change Adaptation Development Plan Until

2030 (Government of Estonia, 2017). The adaptation plan is intended to increase the readiness and capacity of state, regional and local government entities to adapt to the effects of climate change. It sets out sub-goals for eight priority sectors, including infrastructure. The Adaptation Plan explicitly mentions a number of expected effects of climate change on transport infrastructure and highlights the implications for maintenance expenditures. However, the estimated expenditures for implementation of the plan in the infrastructure sector as a whole (i.e. including transport and other sectors) are extremely modest, totalling only EUR 320 000 of the EUR 43.7 million for the eight priority sectors. Most of this expenditure is budgeted for the 2017-2020 period.

The Plan also identifies the National Transport Development Plan 2014-2020 among a large number of "development vision documents related to the adaptation to the effects of climate change" (Government of Estonia, 2017). However, none of the specific action areas addressed in the Plan appears to relate -specifically to adaptation as it relates to transport infrastructure.

The existence of a climate change adaptation plan, which considers these issues at a national, cross-sectoral level, provides a starting point for the development of the more detailed and sector-specific work that will be necessary in order to ensure that high- level resilience to climate risks is built into transport infrastructure as efficiently as possible. However, significant action in these areas is still needed to ensure that these goals are achieved in practice. Estonia's National Transport and Mobility Master Plans have yet to address climate change adaptation and resilience issues, as they relate to transport infrastructure.

Meteorological and climate factors are manageable risks. Asset managers can and should respond to them when designing and siting infrastructure assets. However, because climate parameters evolve in unpredictable ways, failure to address climate change resilience at a systems level, including by developing new or expanded decision-making models, entails significant risk of:

- under-specification of infrastructure design standards, leading to asset failures and/or service degradation
- over-specification of standards, leading to unproductive investments.

Failure to address climate change adaptation systematically, therefore, has substantial efficiency and cost impacts on major infrastructure.

Avenues for reform

The above discussion highlights issues in respect of the lack of strategy, institutional co-ordination and staff capacity in Estonia. Such inadequacies prevent Estonia from taking full advantage of new and emerging transport technologies while ensuring the consistency, coherence and clarity of long-term investment plans. The following identifies key avenues for addressing these issues in an effective and co-ordinated way.

Establish clear goals and priorities for innovation in the transport system

Estonia should better articulate its transport innovation policy goals. Ensuring that goals and priorities are clearly articulated is a prerequisite for the development of the strategies and processes required, and identifying the resources needed to achieve them. The goals and priorities should be broad in scope, reflecting the potential for technological and business innovation to play a key role in delivering better economic, social and environmental performance across the transport system. They should also be consistent with the strategic objectives of the National Transport and Mobility Master Plan and the recommendations contained in the various sections of this report.

The Strategic Policy Division of MEAC should lead the process of evolving and defining goals and priorities. The proposed TRC, which should act as a hub for technical expertise in a number of related fields, should have a core role in this regard. The process should also include sustained engagement with the range of innovation-focused institutions across Estonia's government and society. Dialogue with these bodies should be part of the goal-setting process. This will help ensure that the goals and priorities identified are aligned with broader government policies and with trends in the wider economy. The innovation-related recommendations made in other sections of this report (e.g. Section 2.5 Steering User Behaviour and Public Transport Policy) should also be considered during this process.

Establish a structured dialogue with major innovation-focused institutions

The above discussion highlights the fact that Estonia has many institutions with an innovation focus. They include the various science and technology councils and advisory boards existing at governmental and parliamentary levels, those located in key ministries and those found in universities and the business sector. Estonia is also internationally known for its successes in using innovative technology and service models to improve government services for, and interactions with, citizens. These factors equip Estonia to take a pro-active approach to leveraging innovation in technology and business models in the transport sector. However, the current fragmentation in the transport sector largely compromises its performance. Thus, major improvements are needed in the co-ordination and co-operation arrangements between these entities, if this opportunity is to be realised.

This issue necessarily extends beyond the transport sector, given the breadth of activity of many innovation bodies. While beyond the scope of the current report, a government-wide approach to improving co-ordination between innovation-based bodies across the public and private sectors would likely yield substantial benefits. The example, cited above, of the cross-sectoral impacts of 5G technology highlights the potential benefits of a broader approach.

However, transport-specific initiatives can be put in place even in the absence of broader co-ordination activity. A number of Estonian government bodies, including the Roads Administration and the MEAC, are members of Intelligent Transport Systems (ITS) Estonia, which unites different organisations from public, non-governmental and private sectors in the field of intelligent transportation systems (ITS) and acts as a platform for co-operation and innovation.[64] However, there is scope to supplement participation in this co-operation platform with a process of structured dialogue. This should be broader than the ICT focus of intelligent transport systems and, on the other hand, specifically oriented toward developing a strategic focus on integrating transport innovation in the National Transport and Mobility Master Plan. This dialogue should be maintained over time in order to provide a mechanism for reviewing progress and revising and updating the Master Plan and the proposed Transport Technology Roadmap (TTR – see below).

The MEAC should establish a structured dialogue with a range of innovation-focused institutions that address transport-sector issues, or technologies that have or may have significant transport-related impacts. Improving communication between these bodies by providing channels for information exchange and promoting co-operative endeavours should significantly reduce the efficiency costs of duplication and overlap and encourage specialisation and comparative advantage. Through this process of closer engagement, MEAC would also acquire a greater knowledge of the capacities and foci of the relevant bodies, enabling it to advocate within government for a clearer delineation of their respective roles.

Establishing clear goals and priorities for innovation in the transport sector, as proposed above, will support this co-operation by clearly identifying for all stakeholders the objectives of formalised co-operation and co-ordination. Conversely, engaging with innovation-focused bodies as part of the process of developing these goals and priorities will provide a useful starting point for developing and

deepening future dialogue. The identification of goals and priorities is also a fundamental starting point for the development of a Transport Technology Roadmap, as recommended below.

Develop a Transport Technology Roadmap as part of the Transport and Mobility Master Plan

Box 3 provides an example of a formal Transport Technology Roadmap (TTR), identifying the key inclusions and the objectives that it is intended to serve. Adopting a formal TTR would help Estonia guide the work on the future impact of technology on transport undertaken by various organisations across the government and beyond. It could help ensure the work is strategically directed and operationalise its conclusions via linkage with the National Transport and Mobility Master Plan. It would facilitate better co-ordination among the different organisations addressing these issues by giving expression to the government's vision of the evolution of technology in transport. Given MEAC's lead role in the Master Plan, MEAC should also take responsibility for developing the TTR. The TTR would serve to clarify the government's policy priorities and orientations for transport innovation. It should necessarily take account of the strategic orientations and research undertaken by the European Commission, including:

- the development of the Strategic Transport Technology Plan (STTP) as a strategic framework for transport research, innovation and deployment, based on the 2011 White Paper (European Commission, 2011) which set out a vision for an integrated, efficient, safe, secure and environmentally friendly European transport system by 2050; and
- the Strategic Transport Research and Innovation Agenda[65], developed as part of the Horizon 2020 programme. The Future Transport Technology Roadmap, adopted by the government of New South Wales, Australia (New South Wales Government, 2016), provides an example of a TTR. The Roadmap is outlined in Box 3.

The TTR should be regularly reviewed and updated, with significant input from international experts, to ensure its continuing relevance in a necessarily uncertain and rapidly changing environment. However, while regular updating of the TTR is essential, this must occur within the context of a clearly articulated set of policy principles to ensure a consistent approach and predictability for service providers.

The TTR would form the basis for the development of a number of key dimensions of transport policy, in particular:

- a research and development funding strategy
- a procurement strategy for transport services
- a regulatory strategy for the sector.

A number of ITF Member countries have recently undertaken substantial reviews of the impact of changing technology on the transport sector. The Estonian government could look to its experience when developing its TTR and related strategies. For example, the United Kingdom government announced its "Future of mobility: urban strategy" in March 2019. Its intention is to:

"… explore regulations around new types of vehicles including e-scooters and e-cargo bike trailers, how sharing data can improve services by reducing congestion, and how journey planning and payment can be made more simple. This wide-ranging review will also explore modernising laws from the 1800s that are providing a barrier to innovation." *(UK Government, 2019).*

The strategy also includes funding for the establishment of four "future mobility zones" to test innovative ideas in areas such as payment systems, travel information and transport modes, intended to improve the convenience, reliability and cost of urban travel. Of note, the strategy identifies nine principles as underpinning the approach the government will take to facilitating innovation in urban mobility. These

address issues of system integration, safety, sustainability, consumer benefit, open market places, information sharing and the promotion of active transport.

Box 3. Future Transport Technology Roadmap of New South Wales

The Future Transport Technology Roadmap of New South Wales identifies 12 emerging technologies that are expected to transform transport. They are grouped into four categories:

- customer interface technologies
- data and insight technologies
- infrastructure technologies
- vehicle technologies.

A key orientation of the Roadmap is recognition of the importance of the societal response to the various technologies in determining the role they are able to play in changing transport systems. This results in the specification of four scenarios that may develop over a 20-year period. The scenarios help identify key issues and consequences that may need to be addressed, given the range of different outcomes emerging technologies will make possible. These are based on:

- retention of a predominant orientation toward the use of private vehicles as automated vehicles are adopted
- a mixed-mode model, entailing a substantial shift toward mobility-on-demand services
- a major shift toward public transport, driven by major investment in service improvement
- a major flattening of transport demand due to high take-up of "virtual accessibility" options.

Finally, the Roadmap identifies five strategies, to be adopted by the transport agency to address technological developments and societal responses and develop an innovative and "customer-centric" transport model. These are: personalising customer interactions; transforming mass transit networks; fostering shared, demand-responsive services; enabling connected and automated vehicle platforms; and creating intelligent transport networks managed with data.

Source: New South Wales Government (2016).

Australia provides another example of a high-level approach to addressing the issues raised by technological change in transport. Here, the government established the Office of Future Transport Technology (OFTT) in late 2018. The office has a more limited remit than in the United Kingdom case, in that its role is limited to the issue of autonomous vehicles. However, it is intended to address a wide range of issues within this field in order to "prepare for the deployment of automated vehicles in Australia", in co-operation with sub-national governments. The government's National Policy Framework for Land Transport Technology, under which the OFTT has been established, sets out the following four roles for government:

- Policy leadership – providing a clear, nationally co-ordinated approach across different levels of government, being responsive to changes in the technological environment
- Enabling – ensuring that the private sector is able to bring beneficial new technology to market

- Supportive regulatory environment – ensuring that community expectations of safety, security and privacy are appropriately considered in new technology deployments
- Investment – investing in research, development and real-world trials that benefit the entire transport network customer base or provide a sound basis for government decision-making (including collaboration with the private sector).[66]

The OFTT is responsible for policy co-ordination within the infrastructure portfolio, across other portfolios of the Australian government and with all relevant sub-national governments, as well as for community engagement on related policy issues.

Another approach to addressing the impacts of technological change on the transport sector at a strategic level is the New Zealand Department of Transport's "Regulation 2025" programme. This explored the potential impact of technology on the transport systems and societal willingness to adopt new technology. It saw a core question as being whether governments can simply adapt current regulation to meet future needs, or whether more fundamental regulatory change would be required. The project included the development of a range of research papers addressing different aspects of the topic (New Zealand Government, 2016).[67]

Establish a dedicated group in the proposed Transport Research Centre to develop the Transport Technology Roadmap and facilitate its integration into the National Transport and Mobility Master Plan

Section 2.1 Institutional Structure recommends that a well-resourced Strategic Policy Division within MEAC should have responsibility for strategic policy development across all transport modes and that it should incorporate a Technical Resource Centre (TRC). The TRC would provide high-level technical capabilities in key areas, thus supporting the MEAC's strategic planning capacity and enabling it to prepare high-quality procurement strategies. The TRC should also act as a centre of expertise for transport technology development. It should also lead the development of the TTR.

Section 2.1 Institutional Structure argues that, in order to enhance the role and influence of analysts within the government, the TRC should be led by a Chief Transport Economist and supported by a Chief Procurement Officer. The appointment of a Chief Transport Technology Officer, whose primary responsibility would be to develop the TTR, would also seem fitting. It would provide a focal point for the development of policy on the direction and speed of technological development in the transport sector and would have two related advantages:

- It would clarify that the MEAC holds the primary responsibility for ensuring co-operation and the exchange of information between bodies engaged in transport technology-related research.
- It would ensure the central point for the analysis of transport technology issues lies within the MEAC – i.e. the organisation that has primary responsibility for long-term transport planning, via the National Transport and Mobility Master Plan process.

Section 2.1 also recommends that the Strategic Policy Division be responsible for developing a high-level transport model that is as recommended in Section 2.2 Infrastructure Planning and Project Selection. This provides further rationale for locating co-ordination on transport technology-related issues within the Division, given the importance of these issues for future transport modelling. That is, the TTR would be a core input to the transport model, which would, in turn, inform the timing and sequencing of key elements of the TTR. The TTR should be developed in co-operation with key Estonian research bodies such as the Information Society Advisory Board, the Research and Innovation Council, e-Estonia Council and the

Ministry of Education and Research and with relevant EU bodies (e.g. DG Research and Innovation, DG Mobility and Transport).

The Strategic Policy Division should employ a Senior Data Scientist to ensure transport planning is informed by timely and high-quality data inputs. The importance of the issue was underlined repeatedly in ITF's consultations with government officials and business representatives. They expressed concern that there is currently a lack of accessible data and insufficient data analysis capacity. In addition, opportunities to leverage transport data into value creation opportunities are often missed, partly due to regulatory restrictions. A key role of the Senior Data Scientist would be to identify which bodies hold what data, to disseminate this knowledge, and to work toward improving data access over time. This could be done through better linkages between databases, access agreements and investigating the merits of establishing a central, authoritative database. This is likely to be particularly important as opportunities to develop Mobility as a Service (MaaS) platforms are explored.

Adopt a positive and principles-based approach to regulating new mobility services that is linked to Sustainable Urban Mobility Plans

Disruptive technologies pose fundamental challenges to the way governments regulate in many fields. They bring rapid changes to markets and services that often exceed the capacity of traditional regulatory systems to respond. Existing delineations of markets and sectors are often made redundant, challenging regulatory enforcement and transcending administrative boundaries, domestically and internationally. Conversely, laws and regulations are highly influential in determining the speed and direction in which emerging technologies develop, and their benefits to society. Governments must balance the need to foster innovation and accommodate technology-driven disruption while ensuring adequate protections for people and businesses (OECD, 2020).

New mobility services have provided examples of this paradigm in recent years. They have rapidly transformed the urban transport landscape in many cities globally. They have increased consumer choice and rapidly gained market share due to the large welfare gains that have arisen from the combination of new technologies and/or new business models. In some cases, a key benefit has been the ability of new services to highlight and challenge outdated regulatory arrangements that no longer serve the public good.

Disruptive technologies and business models are likely to have even more transformative effects in the transport field in coming years, as major innovations including drones, autonomous vehicles and Mobility as a Service (MaaS) establish themselves in the urban landscape. Governments must adopt sound and timely regulatory responses to new services and models if their potential benefits are to be realised and the costs and negative externalities associated with their use minimised. This is most readily achieved if policy makers operate within a well-established, principles-based framework when developing regulation. Both the lengthy and apparently confused approach taken to accommodating ridesourcing in Estonia and the failure to adopt a sound regulatory framework for e-scooters, as described above, are indicators of the importance of Estonia pursuing this path. Box 4 sets out ITF's specific recommendations for such a principle-based approach.

More broadly, the OECD's work on regulatory policy points to the need for governments to respond to the challenge of disruptive technologies by adopting "Governance Innovation" that enables more dynamic, flexible and technology-neutral approaches to regulation and its enforcement (OECD, 2020).

When determining how to respond to disruptive innovation, a key question is at what stage to regulate. Regulating early, before the dynamics of the emerging market(s) in which the new technology or business model operates are well-understood obviously carries large risks of adopting poorly targeted regulation that has unanticipated costs and limited effectiveness in addressing actual harms. Conversely, there is

often heavy pressure to regulate new markets and a too cautious approach can, on occasion, lead to substantial harm. Because of these competing concerns, a key characteristic of regulation adopted in a rapidly changing environment is that it should be "responsive" or "adaptive".

Box 4. A principles-based approach to regulating new mobility services

Maintain a permissive regulatory environment for new mobility services

A generally permissive approach should be adopted, recognising that substantial welfare benefits have been derived from new mobility services to date and a prohibitionist stance to future innovations will likely prove highly costly. New products, services and activities should generally be permitted unless there is specific and credible data suggesting they will impose net social costs.

Treat incumbent mobility providers and new entrants equally

The fact that disruptive technologies and business models can impose significant losses on incumbent businesses does not justify using regulation to protect the incumbent businesses' positions. Where governments seek to cushion these losses, other policy instruments should be used. Regulatory differences should be limited to those implied by the different market impacts of their business models.

Revise outdated and fragmented regulatory frameworks for mobility services

Existing regulations that unreasonably prevent the creation of new business models should be urgently reviewed so to reap the benefits of innovation. Regulations that unreasonably prevent incumbent businesses from competing with disruptive entrants should also be reformed, absent continued justifications in terms of consumer safety and security.

Focus regulation on addressing clearly identified market failures

Regulation should address clearly identified market failures or substantial equity concerns. Regulators should avoid acting before the market dynamics of new business models are well understood. However, there may be occasions where *ex-ante* regulation is needed to address clearly foreseeable harms.

Take the broader urban policy environment into account when designing regulations

The likely impact of new mobility services on urban policy goals including pollution, climate change, congestion, liveability, accessibility and connectivity should be considered when designing regulatory responses. However, policy makers should clearly distinguish between objectives that are appropriately pursued through sector-specific regulation and those that can only be properly addressed using broader policy tools.

Consider subsidies where appropriate and invest in supporting infrastructure

Where significant social or externality benefits can be provided by new mobility services at the lowest cost (eg. improved connectivity, reduced congestion), there may be a case for either directly subsidising provision or investing in supporting infrastructure to encourage take-up.

Source: adapted from ITF (2019).

This means that there should be a particular focus on *ex-post* monitoring of regulatory impacts. Aspects of newly adopted regulatory structures will need to be revised or even replaced within a short timeframe, as unanticipated impacts are recognised and understanding grows of new market dynamics. This approach

stands in contrast to traditional views of regulation as changing only infrequently. The fact that Estonia has had a requirement for *ex-post* Regulatory Impact Assessments (RIA) in place since 2012 provides a sound underpinning for a system of adaptive regulation, since an *ex-post* RIA ensures that regulatory impacts are measured against initial expectations and weighed systematically and quantitatively. The MEAC should undertake timely and thorough *ex-post* RIA and ensure that the results drive timely regulatory changes where indicated.

This principle of responsive regulation can also be expanded by encouraging regulators to develop an "anticipatory engagement" in the innovation process. Doing so would help identify concerns at an early stage and to steer, in a co-operative manner, the deployment of technology. This can include the use of experimental models of regulation – so-called "regulatory sandboxes" – which offer limited-term exemptions from pre-existing regulatory rules, within an agreed context and can provide opportunities for rapid learning for all parties. Importantly, as well as presenting regulators with new challenges, innovative technology has the potential to provide them with new tools that enable them to regulate better. For example, digital technologies can support real-time monitoring, while sophisticated data collection and analysis can drive better-targeted inspection and investigation activity. Thus, technology can significantly enhance enforcement capabilities.

Collaborative approaches can also enable better-tailored regulatory responses. On one hand, this can involve collaboration with regulators in other jurisdictions, enhancing the exchange of knowledge and experiences. Such partnerships can speed up the development of well-adapted regulatory responses. On the other hand, it should include collaboration with the adopters of new technology. While stakeholder consultation is an integral part of any high-quality regulatory process, this is particularly important in the context of new technologies and services, where the need to understand the technology, its risks and benefits and the underlying business models is acute.

In the OECD's most recent survey of regulatory policy and governance systems, Estonia scored above the OECD average on five of the six iREG indicators. Three important elements of Estonia's system are the widespread use of RIA, including requirements for both preliminary and *ex-post* RIA; the existence of the Strategy Unit at the Government Office, which co-ordinates stakeholder engagement in policy making across government; and the well-established Legislative Quality Division at the Ministry of Justice, which takes a leading role in implementing a range of key elements of the regulatory policy (OECD 2018). The MEAC should ensure that it engages fully with these agencies to maximise the quality of its regulatory responses to new mobility services.

As noted above, policy formation in relation to new mobility services (including regulatory development) should be guided by a Sustainable Urban Mobility Plan (SUMP). SUMPs are discussed in more detail in Section 2.5 Steering User Behaviour and Public Transport Policy. However, the key considerations in this regard are that regulatory approaches should support the objectives of the SUMP in relation to modal shift. All SUMPs are predicated on the view that urban transport should be re-oriented toward a greater use of public and active transport modes, through both positive incentives (improved public transport provision, cycling and infrastructure, etc) and negative incentives for private vehicle use (e.g. reallocation of road space, parking pricing and availability policies, congestion charging).

Several new mobility services, such as e-scooters and shared bicycle schemes, are clearly consistent with SUMP objectives. However, research suggests there is significant uncertainty about the net impact on vehicle kilometres driven (vkm) of ridesourcing. It is likely that broader policy responses and the wider transport environment potentially have a major impact on the outcome in a specific urban context. For example, incentives for ridesourcing to be used for first/last mile journeys may significantly change the sector's overall vkm impact. Thus, regulatory issues in relation to this and other modes (e.g. autonomous

vehicles) must be addressed within a wider policy context (ITF, 2019). In the medium term, similar considerations will be relevant in developing policy responses to autonomous vehicles.

Develop a nation-wide climate resilience analysis for the Estonian transport system

As previously noted, no national climate change risk assessment plan has been developed despite Estonian officials' awareness of the need to consider climate change risks when planning transport investments. The National Transport and Mobility Master Plan should set out the broad lines of Estonia's approach to this issue. In developing an integrated response to climate resilience, Estonia should keep in mind the principles elaborated in ITF's recent research on adapting transport systems to climate change, which are summarised in Box 5.

Box 5. Adapting transport systems to climate change and extreme weather

Act now to preserve the value of transport infrastructure and maintain network performance

Planning decisions for assets with 50+ year lifespans must take account of their significant potential exposure to climate hazards, including in relation to siting choices. For shorter-lived assets, climate impacts should be considered in asset renewal decisions.

Protect transport infrastructure from climate hazards through good maintenance

Good maintenance practices are a powerful hedging tool, reducing asset vulnerability to climate impacts. Sensors and communication technology can help target maintenance effort.

Prepare for more frequent and unexpected failures of transport infrastructure

Asset managers should plan for scenarios in which multiple hazards lead to unexpected or cascading failures. Co-located infrastructure poses particular risks. Preparing for hazard scenarios requires good communication and co-operation among stakeholders.

Account for temporary unavailability of transport assets in service continuity plans

Extreme weather may make assets temporarily unavailable without significantly damaging them. Continuity plans should include re-routing, use of other modes and plans to bring the asset back online rapidly.

Assess the vulnerability of assets and networks to climate change and extreme weather

Vulnerability assessment allows adaptation efforts to be prioritised based on potential consequences but must be undertaken at both asset and network level. Risk assessment is a key element of this task.

Focus on transport system resilience, not just on designing robust infrastructure

Resilience-based approaches accept occasional asset failure as an unavoidable outcome and focus on minimising the consequences. This means moving from the passive defence of infrastructure to planning for "safe failure".

Re-evaluate thinking on redundant transport infrastructure

Network redundancy has value where more asset failures may occur as a result of climate change. This requires new methodologies for assessing the value of redundancy.

Do not rely solely on cost-benefit analysis when appraising the value of transport infrastructure

Cost-benefit analysis (CBA) is useful where the probability of future climate effects can be assessed and quantified robustly and adopting risk-adjusted discount rates and explicit assessments of climate

uncertainties can extend CBA. However, many climate impacts are subject to deep uncertainty and cannot be effectively incorporated within CBA, suggesting it should be supplemented by other methodologies.

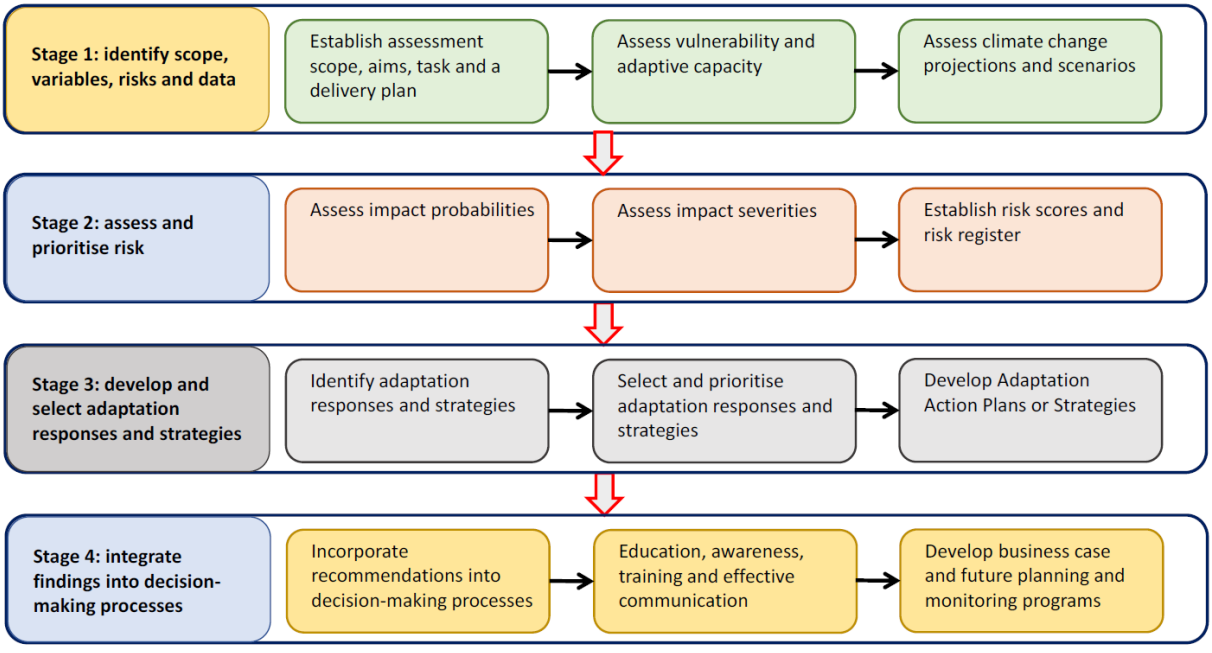
Develop new decision tools that incorporate deep uncertainty into asset appraisal

Appraisal techniques such as Real Options Analysis (ROA) and Robust Decision-Making (RDM), which is specifically adapted to situations in which no probabilistic information exists, offer complementary approaches to CBA.

Source: adapted from ITF (2016).

The issue of adapting transport infrastructure and services in response to climate risk has been the subject of substantial research over more than a decade. The European Union has been engaged with this agenda since publishing its 2009 White Paper *Adapting to Climate Change: Towards a European Framework for Action* (EU, 2009).[68] Its 2014 implementing regulation (215/2014)[69] sets out general methodological provisions considering climate change in transport projects submitted for EU financing under the European Regional Development Fund or the Cohesion Fund. The 2018 report *Climate Change Adaptation for Major Infrastructure Projects* (EC, 2018) reviews available resource materials to support infrastructure project developers' consideration of climate change adaptation. It identifies good practices in adapting to climate change, drawing on the experiences of national authorities and research institutions.

Figure 18. A framework for incorporating climate change adaptation in transport infrastructure planning

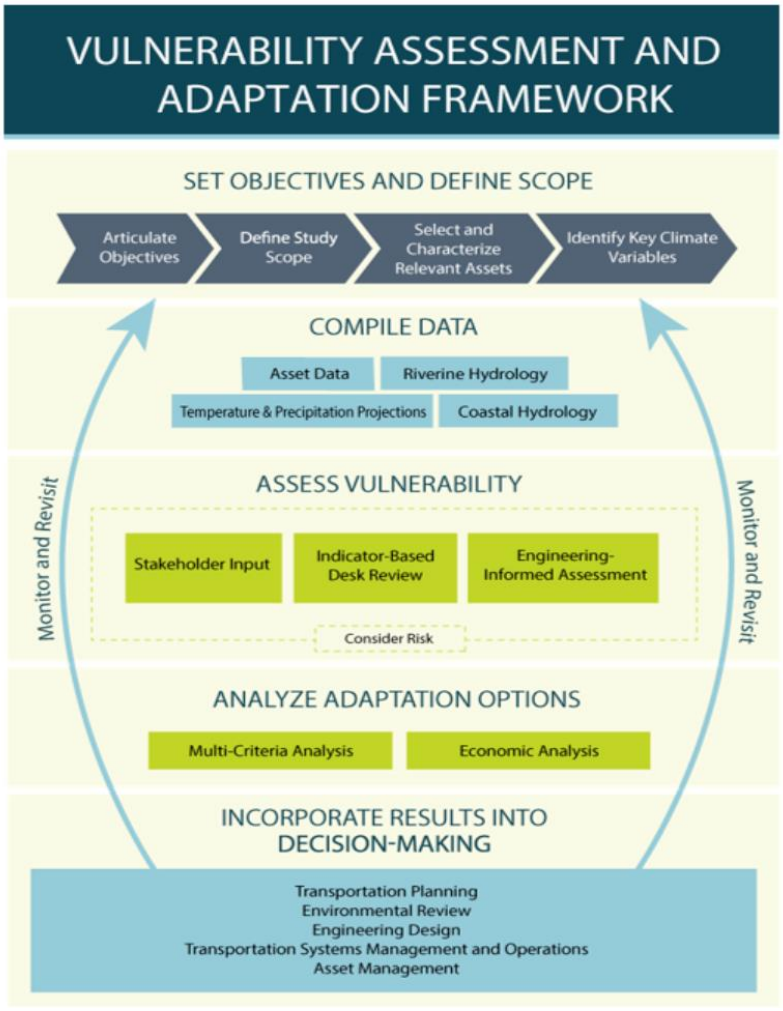


Source: PIARC (2015).

In developing its climate resilience strategies, Estonia should have regard to both relevant EU-published materials and requirements, and the implementation frameworks prepared by a number of individual countries and international organisations. Figure 18 provides a relevant example of a framework developed by the World Road Association for use by road authorities. The framework serves to guide road

authorities through the process of identifying relevant assets and the risks they face from climate change. It also aids with the incorporation of adaptation responses and assessment findings in decision-making.

Figure 19. The United States Government's Federal Highway Administration vulnerability assessment and adaptation framework



Source: FHWA (2018).

Another widely adopted set of tools to assist in climate resilience analysis and planning are those developed by the United States Government's Federal Highway Administration (FHWA). Figure 19 summarises the FHWA's Vulnerability Assessment and Adaptation Framework. As with the PIARC framework, the central concern of the FHWA framework is the assessment and prioritisation of risks and the identification of vulnerable features and assets. The FHWA framework addresses both analytical and modelling requirements and the need for stakeholder feedback. The FHWA approach also provides a suite of supporting analytical tools including:

- a climate data processing tool
- a matrix that documents the sensitivity of different transport infrastructure assets to a range of climate impacts

- a guide to assessing criticality in transport adaptation planning
- a Vulnerability Assessment Scoring Too (FHWA, 2018)

Taylor (2018) notes that both the PIARC and FHWA frameworks have found numerous international applications, with the latter also used extensively by US state transport agencies. Other equivalent frameworks have also been published by Standards Australia (2013) (an ISO member organisation) and Transport for New South Wales (an Australian sub-national transport authority).

Estonia should adopt a consistent approach to adaptation across all types of transport infrastructure. Given this and the need to ensure that adaptation strategies are incorporated into the National Transport and Mobility Master Plan, the MEAC's Strategic Policy Division should take the lead in this process. The Technical Resource Centre could identify specific expertise requirements and manage contractual arrangements to ensure that adequate specialist resources are available as inputs to the process. As highlighted by FHWA, stakeholder consultation should also constitute an integral element of the process of developing and implementing adaptation strategies. Enhanced consultation with foresight bodies in the development of a TTR also constitutes one appropriate mechanism for ensuring such engagement.

Notes

3 The 2017 Survey states ""The efficiency and productivity of public investment could be significantly enhanced by improvements in its management. A recent IMF paper shows that countries whose institutions have stronger public investment management have more predictable, credible and efficient investments and that strengthening these institutions could close up to two thirds of the public investment efficiency gap. In particular, good co-ordination in investment planning and a clear system for the selection and prioritisation of projects is indispensable to identifying strategic priorities and exploiting synergies across investment programmes" (OECD 2017, p. 122).

4 Section 42(1) of the State Budget Act provides that the statutes of state agencies and inspectorates are approved by the Minister. Section 42(2) sets out the required inclusions in these statutes.

5 Statute of the Estonian Roads Administration, 55/2018, S7(8).

6 A major ITF body of work on this topic (ITF, 2018) offers a comprehensive treatment on the role of private investment in transport, whether and how it could be used in the transport sector.

7 See, for example, Sections 11(1) and (2) of the TTJA Statute, which give the organisation functions relating to projects financed by EU structural funds and the initiation and management of development projects in the transport field, respectively.

8 The 2018 National Infrastructure Assessment is available here: https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible.pdf.

9 Infrastructure Australia reviews and approves business cases where Federal government funds are sought by proponents to support nationally significant infrastructure projects. For an overview of the functions and operations of Australia's independent infrastructure advisory body, see: https://www.infrastructureaustralia.gov.au/.

10 Information provided by email to ITF by the Estonian Ministry of Economic Affairs and Communications in a 31 January 2020.

11 At the outline stage the estimates need not necessarily be derived from broad quantities that would require unit prices (broad building block estimates can also be used, derived from past projects). That said, having a unit price database and a price index derived from it will still be helpful in ex-post analysis. For example, the estimates and final costs should be compared fixed prices to measure the estimation error without noise from price fluctuations).

12 This is the global estimated value that is generally published with the tender.

13 The Estonian public procurement register collects basic information from each tender in the public sector, allowing the tracking of the number of bidders per tender the difference between the estimated tender value and the winning bid etc.

14 Into how many contracts should a major project be broken down and where should the boundaries between them lie, i.e. which project activities should be in which project.

15 The delivery model concerns, whether the project phases should be bundled or not (e.g. are Design and Build separate phases or procured as a single contract) and whether the project is based on adversarial principles (i.e. price competition dominates the bidding process) or collaboration.

16 In case of interest Estonia could organise an expert visit at the Belgian Department for Mobility and Public works, who's in charge of the local public works unit price database.

17 A rare example of a systematic approach to ex-post analysis come from France, which has a law that makes an independent audit of CBA mandatory above certain values and requires large projects reserve a portion of their budgets for the establishment of transport observatories in major projects – small teams, which are employed to collect data on ex-post performance). In the UK the Highway company pursues and ex-post analysis of both the CBA and procurement outcomes for all major road schemes (the POPE programme https://www.gov.uk/government/organisations/highways-england/about/research#post-opening-project-evaluation-pope).

18 There is no universal standard on how to qualify complexity, but there are multiple approaches available. One was applied in the FHWA (2016) study.

19 https://www.gov.uk/government/publications/transport-infrastructure-efficiency-strategy.

20 "When high roads, bridges, canals, &c. are in this manner made and supported by the commerce which is carried on by means of them, they can be made only where that commerce requires them, and consequently where it is proper to make them."

21 https://www.theguardian.com/uk-news/2018/oct/29/hammond-abolishes-pfi-contracts-for-new-infrastructure-projects.

22 A PPP can also spread out demand risk over time, by varying the concession duration in a Least Present Value of Revenues model, developed by Engel, Fischer, and Galetovic (2020). Theoretically, PPPs could also capture the same risk diversification possibilities as a state-owned road company, the limit being that very large PPP contracts limit the number of firms that are able to compete, undermining the competition for the PPP contract and thereby introducing both deadweight losses and unwarranted transfers from public to private sector.

23 https://www.eib.org/epec/.

24 https://pppknowledgelab.org/.

25 https://www.gihub.org/.

26 In practical terms the state would then prepare two sets of financial statements. One for the European Union and one for the Estonian public and international financial markets.

27 https://library.pppknowledgelab.org/documents/5749.

28 One example is here: https://www.eib.org/epec/g2g/i-project-identification/11/index.htm.

29 Induced demand refers to a phenomenon that increasing road capacity leads to an increase in traffic volumes, i.e. increases in roadway capacity encourages more people to drive, thus failing to improve congestion. A1994 report developed by the Standing Advisory Committee for Trunk Road Assessment (SACTRA) in the United Kingdom provided an important reference on evidence of induced demand.

30 Information provided in a 16 October 2019 presentation by Elron CEO Merike Saks to the ITF.

31 Scenarios are built under the assumption that alternative fuel technologies account for roughly 60% of new passenger car purchases in 2050 (following the IEA 2DS) and fuel-efficiency improves in line with European standards.

32 While farebox revenues are the most critical and stable revenue source, full operational costs in public transport are never recovered in most cases. For instance, in London, 65% of operational costs are covered by ticket sales; in Stockholm 52% of costs are covered by ticket revenue.

33 The High-Level Commission on Carbon Prices recommended shadow prices in the range of EUR 37 to EUR 74 for 2020 rising to EUR 72 to EUR 144 by 2050 (all in constant 2017 prices). See N. Stern and J. E. Stiglitz (2017).

34 The relevant information is published on www.vrachtwagenheffing.nl.

35 https://www.dw.com/de/lkw-maut-gilt-jetzt-auf-allen-bundesstra%C3%9Fen/a-44476287.

36 The other ports that are part of the port of Tallinn group include: Paldiski South Harbour, Paljassaare and Saaremaa.

37 There are no official studies underlying these informal projections. Stakeholders base their expectations on the current market environment.

38 See https://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=3_SA_53469.

39 The state currently receives between one and two million euros annually in income tax on the wages of crew members of cargo ships. See https://www.baltictimes.com/estonian_parlt_committee_backs_exempting_seamen_s_pay_from_income_tax/.

40 See https://www.mkm.ee/en/news/estonian-merchant-fleet.

41 In the context of studies on potential fixed links between the mainland and islands, the Road Administration commissioned user satisfaction surveys in 2012. For example, 94% of respondents experienced improvements on the Kiuvatsu-Virtsu ferry route between 2009 and 2012. See https://www.mnt.ee/et/tee/saaremaa-pusiuhenduse-arendamine#tab-0.

42 There are only three shipping companies in Estonia which are able to provide the necessary service quality. For smaller islands, the volume of service is so small that companies from outside Estonia are not interested in bidding. The Road Administration is currently choosing contractors for ferry services for the Rohuküla-Sviby, Kihnu-Munalaid and Sõru-Triigi lines. The total annual capacity of the three lines is less than 100 000 km. The Public Transport Act allows to enter into direct contracts for lines of less than 300 000 annual km.

43 Maritime security standards in Estonia are perceived as more burdensome than in other EU countries. The strong security culture of the Estonian maritime administration could be explained by the dramatic sinking of the “Estonia” in 1994. Maritime stakeholders in Estonia recommended adopting similar requirements as in other Nordic countries that are based on risk analysis.

44 In this context, entry costs are high and there is only a small second hand market for ferry vessels.

45 See https://www.portoftallinn.com/news?art=1131.

46 See https://www.portoftallinn.com/news?art=1133.

47 The scheme is put in place by the port. The state does not regulate charges imposed by ports as it currently sees no need for intervention. Managing port-based incentive schemes are not particularly burdensome in terms of efforts and human resources, as a survey of ports carried out for the European Commission showed (COGEA, 2017). The vast majority of environmental port schemes in Europe are based on compliance

with environmental indexes or certifications (e.g. Environmental Ship Index, ESI). This limits implementation, monitoring and managing workload for the ports.

48 See https://www.environmentalshipindex.org/Public/Home. Some caveats are attached to using the Environmental Ship Index, including possible irregularities on the self-reporting of ship-owners. For a larger discussion, see ITF (2018).

49 See https://www.ts.ee/wp-content/uploads/2019/12/Tasud_puhas_010120_eng.pdf.

50 Currently, it is possible to use direct connections from wind parks to power electric ferries only on the mainland. It appears unlikely that the wind park would provide 100% service reliability, e.g. when wind is low. This requires a connection to the larger grid and the possibility to use diesel fuel on a hybrid ferry. The first pilot hybrid ferry was launched on 17 March 2020. The government estimates that the electrification of main ferry lines (to connect mainland-Saaremaa and mainland-Hiiumaa) would cost around EUR 27 million, out of which EUR 4 million would go to the necessary infrastructure (cables, charging infrastructure including improved cabling for connecting the ports with the main grid on the islands). Around 80% of the total investments into electrification of domestic maritime transport will be supported by the State. Current obstacles to integrate wind power to the national grid concern interferences between defence capabilities (Estonian Defence Forces radars) and the locations of wind parks. This information was provided to the ITF by the Estonian Ministry of Economic Affairs and Communications.

51 See https://www.trafa.se/sjofart/sjofartsstodets-effekter-2018-8987/.

52 Currently, a resident is a person whose principal residency is registered on a qualifying Estonian island as of 1 January. Instead of a specific date, residency should be made conditional on a minimum period of residency (e.g. at least eight months per year).

53 In ACI Europe's connectivity rankings, Tallinn Airport is compared against other European airports that serve fewer than five million passengers per year. The full methodology behind the connectivity indices is detailed in the report (ACI Europe, 2019).

54 ACI's Airport Service Quality (ASQ) provided survey data to Tallinn Airport upon request.

55 https://www.ecaa.ee/en.

56 https://www.aci-europe.org/policy/connectivity.html.

57 https://www.riigikogu.ee/en/foresight/work-foresight-centre/ and https://www.riigikantselei.ee/en/research-and-development-council.

58 Responsibility for facilitating the everyday work of the permanent committees lies with the policy advisers of the respective ministries. Ad-hoc committees can be established to complete specific tasks.

59 https://eldis.org/organisation/A5678. The 2001 study of Estonian innovation policy completed for the European Union is found here: https://ec.europa.eu/docsroom/documents/2986/attachments/1/translations/en/renditions/native.

60 Indeed, this lack of co-ordination was even said to arise, on occasion, within the same Ministry.

61 A contextual factor that may help to explain this significant gap is the conflict between the desire to deliver a future transport system that reflects the national-level vision of Estonia as digital innovation leader and the need to address legacy issues of important gaps in transport infrastructure provision and maintenance.

62 https://ec.europa.eu/digital-single-market/en/pre-commercial-procurement.

63 https://news.err.ee/1086432/amendments-to-traffic-act-favor-electric-scooters-rather-than-restrict-use.

64 In addition, the municipal governments of Tallinn and Tartu are members of ITS Estonia. https://its-estonia.com/en/its-estonia-en/.

65 https://ec.europa.eu/info/research-and-innovation/research-area/transport/stria_en.

66 https://www.infrastructure.gov.au/transport/land-transport-technology/office-of-future-transport-technology.aspx.

67 For more information on this programme, see: https://www.transport.govt.nz/multi-modal/keystrategiesandplans/strategic-policy-programme/regulation-2025/.

68 For key resources on this issue see: https://climate-adapt.eea.europa.eu/eu-adaptation-policy/sector-policies/transport.

69 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0215.

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Chapter 3. Transport policy objectives and measuring progress

Inclusive and resilient transport policy requires setting legitimate policy objectives, measuring them accurately and reporting on them regularly. The systematic manner in which objectives can be measured and then used to clearly report on the improvements or setbacks being made to people's lives in a relatable manner is a substantial step toward building trust and accountability between government and citizens.

3.1. Defining transport policy objectives

A more established method of assessing transport policy and monitoring its progress would be helpful for Estonia. The approach taken in the last Estonian transport policy document was the result of ad-hoc internal consultations. No reporting procedures were included. There is a wealth of international research and experience, where indicators have been developed to aid analysis or to enable the communication of policy progress to the public. Different options exist for developing indicators that can serve both purposes.

This is true both for international comparisons (e.g. the TERM framework[70], the SUSTrans Index[71], COST 356[72], ITF Transport Benchmarking Indicators, OECD Indicators for the Integration of Environmental Concerns into Transport Policies[73]) and national policy documents (e.g. the UK National Infrastructure Assessment, the Departmental Plan developed by Transport Canada, the German 2030 Federal Transport Infrastructure Plan, etc.). The first step is to identify the relevant transport policy objectives that the indicators ought to reflect.

Policy objectives relate to more than one initiative and often involve international agreements as well as national decision-making. The United Nation's 2030 Agenda for Sustainable Development is one such initiative. Agreed in 2015, it defines the Sustainable Development Goals (SDGs), which incorporate several targets directly or indirectly linked to transport. A key objective is that of providing "access to safe, affordable, accessible and sustainable transport systems.

The European Commission outlined its European-wide transport policy objectives in 2011. There are ten objectives included in the White Paper "Roadmap to a single European transport area" (EC, 2011), focusing on the EU transport system as a whole. The objectives provide a framework for assessing member states' transport systems. The White Paper includes a mix of specific, quantitative targets (e.g. to make greenhouse-gas emissions 60% lower than 1990 levels by 2050 and 50% reduction in the share of conventionally-fuelled cars in urban transport by 2030) and more qualitative objectives (e.g. "A fully functional and EU wide multimodal TEN-T "core network" by 2030".

There is no uniform approach to transport policy objectives at the national level. Some countries set cross-modal objectives (e.g. in Norway transport policy objectives are defined for the transport sector as a whole[74]). In others, the strategic guidance is developed separately for different sectors or layers. For example, in the United Kingdom, there is a National Infrastructure Assessment for all sectors, including transport, and then there are separate "execution" strategies for individual parts of the transport sector.[75] Sub-sector strategies exist in Spain and France, including separate logistics strategies. From an institutional point of view, not all countries define their transport strategies on a national or federal level. In Belgium, for instance, there is a consultation committee of mobility Ministers from the three main regions (Flanders,

Wallonia and Brussels), who do not refer to the central state. Similarly, in Australia and Canada, provinces and states have a high degree of autonomy in defining transport policies.

There is also substantial diversity in the objectives that countries pursue. For example, French transport policy priorities are the transition from fuel use to renewable energy, adopting new mobility options made available by advancing technologies, the rehabilitation of the infrastructure network, and a focus on users and transport "for everyday life" (Ministère de la Transition écologique et solidaire, 2018). In 2016, the Spanish government presented a Roadmap for transport policy for the next four years. It identifies fundamental objectives as the restructuring of the territory, social cohesion and equal opportunities (Ministero de Fomento, 2018). Following those objectives, the Spanish Ministry for Public Works defined a new Innovation Plan for Transport and Infrastructure, which includes four pillars:

- user experience (including mobility-as-a-service)
- smart platforms (including freight and logistics platforms)
- smart routes (including road and railway digitalisation)
- energy efficiency and sustainability.

3.2. Defining indicator frameworks

A variety of rationales are adopted in developing transport indicator frameworks. There is no single standard, either in the expert literature or in national policy documents. Policy documents tend to group indicators according to high-level objectives, which represent broad dimensions of transport policy. For example, the Departmental Plan 2018-19 of Transport Canada (Garneau, 2018) contains three dimensions, and corresponding annual indicators and targets:

- a safe and secure transportation system
- a green and innovative transportation system
- an efficient transportation system.

The US Department of Transportation releases Annual Performance Plans that include performance indicators grouped under the four strategic goals of safety, infrastructure, innovation and accountability. Each of the strategic goals contains specific objectives under which indicators are grouped and presented for each mode separately, including a baseline and target values for the two following years (U.S. Department of Transportation, 2018).

Academic literature often cites the allocation of indicators to the three pillars of sustainable development – economic, environmental and social (e.g. Dobranskyte-Niskota et al., 2009; Joumard and Gudmundsson, 2010; Litman, 2019). In 2015, the Technical University of Dresden developed a useful set of indicators for sustainable mobility for the German Environmental Agency. First, they identified the most important action points to achieve sustainable mobility development. Second, the researchers identified indicators according to the selected fields of action. This was followed by an evaluation of the identified indicators (Umweltbundesamt, 2015).

The three pillars of sustainable development are an appropriate starting point for Estonia to generate indicators, given that sustainable mobility is important to both Estonian and EU transport policy. Adding to this, the European Conference of Ministers of Transport (2004) defines a sustainable transport system as one that is accessible, safe, environmentally friendly, and affordable. To assist Estonia in the definition

of a transport indicator framework, the ITF defined objectives that correspond to this definition, but added an economic dimension and excluded safety. Whilst safety is a commonly used transport policy objective among ITF countries, it was excluded from the scope of this exercise, as agreed with the Estonian authorities. Based on a review of the options and consultation with the Estonian authorities, the following objectives were selected to help track the performance of the transport system:

1. An environmentally sustainable transport system [ENVIRONMENT]

Transport produces a range of environmental effects, including air and noise pollution, contributing to climate change and impacts on eco-systems due to construction (habitat fragmentation or destruction) or spills and accidents. The extent of the environmental impact depends on transport modes, types of fuels, energy efficiency, and the rate of growth of transport demand. Transport policies and the associated incentive regulations have a strong influence on the environmental impact of transport.

2. An inclusive transport system [SOCIAL]

Social factors can drive transport-demand patterns, for example, household consumption, time spent on leisure activities, urban sprawl and density patterns, socio-economic and socio-demographic changes, etc.. On the other hand, transport facilitates access to goods, jobs, social activities, education, and health services. In addition, transport can generate social costs (accidents, pollution and congestion) and transport policies (e.g. taxes, subsidies, prices) can have important social equity effects, with impacts spread unevenly among population and income groups.

3. A high quality, reliable and efficient transport system [ECONOMIC]

The quality, reliability and efficiency of the transport system can have large impacts on the competitiveness of an economy. Different economic forces shape transport patterns. These include the type and extent of economic activity and related production patterns, land-use patterns, infrastructure, trade flows, and technological change. For example, freight transport is closely linked to production patterns and is influenced by developments in international trade, consumer demand and the use of technologies. Institutions can affect private sector competitiveness through their transport policies.

These objectives are deliberately kept abstract. The intention is to provide a conceptual basis only that focuses on a specific area of attention that informs the choice of indicators. The policy analysis of Estonia's transport sector provides recommendations regarding more specific objectives that should be adopted pursuant to an appropriate political and consultation process. These should be complemented by the EU objectives to form the future transport policy in Estonia.

Combined, these economic, social, environmental feed into an overall objective of sustainable development. The objectives are straightforward and relatively easy to communicate. To give a tangible sense of progress and improvement, the next step consists in attaching suitable indicators to these objectives.

3.3. Developing a transport policy indicator framework for Estonia

The ITF developed a transport policy indicator framework for Estonia. Over 200 possible indicators were collected and a literature review conducted that questioned how the transport system, policy status or progress could be best measured and communicated took place to make this possible. The criteria that applied to the selection of indicators is in the supporting analysis (see Annex 1). The selected indicators were identified using the three objectives numbered above.

Defining a transport policy indicator framework requires a balance in terms of measures that are practical to evaluate, tangible to the broader public, and at the same time still as representative of the performance of the transport sector as possible.

The main audiences for the broad transport indicators will be the public and high-level decision-makers. In order to be relevant and meaningful to them, the size of the indicator set and the level of detail it contains should be limited (OECD, 1999). If accessible communication is the focus, then brevity and clarity must take priority over comprehensiveness. Long lists of indicators are likely to confuse the reader and reduce engagement. A drawback of a short set of indicators, however, is that due to its simplification and adaptation to user needs, the indicators may not meet strict scientific standards and may not necessarily fit within a direct causal chain with the objective that is associated with it.

The number and suitability of indicators are limited to the availability of good quality and comparable data. In the case of Estonia, a pragmatic approach was adopted, seeking to identify the best readily available data that is also relatively easy to understand and interpret. This led to the proposal of the following key characteristics for successful transport indicators. They should be:

1. expressed in terms of outcomes, to which users can directly relate
2. straightforward and readily communicated, avoid composite measures and be easy to imagine and interpret
3. easy to remember, Millers Law (Miller, 1956) states that no more than 7 (+/-2) indicators or concepts should be used per sub-category or in aggregate.

After these conditions have been satisfied, additional constraints on the characteristics of (transport) indicators should be imposed, which are drawn from a review of indicator criteria:

4. data to populate the indicators is easy and cost-efficient to collect, ideally readily available
5. Indicators should allow comparisons. Data collected should be clearly defined and standardised to facilitate comparisons between various jurisdictions, times and groups. For example, an indicator of the "Number of people with good access to food shopping" should define the key terms "good access" and "food shopping".
6. Indicators should not be overly rigid. In other words, they should contain values that *do* change (e.g. number of international agreements, number of airports). Five years was chosen as the threshold for this purpose in the case for Estonia.

With regard to the first three criteria, it is possible that in one case the user will be the passenger and in another, the user will be a firm. Priorities in these two cases will differ, hence these groups are differentiated in the framework. Speed and price are priorities for passengers. For goods (firms) lower travel time variability – or reliability – is more important than speed.

Some indicators only affect user experience indirectly. For this reason, supporting functions like network state of repair, institutional setup, or operational efficiency of infrastructure managers are not represented in the indicators. The ministry and relevant authorities nonetheless need to track these measures, as they are important to monitor the performance of the transport system.

The ITF has identified over 220 indicators[76] that relate to the objectives initially outlined. These indicators contain diverse levels of analysis, from trends and changes in response to a policy to economic impacts and performance evaluations. Some measure inputs (e.g. annual investments in infrastructure) and others measure outputs and final outcomes (e.g. congestion levels, emissions, user satisfaction). Among these, some are quantitative and others more qualitative, requiring a diversity of measuring techniques.

Following the initially outlined criteria, the ITF selected a sample set of indicators, taking theoretical and empirical links between transport and economic development into account, and prioritised those indicators for which these links are strongest (notably accessibility and connectivity).

The ITF consulted with the Estonian authorities and European Commission counterparts as there were a range of possible solutions and a considerable stock of indicators available. The sample set of indicators was then adapted to suit Estonia's circumstances.

Two strata of indicators were defined as a result: cross-modal indicators and mode-specific performance measures. The goal per stratum is to ensure that each of the three transport policy objectives is represented by at least one indicator. It is assumed that any single group of users will be primarily interested in their preferred mode and its performance. For each user group there should also be at least one indicator representing each of the following dimensions:

- accessibility/connectivity
- affordability
- emissions
- efficiency
- safety.[77]

Following the process above, the ITF elaborated the selected indicators in two tables below. The first (Table 4) represents the most abstract level and includes aggregate indicators for passengers and freight. The second (Table 4), reports indicators particular to individual user groups. The indicator categories in the third column reflect the performance dimension to which they relate. The indicators selected that appear there differ across the different user groups. This is the result of multiple factors. For example, the same type of indicator is not equally relevant across all user groups, data may not be available for all user groups or Estonian authorities may have deemed a different indicator better represented as a specific dimension. The greyed out indicator content in the Description column denotes ITF's preferred choice, which in the case of Estonia currently is not possible due to lack of data.

The selection of these indicators is not free from trade-offs. Several indicators can represent more than one dimension within the same framework and multiple causal chains can interact and interconnect. For example, a competitive transport system is often associated with activity growth, which may work against existing sustainability goals. Likewise, cost-effective operations may not always be the "greenest". Green transport may not correspond to the most affordable transport.

Often, sustainability in transport tends to embrace the efficiency concept: energy efficiency, land efficiency (e.g. smart growth), resource efficiency, operational efficiency, efficiency in inter-modality, etc. In contexts of increasing transport demand however, countries will need to rethink their strategies to limit adverse effects on the environment. A key measure of how well the Estonian transport system fares will be its ability to deal with these trade-offs and find solutions that address both growing transport demand and the need to protect the environment and climate.

A critical caveat to the indicators below is that improvements in their values can only be maintained if the service producers (infrastructure managers and service operators) remain economically viable. Improvements in the indicators should not be sought at the expense of reduced cost recovery[78] by (and hence viability of) the service producers.

The mode-specific indicators serve to report the relative performance of each mode separately. They cannot be used to suggest that more investment should go to one mode rather than another. These

decisions require detailed appraisals of alternatives that cannot be satisfied by observing a limited set of high-level indicators.

The indicator tables below should satisfy the need to communicate transport policy progress to the public. The Estonian authorities need to choose how to operationalise this tool. For example, will this be in an annual progress report or will there be homepages for the indicators of individual user groups providing additional context to the readers?

Because of their user/communication orientation, the selected indicators do not provide the detail public servants within the Ministry of Economic Affaris and Communication (MEAC) need to monitor and understand the performance of the executive bodies (i.e. infrastructure companies and/or service operators). A longer, more detailed list of more specific indicators is necessary to monitor performance across individual sectors, geographic units, or income groups. These will depend on more specific objectives and go beyond the scope of task for the ITF. However, the literature and indicator frameworks reviewed for this report will be a useful starting point for the Estonian authorities.

Estonian authorities will need to consider questions concerning the development of indicators such as:

- Will the development of indicators be linked to a public consultation process?
- Will the indicators be embedded within a broader analysis of key drivers for change or a causality chain?
- Who will be the actors responsible for the final selection and publication of the indicators?
- Will the indicators be based on primary data collection or existing data collections?
- How will the indicators be sustained and funded over time?

Estonia also needs to engage itself with EU-wide transport objectives. Progress towards these can be reflected in the indicators below, as well. Table 5 in Annex 3.1. maps which indicator addresses which EU objective.

Table 3. Selected indicators used to measure and report progress made on Estonian transport policy

	Indicator	Description	Indicator category	Transport policy objective
	General Transport Policy			
1.	**CO_2 Emissions***	Overall CO_2 emissions passenger and freight transport	**Emissions**	1
2.	**Transport related injuries**	Injuries and deaths per *1000 inhabitants (Walking/Cycling, Road, Rail, Air, Sea)*	**Safety**	2,3
a.	**Passenger transport (all modes)**			
1.	Time to main markets**	Average time to reach the international market by fastest transport option	**Accessibility**	3
2.	Urban accessibility	Number of jobs accessible by car and by public transport in 30 minutes in all functional urban areas*** Average travel time of urban trips	**Accessibility**	2,3
3.	Inter-urban and rural accessibility	Number of jobs accessible by car and public transport within 60 minutes in rural areas Average travel time of inter-urban trips	**Accessibility**	2,3
4.	Urban passenger mode share	Passenger kilometre (pkm) by transport mode (walking, cycling, bus, rail, car)	**General**	1,2,3

5.	Inter-urban passenger modal share	Pkm by mode (car, coach, rail, air, sea)	General	1,2,3
6.	Fuel efficiency / CO_2 emissions	Energy consumption in kWh per pkm *(global average)* CO_2 emissions per pkm	Efficiency	1,3
7.	Affordability for users	% of total income spent on travel for all modes for the bottom quartile income group******** Average cost of a trip	Affordability	2,3
b.	**Freight (all modes)**			
1.	Time to main markets	Average time to reach the international market by fastest transport option	Accessibility	3
2.	Modal shares of freight transport	% of tonne-kilometre (tkm) by mode	General	1
3.	Logistics reliability	% of on-time arrivals/time variability *(to the borders; to the sea port)*	Reliability	3
4.	Fuel efficiency / CO_2 emissions	Energy consumption per tkm *(global average and by mode)* CO_2 emission per tkm	Efficiency	1,3
5.	Affordability	EUR/tkm *(global average and by mode)*	Affordability	3

* See endnote 1 on why we do not use CO_2 equivalents and chose a simpler approach.

** Time to main markets indicators represent average time to reach the closest concentrations of GDP (i.e. countries with a large economy). It solves the problems of distance and geographic positioning of countries at the same time thus allowing benchmarking between different countries, regardless of whether they are situated close to large economies or further away. Annex 3 provides more detail.

*** Since there is no existing database on the job localisation, the accessibility indicator can be replaced by the average travel time of trips. This also allows to estimate travel time savings of specific policies, that can be also used in cost-benefit analysis.

**** In the framework of this project, the indicator that was estimated from the model is the average cost of a trip. The % of income spent on travel is following the same relative change.

Note: The numbers in the Transport policy objective column correspond to: 1. An environmentally sustainable transport system (environment); 2. An inclusive transport system (social); 3. A quality, reliable and efficient transport system (economic).

Table 4. Mode-specific selected indicators used to measure and report progress made on Estonian transport policy

	Indicator	Description	Indicator category	Transport policy objective
a.	**Road private passenger (car and taxi)**			
1.	Time to border by road	Average time to reach the international market by car (including depart border procedure)	**Accessibility**	3
2.	Urban accessibility	Jobs reachable within 30 minutes by car in cities Average travel time of road urban trips.	**Accessibility**	2
3.	Inter-urban and rural accessibility	Jobs reachable within 60 minutes by car in rural areas Average travel time of road inter-urban trips.	**Accessibility**	2
4.	Congestion	Ratio of average speed/free flow speed[1]	**Reliability**	3
5.	Fuel efficiency	Energy consumption (in kWh per tkm)	**Efficiency**	3
6.	CO_2 emissions	CO_2 emissions per vkm	**Emissions**	1
7.	Average fleet age	Average age of registered vehicles	**Emissions**	1
8.	Affordability of private vehicles	Expenditure on private vehicles, % of household income for bottom quartile of the population Average travel cost of car trips.	**Affordability**	2
b.	**Walking/Cycling (Non-motorised modes)**			
1.	Accessibility on foot	Number of amenities accessible within 15 minute walk	**Accessibility**	1,2,3
2.	Bike and foot	Mode share of active trips in the city	**General**	1,2,3
3.	Availability of bike lanes	Total length of bike network (km) separated from road traffic in large cities.	**Quality**	1,2,3
4.	Availability of bike parking	The number of bike parking places	**Quality**	1,2,3
c.	**Public Transport (Bus, Tram, Rail)**			
1.	Time to border by public transport	Average time to reach the border by PT/fastest mode (including depart border procedure) through land borders	**Accessibility**	3
2.	Urban accessibility	Jobs reachable within 30 minute by public transport Average travel time of public transport trips.	**Accessibility**	2,3
3.	Public transport coverage	Share of population that has public transport stops within 400m radius (with more than six services per hour)	**Accessibility**	2,3
4.	Rural accessibility	Jobs reachable within 60 minutes by public transport	**Accessibility**	2,3

[1] Congestion is not a very present issue in Estonia compared to other European countries. The models developed for this project does not take it into account.

	Indicator	Description	Indicator category	Transport policy objective
		Average travel time of public transport trips		
5.	Affordability	Expenditure on public transport, % of household income for lowest quartile income group Average travel cost of public transport trips.	Affordability	2,3
6.	Fuel efficiency	Energy consumption (in kWh per pkm)	Efficiency	3
7.	CO_2 emissions	Emissions per vkm	Emissions	1
8.	Average delay	On-time performance by mode: % of buses/tram/trolleybuses/rail arriving with a five-minute delay or less	Quality Reliability	2,3 3
9.	Public transport priority in traffic	Length and share of dedicated transport lanes	Accessibility	3
d.	**Road-based freight**			
1.	Time to border by road	Average time to reach the international market through land borders	Accessibility	3
2.	Load factors of trucks	Ratio of the average load to total vehicle freight capacity[2]	Efficiency	1,3
3.	Average delay	Average vehicle speedfree flow speed	Reliability	3
4.	Average fleet age	Average age of registered vehicles	Emissions	1
5.	Fuel efficiency	Energy consumption (in kWh per tkm)	Efficiency	3
6.	CO_2 emissions	CO_2 emissions per tkm	Emissions	1
7.	Affordability	Cost to the shipper in EUR per tkm	Affordability	3
8.	Border crossing efficiency	Time required to cross international border (border procedures)	Efficiency	3
e.	***Rail-based freight***			
1.	Time to border by rail	Average time to reach the international market through land borders (excluding depart border procedure)	Accessibility	3
2.	Rail speed	Average rail freight operation speed Average time per tkm	Accessibility, Efficiency	3
3.	Delays in delivery/On-time performance	% of trains running on time/ % of cancelled trains	Reliability	3
4.	Fuel efficiency	Energy consumption (in kWh per tkm)	Efficiency	3
5.	CO_2 emissions	Emissions per tkm Note: taking into account empty trains	Emissions	1
6.	Average load of trains	Average load of trains in tonnes per normalised train	Efficiency	3
7.	Affordability	Cost to the shipper expressed as rail revenues per tkm	Affordability	3
8.	Border crossing efficiency (Inter-operability)	Time required to cross international border (border procedures)	Efficiency	3

[2] This indicator can be difficult to measure and estimate.

	Indicator	Description	Indicator category	Transport policy objective
f.	**Airplane (passenger and freight)**			
1.	Airport accessibility	Catchment area (number of people who live within one, two and three hours away from Tallinn Airport – by public transport and car)	**Accessibility**	3
3.	Airport or airspace congestion	Number of days per year on which non-weather related disruptions occur at Tallinn Airport	**Reliability**	3
4.	CO_2 emissions	CO_2 emissions from domestic flights per passenger	**Emissions**	3
g.	**Sea/river general**			
1.	CO_2 emissions	CO_2 emissions per tkm or vkm and total	**Emissions**	1
2.	Local air pollution in port cities	Emissions per tkm or vkm and total	**Emissions**	1
3.	Fuel efficiency	Energy consumption (in kWh per tkm or vkm)	**Efficiency**	3
h.	**Sea/river *Passenger***			
1.	Port connectivity	Number of direct connections to other ports	**Connectivity**	2,3
2.	Port Accessibility	Average time to reach port(s) (including depart border procedure), by public transport; by car	**Accessibility**	3
3.	Port capacity utilisation	Actual vs. estimated potential	**Efficiency**	3
4.	Island remoteness	Average headway + travel time to get to the mainland	**Accessibility**	2
5.	Affordability	Expenditure on public transport, % of household income for bottom income quartile	**Affordability**	2,3
6.	Delays on domestic ferry routes	Average delays for ferries	**Reliability**	3
i.	**Sea/river Freight**			
1.	Port accessibility for freight	Average time to reach the sea port by road or rail (excluding departure procedure)	**Accessibility**	3
2.	Transport availability	Percent of time a certain seaway or river is ice free	**Accessibility**	3
3.	Port connectivity (I)	Number of direct connections to other ports	**Connectivity**	3
4.	Port connectivity (II)	Service frequencies at ports	**Connectivity**	3
5.	Port capacity utilisation	Actual vs. estimated potential	**Efficiency**	3
6.	Ship turnaround times	Average time of vessels spent in port	**Efficiency**	3
7.	Train turnaround times	Average time of trains spent in port	**Efficiency**	3
8.	Border crossing efficiency	Time required to cross international border (border procedures)	**Efficiency**	3

* Congestion is not a very present issue in Estonia compared to other European countries. The models developed for this project does not take it into account.
** This indicator can be difficult to measure and estimate.
Note: The numbers in the Transport policy objective column correspond to: 1. an environmentally sustainable transport system (environment); 2. an inclusive transport system (social); 3. a quality, reliable and efficient transport system (economic).

Notes

70 The European Commission, with the support of the European Environment Agency (EEA), has initiated in 1998 the development of an indicator-based transport and environment reporting mechanism (TERM). It aimed at monitoring and assessing the effectiveness of integration measures at EU level and at supporting the development of a sustainable transport system. Indicators are structured according to the following issues: environmental consequences of transport; land use and access; transport demand and intensity; transport supply; price signals; and transport efficiency.

71 The SusTrans Index is a five-dimensional index of sustainable transport, including an environmental dimension, economy, a social dimension, technology and institutions. The index contains 55 indicators of which only 32 were measured due to data availability issues. It is computed following a distribution of weights using the EWA (equal weight distribution) approach. Each sustainability dimension is represented by the corresponding aggregated index (e.g. economic transport sustainability index, social transport sustainability index, etc.), which is composed of another 3-5 equally weighted sub-dimensions, each containing a number of specific indicators.

72 COST 356 (2010), "Towards A Measurable Environmentally Sustainable Transport" (http://cost356.inrets.fr) developed indicators for environmentally sustainable transport. Final report: http://cost356.inrets.fr/pub/reference/reports/Indicators_EST_May_2010.pdf.

73 Along other OECD sets of sectoral indicators, the OECD (1999) has developed a set of transport-environment indicators, see http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?doclanguage=en&cote=ENV/EPOC/SE(98)1/FINAL.

74 See https://www.regjeringen.no/contentassets/7c52fd2938ca42209e4286fe86bb28bd/engb/pdfs/stm201620170033000e-ngpdfs.pdf.

75 For sector specific strategies see for example the UK Road Investment Strategy: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/752066/draft-road-investment-strategy-2-governments-objectives.pdf.

76 Additional time devoted to reviewing the literature and other sources would undoubtedly yield an even greater number of indicators. Experience however, suggests that the most important and suitable indicators were accounted for.

77 Although safety is not included in this scope of work - which consists of policy analysis and modelling/scenario building - it is included here as an important category that has to be taken into account in any transport policy indicator framework.

78 The revenues are sufficient to cover all of the producer's cost and a small (normal) profit. This will allow it to pay the workers and maintain and replace its assets, when their lifetime expires. This is not to be taken for granted in the public sector. For example, states can "borrow" temporarily from the infrastructure, by deferring maintenance or renewal. That money can then be reallocated to improve another service. However, the debt is then transferred to the future years.

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Annex 3.1. Interaction of the indicator framework with the EU-wide transport objectives

Table 5. Interaction of the indicator framework with the EU-wide transport objectives

EU Overall objective	Key EU transport related objectives	In which Indicator will improvements show
EU climate policy 2050	By 2050, greenhouse gas emissions from transport will need to be at least 60% lower than in 1990 and be firmly on the path towards zero.	Fuel efficiency, reduction of fleet age, improved modal share for rail, public transport, and non-motorised modes, CO_2 equivalent emissions per vkm for pax, tkm for freight
EU energy policy	The share of advanced biofuels and biogas must be at least 1% in 2025 and at least 3.5% in 2030.	CO_2 equivalent emissions per vkm for pax, tkm for freight, CO_2 equivalent emissions per vkm for pax, tkm for freight, global and across user groups/modes
EU Transport policy white paper (2011)	Developing and deploying new and sustainable fuels and propulsion systems	
	Halve the use of "conventionally-fuelled" cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO_2-free city logistics in major urban centres by 2030.	Urban passenger mode share, CO_2 equivalent emissions per vkm for pax, Fuel efficiency for road-based passenger and freight transport
	Low-carbon sustainable fuels in aviation to reach 40% by 2050; also by 2050 reduce EU CO_2 emissions from maritime bunker fuels by 40% (if feasible 50%).	N/A for aviation (international aviation is outside of the remit of the Estonian transport policy); CO_2 equivalent emissions per tkm, fuel efficiency for maritime
EU Transport policy white paper (2011)	Optimising the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes	
	30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed.	Improvement of rail/sea mode share in mode shares of freight transport indicator, CO_2 equivalent emissions and fuel efficiency indicators per tkm, global and by mode.
	By 2050, complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all member states. By 2050 the majority of medium-distance passenger transport should go by rail.	Inter-urban passenger modal share
	A fully functional and EU-wide multimodal TEN-T "core network" by 2030, with a high quality and capacity network by 2050 and a corresponding set of information services.	Time to main markets (fastest mode), average time to border for road pax and freight transport, time to border for rail pax and freight transport; time to border by public transport, airport and seaport accessibility

	By 2050, connect all core network airports to the rail network, preferably high-speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system.	Airport and seaport accessibility
EU Transport policy white paper (2011)	Increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives	
	Deployment of the modernised air traffic management infrastructure (SESAR) in Europe by 2020 and completion of the European Common Aviation Area. Deployment of equivalent land and waterborne transport management systems (ERTMS, ITS, SSN and LRIT, RIS)*. Deployment of the European Global Navigation Satellite System (Galileo).	These measures increase the capacity/potential throughput of individual modes (e.g. in rail reduced safety distance between trains potentially allows higher frequency of trains or longer trains in the absence of infrastructure constraints). Potential impacts therefore range from fuel efficiency/lower emissions (e.g. longer trains), reduced cost/improved affordability to reduction in cross-border procedures and others.
	By 2020, establish the framework for a European multimodal transport information, management and payment system.	Such systems allow users to optimise their choice of transport mode depending on users' priorities (e.g. speed, cost etc.). In practice, the result would be reduced cost for the users, minimised emissions impact and others. The ITF model already assumes optimal assignment so progress towards this objective would not be reflected.
	By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.	Transport related injuries and deaths per 1 000 inhabitants.
	Move towards full application of "user pays" and "polluter pays" principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues and ensure financing for future transport investments.	The application of these two principles would lead to modal shifts and by implication reduction in affordability, reducing transport flows and emissions. This would be reflected in the respective indicators.

* European Rail Traffic Management System (ERTMS), Intelligent Transport Systems (ITS), SafeSeaNet (SSN), Long-Range Identification and Tracking (LRIT) and River Information Systems (RIS).

Chapter 4. Reforms and transport policy scenarios: How progressive does Estonia want to be?

The following chapter realises the third element of the Future of Passenger Mobility and Goods Transport in Estonia: Input study for the National Transport and Mobility Master Plan – the modelling of policy scenarios using bespoke tools developed for Estonia.

Analysis must precede decision-making when introducing policy reforms or infrastructure plans. Chapter 2, Section 2.2. Infrastructure planning and project selection details the recommended types of modelling and appraisal that constitute this process. Transport models provide essential insights to existing transport systems, supporting infrastructure design and operational planning. They are an essential tool for strategic planning and decision-making because their outputs can identify impacts from proposed projects or policies. Today, Estonia does not have comprehensive strategic transport models and a crucial part of this project was to develop a basis for such models for the country.

This chapter analyses the impacts of alternative policy scenarios for Estonia using the strategic modelling tools developed specifically for this case study. Essential indicators that track transport policy progress, such as mode share, CO_2 emissions, accessibility, and affordability of transport were used to evaluate the scenario results.

Three scenarios are analysed over a 30-year period from 2020 to 2050:

- business as usual (BAU)
- high ambition (HA)
- low ambition (LA).

HA and LA scenarios are potential combinations of policies based on the key reforms suggested by the ten policy area reviews in Chapter 2 and feedback from Estonian stakeholders. They provide a concise way of analysing and presenting impacts rather than reporting on each measure individually. Individual tests of measures are possible with the modelling tools. However, only select individual impacts are presented in the report in the interest of brevity. The aim of the scenarios is to shed light on possible pathways (or "what if" scenarios) and their impacts rather than to define the right path for policy makers to choose as a strategy. The scenario results, alongside all the policy recommendations, should be considered as a starting point when developing Estonia's national transport strategy.

It is important to note that these scenarios do not include all reforms or recommendations. Strategic scenario models, such as the ones developed for Estonia, model aggregate reforms while a more detailed analysis would require data or more specific models that are not yet available. There are also several recommendations, such as institutional reforms and qualitative impacts like comfort and health that cannot be meaningfully estimated using strategic transport models. The tools developed for Estonia's strategic modelling suite simulate real-life travel behaviour in a simplified manner. They can help generate indicators and compare the aggregate impacts of several options, helping narrow the most compelling policy options. Final decisions will require further modelling, consideration of wider regional goals, accounting for political constraints, and a thorough investment appraisal.

The quantitative tools and analysis from this policy review can be used as a starting point for more detailed work. They were built using the data available to The International Transport Forum (ITF) at the time of

this study, and can be improved to better represent the travel behaviour and freight patterns in Estonia as data collection and survey efforts expand.

The modelling tools developed are flexible to allow for customisation of future policy measures that Estonia may wish to test. Annex 4.1 provides a brief summary of the methodology and additional details can be found in the accompanying model methodology report.

4.1. Policy scenarios to assess the impact of reforms

The business as usual (BAU) scenario assumes there is no change to current transport policies. It accounts only for changes in population and GDP, and corresponding changes in trip volumes (rail freight volume is assumed to be constant in the BAU scenario). The high ambition (HA) and low ambition (LA) scenarios account for recommended policy measures but differ in the extent to which they are implemented and the timeline over which they are put in place.

The HA scenario represents what could be feasible with strong political alignment, and prioritisation of the transport reforms with a focus on sustainable growth. The LA scenario represents the impact of measures if they are not implemented to their full potential, or if there is delayed implementation. These scenario definitions are based on the February 2020 workshops during which ITF received feedback from relevant Estonian stakeholders regarding the feasibility of some of the suggested policy measures.

It is important to note that the scenarios are not target-based to fully meet Estonia's economic, social or environmental targets. Sometimes adding a new measure may be more efficient than increasing the level of implementation of the modelled measures unrealistically to meet a target. The models and analysis of this study focus on realistic measures and policy scenarios as discussed with the stakeholders. High level, aggregated-transport models cannot model all possible policy measures that could contribute to these targets.

Policy measures from each scenario are modelled using the applicable sector-specific model. The HA or LA results are always compared with the BAU results *in the same year* to ensure an accurate baseline. Further rationale for the proposed measures and examples can be found in Chapter 2. The next sections describe how the measures are modelled in each of the following transport sectors:

- urban passenger travel (includes Harju County and a portion of Rapla)
- national passenger travel
- international passenger travel
- national and international freight transport

Modelling urban passenger transport policy measures

Table 6 describes measures related to urban passenger transport that are included in the scenarios, and the travel characteristics they manipulate within the model. These measures represent the *result* of policy reforms taken by Estonia in a way that best suits their context, rather than being prescriptive action items on how to institute the reform. For example, reallocation of road space to prioritise active travel can incorporate many changes, including but not limited to the expansion of cycling and walking infrastructure, closure of certain streets to through car traffic, and traffic calming measures. Regardless of how road space is reallocated, these actions would contribute to the travel time impacts described in the table (first column). These time changes are modelled to simulate shift in travel behaviour and mode choice.

Rationale for the policy measures can be found in Chapter 2, Section 2.5. Steering user behaviour and public transport policy.

Table 6. Modelling urban passenger measures in high and low ambition scenarios

Measure description *(How the measure is modelled within the model)*	High ambition (year implemented)	Low ambition (year implemented)
Measures that target behaviour change		
User charging – Congestion charge for Tallinn *An average EUR 1.80 charge is applied to private car trips starting or ending in Tallinn.* The charge represents the average charge for a trip that includes a portion within Tallinn (i.e. EUR 3.60 applied to half of the car trips). The charge amount reflects other European cities that have instated similar regimes, adjusted for incomes in Estonia and incorporates feedback from Estonian authorities received during the 22 April 2020 webinar.	2030	NA
User charging – Tolling *A toll of EUR 0.09 per km is added to the cost of all private car travel.* The distance-based charge better represents maintenance costs associated with infrastructure, which is often viewed as "free". Moving away from solely a fuel duty will be essential to maintain a viable tax base as fuel taxes decrease due to decarbonisation of road transport.	2025	2025, but fuel costs are reduced by the same amount (no change in net per km cost of car travel)
Parking pricing *The lowest current parking rate is applied to all zones that did not have higher parking costs (EUR 0.60 per hour, assuming one hr of parking on average). It is assumed that all car trips are subject to this parking price*. The average parking time is based on the household travel survey which suggested approximately one hour. Higher priced parking rates were preserved for the model zone in central Tallinn.	2020	2025
Reallocation of road space (in Tallinn) *Increase time to travel by car and shared modes by 10% for trips starting or ending in Tallinn. Decrease travel time by 10% for walk and bike trips as well as public transport (PT) access time in Tallinn.* These measures prioritise active travel over car trips when (re)designing roads. Travel time of cars is reduced while active modes appear more attractive due to reduced network severance, reduced car traffic, and other measures. PT access is assumed to be by foot and is therefore included in the improvements.	2025	2030
Off-street parking regulations (in Tallinn) *Increase time to travel by car by five minutes for trips starting or ending in Tallinn.*	2025	2030

Measure description *(How the measure is modelled within the model)*	High ambition (year implemented)	Low ambition (year implemented)
Regulating the currently plentiful off-street parking should limit the options available and make searching for a parking spot more difficult. This is applied as an absolute increase in car travel time since the time required for parking is not trip distance-dependent.		
Public transport improvements *Reduce onboard time by five minutes* and reduce wait time by 5% for all trips.* PT improvements include, but are not limited to; schedule integration, priority measures at intersections, or allocation of road space for PT services. Some changes have a greater impact on longer trips, while other impacts offer a greater impact on short trips—using both an absolute and percentage-based reduction in travel time reflects this combination.	2025	2035
Vehicle fleet transition optimisation *Decrease average carbon emission factors for car, shared, and PT fleets. Emission factor reduction applied at a decreasing rate (faster at the beginning) until a maximum in 2050. The reduction is compared to BAU in 2050, which also assumes a decreasing emission factor.* *Increase average vehicle occupancy for car, shared, and PT fleets.* Transitioning the Estonian car, shared and PT vehicle fleets requires shifting to a higher proportion of sustainable vehicles, which decreases carbon emission factors. The shift in fleet composition can involve taxation of vehicles based on emissions to encourage adoption of lower emission vehicles, rebates, and other incentives/disincentives. Increasing the occupancy of these vehicles can further optimise their use. This can be met through lower car ownership, carpooling or ridesharing incentives, and optimised PT scheduling	Emission factor reduction reaches a maximum of -25% in 2050 Vehicle occupancy increases less than 1% every five years to reach a maximum increase of 4% in 2050	Emission factor reduction reaches a maximum of -5% in 2050 No change in vehicle occupancy
Measures that could improve cost recovery		
Increase PT tariff *Increase PT cost by a given percentage.* This measure is not meant to influence travel behaviour directly, in the way the other measures do. Rather, testing an increase in PT tariff allows decision-makers to determine whether increasing tariffs would significantly reduce ridership (which would not help with sustainability goals). If the negative impacts are minimal, increasing tariffs can improve cost recovery, and help agencies invest in better quality/more frequent services.	2025 (50% increase)	2025 (10% increase)

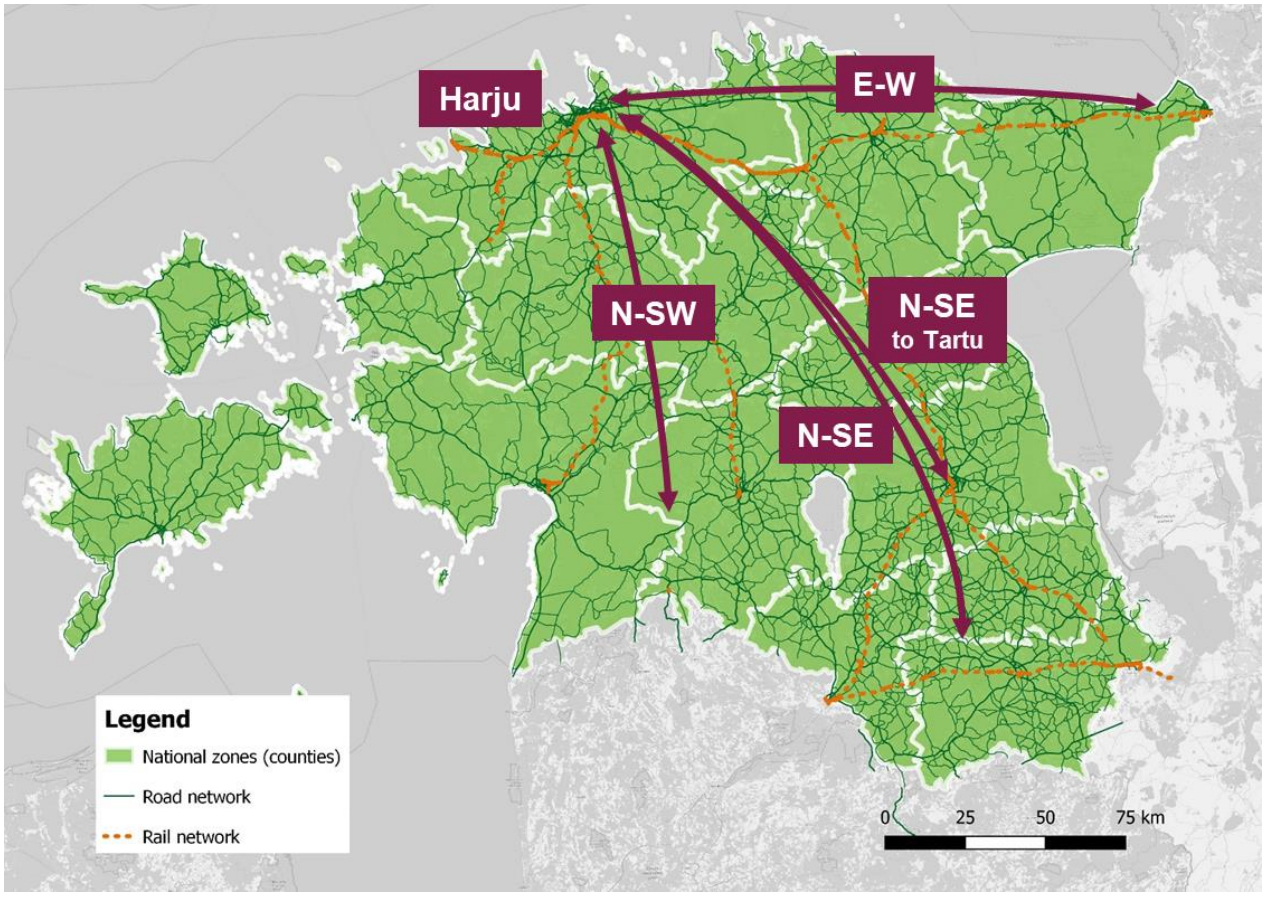
***** A perceived five minute time saving for all trips with onboard time greater than five minutes. Modelling national passenger transport policy measures.

Modelling national passenger transport policy measures

The national passenger model estimates the impact of the measures based on the three defined scenarios (BAU, HA, LA). The focus is on improving rail travel, and these are specified by rail corridor for the measures that target user behaviour. Figure 20 below shows the five aggregate rail corridors/areas of service specified in the model, as well as the aggregate zone system used. Rationale for the policy measures can

be found in Chapter 2, sections 2.5 Steering User Behaviour and Public Transport Policy and 2.6 Rail Freight and Infrastructure.

Figure 20. Aggregate rail corridors and zone system in the national passenger model for Estonia



Source: GIS data from Estonian Road Administration (2018a) and OpenStreetMap contributors (2020).

The following table describes how the measures related to national passenger transport are modelled and the years in which they are implemented for each of the scenarios.

Table 7. Modelling national passenger measures in high and low ambition scenarios

Measure description	Rail corridor	High ambition (year implemented)	Low ambition (year implemented)
Modernisation of rail measures			
Electrification of rail lines	Harju	NA – already electrified	NA – already electrified
CO_2 emission factor for trips on electrified lines is zero.	E-W, Tallinn to Narva	2030	NA
Rail travel on electrified lines is assumed to produce zero emissions. CO_2 emissions due to	N-SE, Tallinn to Tartu only	2025	2030

Measure description	Rail corridor	High ambition (year implemented)	Low ambition (year implemented)
electricity production is not included in the analysis, as the analysis is limited to tank-to-wheel emissions.	N-SE, whole line, Tallinn to Valga/Koidula	2025	NA
	N-SW, Tallinn to Parnu/Viljandi	2025	NA
Rail improvements Speed is increased by 30% from 120 kph to nearly 160 kph, on average. Wait times are reduced by 50%. A doubling of frequencies is assumed due to the planned increase in rolling stock. Speed improvements may be the result of electrification as well as other rail upgrades.	Harju	2025	2030
	E-W, Tallinn to Narva	2030	NA
	N-SE, Tallinn to Tartu only	2025	2030
	N-SE, whole line, Tallinn to Valga/Koidula	2025	NA
	N-SW, Tallinn to Parnu/Viljandi	2025	NA
Vehicle fleet optimisation Decrease average carbon emission factors for car, shared, and public transport (PT) fleets. Emission factor reduction applied at a decreasing rate (faster at the beginning) until a maximum in 2050. The reduction is compared to BAU in 2050, which also assumes a decreasing emission factor. Increase average vehicle occupancy for car, shared, and PT fleets. Transitioning the Estonian car, shared and PT vehicle fleets to a higher proportion of sustainable vehicles, will decrease carbon emission factors. The shift in fleet composition can involve taxation of vehicles based on emissions to encourage adoption of lower emission vehicles, rebates, and other incentives/disincentives. Increasing the occupancy of these vehicles can further optimise their use. This can be achieved through lower car ownership, carpooling or ridesharing incentives, and optimised PT scheduling.	All trips	Emission factor reduction reaches a maximum of -25% in 2050 Vehicle occupancy increases less than 1% every five years to reach a maximum increase of 4% in 2050	Emission factor reduction reaches a maximum of -5% in 2050 No change in vehicle occupancy

Modelling international passenger and freight transport policy measures

Railway improvements are the only international element for Estonia that this chapter focuses on. The main measures identified in the February 2020 workshop for international demand stand in the rail and road sectors. The limited data available on road and air were not adequate for detailed mode-split modelling. The international passenger and the freight models estimate impacts of the same rail measures as on the national level.

Table 8. Modelling international passenger and freight measures in high and low ambition scenarios

Measure description	Rail corridor	High ambition (year implemented)	Low ambition (year implemented)
Modernisation of rail measures			
Electrification of rail lines and speed improvements CO_2 emission factor for trips on electrified lines is highly reduced (0 emission tank-to-wheel). Speed is increased by 30%. Rail freight operating cost is decreased by -30% on electrified lines.	Harju	NA – already electrified	NA – already electrified
	E-W, Tallinn to Narva	2030	NA
	N-SE, Tallinn to Tartu only	2025	2030
	N-SE, whole line, Tallinn to Valga/Koidula	2025	NA
	N-SW, Tallinn to Parnu/Viljandi	2025	NA

Interpreting modelled outcomes

The indicator framework presented in Chapter 3 recommends a list of indicators to track and communicate the progress of transport policies. The modelled results discussed in the following sections are directly related, but in some cases provide alternative ways of looking at the same topics covered by this framework. While the focus of the framework is the ease of communication, the model outputs are directly applicable to decision-making and feeding into subsequent appraisal and analysis. The following table describes the similarities and differences between the two sets of indicators.

Table 9. Modelled indicators to track impacts of policy measures on transport outcomes

Measure description	Mode share	CO_2 emissions	Accessibility	Affordability
Indicator framework for passenger	Passenger kilometre (pkm) by mode	CO_2 emissions per vehicle kilometre (vkm)	Number of jobs accessible within 30 mins	% of total income spent on travel (all modes) by lowest income quartile
Passenger model output	Daily trips and pkm by mode	Daily CO_2 emissions based on vkm	Average travel time per trip* and per km, per mode	Average travel cost per trip* and per km, per mode
Indicator framework for freight	Tonne kilometre (tkm) by mode	CO_2 emissions per vkm	Average time to reach the international market (or borders)	Cost in Euros/tkm
Freight model output	Annual tkm by mode	Annual CO_2 emissions based on tkm	Average travel time per tkm.	Average travel cost per tkm

* per trip results are included in Annex 4.2.

Mode share is an important indicator that drives many of the other results. Understanding the breakdown of the modes people and freight use, and the resulting kilometres travelled on each mode, forms the backbone of subsequent analysis. The model calculates CO_2 emissions based on the distances travelled and distance-based emission factors for private, shared and public transport (PT) vehicle fleets for passengers. CO_2 emission factors per tkm of freight are used for rail and road. Accessibility, based on the data available, is measured as travel time, a crucial input also for cost-benefit analyses. The model bases travel time on access to all destinations, not just jobs. Spatial distribution of jobs data was not available. Affordability is also based on all trips. The cost per trip and per kilometre can be multiplied out by monthly averages to understand how these costs compare to incomes.

The following sections analyse the performance of these main indicators in each of the transport sectors, based on the recommended policy measures included in each of the scenarios. It is important to consider that a positive change in one indicator can appear to make a "negative" change in another indicator. For example, shifting to more active modes means travel times can increase. Often the goal of a measure is not to improve all these indicators but to impact a subset of them. Transport models and their results help understand some of these trade-offs between different outcomes. Finally, there are important considerations not covered by selected indicators which are difficult to model, such as physical or mental health, liveability, or quality of life.

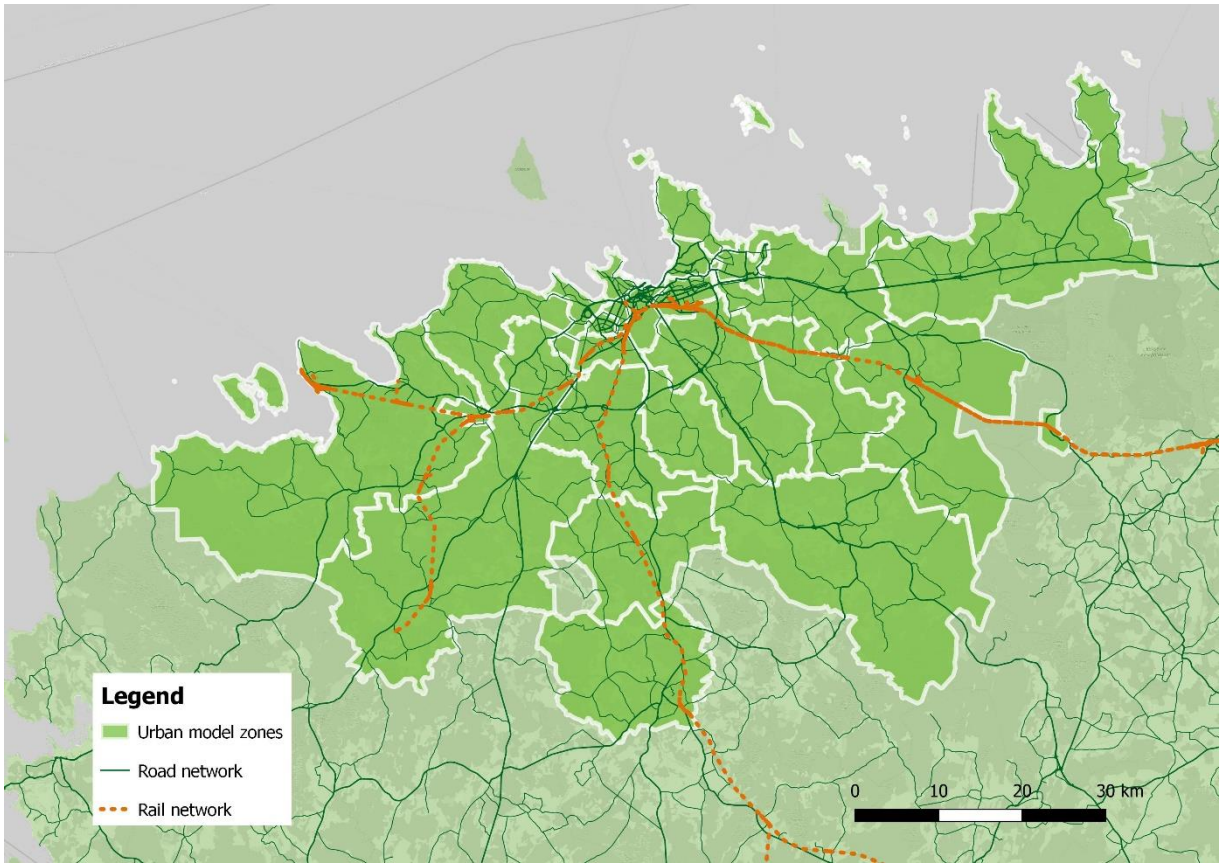
4.2. Urban passenger transport in high and low ambition scenarios

The strategic urban model allows policy makers to simulate the aggregate impacts of policy scenarios on urban travel by private modes, shared mobility (such as taxis), public transport (PT), cycling and walking. Due to Household Travel Survey (HHTS) data availability, the urban model focusses on Harju county, where Tallinn is located, and a portion of neighbouring Rapla county. The results should be interpreted in this context.

There is strong potential for behavioural change concerning urban travel in Estonia. In the HA scenario, car trips could drop from the majority share to less than a third of all trips. Changes to the vehicle fleet coupled with the mode shift away from cars could reduce CO_2 emissions by nearly 50% in the HA compared to the BAU scenario. Estonia identifies transport as a key sector in their National Energy and Climate Plan (EC, 2018) with the long-term goal of reducing total carbon emissions by 80% compared to 1990 levels by 2050. Estonia is also committed to a shorter-term goal of a total 13% reduction compared to 2005 by 2030. Policy measures targeting urban transport can significantly help in achieving this target.

The model tests the impact of policy scenarios on mode choice at an aggregate level based on the zoning structure shown in the figure below. It should not be used to test changes at a finer neighbourhood level. The model reacts to changes in trip characteristics for each mode but does not reflect changes in land use, and therefore, changes in desired trip destinations. The distribution of the trips remains constant over time, though volumes change. Land use-transport interactions would require more detailed data and modelling.

Figure 21. Extent of urban model coverage and zoning system in Harju/Rapla



Source: GIS data from Estonian Road Administration (2018a) and Open Street Maps (2020).

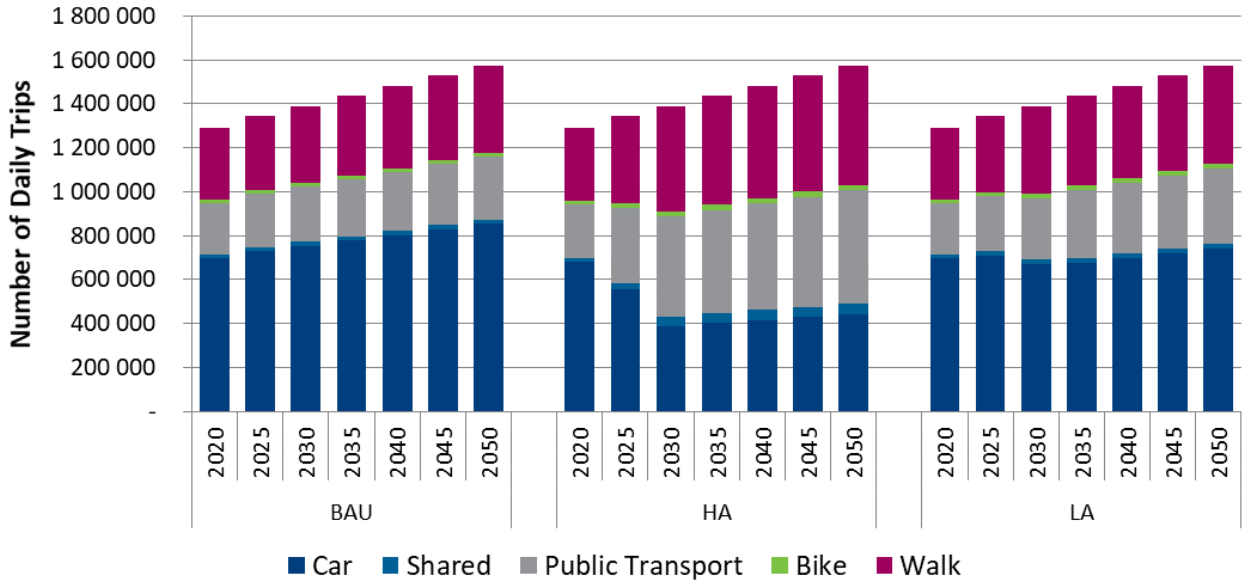
All the measures listed in Table 6 are included in the scenarios with the exception of the public transport tariff increase. The other measures seek to encourage mode shift to sustainable mobility. The suggested tariff increase is a measure to improve cost recovery for public transport agencies. Tests with this measure are discussed separately as a sensitivity test, to demonstrate that a tariff increase will not lead to significant loss of ridership, and therefore should be considered.

Mode share: Urban car trips shift to public transport and active modes

In 2018, over 50% of all urban travel was done by car. By 2050, car trips account for 28% of total trips in the HA scenario while the LA scenario results in no major change (47% share by 2050). Figure 22 shows that in the HA scenario, the mode split remains constant after 2030 as all measures are implemented in full by 2030. In the LA scenario, the measures are phased in until 2035, and to a lower extent (see Table 6 for descriptions of measures).

As trips shift to alternative modes, walking and public transport trips together account for the majority share in both scenarios. In the HA case, walk and public transport make up 34% and 33%, respectively, while, in the LA scenario 28% and 22%. Shared mobility and bike trips in the HA case contribute to 5% of trips overall, a significant increase from 2% in 2018, but there is little improvement in these modes from BAU if measures are implemented according to the LA scenario.

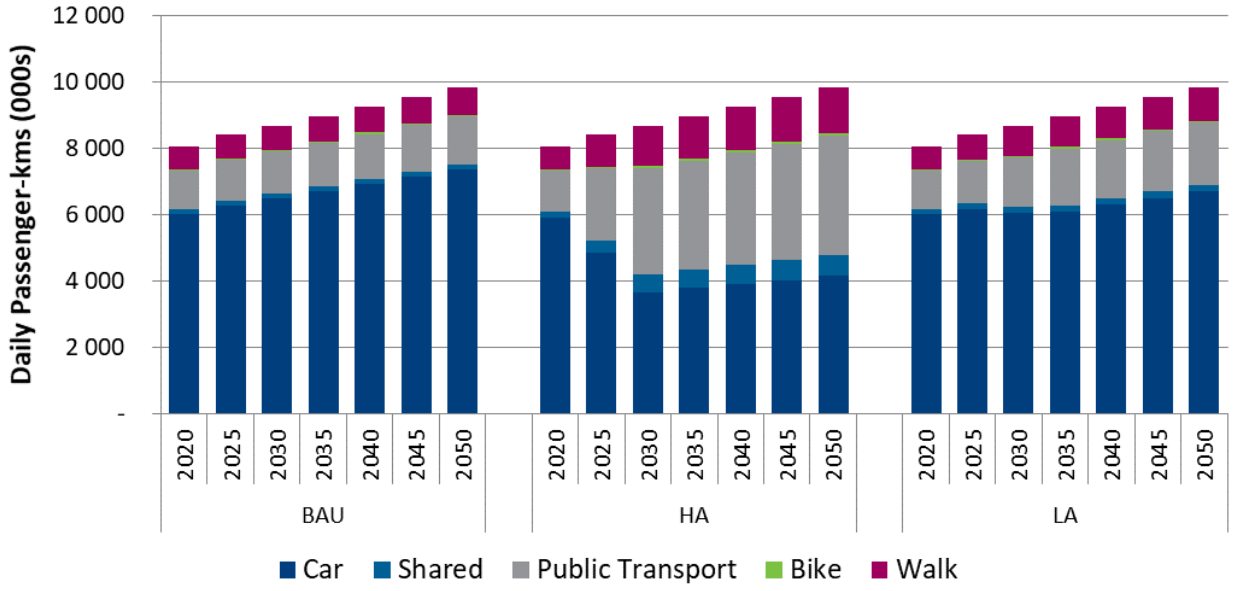
Figure 22. Daily modal trip share of urban travel by scenario



Note: BAU = Business as usual, HA = high ambition, LA = low ambition scenarios.

The total passenger kilometres (pkm) travelled is expected to grow from 7.9 to 9.9 million due to population increases in Tallinn between 2020 and 2050. Car trips account for the vast majority (75%) of pkm in 2018, as car trips are longer, on average, than trips by other modes. The share of car pkm declines to 42% in the HA scenario and 68% in the LA scenario by 2050.

Figure 23. Daily modal passenger kilometre share of urban travel by scenario



Note: BAU = business as usual, HA = high ambition, LA = low ambition scenarios. Shares are rounded to the nearest whole number. Bike share rounds to 0% as it is less than 0.5%.

The HHTS results suggest that the inhabitants of the region are not very sensitive to the changes in cost for public transport. If a tariff on public transport is re-introduced to aid in cost recovery for the transit authorities, the results indicate only a small shift away from its use. A 50% increase in the average public transport tariff results in only a 1% decrease in public transport trips by 2050, causing the public transport mode share to fall by only 0.2%.

User charging is the primary driver of the changes in trip and pkm shares in the HA scenario. The congestion charge and toll together are responsible for shifting the pkm share of car from 75% to 49%. All the other measures contribute to the additional drop of 7% (from the 49% due to user charging to the final 42% carshare mentioned above). In the LA scenario, these other measures are the only incentive for shifting from car use since the scenario does not include congestion charging, and the toll is offset by a decrease in fuel cost.

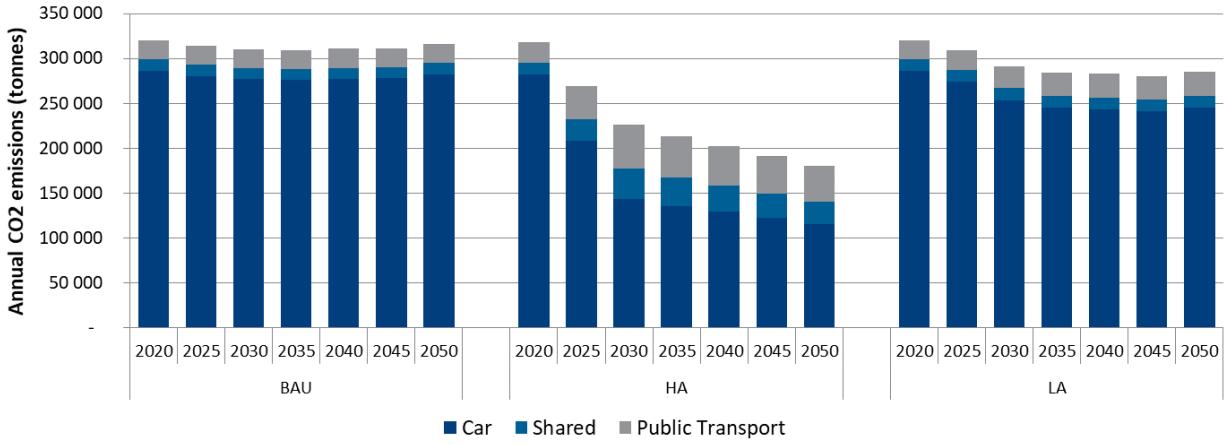
Overall, the model is not very sensitive to changes in bike trips. The HHTS data, which was used for calibration, indicated a very low share of bike trips (less than 0.5%) in urban areas. Bike trip demand depends only on travel time in the model and does not account for factors like safety and comfort. Stated preference surveys are needed to understand the sensitivity of residents to these factors, which would further improve the sensitivity of the model.

CO_2 emissions: Reduce emissions by mode shift and optimisation of vehicle fleets

The HA scenario achieves a 43% reduction of CO_2 emissions by 2050 compared to the BAU emissions in the same year. In contrast, in the LA scenario emissions fall by 10%. In the BAU scenario, CO_2 emissions for the region are approximately 869 tonnes per day in 2050 while the HA scenario reduces daily emissions to 495 tonnes in 2050. Most of the measures reduce private car travel, as noted in the previous section. Fewer pkms travelled by car means lower CO_2 emissions. These measures are responsible for a reduction in CO_2 of 19% for HA and 5% for LA scenarios, compared to BAU in 2050.

The remaining reduction (24% in HA) is due to vehicle taxation and changes in vehicle occupancy. A vehicle taxation policy based on their emission ratings (higher taxes for higher emission vehicles) encourages the purchase of low emission vehicles. As a higher percentage of low emission vehicles enter the Estonian fleet, the average emission factors per vkm decrease. Increasing the occupancy of vehicles by disincentivising car ownership, increasing costs, encouraging carpooling initiatives, etc. further reduces the number of vkm travelled which has a compounding effect on reducing CO_2 emissions.

Figure 24. Modelled CO_2 emissions from urban passenger travel by scenario



Affordability: User charging increases cost of car use to encourage mode shift

Most of the urban measures focus on behaviour change; sustainable modes are made more "attractive" while private car use is made less attractive. Increasing the cost of modes is one of the most effective ways of encouraging behaviour change. As noted in the previous sections, user charging is largely responsible for the mode shift achieved in the HA scenario. As a result, the cost of car travel increases, and the affordability of car travel decreases. While making a travel option less affordable may seem like a negative consequence, it is this very cost increase that leads to the positive shifts to PT, biking and walking. The changes to the relative affordability of different modes is a primary effect of the measures. Additional policies such as subsidy programmes should be considered to alleviate unfairly burdening residents who do not have the option to shift to other modes due to service availability.

Table 10 below shows, as expected, that the unit cost for travel per km increases the most for car travel, mainly due to the implementation of user charging. Bike and walk trips are considered to have no cost. Shared- and public transport-unit costs decrease slightly. Since there are no direct changes to shared mobility and public transport cost, as the scenarios are presented without the public transport tariff increase, this finding may not be intuitive at first without an understanding of how public transport and shared mobility costs are calculated. As car costs increase, longer car trips in the BAU case switch to shared and PT. Shared mobility costs are based on a fixed cost and a per-kilometre fee. As the share of longer shared trips increases, the average cost per kilometre decreases since the fixed cost is effectively spread over a higher number of total kilometres. Public transport costs are estimated based on the Harju area zone system. The cost between zones does not increase linearly; travelling between three zones is less than three times the cost of travelling within one zone. Therefore, as public transport gains a larger share of these longer trips, the average per kilometre cost is less.

The weighted average for all modes accounts for changes in trip patterns. Even though there is a significant shift to public transport and active modes, the increase in shared mobility and increase in car use costs (which still make up a significant portion of total pkm) means that the average cost of travel per km increases.

Table 10. Average travel cost per kilometre by mode

Scenario	Car	Shared mobility	Public transport	Bike	Walk	All modes
Business as usual	EUR 0.14	EUR 1.74	EUR 0.09	0	0	EUR 0.15
High ambition	EUR 0.39 (+174%)	EUR 1.54 (-12%)	EUR 0.07 (-22%)	0	0	EUR 0.29 (+91%)
Low ambition	EUR 0.20 (+41%)	1.72 EUR (-1%)	EUR 0.09 (-7%)	0	0	EUR 0.19 (+24%)

Source: Fuel costs for car travel calculated based on IEA MoMo model (2018) and Global Petrol Prices (2020); shared mobility costs based on Tallinn City Tourist Office and Convention Bureau (2020); public transport prices based on combination of Pilet.ee (2020), Samat (2020) and discussions during the April 2020 online workshop.

The average trip cost per mode, changes by the same proportion as the per kilometre changes, as they take into account changes in trip-making patterns. In the HA scenario, in 2050, the average trip cost is EUR 1.79 and the LA case is EUR 1.16. This represents a 91% and 24% change from the BAU case, of EUR 0.94 per trip, largely driven by user charging for car travel. A more detailed breakdown of average trip cost by mode is included in Annex 4.2.

If a public transport tariff increase is introduced, as described in Table 6, the per kilometre cost increases 17% and 40% in the HA and LA scenarios respectively compared to BAU in the same year, rather than decreasing as presented in Table 10. The mode share, and trip characteristics, as described previously, change only minimally as a result of the tariff increase. Targeted subsidies should be provided to vulnerable users to ensure a balance between affordability and financial sustainability can be achieved. See Chapter 2, Section 2.5. Steering user behaviour and public transport policy for further recommendations.

Accessibility: Travel time of active modes and public transport decrease and their mode shares increase

The policy measures in the scenarios play directly on car and public transport costs, while the impacts on the cost of other modes are secondary due to changes in mode choice. Travel time, however, is directly influenced for all modes by various measures to encourage a shift to more sustainable mobility options.

Car travel time is increased due to changes to off-street parking in Tallinn. Reallocation of road space to prioritise active modes increases travel time for both car and shared mobility services, while decreasing time for active travel—including the portion of a public transport trip spent walking to a stop. Public transport onboard time and waiting times are also reduced as a result of improvements due to the integration of services. The resulting travel time per km for each mode reflects these changes: Public trasport times improve by 17% while reductions in travel time are 7% for bike and 8% for walk trips in the HA scenario compared to BAU in 2050. Car and shared mobility speeds fall. The average travel time increases 43%, compared to BAU, due to the shift of more trips to slower (but more sustainable) modes.

In both HA and LA scenarios, by 2050, travel times for public transport and active mobility have reached the same magnitude of change. User charges for car travel, however, are not implemented in the LA scenario. The Tallinn congestion charge, in particular, shifts a large proportion of Tallinn based car trips to alternative modes in the HA scenario. Without this shift in Tallinn, the speed reductions due to the reallocation of road space in the city affect a greater proportion of car trips in the LA scenario, increasing average travel time more than in the HA scenario (29% rather than 18%). Overall there is less shift in trips in the LA scenario compared to BAU. Therefore, there are more Tallinn-based shared trips in the LA scenario, which are subject to the travel time increases than in the HA scenario where trips shift to PT. Therefore, the shared trips also experience longer travel times, on average, in the LA scenario.

Table 11. Average travel time per kilometre by mode

Scenario	Car	Shared mobility	Public transport	Bike	Walk	All modes
Business as usual (minutes)	1.3	1.3	5.6	3.3	13.1	2.9
High ambition (minutes)	1.5 (+18%)	1.5 (+17%)	4.6 (-17%)	3.1 (-7%)	12.1 (-8%)	4.2 (+43%)
Low ambition (minutes)	1.7 (+29%)	1.7 (+33%)	4.6 (-17%)	3.1 (-7%)	12.1 (-8%)	3.3 (+13%)

Note: Congestion (changes in speed) in response to changes in demand is not modelled at this strategic level.

Source: Travel time calculations based on OpenStreetMap (2020) road network and GTFS data for Estonia provided by the Estonian Road Administration (2020a).

The average trip time per mode, changes by the same proportion as the per kilometre changes, as they take into account changes in trip making patterns. In the HA scenario, in 2050, the average trip time is 25.9 minutes and the LA result is 20.6 minutes. This represents a 43% and 13% change, respectively, from the BAU case of 18.2 minutes per trip. A more detailed breakdown of average travel time per trip, by mode is included in Annex 4.2.

This model assumes static trip patterns. This should be considered when interpreting the accessibility and affordability results. The land-use patterns and the location of destinations remain constant over time. When active modes and public transport is prioritised in cities, despite the speed of these modes improving, the average trip may cost more or take more time, simply because people start accessing further destinations via these modes. However, this shift, in the long term, encourages changes in land-use patterns to denser development. This discourages people to drive to their work, commercial and social outings. As provision for pedestrian and bike path connectivity and accessibility by public transport is improved, these travel distances can become shorter, further improving the average trip time and cost characteristics. For more on improving the linkages between transport and land use, please see the Chapter 2, Section 2.5. Steering user behaviour and public transport policy.

4.3. National passenger transport in high and low ambition scenarios

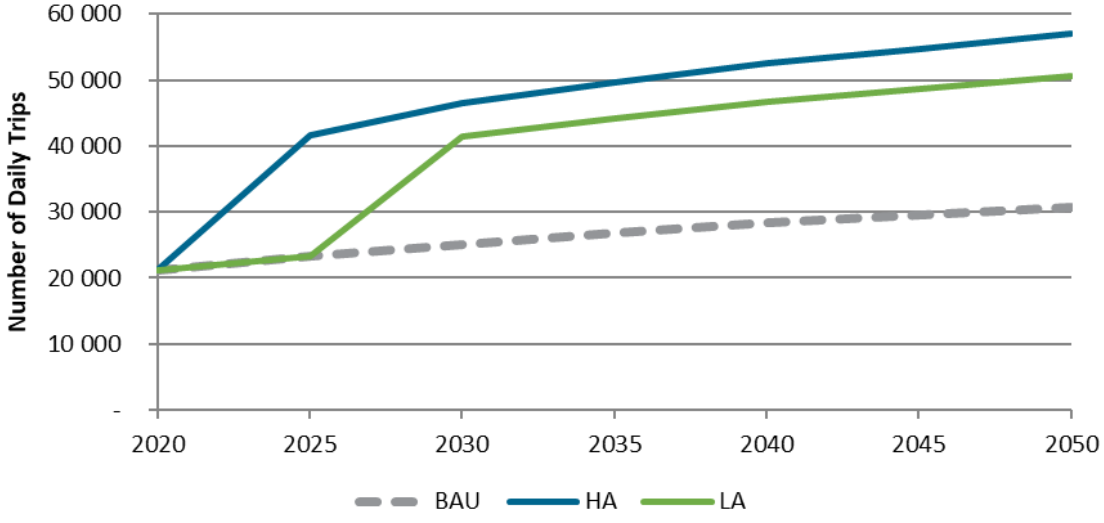
The national passenger transport model simulates the aggregate impact of rail improvement measures and changes in the car and public transport vehicle fleets. The model focuses on rail, bus, and car travel, which are the primary modes for inter-urban trips. Both inter and intra-zonal trips are included in the model. Walking, biking or shared modes were not modelled as they are typically only applicable to shorter urban trips and hence not viable for inter-urban distances.

The rail service improvements lead to significant increases in rail travel from the current levels. However, due to the comparatively small share of rail passengers today, results do not have a significantly transformative impact on a national scale. Since car and bus travel make up the majority of the pkm, transitioning to more sustainable private and public fleets lead to the majority of the 30% total CO_2 emission savings from national passenger travel in the HA scenario.

Mode share: National passenger travel shifts to rail due to service improvements on corridors

The measures that target user behaviour focus on improving rail travel. The rail improvement measures affect speed and service frequencies of rail travel leading to an overall trip increase of 85% in the HA scenario and a 65% in the LA scenario, compared to BAU in 2050. The overall mode share of rail increases from 2% to 4% due to the improvements in the HA scenario, and 3.5% in the LA scenario. While the mode share nearly doubles in the HA scenario, this still means a modest change in the overall mode share of national travel due to the dominance of car travel for national passenger travel.

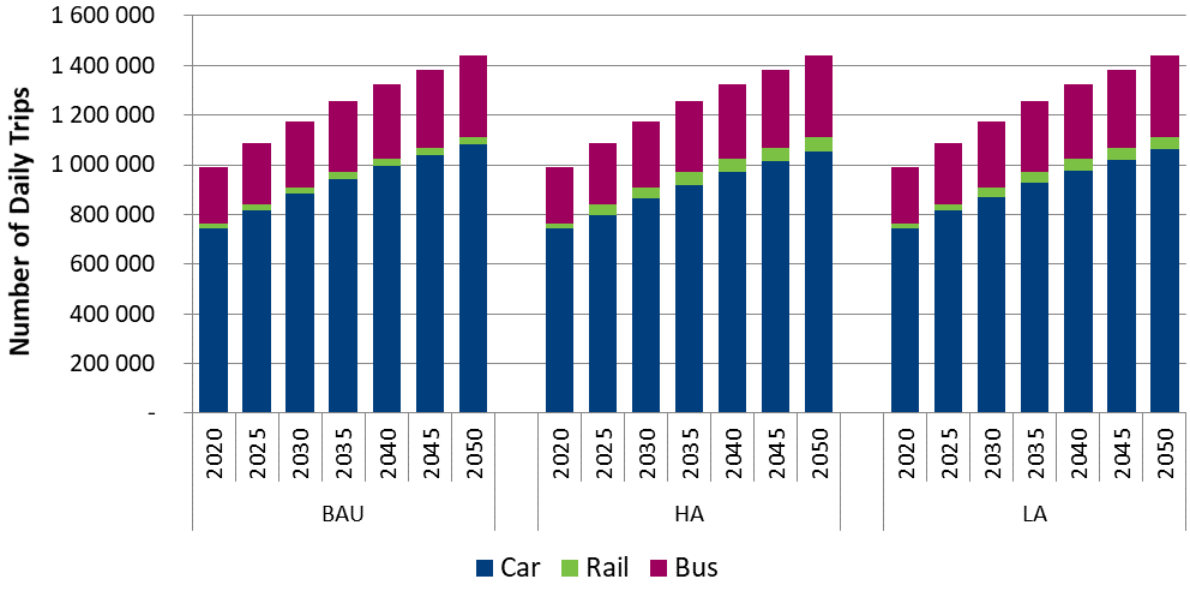
Figure 25. Change in daily rail trips by scenario



The assessment does not consider any direct measures for bus travel, therefore bus share remains unchanged overall while the shift to rail is driven by car users changing to rail. The model is not sensitive to user choices between rail and bus due to the lack of mode-specific data from a national HHTS or stated preference survey. The split between rail and bus is estimated using post-processing steps instead. As a result of these limitations, bus services are assumed to remain constant, and that the rail measures cause mode shift from car only. This assumption is based on the fact that bus services in competition with rail

would likely experience a decrease in ridership due to enhanced rail service. Buses, however, are also an important feeder service for rail, and therefore an increase in demand for these routes to serve the growing rail demand is expected. Overall, these gains and losses are not expected to create a significant net change in the bus market as a result of improvements in rail frequency and service level.

Figure 26. Daily modal trip share of national passenger travel by scenario



The shift in share of pkm, nationwide, is less than that for trip share (around 1% in both scenarios). There are two possible reasons for this. For one, the shift from car to rail stems mainly for relatively shorter trips. Additionally, a trip where rail is the primary mode also involves a certain portion of non-rail travel to access the station, whether by car or bus. Therefore, rail pkm do not increase as significantly as rail trips.

Figure 27. Change in daily rail passenger-kilometres by scenario

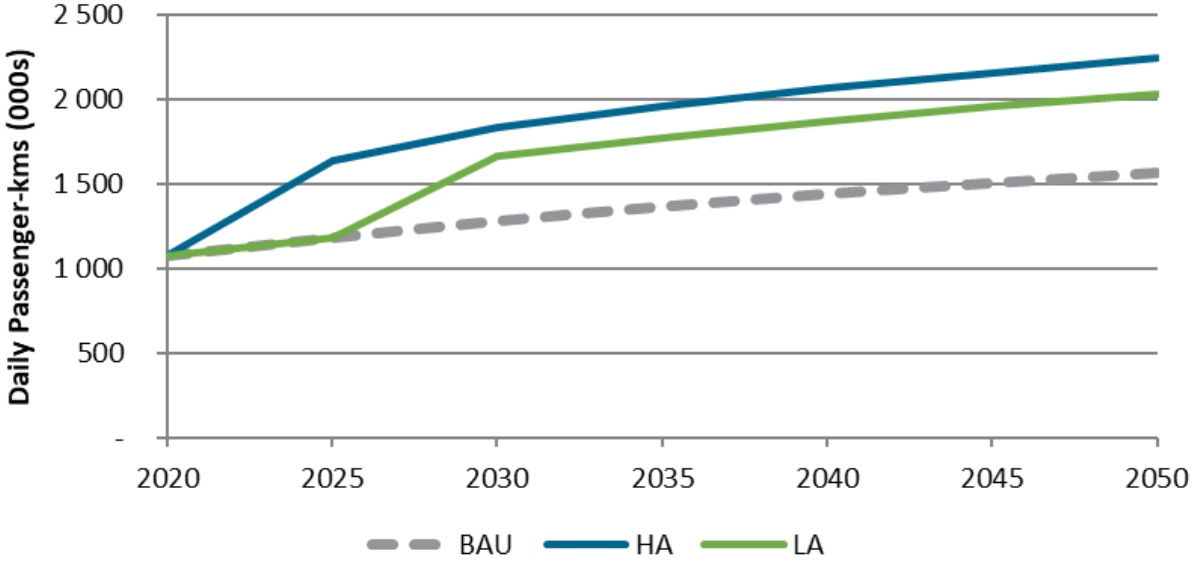
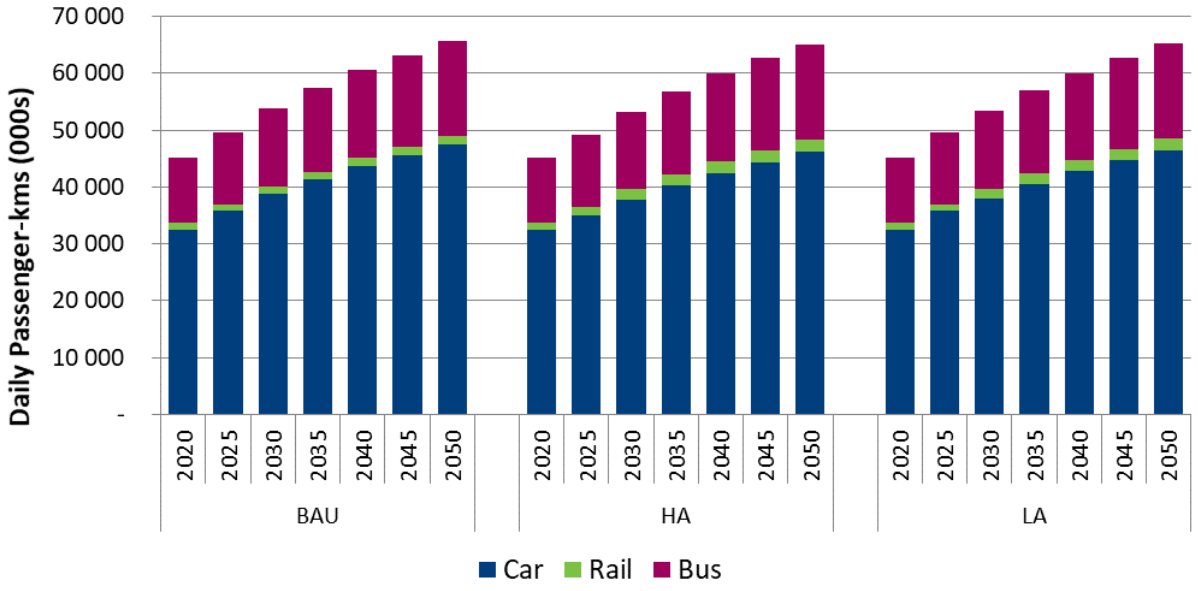


Figure 28. Daily passenger-kilometre share of national passenger travel by scenario



Disaggregating the results by corridor, the most pronounced increase in rail passenger-kilometres occurs in Harju, which has the greatest share of rail to begin with due to multiple rail lines, dense population, and therefore the highest rail usage. The N-SE corridor from Tallinn to Tartu and further South witnesses the second-highest absolute change in pkms due to the higher volume of travel on the corridor. However, as a percentage increase from the BAU rail passenger-kilometres, the increase is not as large because there are alternative PT options due to competing bus routes along the corridor. The second-highest percentage increase in rail compared to BAU stems from the N-SW corridor, which currently serves Viljandi by rail.

Table 12. Change in daily rail passenger kilometres by rail corridor and scenario in 2050

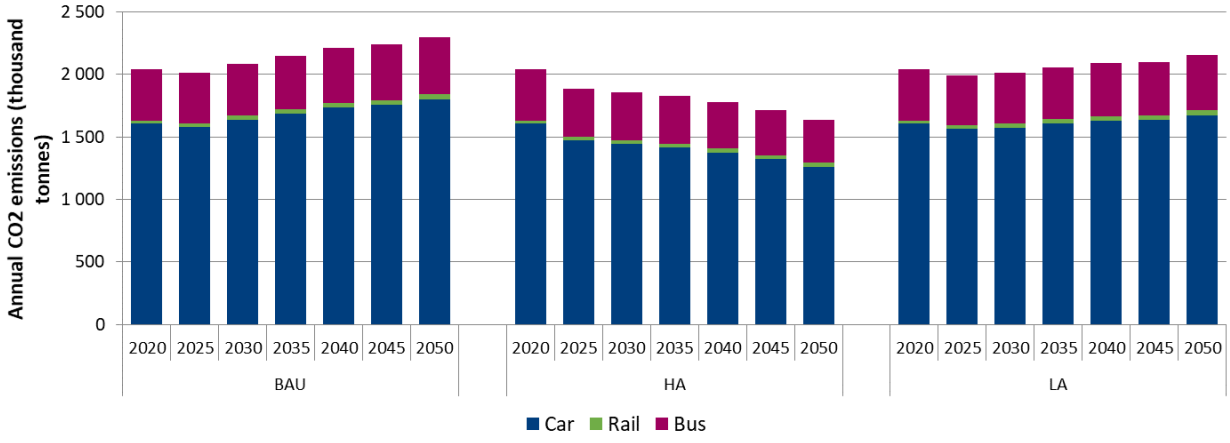
Rail Corridor	Absolute increase in daily rail passenger-kilometres compared to BAU		% increase in rail passenger-kilometres compared to BAU	
	High ambition	Low ambition	High ambition	Low ambition
Harju	428 000	428 000	99%	99%* (0% before 2030)
E-W, Tallinn to Narva	76 000	0	28%	0%
N-SE, whole line, Tallinn to Valga/Koidula	89 000	42 000	13%	6%
N-SE, Tallinn to Tartu only	61 000	42 000	14%	10%
N-SW, Tallinn to Parnu/Viljandi	104 000	0	44%	0%

* Harju is electrified in both HA and LA scenario, but later in 2030 for LA (2025 in HA). So there is no difference between the two alternative scenarios after 2030. However, before 2030, the change in LA is 0%.

CO_2 emissions: Emissions from national passenger travel reduce due to electrification and a shift to rail

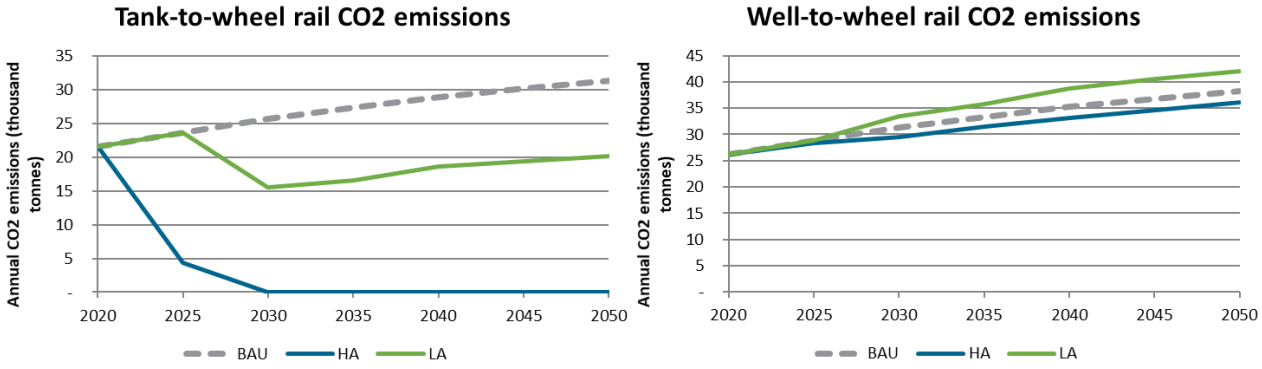
The HA scenario results in a 29% reduction of CO_2 emissions by 2050 compared to the BAU emissions in the same year. In contrast, the LA scenario results only in a 6% reduction. In 2050, the CO_2 emissions for Estonia decrease from approximately 635 000 tonnes per year in BAU, to 140 000 tonnes in the HA scenario. All measures contribute to the decrease in CO_2 emissions. The pkm share by mode responds to service improvements. The emission factors change due to the electrification of rail and changes in vehicle fleet composition and occupancy.

Figure 29. Daily carbon emissions due to national passenger transport by scenario



Full electrification of rail in the HA scenario means that all rail trips are assumed to be emission-free (considering tank-to-wheel emissions). The estimations of well-to-wheel emission are based on the European average for the emission factor for electric production. However, given the relatively small share of rail, electrification and service improvements together result only in a 2% decrease in CO_2 emission in the HA scenario, and a 1% decrease in the LA scenario in 2050 (mainly brought from modal shift to rail). The figure below highlights the change in rail emissions over time.

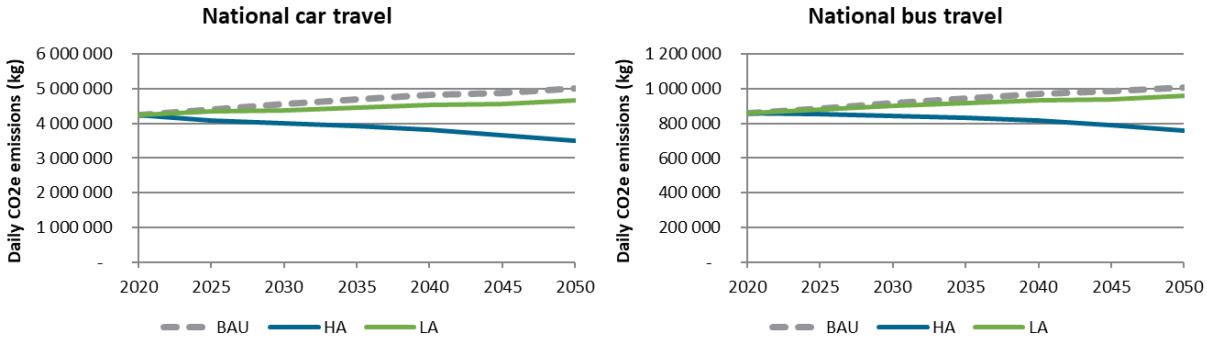
Figure 30. Change in carbon emission due to national rail travel, tank-to-wheel and well-to-wheel comparison



In the LA scenario, the increase of well-to-wheel emissions on rail due to the increased rail traffic is not compensated by the electrification of the Harju and Tallinn to Tartu railway lines.

Changes in vehicle fleet composition and changes in vehicle occupancy for both car and bus fleets are responsible for the majority of the CO_2 emissions savings. If the Estonian fleets shift to a higher proportion of low emission vehicles, the average emission factors per vehicle kilometre decrease as previously explained in the urban results section. Increasing the occupancy of vehicles reduces the number of vehicle-kilometres travelled, further reducing CO_2 emissions. The figure below highlights this change in emissions due to car and bus travel, which are responsible for 82% and 17% of total emissions, respectively.

Figure 31. Change in daily carbon emissions due to national car and bus travel by scenario



Affordability: There is virtually no change in cost of travel per trip

The measures do not target cost of travel directly. While changes in mode choice can alter costs slightly, as seen in the urban case, the increase in national rail travel does not shift the overall mode share drastically enough to make a significant change in travel costs per trip at the national aggregate level

Accessibility: Rail travel time reduces due to service improvements

Rail service improvement is the only measure that affects mode choice characteristic by decreasing travel time by 30% and waiting time (due to higher service frequency) by 50%. All rail trips experience this change in the HA scenario, while in the LA scenario, only rail lines in Harju, and from Tallinn to Tartu are assumed to change.

Complementary tests on road investments

The following additional road investments were not included in the two alternative scenarios but were evaluated for Estonian authorities in separate and independent tests. The road investments consist of the improvements of main road corridor sections with only one lane on each side or 2+1 lanes. In the tests, investments are made to enlarge all selected sections of road to 2+2 lanes (average speed of 113 kph) in one case. In the other case, the 1+1 sections are enlarged to 2+1 (average speed of 102 kph) except for Tallinn ring road sections, which are enlarged to 2+2 but at a later date. The resulting time savings for each corridor (provided by the Estonian Road Administration) are indicated in Table 13, which also shows the scenarios (HA* for 2+2 improvements, and LA* for 2+1) used as a basis for the evaluation, even if these measures are not included in the final HA and LA policy scenarios.

Table 13. Road improvement assumptions

Road improvements by corridor		Average daily traffic in 2018		Length in km of the sections to be improved	Speed increases (from -> to) in km/h	Time savings in minutes	Test year of implementation in the alternative scenario	
							HA*	LA*
Harju	Tallinn ring road (2+2)	14 150	9 795 15 218	8 31	90 -> 113 102 -> 113	1 2	2025	2030
E_W	Tallinn-Narva (2+1) (LA*)	6 013		111	90 -> 102	9		2030
E_W	Tallinn-Narva (2+2) (HA*)	8 435	6 013 11 437	111 89	90 -> 113 102 -> 113	15 5	2025	
N_SW	Tallinn-Parnu (2+1) (LA*)	8 861		86	90 -> 102	7		2030
N_SW	Tallinn-Parnu (2+2) (HA*)	10 227	8 861 18 968	86 15	90 -> 113 102 -> 113	12 1	2025	
N_SE	Tallinn-Tartu (2+1) (LA*)	8 108		79	90 -> 102	6		2030
N_SE	Tallinn-Tartu (2+2) (HA*)	9 906	8 108 11 925	79 90	90 -> 113 102 -> 113	11 5	2025	

* the scenarios indicated here are the ones used as a basis for the test implementation, to calculate and present the results, even if these measures are not included in the final HA and LA scenarios.

Source: Estonian Road Administration (2020b).

We consider that traffic is currently captive at the selected road section with no real alternative routes. However, the increase in speed shifts traffic from other modes but not from other roads.

We use our model to estimate the modal shift to road, using travel time savings shown in Table 13. Table 14 and Table 15 respectively show the results in terms of traffic per section and per corridor (a corridor corresponds here to a group of origin-destinations, county to county).

The resulting traffic increases from modal shift are quite modest on the road sections we assessed, ranging from 3% for Tallinn ring road to 13% for Tallinn-Tartu route (Table 14).

Table 14. Road improvement traffic results per section (average daily traffic)

Road section to be improved	Average daily traffic in 2018	Traffic increase on the road section	
		in HA* (2+2)	in LA* (2+1)
Tallinn ring road	14 150	3%	3%
Tallinn-Narva	8 435	9%	5%
Tallinn-Parnu	10 227	8%	5%
Tallinn-Tartu	9 906	13%	5%

Table 15 includes all resulting car trips for each region, so the relative increases in the total number of daily car trips look even smaller: compared with the business-as-usual, the HA* (2+2 lanes) scenario results in an overall increase of 0.4% in car traffic, double that of the LA* (2+1) scenario (0.2%). The corridor which benefits the most from the assessed road improvements is the N-SW axis (Tallinn – Pärnu) with a 0.8% increase in the total number of daily car trips in the HA* scenario. These results are very similar in relative terms for the number of vehicle kilometres and passenger-kilometres.

Table 15. Road improvement traffic results per corridor (total number of daily car trips)

Corridor	BAU 2050	HA* 2050	HA* / BAU	LA* 2050	LA*/ BAU
Harju	432 900	433 500	0.16%	433 500	0.16%
E_W	180 200	181 400	0.7%	180 800	0.4%
N_SW	169 300	170 600	0.8%	170 100	0.5%
N_SE	280 900	282 700	0.7%	281 700	0.3%
Whole country	1 080 900	1 085 500	0.4%	1 083 600	0.2%

Table 16 and Table 17 give the results in terms of affordability and accessibility for the whole country (to allow for comparison of any kind of measures). The average travel cost by car per trip and per kilometre does not increase compared with the business-as-usual. However, the total travel cost by car increases as a result of the growth in the number of car trips (+0.4% in HA* scenario). The average travel cost for all modes also increases (0.2% in HA* scenario) because of the modal shift to car from less expensive public transport. In line with the traffic results, the travel costs for the HA* scenario are double those for the LA* scenario.

Table 16. Road improvement affordability results (countrywide)

	Total travel cost (EUR)		Average travel cost in Euro per trip		Average travel cost in Euro per km	
	HA* / BAU	LA*/ BAU	HA* / BAU	LA*/ BAU	HA* / BAU	LA*/ BAU
cars	0.4%	0.3%	0.0%	0.0%	0.0%	0.0%
all modes average	0.2%	0.1%	0.2%	0.1%	0.1%	0.0%

In both scenarios, the total travel time, as well as average travel time, (per trip and per kilometre) are reduced (-1.4% for HA*, -0.7% for LA*). This is due to travel time savings stemming from the road improvements and speed increases. The overall travel time reduction for all modes is -1.1% in the HA* scenario, -0.6% in the LA* scenario (Table 17).

Table 17. Road improvement tests accessibility results (countrywide)

	Total travel time (min)		Average travel time (min/trip)		Average travel time (min/km)	
	HA* / BAU	LA*/ BAU	HA* / BAU	LA*/ BAU	HA* / BAU	LA*/ BAU
cars	-0.9%	-0.5%	-1.4%	-0.7%	-1.4%	-0.7%
all modes average	-1.1%	-0.6%	-1.1%	-0.6%	-1.3%	-0.7%

To conclude, the road investment scenarios evaluated above (enlarging all selected road sections to 2+2 lanes, or only 1+1 sections to 2+1 lanes) result only in marginal improvements in terms of overall travel time and travel costs. This result is mainly due to the relatively low level of traffic currently on the corridors and sections of roads analysed. As such, these results do not support investment, however, we have not carried out comparative cost-benefit assessments to further analyse and compare the social costs and benefits of these improvements.

4.4. International passenger transport in high and low ambition scenarios

This assessment only concerns international passenger travel by rail under the HA and LA scenarios. The main measures identified in the February workshop for international demand stand in rail and road sector. Moreover, the limited available data on road and air were not adequate for detailed mode split modelling.

International passenger trips on railways are concentrated on the East-West axis Tallinn - Narva - Russian Federation. Given the length of the average trip on this line (about 16 hours Tallinn to Moscow, including more than 1 hour and 30 minutes of stops at the border), improvement of railway speed in Estonia does not have a significant impact on passenger transport. An increase of 30% of the rail speed in Estonia would bring only a 5% gain on the Tallinn to Moscow travel time.

The only measurable effect concerns the CO_2 emission savings that are brought by the electrification of the East-West axis in the HA scenario. With one train per day per direction (728 trains per year) on the

153 km of the rail axis, with an average diesel consumption of 1.7 L/km (containing 3.07 kg of CO_2 per L, (UNECE 2012)), this represent about 580 tonnes of CO_2 per year that could be saved moving to the electric locomotive (tank-to-wheel estimates).

4.5. Freight transport in high and low ambition scenarios

The lack of data on road freight by origin-destination and by type of commodity has limited the scope of the analysis on freight transport. It is difficult to validate a freight model by mode without this type of data. Instead, the freight model assesses the impact of the main policy measures based on a model developed from the Estonian railway dataset of freight flows. This dataset includes information on transported goods volume in tonnes, per commodity, the country of origin and destination, and the railway axis used in Estonia. Then changes to these flows for the two alternative scenarios are estimated using cost elasticities extracted for ITF global freight model by origin-destination (OD) and by commodity.

The following estimates are mainly based on the railway flows as observed in 2018. A large majority of freight (over 90% of the tkm) is international traffic, with domestic traffic accounting for the remaining tkm on Estonia's public railways.

Table 18. Current railway freight activity

Railway freight activity	Thousand tonnes		Millions tkm	
International	10 633	79%	1 847	91%
Domestic	2 772	21%	176	9%
Total	13 405	100%	2 023	100%

The objective of the assessment is to test the impact of the electrification of the Tallinn to Tartu railway line (LA scenario) and of all railway lines (HA scenario). Given the high uncertainty on the future evolution of trade, the assessment of both scenarios is done here on 2018 flows as a basis. This allows for eliminating the impact of the uncertainty over trade growth from the analysis but still is sensitive to the impact of cost on mode share.

It is assumed that the electrification will reduce the railway operating costs by 30% (in EUR/tkm) for the lines considered. This impact is then applied according to the estimated distance per axis travelled for each OD on the network.

The variation in tkm is estimated by each OD and by commodity group, using the elasticities (ranging from -0.1% to -80%) that are extracted from the ITF Freight model described in more details in Annex 4.1.

The following table illustrates the calculations for two theoretical OD pairs, for the effect of a -30% reduction in cost in increasing tkm transported.

Table 19. Illustration of the impact of rail cost reduction using elasticities on theoretical origin-destination pairs

Tkm 2018	Distance of the section to be electrified	Total distance of the OD	Elasticity to cost of the commodity group for that OD	Cost reduction	% relative change in tkm	Resulting tkm
100	100 km	/ 100 km	-50%	-30%	15%	115
100	100 km	/ 500 km	-20%	-30%	1.2%	101.2

Table 19 also shows that the longer the OD is, the smaller is the impact of the cost reduction on a given section.

Impact of the railway electrification on mode share

The following table shows the overall results for the HA and LA scenarios by commodity group.

Table 20. Impact of railway electrification on freight flows by commodity group for the two alternative scenarios

Freight volumes and tonne-kilometres by Commodity group	Thousand tonnes 2018	% of total	millions tkm 2018	millions tkm in HA	% relative diff.	millions tkm in LA	% relative diff
Fertilizers	5 378	40%	681.5	683.0	0.2%	682.1	0.1%
Mineral fuels (liquid)	4 411	33%	736.4	750.1	1.9%	741.2	0.7%
Mineral fuels (solid)	1 450	11%	237.1	237.5	0.2%	237.3	0.1%
Chemical products	1 066	8%	122.5	122.8	0.2%	122.6	0.1%
Bulk goods	313	2%	55.7	55.8	0.2%	55.7	0.1%
Perishable goods, animals, vegetables	243	2%	67.0	67.2	0.3%	67.1	0.1%
Metals	196	1%	44.2	44.3	0.1%	44.2	0.1%
Industrial goods, machinery, building materials, others	175	1%	39.7	39.9	0.6%	39.8	0.3%
Timber	135	1%	33.2	33.2	0.0%	33.2	0.0%
Grain	36	0%	5.5	5.5	0.3%	5.5	0.1%
Total	**13 405**	**100%**	**2 023**	**2 039**	**0.8%**	**2 029**	**0.3%**

The impact of the electrification on rail tkm is modest: +0.8% in HA scenario and 0.3% in LA scenario. However, these results should be considered as low boundary estimates as the elasticities used are somewhat lower than those used usually. Further, only the elasticity to rail cost has been taken into account here (because elasticities to travel time by rail are even smaller).

Impact of the railway electrification on CO_2 emissions

In order to assess the impact of the electrification on CO_2 emission, the following assumptions in Table 21 (UNECE 2012) on emissions factors per tkm were used.

Table 21. Assumptions regarding CO_2 emission factors for diesel and electric freight trains per tonne-kilometre

CO_2 emission factor per tkm by rail:	g CO_2 / tkm
Non-road diesel	27.1
Electricity consumed in Europe	13.5

The resulting CO_2 emissions per axis are as follow:

Table 22. Resulting CO_2 emissions per railway axis for the two alternative scenarios

CO_2 emissions in tonnes per railway axis	2018 estimates	High ambition	Difference HA - BAU	LA	Difference LA - BAU
Harju (already electrified)	3 903	3 928	25	3 914	12
Harju (lines to be electrified)	2 242	1 124	-1 118	1 120	-1 122
E - W (Narva)	15 873	7 991	-7 882	15 902	29
N-SE (Harju to Tartu)	17 293	8 677	-8 616	8 646	-8 647
N-SE (Tartu to border)	11 455	5 749	-5 706	11 497	42
N-SW (Viljandi)	119	59	-60	119	0
Total	**52 902**	**27 528**	**-25 374**	**41 198**	**-11 704**

Full electrification of freight railways in HA scenario would result in 48% reduction of CO_2 emissions with a total saved of more than 25 000 tonnes of CO_2 per year. While the electrification of only Tallin-Tartu axis (LA scenario) would result in 22% reduction of emissions (more than ten thousand tonnes of CO_2 per year).

4.6. Prioritising policy reforms to meet policy goals

The analysis of the scenario results in the previous sections shows how different levels of implementation of measures affect the transport system to different degrees. Each of the measures needs to be evaluated and prioritised based on the desired policy goals. While this report describes these measures aggregately as part of policy scenarios, Table 25 in Annex 4.2 tabulates the individual impacts on mode shares, affordability, and accessibility of each measure applied on its own. To encourage a transition to active travel and public transport it is important to make these modes more attractive. This would bring significant health advantages, encourage denser urban development, improve the urban environment more generally and reduce CO_2 emissions and other pollutants. The difference between the HA scenario and the LA scenario highlights the importance of disincentivizing car travel for urban transport. User charging is the main driver for reducing the carshare for urban travel (without charging carshare of passenger-kilometres reduces by 7%, while with user charging it falls by 33%). Unless car travel is actively discouraged, changes due to reallocating road space for active travel and improving public transport services are minimal. The combination of a flat congestion charge for trips in Tallinn and a distance-based toll acts on a range of trip types. The congestion charge shifts trips from car to sustainable modes in urban areas which have better public transport service and denser development, while the toll also discourages longer car trips. At the same time, it is important to consider the effects of user charging to those with

limited alternatives, using differentiation of charges and/or cross-subsidisation among different groups of users.

If climate change is the first priority, Estonian transport officials should consider the transition to cleaner private and public vehicles and optimising their occupancy. In the ITF's analysis of both urban and national passenger travel, the transition to cleaner vehicles and optimisation of their use would account for around half of the CO_2 emission savings compared to the BAU scenario. National passenger travel is dominated by car travel. Cars still account for at least 42% of pkm in the most ambitious scenario, even though the HA scenario demonstrates a strong shift away from cars in urban passenger travel. If the vehicles in the Estonian fleets have lower emission factors, even with the high passenger-kilometres, it is possible to significantly reduce the carbon emissions from the sector.

Transitioning to a more efficient private fleet requires encouraging people to purchase newer and less-polluting vehicles, while also disincentivizing older vehicles from remaining in the active fleet. Policy reforms to achieve this include differential tax regimes and bonus-malus programmes. Investing in lower-emission vehicles in public transport fleets will also help lower the emissions from this sector, especially as their pkms grow due to mode shift caused by other policies. Public vehicles have a higher intensity of use by nature and their uptake enables wider uptake of low emission vehicles more generally in the region. Further optimisation is possible if vehicle occupancy is increased. Lowering car ownership through carpooling and ridesharing schemes can help encourage higher occupancies during car travel. public transport fleets can also be run closer to optimal capacity through regular review and optimisation of schedules.

Rail improvements could be very effective at increasing ridership, but they are restrained by rail's overall small share. Improvements to service frequency and speed have significant impacts on the existing rail share for passenger transport, albeit from very low starting levels; the share of rail remains small despite doubling from 2% to 3.5%-4% in the LA and HA scenarios. Electrification has a significant impact in reducing the share of CO_2 emissions from passenger rail transport—rendering tank-to-wheel emissions effectively zero. As rail accounts for a small share of total passenger transport however, the effects are negligible on the total emissions from all national passenger travel. On the other hand, full railway electrification would bring significant CO_2 savings for freight with more than 25 000 tonnes of CO_2 reduced per year.

The modelling results presented in this report are defined by the data available at the time of model construction. To better equip Estonia for more detailed transport modelling, a nationwide travel survey should be prioritised to better understand trip-making patterns and mode choice behaviour. Future modelling efforts would also benefit if the household travel survey questions were streamlined to match the definitions of sociodemographic questions in the Estonian census, as well as co-ordination of spatial zoning systems with other official data sources. The ITF understands there are efforts underway to conduct such a survey in the immediate future.

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Annex 4.1. Building strategic models

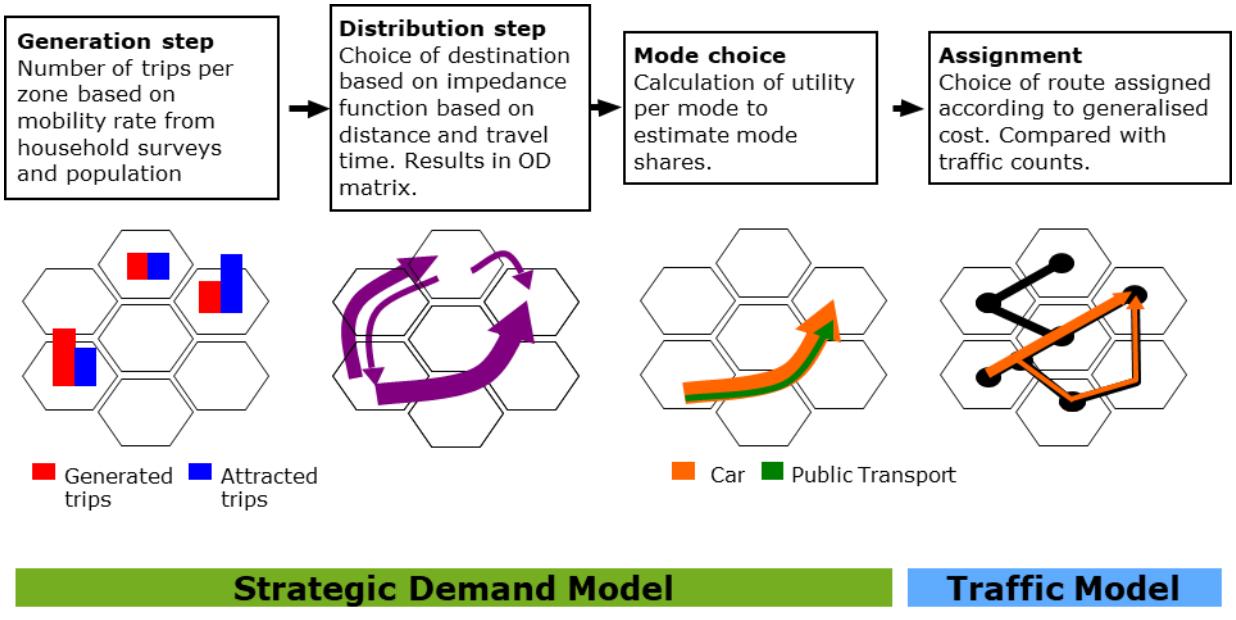
Transport models simulate real-life travel behaviour in a simplified manner. As part of the quantitative component of this policy review, the ITF created a strategic modelling suite comprised of a series of four high-level, sector-specific models. They allow policymakers to test the impact of policy measures on transport indicators which are key to measuring progress in areas such as CO_2 emissions, accessibility, affordability and mode share.

This annex provides a concise overview of the modelling approach. A detailed technical explanation of the methodology has been provided to the Estonian ministry, as with instructions on how to use the strategic modelling tools.

The strategic models follow a well-established approach

The models largely follow a traditional four-step approach to transport modelling to determine travel demand, with an additional step to calculate CO_2 emissions. The outputs of each step feed into the next step as inputs, illustrated in Figure 32. The first step is *trip generation*. Its purpose is to determine the number of trips originating and ending at each zone. The second step, *trip distribution*, distributes trips between all possible combinations of zone pairs in a way that preserves the total trip origins and destinations as determined in the first step; the result is an origin-destination (OD) matrix. The third step, *mode choice*, estimates the share of trips taking each mode for each OD.

Figure 32. Four-step transport modelling methodology to determine travel demand and calculate CO_2 emissions



A demand model encompasses the first three steps. The fourth step, *trip assignment*, assigns each trip, from each more to the available road and public transport network. The additional step is required when developing a traffic model. Traffic models are useful for making specific project design decisions. They go

beyond the scope of a strategic model such as this one, which allows the testing of high-level policy scenarios.

Data availability defines model robustness

Data is at the heart of a model building and validation process. The level of detail that is possible within the model, as well as tests of its validity, require adequate data. For the urban passenger model, two household travel surveys provided by the Estonian Road Administration, Tallinn HHTS (2015), and Harju/Rapla (2018b) indicate the *revealed preferences* of individuals, connecting their sociodemographic and geographic characteristics with their travel choices. The respondents are asked their residential location, several sociodemographic questions, the origin and destination of all trips on a given day, and the mode used. This data informs the algorithm that mimics decision-making within the model. Sociodemographic data is also used to expand the insights of the HHTS data to the population of the region. The boundaries of the modelled region are limited to the area covered by the HHTSs. Trip characteristics are computed using OpenStreetMap road network data and the nationwide GTFS feed. The ITF validated the urban model using commuting data from Statistics Estonia.

The national passenger model uses some assumptions from the urban model to determine the trip rate, or volume of trips being made in each of the counties, as well as the sensitivity to certain trip characteristics. These calculations are adapted to the national transport context, using Statistics Estonia data on commuting choices. This is coupled with mobile phone-based OD data from the Mobility Lab at the University of Tartu to understand the distribution of trips. The model is validated using rail trip and pkm data and bus and car vkm data.

International passenger model

The framework for modelling international passengers is based on the work done for the ITF Transport Outlook (2019) at the global level. In the recent years, the ITF's previous international aviation model has been extended to include all non-urban passenger mobility in all main passenger modes (except maritime passengers' movements such as cruise shipping that are mainly recreational and not a derived transport activity). The model separates the inter-urban traffic from the regional traffic not measured already in the urban passenger model. The inter-urban traffic is assessed using a four-step model approach that starts with the setting of the travel demand - propensity to travel (for different travel ranges), continues with destination choice, mode choice and finally route assignment (for the aviation component). All this is developed under a unified model where surface modes can be used as "feeding" modes to aviation and the propensity to travel of all modes is interdependent while allowing for modal transfers to occur.

The regional model results originate from a travel activity generation model; the travel demand is then split among the surface modes available in each region, given the local context variables (e.g. infrastructure, car ownership).

Freight Model

The framework for modelling freight is based on the work done for the ITF Transport Outlook (2019) at the global level. International and domestic flows are aligned to match the national tkm activity forecast calibrated from the data reported by countries. Both are matched using a calibration procedure that

improves the route assignment but also assesses the domestic component of international freight and the share of urban freight. The international component still estimates activity for 19 commodities for all major transport modes and routes, while taking into account different transport and economic policy measures (e.g. the development of new infrastructure networks, or the alleviation of trade barriers). OECD trade projections (https://stats.oecd.org/) are used to convert trade in value terms into freight volumes. The ITF model framework consists of the following components: 1.Trade flow disaggregation model, 2.Value-to-weight model, 3.Mode choice model, and 4. Equilibrium route choice model. The following elements were extracted from the model to build a simplified model under Excel: OD characteristics (time and cost), OD flows in weight by commodity and by mode, elasticities of mode share to the ODs characteristics. The model was validated against available statistics of the freight activity in Estonia in tkm.

The model components of the ITF Freight model are:

- International components
    - Trade forecast model: uses the ENV-Linkages model (ENV-OECD) [https://www.oecd.org/env/45334643.pdf]
    - Spatial discretisation: currently with 404 zones around the world
    - Generation of trade OD matrix: based on raster-based estimates of GDP in the influence area of each centroid. The model now splits the trade of each commodity and takes into account the structure of the economy in the region of each centroid (economic sector).
    - Value-to-weight model: converts the trade value into weight, given the economic profile of each OD pair but also the existing connectivity (log-sum indicator of the transport supply costs for the OD pair).
    - Mode choice model: improved representation of logistic chains in the intermodal transport in maritime routes. The model has a better representation of costs and a relevant element for mode choice.
    - Equilibrium assignment: assignment to the shortest path and updating of cost and times of capacitated network elements (ports, road, rail and sea links). The model incorporates the cost estimation of each route as the main element to estimate route choice.
- Surface domestic model:
    - Demand generation module: Poisson regression with socioeconomic variables
    - National surface centroids: set coverage model over the GDP raster background
    - National OD matrix: gravitational formula to estimate the flow between each OD pair, given the average distance between OD pairs and the cost structure of shortest paths between origin and destination in different transport surface modes (ail, road and waterways).
    - Network assignment: cost function updated every iteration in co-ordination with the international model.

User-friendly tools are a priority

All four simplified modelling tools are user friendly, fast, and can be operated in Excel. While the Excel-based tool is more pragmatic for use at a strategic level, they are based on more detailed modelling

by ITF. In the case of the urban and national passenger models, the ITF first built a more detailed model using R software which was calibrated at a finer level of detail. The second, aggregated Excel-based model relies on some outputs from R and produces similar results in an Excel-based version of the tool. The complexity of the trip generation and distribution steps are better suited for software like R, while Excel allows for user-friendly manipulation of the mode choice step which is key to testing changes in user behaviour. For international freight and passenger models, the same simplifying principles have been applied: the mode choice estimates are implemented through elasticities to cost and time that are extracted from the models.

Annex 4.2. Affordability and accessibility modelling results

Urban model affordability and accessibility results by trip

To understand the time and cost average per trip results, it is first important to understand how average trip lengths per mode change. Average trip time is calculated as the total travel time taken on a given mode, divided by the number of trips made by that mode. Likewise, average trip cost is the total travel cost on a given mode, divided by the number of trips on that mode. Both time and cost are driven by the length of trips.

The distance and demand for each OD is fixed between all three scenarios. It is assumed that trip distribution does not change, therefore, the measures play primarily on mode choice. Therefore, the total demand (number of trips) and total distance travelled does not change between scenarios, what changes is the modes on which they occur.

The challenge in understanding these results come from the fact that average trip lengths per mode, increase for all modes. This sounds paradoxical, but consider this simplified theoretical example below.

Imagine cases A and B, below, which describe travel between three different zones by three different modes. The total kilometres travelled do not change (142 km), nor do the number of trips (26). You have the same origin-destination pairs with the same distance between them. In Case B, the 5 km car trips drop from 2 to 1; one of these trips from case B switches to bike instead. Since in Case B, car loses one of its shorter trips, its average distance per trip *increases* compared to Case A. This new 5-km bike trip in Case B is longer than the average bike trip, therefore, its average distance per trip *increases*. We see a favourable transition from car to active mode, but since the trip being lost by car is relatively short (for car) and relatively long for an active mode (bike), we see both modes increase their average trip distance. All this is achieved by maintaining the same total distance travelled, total trips travelled, and average of 5.46 km per trip, when considering all modes together.

Figure 33. Theoretical example to explain change in average trip lengths per mode

CASE A:

		Mode			
O-D	Dist (km)	**Car**	**PT**	**Bike**	Total Trips
1 to 2	1	1	1	5	7
2 to 3	5	2	8	1	11
1 to 3	10	7	1	0	8
	Total Trips	10	10	6	26
Total distance (km)		81	51	10	142
Average distance (km)		8.10	5.10	1.67	5.46

CASE B:

		Mode			
O-D	Dist (km)	**Car**	**PT**	**Bike**	Total Trips
1 to 2	1	1	1	5	7
2 to 3	5	1	8	2	11
1 to 3	10	7	1	0	8
	Total Trips	9	10	7	26
Total distance (km)		76	51	15	142
Average distance (km)		8.44	5.10	2.14	5.46

The principles described in the above example are what guide the changes seen in the following sections. The relative increase in trip length between BAU and HA or LA scenarios is responsible for the unintuitive results.

Average trip travel time increases due to mode shift to active modes and public transport

When comparing average trip costs tabulated below (Table 23), the results indicate an increase across all modes. The increase in cost for car trips is intuitive given the results in Table 10. Average travel cost per kilometre by mode. The cost increase per trip for shared mobility and public transport is due to the increase in average trip length for each of these modes. In 2018, trips using shared modes were on average 8.7 km but in the HA scenario the average is 12.6 km. Public transport trips start out as 5.0 km on average and are an average of 7.0 km by 2050 in the HA scenario. Though shared and public transport trips become 45% and 37% longer, respectively, their average trip costs only increase by 29% and 8% due to the per kilometre cost savings. In the LA scenario, trip lengths increase minimally, hence the much smaller impact on total trip cost.

Table 23. Travel cost of an average trip by mode

Scenario	Car	Shared mobility	Public transport	Bike	Walk	All modes
Business as usual	EUR 1.21	EUR 14.92	EUR 0.47	NA	NA	EUR 0.94
High ambition	EUR 3.64 (+201%)	EUR 19.31 (+29%)	EUR 0.51 (+8%)	NA	NA	EUR 1.79 (+91%)
Low ambition	EUR 1.78 (+47%)	EUR 15.25 (+2%)	EUR 0.48 (+1%)	NA	NA	EUR 1.16 (+24%)

Even with the public transport tarif there is substantial mode shift resulting in longer public transport trips (compared to BAU). The longer trips, combined with the per kilometre costs (tariff) increase, results in a 62% and 51% increase in cost per trip, respectively, for the HA and LA scenarios.

User charging increases cost of car use to encourage mode shift

When comparing travel time at the trip level, there are increases in the HA scenario across all modes despite the speed improvements shown in Table 11. Average travel time per kilometre by mode. The explanation is the same as for the increase in cost per trip. Due to the mode shift, there is a disproportionate increase in longer PT, bike and walk trips. In the LA scenario, as explained above, there is less shift in trips overall. The lack of shift to public transport trips means the trip distance remains about the same, and therefore total trip time decreases. There is minimal change in the active trips. The changes in car and shared trip times are more significant because LA scenario does not discourage Tallinn based car trips in the absence of congestion charges.

Table 24. Travel time of an average trip by mode

Scenario	Car	Shared Mobility	Public Transport	Bike	Walk	All Modes
Business as usual (minutes)	11.0	11.0	28.1	8.2	27.4	18.2
High ambition (minutes)	14.3 (+29%)	19 (+72%)	32.4 (+15%)	9.7 (+18%)	30.7 (+12%)	25.9 (+43%)
Low ambition (minutes)	15 (+36%)	15.1 (+37%)	25.1 (-11%)	8.3 (+1%)	27.4 (0%)	20.6 (+13%)

Note: It was noted during the Apr 22, 2020 virtual workshop with Estonian stakeholders that the average walk times were longer than expected. ITF relied on the HHTS data from Harju/Rapla and Tallinn when calibrating the model. While data was "cleaned" to remove any trips longer than an hour, there were a significant number of trips between zones that resulted in the averages seen above. It is also important to note that the granularity of this model prevents the differentiation between very short walking trips of a few minutes and those closer to the times seen here.

Combining the benefits of individual measures can be greater than the sum of its parts

Table 25 summarises the individual impact of each measure if implemented in isolation. The total effect of all behaviour change measures is also listed, as is the full implementation of all measures. It is important to note that the collective impact of a group of measures is not the sum of the impact of individual measures. Each outcome from a combination of policies will differ from the sum of its parts due to interaction between policy outcomes.

Note that the time and cost calculations are presented as all mode averages and are weighted by trip lengths per mode.

Table 25. Percentage change in mode shares, affordability, accessibility, and CO_2 emissions due to suggested urban policy measures.

Proposed measures	Relative trip mode share changes compared to BAU										Affordability: Change in average trip cost		Accessibility: Change in average travel time		CO_2 emission reduction	
	HA					LA					HA	LA	HA	LA	HA	LA
	Car	Shared	Public Transport	Bike	Walk	Car	Shared	Public Transport	Bike	Walk	All mode average		All mode average		Total CO_2 emissions	
Behaviour change measures																
User charging – Congestion charge for Tallinn	-27%	64%	44%	26%	23%	0%	0%	0%	0%	0%	53%	0%	25%	0%	-9%	0%
User charging – Tolling	-10%	53%	19%	7%	5%	0%	0%	0%	0%	0%	52%	0%	12%	0%	-4%	0%
Parking pricing	-3%	5%	4%	3%	3%	-3%	5%	4%	3%	3%	30%	30%	2%	2%	-1%	-1%
Reallocation of road space (in Tallinn)	-3%	-2%	1%	6%	7%	-3%	-2%	1%	6%	7%	-2%	-2%	3%	3%	-2%	-2%
Off-street parking regulations (in Tallinn)	-5%	7%	8%	5%	5%	-5%	7%	8%	5%	5%	-0.3%	-0.3%	13%	13%	-2%	-2%
Public transport improvements	-2%	-2%	8%	-2%	-1%	-2%	-2%	8%	-2%	-1%	-1.1%	-1.1%	-3%	-3%	-1%	-1%
Vehicle fleet transition optimisation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-29%	-5%
TOTAL (Behaviour change measures	**-48%**	**138%**	**81%**	**42%**	**37%**	**-13%**	**7%**	**20%**	**13%**	**13%**	**91%**	**24%**	**43%**	**13%**	**-43%**	**-10%**
Cost recovery measures																
Increase PT tariff	0%	0%	-1%	0%	0%	0%	0%	-1%	0%	0%	5%	5%	-0.2%	-0.2%	0.2%	0.2%
TOTAL (Behaviour change measures + Cost recovery)	***-48%***	***140%***	***79%***	***43%***	***37%***	***-13%***	***8%***	***19%***	***13%***	***13%***	***100%***	***29%***	***42%***	***13%***	***-48%***	***-11%***

Note: Affordability and accessibility are tabulated as an all mode average. These values are weighted based on the number of passenger kilometres travelled by each mode. Therefore, policies which slow down car travel but speed

up other modes, like reallocation of road space for example, can result in a small overall increase in the average mode travel time, because the majority of passenger kilometres are travelled by car.

Table 26 summarises the main findings from the inter-urban models, for each individual measure tested at the national level, and all together.

Table 26. Summary of main findings from inter-urban models

Proposed measures for the high ambition scenario	Main passenger result	Main freight result
Railway improvements	Rail share double (from 2% to 4%) (-34 000 yearly tonnes of CO_2)	Rail share +0.3%
Electrification of railways	Passenger CO_2 reduced by -0.7% (-13 000 yearly tonnes of CO_2)	Rail freight CO_2 reduced by -46% (-25 000 yearly tonnes of CO_2)
Car fleet transition and optimisation	Passenger CO_2 reduced by -30% (-508 000 yearly tonnes of CO_2)	-
All measures together	Rail share double (from 2% to 4%) Passenger CO_2 reduced by -30% (-544 000 yearly tonnes of CO_2)	Rail share +0.3% Rail freight CO_2 reduced by -46% (-25 000 yearly tonnes of CO_2)

International Transport Forum

The Future of Passenger Mobility and Goods Transport in Estonia

Input Study for the Estonian Transport and Mobility Master Plan

This report reviews strategic planning in Estonia's transport sector to support the development of a Transport and Mobility Master Plan 2021-30 for Estonia. It assesses ten key aspects of transport policy with recommendations for reform. The impact of selected proposed reforms are examined under different scenarios modelled for this study.

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