



ENVISIONING THE TRANSPORT AGENCY OF THE FUTURE

STATE OF EXISTING KNOWLEDGE

TECHNICAL COMMITTEE 1.1 *PERFORMANCE OF TRANSPORT ADMINISTRATIONS*



STATEMENTS

The World Road Association (PIARC) is a nonprofit organisation established in 1909 to improve international co-operation and to foster progress in the field of roads and road transport.

The study that is the subject of this report was defined in the [PIARC Strategic Plan 2024–2027](#) and approved by the Council of the World Road Association, whose members are representatives of the member national governments. The members of the Technical Committee responsible for this report were appointed by the member national governments for their special competences.

Any opinions, findings, conclusions and recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of their parent organisations or agencies. For further details see www.piarc.org.

*Copyright by the World Road Association. All rights reserved.
World Road Association (PIARC)
Arche Sud 5° niveau
92055 La Défense cedex, France*

International Standard Book Number: 978-2-84060-

Front cover © Shutterstock

ENVISIONING THE TRANSPORT AGENCY OF THE FUTURE

STATE OF EXISTING KNOWLEDGE

TECHNICAL COMMITTEE 1.1 *PERFORMANCE OF TRANSPORT ADMINISTRATIONS*

AUTHORS / ACKNOWLEDGEMENTS

This Report is written within the mandate of PIARC Technical Committee (TC) 1.1 (Performance of Transport Administrations) and the activities of Working Group 1 (WG1) which, between 2024 and 2027, is studying the topic of *Envisioning the Transport Agency of the Future* as set out in the PIARC Strategic Plan and associated programme of activities.

The Working Group consists of: Co-leaders, Jonathan SPEAR (United Kingdom) and María Eugenia MARTÍNEZ DONAIRE (Spain) and the following members:

- Sylvain HAON (Belgium)
- Romaine MORRISON (Canada)
- Xiadong GU (China)
- Zilong XIE (China)
- Mingyue YAN (China)
- Hamideh DEGHANI SAMANI (Iran)
- Pierpaolo CARTOLANO (Italy)
- Berik KAMALIEV (Kazakhstan)
- Nurzhan ZHUKABETOV (Kazakhstan)
- Alexandru PETCOVICI (Romania)
- Wee Shan LAM (Singapore)
- Chandrasekar s/o PALANISAMY (Singapore)
- José Manuel BLANCO SEGARRA (Spain)
- María Eugenia MARTÍNEZ DONAIRE (Spain)
- Silvester HAONGA (Tanzania)
- Kitti SAPRASSOM (Thailand)
- Mark Henry RUBARENZYA (Uganda)
- Isaac WANI (Uganda)
- Jonathan SPEAR (United Kingdom)
- Christos XENOPHONTOS (United States)
- Matthew DAUS (United States)

The following individuals have directly contributed during the writing process of this Report with their feedback and recommendations: Jonathan SPEAR (United Kingdom), M^a Eugenia MARTÍNEZ DONAIRE (Spain), Deanna BELDEN (USA), Hannah DiLULLO (USA) and Christos S. XENOPHONTOS (USA). Quality control was carried out by Caroline EVANS (Australia) PIARC Strategic Theme Coordinator – Road Administration and PIARC General Secretariat.

The Technical Committee is chaired by Christos S. XENOPHONTOS (USA). Alan COLEGATE (Australia), Ariane DUPONT-KIEFFER (France) and José Manuel BLANCO SEGARRA (Spain) are respectively the English, French and Spanish-speaking Secretaries.

In addition, the Working Group wishes to acknowledge the constructive contributions and feedback of other members of TC 1.1 and wider PIARC roads and transport community, as well as various initiatives of the American Association of State Highway and Transportation Officials (AASHTO), International Association of Transport Regulators (IATR), and Transportation Research Board (TRB), in discussing, shaping, challenging and evolving the material set out in this Report.

Furthermore, PIARC and Technical Committee 1.1 would like to recognize the organisers and participants of the following multilateral partner events that have continued the discussions on the Transport Agency of the Future. A portion of this report provides a summary of these discussions and recommendations.

PIARC World Road Congress – Prague (October 2023)

Title: [The Transportation Agency of the Future \(Workshop WS05\)](#)

Organizer: PIARC's Technical Committee 1.1, Performance of Transport Administrations

Additional Organizers: AASHTO, ERTICO, FHWA, IATR, PIARC, TRB

Organizing Committee: Christos S. XENOPHONTOS (TC 1.1, AASHTO, TRB), Matt DAUS (TC 1.1, IATR, TRB), Jonathan SPEAR (TC 1.1), Nathan HIGGINS (TC 1.1), John KALISKI (TRB AJE10)

Workshop Chairs: Christos S. XENOPHONTOS (PIARC TC 1.1 Chair) & Victoria SHEEHAN, Executive Director (Transportation Research Board)

Moderators: Karen BOBO (for Shailen BHATT, USA) & Victoria SHEEHAN, USA

Participants: Nazir ALLI (South Africa), Alan COLEGATE (Australia), Susanne NIELSEN SKOVGAARD (Sweden), Carlos BRACERAS (USA), Dr. Angelos AMDITIS (ERTICO), Matt DAUS (IATR), Emanuela STOCCHI (IBTTA), Patrick MALLEJACQ (PIARC), Sylvain HAON (UITP)

TRB Annual Meeting – Washington DC (January 2024)

Title: [Designing the Transportation Agency of the Future \(Workshop 1050\)](#)

Organizer: TRB's Standing Committee on Strategic Management (AJE10)

Additional Organizers: AASHTO, PIARC, TRB's International Coordinating Council (A0020C)

Workshop Chair: John KALISKI (TRB AJE10)

Moderators: Victoria SHEEHAN (TRB) & Shailen BHATT (FHWA)

Participants: Christos S. XENOPHONTOS (PIARC TC 1.1), Patrick MCKENNA (Missouri Department of Transportation, USA), Deanna BELDEN (Minnesota Department of Transportation, USA), Meghan HAGGERTY (Massachusetts Department of Transportation, USA), Patrick MALLEJACQ (PIARC), Jannine MILLER (State Road and Tollway Authority, Georgia, USA), Greg SLATER (Tampa Hillsborough Expressway Authority, USA), Alex WALCHER (ASFINAG Bau Management GmbH, Austria), Pat MAHER (Transport Infrastructure Ireland, Ireland)

Transport Research Arena – Dublin (April 2024)

Title: [TRA 2024 Host Session - Transport Agency of the Future](#)

Organizer: Transport Infrastructure Ireland, TRB's International Coordinating Council (A0020C), PIARC's TC 1.1, and AASHTO

Workshop Coordinators: Dr. Albert DALY and Jennifer SHERRY (Transport Infrastructure Ireland - TII), Christos S. XENOPHONTOS (TRB A0020C & PIARC TC 1.1)

Moderators: Victoria SHEEHAN (TRB) & Patric MALLEJACQ (PIARC)

Participants: Shailen BHATT (FHWA), Victoria SHEEHAN (TRB), Maja MARKOVČIĆ KOSTELAC (European Maritime Safety Agency EMSA), Sylvain HAON (UITP), Hugh GILLIES (Transport Scotland),

Kenny JACOBS (Dublin Airport Authority Daa Plc, Ireland), Brendan WALSH (Road Safety Authority of Ireland), Patrick MALLEJACQ (PIARC), Patrick McKENNA (Missouri Department of Transportation), Rachel CAHILL (Transport Infrastructure Ireland - TII), Anne GRAHAM (National Transport Authority, Ireland), Brian CRONIN (USDOT ITS Joint Program Office), Andreas BOSCHEN (SESAR 3 JU), and Dr. Angelos AMDITIS (ERTICO & ICCS)

TRB Online Webinar (August 2024)

Title: [Designing the Transportation Agency of the Future](#)

Organizer: TRB's Standing Committee on Strategic Management (AJE10)

Additional Organizers: TRB's Executive Office, National Cooperative Highway Research Program

Moderator: John KALISKI (TRB AJE10)

Participants: Victoria SHEEHAN (TRB), Roger Millar (Washington State Department of Transportation) & Jonathan SPEAR (PIARC TC 1.1)

International Conference on Highway Engineering – Bangkok (September 2024)

Title: [Envisioning the Transport Agency of the Future](#)

Organizer: PIARC's Technical Committee 1.1, Performance of Transport Administrations

Additional Organizers: Department of Highways Thailand & Roads Association of Thailand

Organizing Committee: Christos S. XENOPHONTOS (TC 1.1), Alan COLEGATE (TC 1.1), and Dr. Auckpath SAWANGSURIYA (Department of Highways, Thailand)

Moderator: Christos S. XENOPHONTOS (TC 1.1)

Participants: Patrick MALLEJACQ (PIARC), Jonathan SPEAR (TC 1.1), Dr. Punya CHUPANIT (Office of Transport and Traffic Policy and Planning Ministry of Transportation – Thailand), Dr. Pattharin SARUTIPAND (Bureau of Planning, Department of Highways – Thailand), Mark Henry RUBARENZYA (TC 1.1), Matthew W. DAUS, Esq. (IATR & TC 1.1).

CONTENTS

1. INTRODUCTION 2

1.1. ENVISIONING THE TRANSPORT AGENCY OF THE FUTURE 2

1.2. WORK PROGRAMME 2023 – 2027 4

1.3. THIS REPORT 5

2. EVIDENCE FROM PREVIOUS PIARC REPORTS 6

2.1. OVERVIEW..... 6

2.2. MULTI-MODAL TRANSPORT GOVERNANCE (2015) 6

2.3. CHANGE MANAGEMENT (2019) 9

2.4. DISRUPTIVE TRANSPORT TECHNOLOGIES AND SERVICE MODELS (2023) 12

2.5. MANAGING INNOVATION (2023) 18

2.6. FINAL REMARKS ON PREVIOUS PIARC REPORTS 22

3. EVIDENCE FROM PREVIOUS EVENTS 23

3.1. OVERVIEW..... 23

3.2. PIARC WORLD ROAD CONGRESS – PRAGUE (OCTOBER 2023) 23

3.3. TRB ANNUAL MEETING – WASHINGTON DC (JANUARY 2024)..... 27

3.4. TRANSPORT RESEARCH ARENA – DUBLIN (APRIL 2024) 29

3.5. TRB ONLINE WEBINAR (AUGUST 2024)..... 36

3.6. INTERNATIONAL CONFERENCE ON HIGHWAY ENGINEERING – BANGKOK
(SEPTEMBER 2024) 40

3.7. FINAL REMARKS FROM WORKSHOPS AND SEMINARS 47

4. EMERGING CONCLUSIONS FROM PREVIOUS EVIDENCE... 49

4.1. OVERALL CONCLUSIONS 49

4.2. UPDATE TO WORKING HYPOTHESES FOR THIS PROGRAMME..... 49

4.3. NEXT STEPS..... 51

5. GLOSSARY 52

1. INTRODUCTION

1.1. ENVISIONING THE TRANSPORT AGENCY OF THE FUTURE

Over the last decade, there have been unprecedented changes impacting the roads and transport sector with the rise of new technologies and service models, climate change, new forms of work and leisure, and the evolution of a complex and technology-enabled mobility ecosystem at a fast pace. This creates a context of the sector facing important challenges originating from systemic and ongoing changes in society, economy and environment.

Transportation agencies must keep on track of these trends while continuing with their central mission of providing essential services in the movement of passengers and freight, building, operating and maintaining critical infrastructure, as well as ensuring customer safety and welfare within the limits of environmental and social sustainability. On top of that, the COVID-19 Pandemic, changing weather patterns and extreme events due to climate change, and ongoing geopolitical conflicts, and associated economic tensions, have directly impacted the transport sector and have surfaced two main facts. On one hand the traditional “predict and provide” method for planning infrastructure is no longer valid with transport agencies having to learn to deal with future uncertainty by becoming more flexible, adaptable and resilient; on the other hand, transportation continues to play an essential role in serving basic social and economic needs of individuals and communities, including agile management, resilience and recovery to a range of foreseen and unforeseen events.

Moreover, transportation is central, and must adapt, to achieve the Sustainable Development Goals by 2030, and to meet the Paris Agreement target of limiting global temperature increase to 1.5 degrees above pre-industrial levels by 2050. The UNFCCC Climate Action Pathway – Transport, and the European Green Deal, share the vision of a net zero or carbon neutral, transport system by 2050, requiring a range of multi-faceted technical, policy, regulatory and governance actions.

Addressing this new paradigm of transportation and mobility will not be possible for transport agencies without embracing transformative visions for the future. This requires a change of mindset and the adoption of collaborative, agile and open innovation not only in the movement of people, goods and services, but also in agencies’ own organisational structures, processes and resources. Governance models should also reflect wider trends in human resource management and change externally through engaging with and convening partners and stakeholders from multiple interests. The latter include private sector, academia, civil society, advocacy groups and grassroots associations, recognising and enabling each to play a productive, aligned and appropriate role.

With this context in mind, Working Group 1 (WG1) of PIARC Technical Committee 1.1 (Performance of Transport Administrations) has been convened over the 2023 – 2027 Strategic Planning Cycle to undertake a study programme entitled *Envisioning the Transport Agency of the Future (ETAF)*. This programme, building on previous research, will focus on how transport agencies should evolve to meet changing needs and customer expectations with highlights on important aspects such as evolving role and function, planning for uncertainty, future operating models, workforce and skills definition, assessing the impact of technology and digitalisation and incorporating innovation at the organizational level. In addition, the Working Group seeks to identify how transport agencies enable effective engagement and dialogue with the evolving stakeholder ecosystem and how they work with other public, private and civil society entities to carry out their mission.

Honing the work programme to be efficient, focused and avoiding duplication with other parallel investigations, Figure 1.1 sets out the key areas which will direct WG1's activities over the coming four years. It is emphasised that the primary focus of enquiry is organisational visioning, strategic planning, policy, regulation, operating models, and structural change within transport agencies with a medium-term time horizon of 2030, as well as long-term potential for broader change to 2050. This leaves technical issues such as infrastructure standards, design approaches, and specification of products and concepts to other PIARC Committees, Task Forces and external fora.

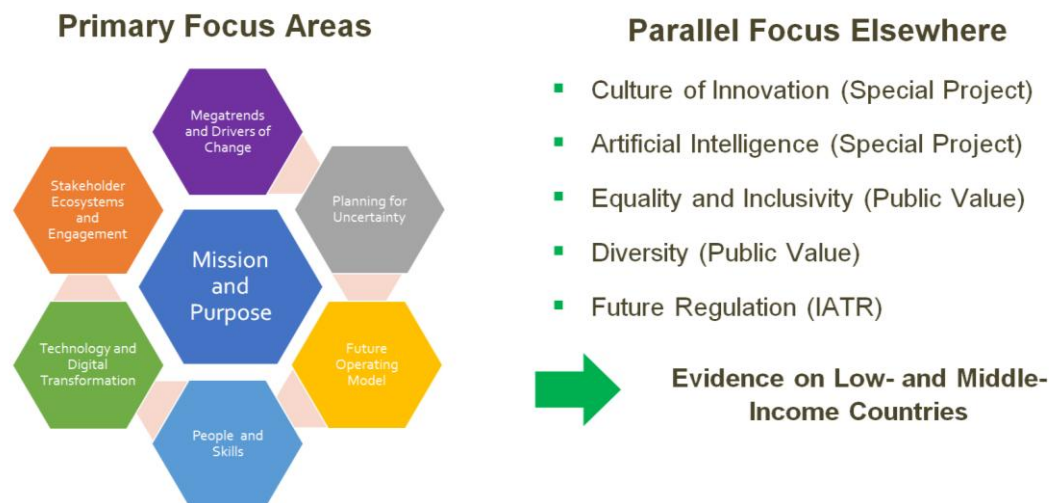


Figure 1.1: Key Focus Areas for Investigation of The Transport Agency of the Future

In undertaking its programme, WG1 is seeking to answer the following Key Lines of Enquiry (KLOEs) on the selected topics:

1. What are the key drivers, external and internal, of interest to transport agencies in the medium-term and far future in terms of socio-economic agendas, environmental sustainability, customer expectations, technological innovation, new forms of mobility and workplace transformation?
2. In the context of uncertainty in the transition or endpoint of these drivers, how might transport agencies set and plan for a range of plausible future circumstances and outcomes, ensuring resilience in policy making, investment and management decisions?
3. What is the purpose, function and mission (raison d'être) of the future transport agency and how does this differ (or does not differ) from the current state?
4. How are transport agencies reviewing and looking to adapt their current organisational arrangements to address their priority drivers and deliver optimum future outcomes, and in which key areas of institutional change, including stakeholder relationships?
5. From potential organisational changes, do distinct operating models emerge for what future transport agencies might look like, how and in which areas it might differ from existing models?
6. How might transport agencies be transformed by advances in technology, digital processes and systems and data, including the emergence of Artificial Intelligence?
7. How can transport agencies foster a culture and enabling environment for innovation?
8. How do organisational challenges, potential responses and the capacity to implement them

vary between transport agencies and associated organisations in high-income countries and countries and regions at different stages of development?

9. In moving towards the envisioning future stage, what actions and support are recommended for transport agencies now in order to ensure optimal medium and longer-term outcomes, reduce disruption and avoid unintended consequences?
10. How do the recommendations of WG1 align with other research by TC 1.1, namely on public value creation and future workforce development, and inform future PIARC activities?

1.2. WORK PROGRAMME 2023 – 2027

Working Group 1 has adopted an interactive work programme to address the focus areas and answer the questions above, commencing in February 2024 (in Paris) and reporting at the next World Road Congress in October 2027 (in Vancouver). The outline programme approach is set out in Figure 1.1 below, with methods and evidence base including literature review, questionnaire surveys of transport agencies, development of conceptual frameworks and investigation of in-depth case studies. In addition, the Working Group’s participation in Technical Committee 1.1 meetings and seminars is expected to generate ongoing discussions and exchanges between road and transport professionals which should inform answers to the key questions posed and prompt new questions of research.

In order to focus efforts, the work programme has been split into eight focused tasks as follows:

- Task 1 – Review of Previous Work and Evidence;
- Task 2 – Literature Review;
- Task 3 – Questionnaire Survey;
- Task 4 – In-Depth Case Studies;
- Task 5 – Roundtable and Discussions, aligned with TC 1.1 Meetings;
- Task 6 – Operating Model, Key Dimensions and Components;
- Task 7 – Technical Reporting; and
- Task 8 – Preparation and Participation at the World Road Congress 2027.

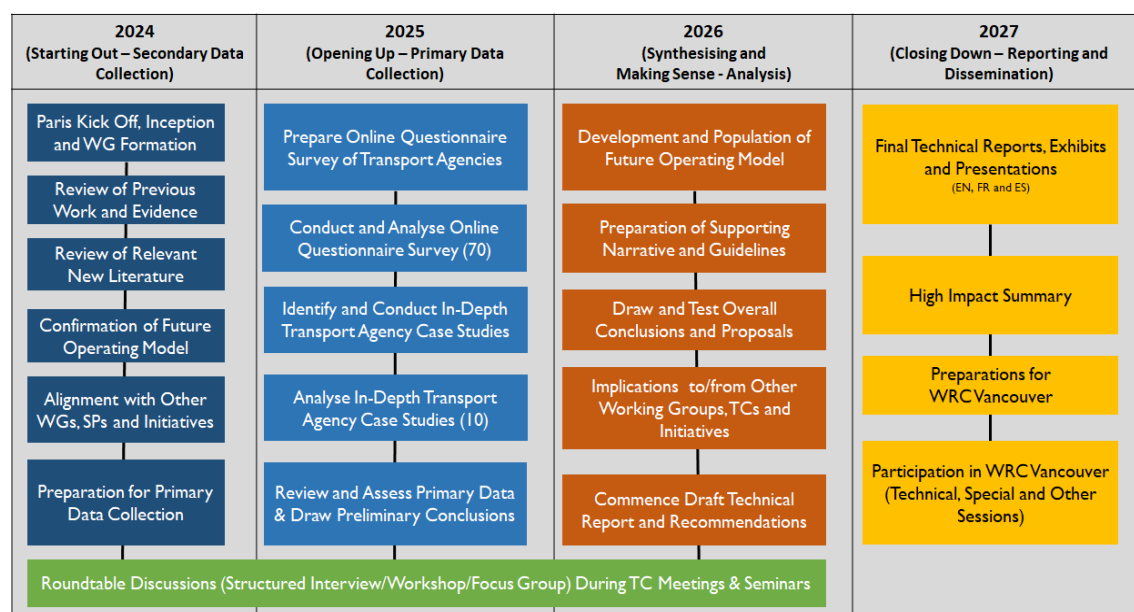


Figure 1.2: Methodological Approach to Envisioning the Transport Agency of the Future

The initial focus in 2024 is on Tasks 1 and 2 which will be combined to produce an integrated State of Knowledge. This will focus on secondary evidence which will inform primary data collection and development of concepts in 2025 and 2026, and the Final Technical Report in 2027.

Working Group 1 will actively collaborate with the other Working Groups within TC 1.1 in ensuring that key issues associated with the topic are tackled without duplication. These include Transport Agency purpose around public value, workforce and skills, as well as issues around equity, inclusivity and diversity. Liaison will also include other PIARC Technical Committees, Task Forces and Special Projects as required.

1.3. THIS REPORT

Working Group 1 is fortunate that considerations around The Transport Agency of the Future commenced during the previous PIARC Cycle and can draw on a range of previous evidence. This Report draws on this, including results from previous PIARC research such as:

- Evolution of the Mission and Structure of Transport Administrations (TC 1.1, 2016);
- Evaluating the Transformation of Transport Administrations (TC A.1, 2019);
- The Role of Transport Agencies in Shaping Disruptive Technologies and Service Models (TC1.1, 2023); and
- Managing Innovation in the Road Sector (PIARC Special Project, 2023).

This Report also draws on parallel development of technical ideas by TRB and AASHTO on Critical Issues for Transportation and the NCHRP Collective and Individual Actions to Envision and Realize the Next Era of America's Transportation Infrastructure (Moonshot) Project. It reflects discussion at dedicated workshops on relevant topics, including the World Road Congress in Prague (October 2023), TRB Annual Meeting in Washington (January 2024), Transport Research Arena in Dublin (April 2024) and an online webinar on Designing the Transport Agency of the Future held by TRB (August 2024).

Finally, the Report has been updated to include relevant workshop discussions hosted by TC 1.1 at the International Conference on Highway Engineering (iCHE) organised between the Ministry of Transport, Department of Highways of Thailand, and PIARC, in Bangkok in September 2024.

The remainder of this report is structured as follows:

- Chapter 2 summarises PIARC technical reports produced by predecessors to TC 1.1;
- Chapter 3 sets out evidence from PIARC workshops, as well as associated events held by TRB, TRA and others, on the topic of The Transport Agency of the Future over the past year; and
- Chapter 4 summarises overall conclusions and sets out an evolving, working hypotheses for the Transport Agency of the Future which will be subject to further consideration over the remainder of the WG1 work programme to 2027.

The intention is that the findings of this Report will be combined with evidence from Task 2 (Literature Review) of the work programme to produce a combined State of Knowledge by the beginning of 2025. This will lay the basis for subsequent primary data collection and analysis, principally a questionnaire survey and in-depth case studies, over the remainder of 2025 leading to policy recommendations and guidance in subsequent stages.

2. EVIDENCE FROM PREVIOUS PIARC REPORTS

2.1. OVERVIEW

This Chapter sets out evidence relevant to the research focus areas contained in a range of previous Technical Reports produced by predecessors to Technical Committee 1.1, as well as Special Projects, under PIARC Strategic Planning Cycles from 2013 to 2023. Four reports have been reviewed as follows:

- *Evolution of the Mission and Structure of Transport Administrations (2015);*
- *Evaluating the Transformation of Transport Administrations (2019);*
- *The Role of Transport Agencies in Shaping Disruptive Technologies and Service Models (2023); and*
- *Managing Innovation in Transport Agencies (2023).*

At the time of writing, a second Special Project – *Artificial Intelligence in the Road Sector* – is under way and is expected to be reported in November 2024. WG1 is represented on the Project Oversight Team (POT) of this Special Project and will incorporate relevant findings for transport agency structures, processes and other dimensions as appropriate in due course.

2.2. MULTI-MODAL TRANSPORT GOVERNANCE (2015)

Evolution of the Mission and Structure of Transport Administrations (2015)

This PIARC research commenced with the proposition that road agencies exist within, and must pay increasing regard to, a multi-modal and multi-sector environment linked to broad economic, social and environmental objectives. Transport needs to be explained in a wider context which is constantly evolving. Users of the transport network want to conveniently and easily travel, with flexibility and convenience to switch between modes and networks as they need and as network conditions require to get to their destination and meet their goals on a whole journey basis.



In the 2012 – 2015 Cycle, TC 1.1 focused on investigating the evolution of missions and structures of road agencies in the context of multi-modal planning and delivery. This included a focus on various mechanisms for integration of roads and transport planning, approaches for informal and formal collaboration between mode-specific delivery agencies as well as the shift seen in some countries, regions and cities towards the development of new integrated transport agencies with responsibilities, powers and resources across all transport modes and networks.

The Working Group's programme was based on a literature review, questionnaire survey and in-depth case studies to consider the benefits of, and the optimum means of achieving, multi-modal planning and delivery across the asset life cycle. From these approaches, a Conceptual Model and Toolkit for Multi-Modal Planning and Delivery was developed, as shown below, further supported by

guidance on process, issues and practicalities associated with structural reform for those organisations considering going beyond collaborative models between mode-specific agencies for the achievement of multi-modal outcomes.

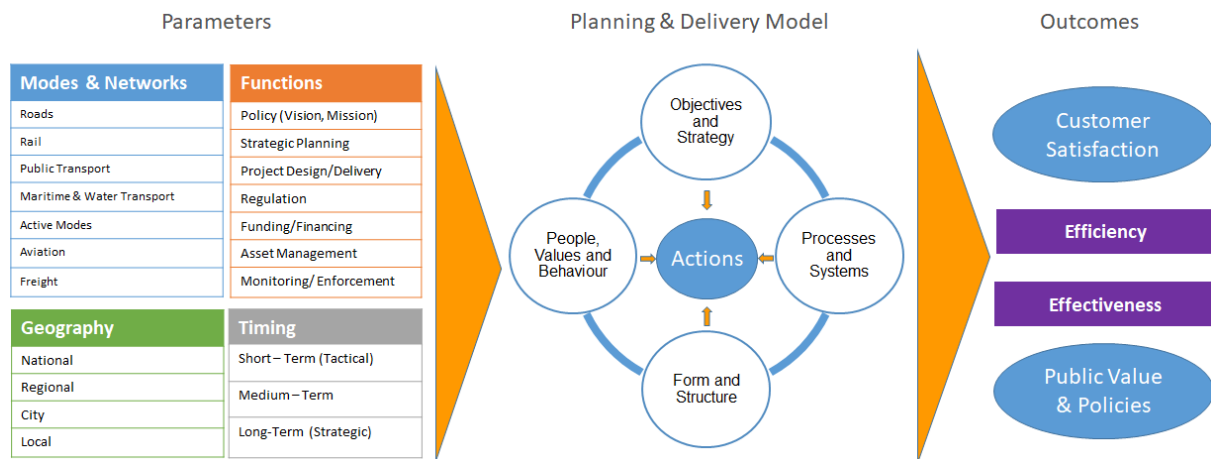


Figure 2.1 – Multi-Modal Transport Planning and Delivery Framework

In most countries, there is a need for at least some kind of body (e.g. Planning Unit, Ministry of Transport or equivalent) to play the “integration” role, working with one or more “supplier” organisations (of which road agencies may be one) to plan, specify, monitor and review multi-modal and mode-specific programmes. Beyond this, there are a range of approaches for achieving multi-modal integration in organisational terms, ranging from informal agreements, through formal partnerships to structural merger and integration – this is set out in the Transport Planning and Delivery Model and Toolkit , with different approaches shown as applying , and being successful , in different countries, regions and localities.

Critical Success Factors

Irrespective of governance model a number of critical success factors were identified for supporting multi-modal planning and delivery as follows:

- **Objectives:** These should relate to higher level economic, social and environmental goals and outcomes which transcend individual transport modes in narrow sectoral terms;
- **Tasks:** With relevant guidelines, models, processes, data and systems towards multi-modal mobility, including identifying and resolving key interfaces; .
- **Stakeholders:** A variety of stakeholders engaged as partners, including policy makers, media, and infrastructure owners and operators at local, regional or national level with the same, or aligned, objectives to provide multi-modal options for users, communicated to the user as a “single source of truth” irrespective of organisational or governance form;
- **Customer Focus:** The customer’s needs must be articulated, understood and optimally satisfied on the basis of whole journeys and shared utility irrespective of mode and network deployed to fulfil individual requirements.
- **Coverage and Values:** Individual transport providers must have a transparent, clear and open organisational structure as well as collaborative relationship with others, reflected and articulated in terms of leadership, culture and values, followed by consequent behaviours and actions.

A key conclusion from the research was that significant benefits for multi-modal planning and delivery geared to the needs of customers can be achieved through common or aligned objectives and policies, shared strategies and plans, data exchange, collaboration and joint working between different agencies. These approaches should be considered and tested before more extensive proposals for structural merger or integration of separate mode-specific organisations are proposed. However, under the right circumstances, and with well-planned and executed reform,

multi-modal transport agencies with the full set of planning, delivery, operational and customer-facing resources across infrastructure and services can achieve substantial benefits of strategic leadership, fulfilment of customer expectations, effective and economically optimised scheme prioritisation and delivery, as well as organisational efficiency savings.

Detailed governance arrangements, implementation practicalities and success factors behind different models are highly place and context specific; there is no evidence which points towards a single set of institutional arrangements being universally applicable or accepted. On this basis, it is for each locality and organisation to largely decide its own course of action and structural form based on the challenges faced, legal and cultural framework, appetite and ambition for change and the specific enablers and constraints on reform posed by stakeholders and political process.

Toolkit of Multimodal Governance Options

Within this context, a toolkit of options was assembled for use in building locally-applicable programmes for multi-modal planning and delivery which encompassed (i) objectives, strategies and plans, (ii) processes, systems and data, (iii) people, values and behaviour and (iv) internal and external organisational form and structure. Many of the dimensions of the Toolkit were less about structure and more around “soft” aspects for processes, values, attitudes, mindsets and behaviours which will be highly applicable to all transport agencies. This is key to success irrespective of organisational form which needs to be embedded through awareness raising, professional development and joint working across different agencies, disciplines and technical backgrounds.

Building on such considerations, conclusions for mode-specific and multi-modal agencies, were drafted for how roads planning and delivery should be taken forward in a wider, complex and rapidly evolving set of policy, customer, programme delivery and public value challenges.

The Report can be accessed from the PIARC website at [2016R23EN](#).

Lessons for the Transport Agency of the Future

The PIARC TC 1.1 research on multi-modal governance from 2012 – 2015 suggests that the Transport Agency of the Future should be:

- *Focused on higher level economic, social and environmental goals and outcomes which transcend individual transport modes in narrow sectoral terms and ultimately define organisational purpose;*
- *Committed to meeting the needs of the customer who often require a range of transport networks, modes and services to get door-to-door to their destination irrespective of the institutional mandates, jurisdictions or functions of individual entities;*
- *Multi-modal, in strategic planning or delivery terms, either through internal organisation or through managing the relevant interfaces with external stakeholders in the public and private sectors;*
- *Capable of securing higher-level goals through “soft” elements of organisational design such as leadership, values, mindsets, culture and aptitude toward open collaboration.*

The research did not find that creating fully integrated multi-modal transport agencies was necessarily an optimum form of organisational structure over retention of single-mode road agencies within wider organisational and stakeholder networks and value chains. Many benefits of integration achievable through informal or formal collaborative governance models without the costs, disruption and potential unforeseen impacts of structural re-organisation.

2.3. CHANGE MANAGEMENT (2019)

Evaluating the Transformation of Transport Administrations (2019)

This PIARC research commenced with the proposition that road and transport administrations across the world face a range of pressures to change the way they plan, organise and deliver services. These pressures vary in nature, for example from changes in the demographic and customer base, new disruptive technologies, evolving economic, social and environmental regulations, through to the constant political drive to deliver enhanced outcomes with reduced public funding and resources.

Transport administrations may have limited direct control or influence over the extent or scope of such pressures. However, they can shape the way they respond, either mitigating negative risks or realising net positive opportunities. This in turn is more likely to maintain or deliver enhanced organisational efficiency, targeted deployment of resources, customer satisfaction and the achievement of public value and policy outcomes.

For this reason, Technical Committee A.1 in the 2016 – 2019 Cycle was charged with evaluating the role of change management in addressing external drivers on the basis of two hypotheses:

- Organisations which anticipate, plan and communicate change in a comprehensive and strategic manner understand what success looks like and how to achieve it; and
- Organisations which are reactive, narrow and tactical in the face of their challenges may experience unforeseen impacts and results well short of desired outcomes.

In considering approaches to transformation and change management, TC A.1 was keen to understand whether there are unified models for achieving successful outcomes or whether local context meant no universal rules and principles could be determined with confidence. Alternatively, there may be a “middle way” for managing change whereby certain central principles could be established, but with organisations left to determine their own way forward in light of their individual local circumstances.

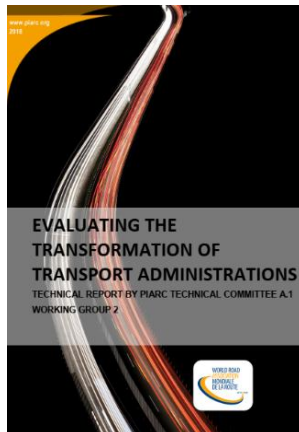
The Working Group’s work programme consisted of a literature review, questionnaire survey, case studies and development of concepts. The main outcomes of the questionnaire were:

- Key change drivers on transport agencies of most significance included technological developments, mitigating and adapting to climate change, multimodality, environmental regulations and budgetary pressures to ensure cost-efficiency whilst maintaining services;
- Transport administrations often attempt to address several external drivers and strategic objectives at once, and may use major changes to introduce additional agendas such as customer orientation, process re-engineering, culture change, and renegotiating relations with partners and stakeholders; and
- Major changes undergone by organisations are mostly planned and proactive, rather than unplanned and reactive, and generally seen as producing positive outcomes.

A key conclusion from the case studies was that transport agencies, as public bodies, potentially carry a ‘bureaucratic heritage’ with traditional management procedures which are often complex and may adapt slowly and with limited opportunities for, and aversion to, innovation. The nature of infrastructure delivery, requiring long-term planning, also shapes organisational culture and processes. Compared to other public agencies and the private sector, infrastructure providers tend to have more risk averse, conservative, centralised and hierarchical organisational values and

culture. On the other hand, staff in public agencies are more likely to be motivated by serving the public interest; this should be positively harnessed in change management exercises.

At the same time, organisational culture, underlying any processes and behaviour, constitutes a force of inertia and a source of potential resistance to change if not addressed carefully. Communication plays a crucial role in preventing and managing such resistance. Providing meaningful narratives in a clear, consistent and targeted manner motivates employees and other stakeholders, creates a sense of shared purpose and is a significant means in the transformation of mental models, beliefs and attitudes.



A dedicated leader, with clear vision and change objectives, can improve chances of a change exercise being successful. Internal leaders of change have the advantages of 'speaking the same language' as current employees, and possessing an understanding of organisational norms, attitudes and culture, as well as procedures, chains of command and hierarchies. On the downside, they run the risk of possessing preconceptions on organisational practices and not being able to adopt the 'eyes of a stranger,' reflecting taken-for-granted beliefs, assumptions and norms. External change managers possess an outsider view, helpful for reflection, critical evaluation and novel ideas, while having comparatively fewer ties and constraints arising out of

organisational membership and belonging to the same culture and hierarchies. Their ability to act more freely than in-house staff can also be advantageous, especially where change is radical, controversial and challenges existing corporate culture.

Conceptual Framework for Change

A Conceptual Framework of Change was produced for how organisations should think about their own change management processes and programmes, adapted to reflect specific ideas, values and needs from a transport administration perspective. The framework is shown below and is conceived within a basic Cause and Effect relationship, broken down into:

- Inputs and Context for Change, including key internal and external drivers;
- Structured Process of Change, with 10 sequential steps of planning, implementation, monitoring and refinement/embedding;
- Dimensions of Change, around seven direct and indirect organisational characteristics; and
- Outcomes of Change, reflecting objectives and desired benefits from the change exercise.

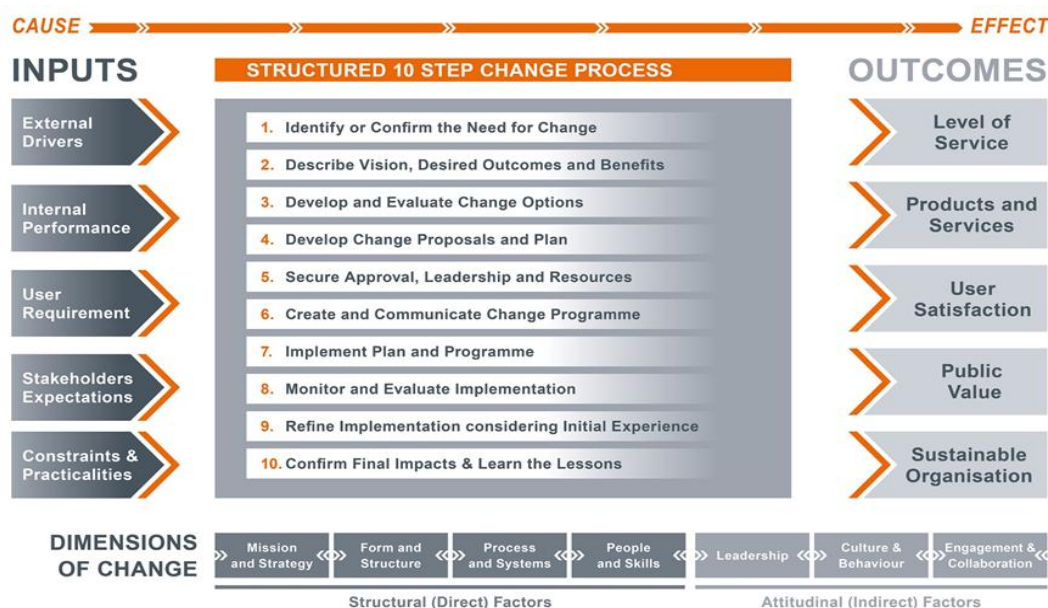


Figure 2.2 – Conceptual Framework for Change

The framework did not take a mechanistic ‘one size fits all’ methodology. Instead its premise was that account needs to be taken of multiple variables, complex and dynamic environments and ongoing adaptation and evolution – involving context, people and key levers of change. It provides a broad-brush approach, based on the chronological stages that typically need to be taken in leading and managing change, whilst leaving details of application, tactics, culture and politics to individual circumstances. As such the framework reflects, and follows, the “middle way” paradigm of change cited above as an initial hypothesis for the Working Group at the start of its programme.

Indeed, within the framework, change varies across several contexts, as follows:

- From incremental (smaller scale changes that build up over time) to transformational (significant or substantial changes in working);
- From planned (designed and orchestrated to provide benefits to the organisation) to emergent (responding to events or external circumstances); and
- From narrow focus (single aspect) to holistic focus (wide ranging covering multiple aspects).

Whilst the presentation of the framework is a logical, orderly and sequential format, in reality change is often fluid, complex, organic and multi-faceted. It may sometimes be (or feel) disorderly, chaotic and full of surprises. Change managers need therefore to be flexible to how they operate, communicate and monitor the process, and adjust, reschedule and flex key activities accordingly, whilst retaining the fundamental vision, objectives and original mandate of change.

In parallel with the Conceptual Framework of Change, TC A.1 drafted guidance for how it should be applied. Of particular significance were six Core Principles of Change which were:

- Be clear about the case for change, with a firm vision and a sense of purpose which has been strongly challenged and tested before action is initiated;
- Focus on a central programme, keeping change as simple as possible and taking care to avoid unnecessary distractions or side-issues;
- Be realistic about the effort and investment needed, budget and release resources with (demonstrated) clarity that long-term benefits outweigh the short-term costs;

- Consider and address all the implications of change, including the potential for blind spots and unforeseen consequences, and anticipate and manage risk;
- Pay attention to people and stakeholder aspects, including issues of organisational culture, taking care to tackle “difficult” issues openly, fairly, honestly and sensitively; and
- Create and maintain momentum, including focus on short-term gains, maintaining business as usual and stakeholder expectations whilst change is ongoing, ensuring follow-through to derive the benefits and avoid declaring victory too soon.

The Report can be accessed from the PIARC website at [2019R21EN](#).

Lessons for the Transport Agency of the Future

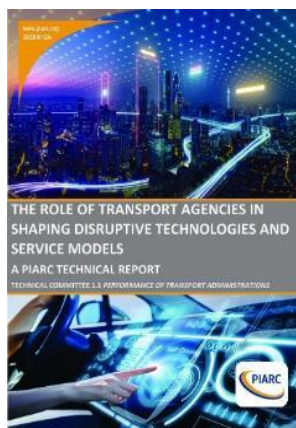
The PIARC TC A.1 research on change management from 2016 – 2019 suggests that the Transport Agency of the Future should be:

- *Focused on identifying, tracking, adapting to and mitigating a range key future trends, both in mitigating potential risks and realising opportunities;*
- *Flexible, and agile to innovation across multiple organisational dimensions, including mindsets, attitudes, culture and behaviour as well as structure and process; and*
- *Committed to planning organisational changes in a strategic and objective-led way, with adequate purpose, method and resources, as well as focusing on business-as-usual operations and reacting tactically to day-to-day challenges as they arise.*

2.4. DISRUPTIVE TRANSPORT TECHNOLOGIES AND SERVICE MODELS (2023)

The Role of Transport Agencies in Shaping Disruptive Technologies and Service Models (2023)

Between 2020 and 2023, Technical Committee 1.1, through its Working Group 2 undertook an extended investigation of disruptive technologies and service models impacting the roads and transport sector, and how transport agencies are responding.



The figure below sets out the key categories of technologies and service models which informed WG2’s analysis and reporting. WG2 sought to answer questions within its scope via a range of data collection and analytical methods, including development of key terminology, an in-depth literature review, questionnaire survey, private sector roundtable, case studies and development of key concepts. The outputs of these methodologies were published as separate Reports, whilst

other outputs are either included within, or available separately alongside, the Final Technical Report.

The combination of new technologies and service models is altering the landscape of how people view mobility, how they travel, and their associated travel attitudes, behaviour and expectations. The convergence of new technologies with the shared economy to connect people, places and things to each other, with innovation driven mainly by the private sector, and to create ecosystems of increasing complexity, responsiveness and personalisation, is resulting in transport agencies re-evaluating their policy and regulatory frameworks, business-models, infrastructure and customer-service concepts, as well as their internal organisational structures, skills and capacities.

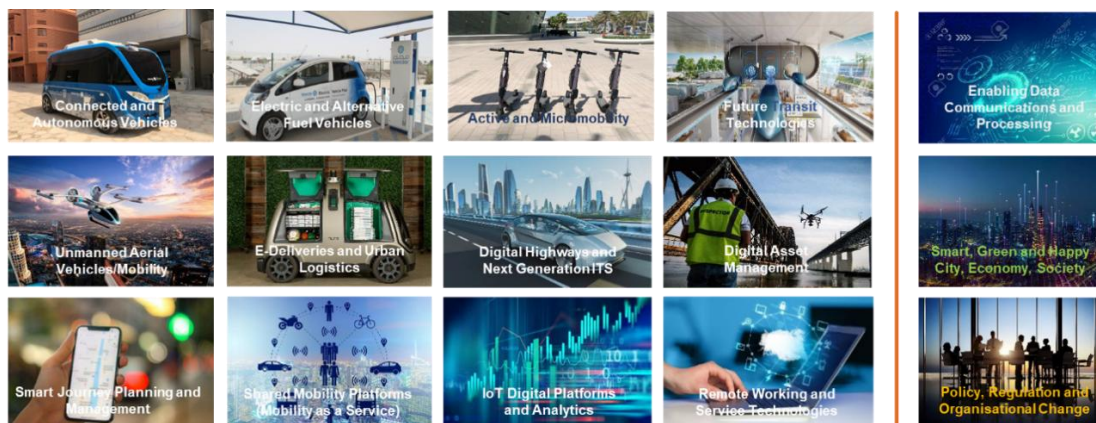


Figure 2.3 – Disruptive Transport Technologies and Service Models

This is an area which is very rapidly moving in terms of technological and service-concept development, testing and initial adoption, but also highly uncertain in terms of public policy and regulatory approaches, including required governance structures and processes. The fact that much innovation is being driven by private entrepreneurs, start-ups and enterprises, with their own motivations and behaviours, only adds to this uncertainty. Some public agencies are seeking to develop proactive policies to enable and guide new forms of mobility, whilst others are resisting adoption until more is known about implications for public safety and interest; many are taking an agnostic “wait and see” stance, leaving initiatives to the market, or narrowly reacting to media debate and public opinion as it emerges.

Looking forward, it is important that such dynamic change is anticipated, understood, managed and implemented in a structured manner in order to provide certainty and confidence within government, private sector, customers and civil society. In achieving an appropriate balance, transport agencies need the pre-requisite skills, capacity, culture, management and organisation to make informed and proportionate decisions appropriate to the pace and direction of change. WG2 therefore sought to ascertain whether appropriate policy, governance and organisational arrangements are in place or being prepared, whether gaps exist in knowledge and established practice, and what more needs to be done.

WG2’s research produced a number of firm findings. First amongst these is that disruptive technologies and service models will have a major future impact on the transport and mobility sector, and its associated entities, individually and in combination. Generally, this impact of what is termed as the Future Mobility Ecosystem is seen as positive in such areas as operational efficiency, sustainability and safety. However, there is an urgent need for robust and objective research, and empirical evidence, to support many of the claims made by technology advocates, identify and manage risks, as well as ensure public value, fairness and equity in outcomes.

Many of the key issues are not specifically focused on technology and individual technical solutions themselves, which are subject to varying degrees of “technological optimism,” but are questions of appropriate public policy, regulation and governance to deliver the optimum balance of benefits to people, communities, civil society and long-term sustainability of natural ecosystems. It is therefore important to take an approach focused not on technology per se, but the future vision, objectives and guiding principles for development, deployment and scaling up of different transport assets, infrastructure and services.

Whilst transport agencies are responding in a variety of ways to technological disruption, most believe they are not yet fully, or adequately, prepared to develop and implement comprehensive, policy-aligned, informed and effective solutions, and require substantial assistance to address emerging challenges.

The current focus of most agencies is on the deployment of near-term technologies and service models (e.g. road vehicle electrification, micromobility, digital highways) and early testing and demonstration of more complex concepts which will be deployed in the longer term (e.g. Autonomous Vehicles, Advanced Air Mobility). Very few entities have a clear and unambiguous line of sight and roadmap in terms of the ultimate combination of technologies and services which will successfully develop, be applied and converge through to 2050, and how users and wider society will adopt and use them.

Many transport agencies also view innovation as a broader theme to address within their organisations. This covers other aspects, such as people and process, as well as technology, and may often be in response to a range of everyday operational and practical problems faced by customers, managers, employees and stakeholders, as well as longer-term programmes for technological disruption and transformation. Innovation in this context is focused on organisational culture, employee management and support and providing mechanisms for the generation, assessment and filtered implementation of ideas

Evolving Roles and Strategies of Transport Agencies

Moving forward, several overarching roles are available to transport agencies in shaping disruptive technologies and service models. These roles, which are applicable to other themes and domains, include (i) Policy Maker and Regulator (ii) Researcher and Developer (iii) End User, Operator and Manager and (iv) Convener, Enabler and Integrator. As shown in the figure below, application of these roles is highly context specific and varies across organisations, as does the extent of public sector intervention desired across technology development and deployment coming predominantly from the private sector.

The necessary regulation from the public sector should be proportionate, informed, investor-friendly, ethical and agile, seeking to reflect evolving benefits and risks of new technologies, as well as balancing the legitimate search for private profit, with wider public safety, equity and value.

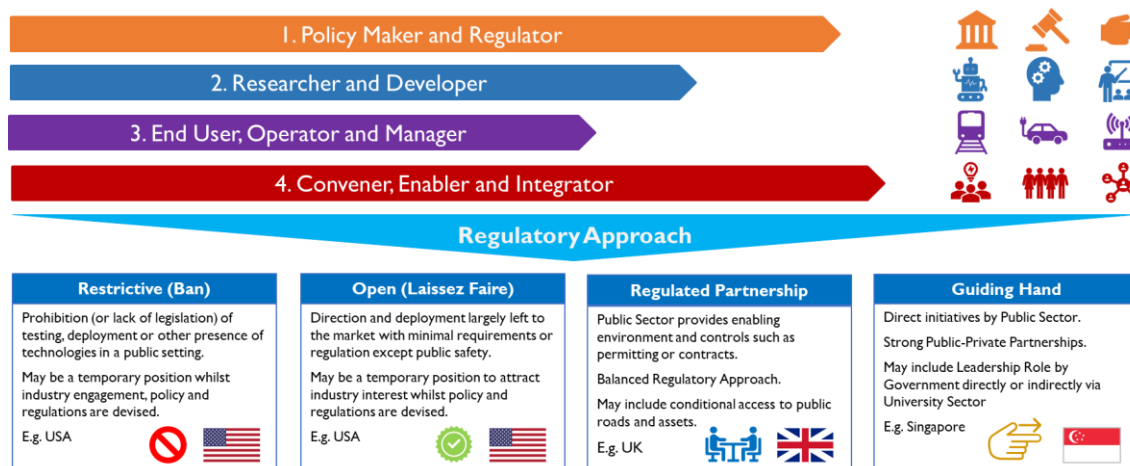


Figure 2.4 – Role of Transport Agencies in Shaping Disruptive Technologies and Service Models

Within the four overarching roles that transport agencies may play, there is a very wide range of specific strategies and actions which can be, and are being, applied to make progress. They are categorised and listed in the table below. At present, the actions of transport agencies tend to focus more on policy, strategy and technical dimensions than broader governance, regulatory or organisational change, which may be seen as more complex, political and uncertain at this point, and best tackled in the longer-term.

It is also emphasised the table is a high-level “a-la-carte” menu of options rather than a prescriptive schedule to be adopted by all agencies in all circumstances. Combining approaches will be highly context-specific and detailed planning, assessment and execution, is required for this purpose. Therefore, many of the principles around change management apply, as already explored by TC A.1 in the 2016 – 2019 Cycle and summarised above,

Not every transport agency takes on roles and strategies in the same way. There are leaders, early adopters and those which choose to take a more conservative or even resistant approach. In this context, we have identified a Future Mobility Maturity Curve as a series of benchmarks in facing disruptive change. Agencies may assess themselves against this Curve and the extent, shape and nature of organisational change to respond to, and shape, the Future Mobility Ecosystem.

As well as the leadership role of transport agencies themselves, collaboration across a wide range of organisations is recognised as key in making progress in successfully delivering the Future Mobility Ecosystem. This collaboration spans the public, private and academic sectors in terms of research, initial deployment, accountability, consultation and long-term delivery. However, the level of engagement currently taking place, especially between the public and private sectors, is not yet sufficient to enable or support actions in all required dimensions. Greater levels, and smarter methods, of joint working are needed. In addition, most transport agencies believe they need further external support to make progress on technological disruption, with professional associations and industry bodies such as PIARC well-placed – and indeed expected – to provide such support.

New transport and mobility technologies and service models appear to be impacting Low and Middle-Income, as well as High-Income, Countries, with a few use cases and examples identified during WG2’s research. However, the pace and scope of innovation appear more limited to particular applications, and balance of benefits and risks, and therefore the business case, is likely to be significantly different. There is a need for further evidence on disruptive technologies and service models within LMICs, and how roadmaps, capacity building, enabling strategies and approaches by transport agencies may need to differ from more advanced economies.

Strategies	Evidence Taking, Policy and Strategy Development	Legal, Regulatory and External Governance Frameworks	Technical Development and Implementation	Internal Organisational Changes and Capacity Building
Actions	- Technical Studies & Investigations - Technology Scanning - Setting Vision and Strategic Goals - Strategies & Road Maps - Scenario Planning and Forecasting - Double Diamond and Design Thinking - Data Gathering, Analysis, Sharing - Reviewing, Amending or Developing Policies - Public Surveys, Focus Groups and Awareness Raising - Benchmarking and Gap Analysis - Impact Analysis - Skills, Capacity and Training Needs Assessment	- Defining Legal and Regulatory Approach and Framework - Reviewing, Amending or Developing Laws or Regulations - Reviewing, Amending, Developing Standards and Guidelines - Reviewing Sector Governance and Stakeholder Relations - Engaging Industry within and outside Transport Sector - Pursuing Public-Private Partnerships (or Equivalent) - Partnering with Academic or Research Bodies - Balancing Innovation with Protection of Public Interest - Addressing Market Failure	- Sponsorship or Participation in Research and Development - Pilot/Demonstration Projects - Technology Testbeds/ Sandboxes - Innovation Challenges or Competitions - Public Procurement and Contracting Specifications and Conditions - Public Operating Franchises or Concessions - Data, Digital and Communications Networks - Implementation or Adaptation of (Physical and Digital) Infrastructure - Implementation or Adaptation of Mobility Facilities	- Changes to Corporate Vision, Mission or Objectives - Updating Strategic or Business Plan - Changes to Organisational Processes - Changes to Corporate Structure - Changes to Business Model and Funding - Appointing a New Leadership Role - Setting up New Unit, Department or Division - Innovation/Ideas Schemes - New Roles, Job Descriptions and Duties - Recruiting New or Broader Talent - Skills, Capacity Building - Changes to Corporate Culture - Engagement with Users

Figure 2.5 – Strategies for Transport Agencies in Shaping Disruptive Technologies and Service Models

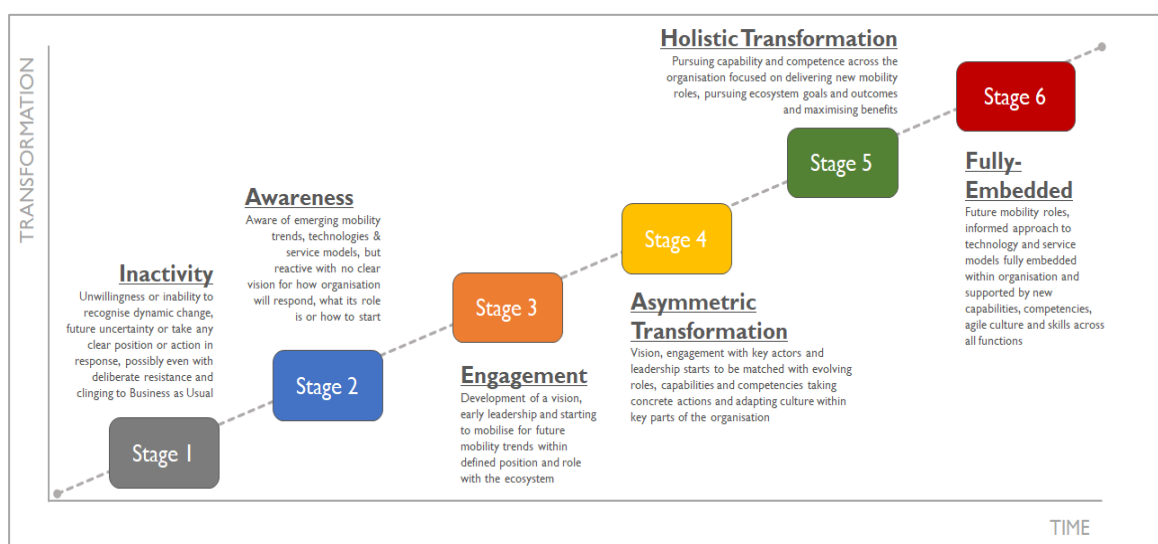


Figure 2.6 – Maturity Curve for Transport Agencies in Shaping Future Mobility

It is clear that transport agencies will need to evolve functionally, organisationally and culturally in the future in the face of disruptive technologies and service models. In addition, change will be driven by evolving customer needs and expectations, new workforce and management practices and the progressive digitisation of key tasks and jobs.

In the context of WG2's research, the transport agency of the future will need to focus on a vision, operating model, organisation, capacity and skills which accommodate, regulate and enable new transport and mobility technologies, services, customer propositions and supporting infrastructure. Future transport agencies will also need to put more focus on convening, integrating and facilitating effective stakeholder partnerships. An objective-led, agile and flexible approach to planning, regulation and delivery will be important to bring this about.

As the Future Mobility Ecosystem develops, transport agencies may evolve from planners and operators of fixed (and predominantly physical) infrastructure and assets to broader mobility management organisations across the physical and digital environment. This evolution will be context-specific within the four principal roles, strategies and stages of maturity set out above.

Future mobility needs to put the end user, and their needs and expectations, at the center of technology, infrastructure and service provision. The public and private sectors need to work together to make this possible and mindsets must be open to innovation. Innovation in this context is not just about technologies and advanced concepts, but may also relate to processes, people and ways of working. Tactical approaches are also needed which tackle everyday problems facing organisations or their customers, as well as driving more long-term and transformational activity.

Recommendations

Building on the conclusions above, a number of recommendations were made:

- Fully recognising, anticipating and proactively preparing for changes of the transport and mobility landscape, for example connectivity, autonomy, electrification, shared use and digitisation which are already in train and likely to occur, mature and scale up in future;
- Ensuring that policy is led by a clear vision, objectives, guiding principles and desired outcomes rather than technology as a stand-alone goal for its own sake;
- Assessing organisational position and performance highlighted future roles, regulatory approaches, potential strategies and activities, as well as stages of institutional maturity;
- Enabling innovation in the broadest sense, including processes and people as well as technology and service models, deriving practical solutions to everyday problems, and supporting this through political and management leadership, understanding of customer and stakeholder needs, and building supportive organisational skills, capacity and culture;
- Convening, integrating, engaging and enabling stakeholders across the public, private and academic sectors, including building and capacitating appropriate collaborative governance mechanisms across key functions, interest groups and constituencies;
- Appropriately regulating the private sector, seeking to balance protection of safety, equity and pursuit of public value with the legitimate right of companies and individuals to innovate, push boundaries and seek long-term profit and commercial rates of return;
- Seeking to understand how institutional arrangements may need to change around future organisational mission, functions, form and capacity, followed by working back to the present via a credible roadmap and action plan together with key milestones and activities of how to get there;
- Retaining a high degree of tactical flexibility, resilience and future-proofing in setting and implementing policies, strategies and activities; and
- For transport agencies in Low and Middle-Income Countries reviewing the implications of the research for their specific context, situation, challenges and stage of development.

Finally, TC 1.1 identified a number of gaps and areas for further work for PIARC to consider during the next Cycle 2024 – 2027. These include road transport electrification, digital connectivity, fostering innovation as a broader theme and developing the transport agency of the future.

The Report can be accessed from the PIARC website at [2023R01EN](#).

Lessons for the Transport Agency of the Future

The PIARC TC 1.1 research on disruptive transport technologies and service models from 2020 – 2023 has been a major precursor to the current focus on the Transport Agency of the Future. Whilst many of the conclusions and recommendations are made in the context of how agencies respond to and shape disruptive technologies, these are also more broadly applicable to the full range of changes, objectives and agendas which agencies need to consider in their wider evolution. The research in particular suggests that the Transport Agency of the Future should:

- *Constantly scan, track and anticipate changes in technology, stakeholder and customer expectations, public policies and priorities, both to realise and exploit positive opportunities as well as identify, mitigate and manage risks, including the potential for actual or perceived market failures and need to deliver public value;*
- *Consider carefully its future roles in the future mobility ecosystem, ranging from policy maker to researcher and developer, manager and operator or integrator and convener;*
- *Identify, engage with and proactively manage, influence or regulate a range of stakeholders, including other public agencies, academia and private sector;*
- *Self-assess ambition, willingness and ability to evolve against various forms of maturity curve in terms of awareness, application, embedding and transformation of organisational arrangements to face and address future challenges;*
- *Consider, select, implement and monitor against a range of strategies, and associated actions, to evolve the future mobility ecosystem, including evidence gathering and assessment, legal, regulatory and external governance frameworks, technical studies and planning as well as internal organisational change and transformation.*

The latter set of strategies provides the basis and mandate for the Transport Agency of the Future research in this current PIARC Cycle 2024 – 2027.

2.5. MANAGING INNOVATION (2023)

Managing Innovation in Transport Agencies (2023)



Innovation was identified by PIARC as one of the four cross-cutting issues in the 2020-2023 work cycle. TC 1.1 held two workshops on “Innovation and the Innovative Organisation” (Seville, Spain, November 23rd, 2021) and “Implementing Innovation – the Critical Step” (Warsaw, Poland, April 16th, 2022). Innovation was also themed at break-out session at PIARC’s Mid-Term Meeting in December 2021.

Following these workshops, PIARC commissioned a Special Project to investigate best practices employed by road and transport agencies to encourage and sustain innovation at the organisational level, and to better identify and implement innovations.

The Special Project identified a range of key drivers for innovation in transport agencies. These key drivers arise from within the organisation itself (for example, the need for cost reduction, improved productivity, improved management of risk), and from a complex mix of drivers from customers (for improved quality of infrastructure, better mobility services, improved safety), the national innovation ecosystem (better and cheaper public services, more inclusion, national competitiveness), the technology sector (crowd sourcing, big data, digital twins, artificial intelligence, connected and autonomous vehicles, automated construction, solar roadways, materials development), as well as international challenges (climate change, the environment, economic development, sustainability).

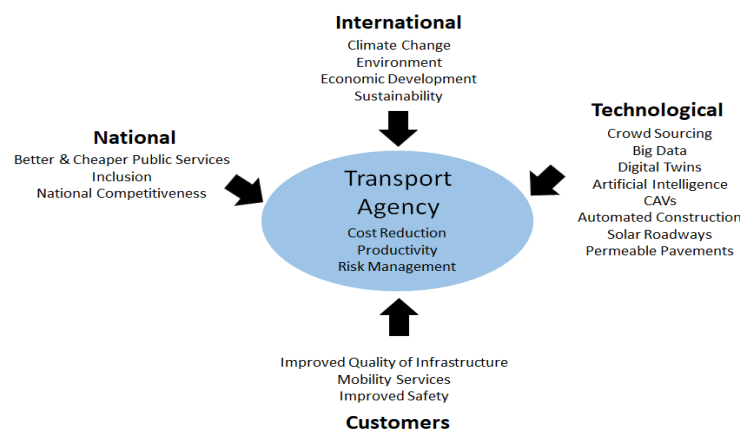


Figure 2.7 – Drivers for Innovation in Transport Agencies

The Special Project attached particular focus to creating a culture of innovation. This refers to the organisational environment, values, attitudes and practices that encourage the identification, development and implementation of new and creative ideas. Such a culture is about providing resources, recognising and rewarding innovation, celebrating success, leading by example, and promoting collaboration. It is also about, in some instances, accepting the risks of, and learning lessons from, failure. Thus the culture of innovation is affected by many of the policies, processes and day-to-day management of an organisation.

An organisation's structure and human resource management functions can have a significant impact on the way in which innovation is encouraged or sustained in an organisation. A significant body of knowledge and theory has built up around this aspect and has been summarised in the main report. Ideally, innovation would not be limited to specific roles or departments within an organisation but would permeate across all levels and functions. The organisational structure can be both a help and a hindrance in this regard.

For many transport agencies, the way in which they interact with their suppliers and with wider industry and stakeholders can create opportunities for innovation, as well as a need to understand and regulate innovation by others. Given the pace and scale of innovation in the transport sector, innovation in the supply chain and wider stakeholder ecosystem is an area which many transport organisations are actively embracing, through innovative procurement initiatives, competitive challenges, and collaborative long-term roadmaps to deal with more disruptive technologies.

Organisational Structure

The structure of an organisation determines how it identifies and manages its activities. The structures in an organisation influence and prescribe how activities are assigned, managed,

monitored and reported. Due to its fundamental effects on the operation of an entity, various academic authors have found organisational structure to have significant effects on the capacity to innovate. Adopting a flatter, decentralised organisational structure, where decision making power is found closer to those staff who carry out those decisions, is more likely to lead to successful innovation outcomes. Related to this, establishing clear and open communication between decision making staff and staff who implement those decisions will also likely lead to more innovative outcomes. There may also be some benefit in adopting less formal work roles, and in not being prescriptive about job functions or positions in the organisational hierarchy.

Human Resource Management

A well-designed human resource management system may be a strong instrument for attracting, nurturing, and retaining individuals with distinct attributes required to drive innovation.

The literature highlights different approaches to progress institutions' innovation goals from a HR perspective, such as having established leadership, promoting work flexibility, and diversifying the workforce and individual teams. Also, recognising frontline employees who go above and beyond their usual tasks to encourage everyday innovation to solve practical problems ("brilliant basics") has positive implications on the institution's overall performance with respect to innovation.

The case studies provide many examples in which transport agencies have used human resource management to help drive innovation in their organisation. These include establishment of a fully established and structured division, or establishment of a smaller business unit or project management office if a full organisational unit is not feasible or desirable; establishment of innovation programmes to encourage both internal and external innovation; staff performance requirements to drive innovation; creation of positions of innovation facilitators and innovation ambassadors with specific roles and responsibilities; incentives to help drive staff recruitment and retention; policies to create a 'safe space' for innovations; employee well-being. Linked to these are a whole host of education and training initiatives. These include training in both technical and non-technical areas, training for senior agency leaders, training on building networks for professional collaboration, and training in legal or business aspects relating to a particular area of innovation.

Open Innovation

Historically, transport agencies, and in particular roads agencies, have focused on a prescriptive approach to innovation, for example through updating design guidelines which include highly technical specifications with limited flexibility. Gradually, they are experiencing a more flexible and open approach where citizens, startups, and technology companies are getting involved, and where the supply chain is being encouraged to participate in innovation. Thus transport agencies are thinking in a completely different way. Procurement is also becoming more open to innovation and to alternative methods of collaboration.

This openness to innovate with external resources is what is known as Open Innovation. It is a strategic approach that ensures that the process of innovation, i.e., from the development of new ideas to their implementation, is open. As identified in the literature, innovation can be inbound where firms collaborate or partner with external institutions to leverage their technology and ideas to innovate, or outbound where they work with external institutions to market or distribute knowledge and ideas that have been internally generated.

Innovation in the Supply Chain and Wider Industry

The gradual shift in the transport industry towards a more open approach to innovation also applies to the supply chain. Effectively managing innovation in the supply chain requires organisations to

not only adapt to market shifts but also to shape the future of their operations. Disruptive innovation in the transport industry, seen for example in the development and deployment of connected and autonomous vehicles, or in the introduction of connected and autonomous plant in the construction sector, necessitates innovative approaches to engagement with the supply chain.

Globalisation of the supply chain means that large contractors and consultants are able to transfer experience and expertise into the transport sector and so help accelerate innovation. Transport agencies are under increasing pressure to keep up with these innovations to help shape the future of their national, regional or local economies.

This is reflected in many case study agencies in the report, who report a variety of ways of promoting and encouraging innovation in procurement. These include co-design and co-creation of projects among their stakeholders, getting the supply chain involved earlier in the procurement process, reviewing and modifying technical provisions in their contracts, re-balancing risk between the client and the contractor to encourage innovation, and giving specific assistance to startups in order to bring a fresh perspective to technical challenges.

Innovation as a Process

Viewing innovation as a process, rather than as something that ‘just happens’, has proved a transformative shift in many organisations. This view recognises innovation as a systematic, repeatable set of activities that have defined goals, and which can be managed, measured, encouraged, and improved.

The project reviewed several different process models representing innovation or innovation management as described in the literature review. The report developed a generic process, illustrated below, based on a synthesis of that literature and cases studies. It uses this as a framework for discussion of best practice or good practice as identified in the project.

The report describes examples of how transport agencies implement various parts of this process. The examples include various concepts such as foresighting, scenario planning, or horizon scanning to anticipate future trends, conduct of user surveys, use of suggestion boxes, calls for ideas; cost/benefit analysis; risk assessment; technology readiness levels; prioritisation; creation of innovation portfolios; trialling policies and procedures; measurement systems; and dissemination.

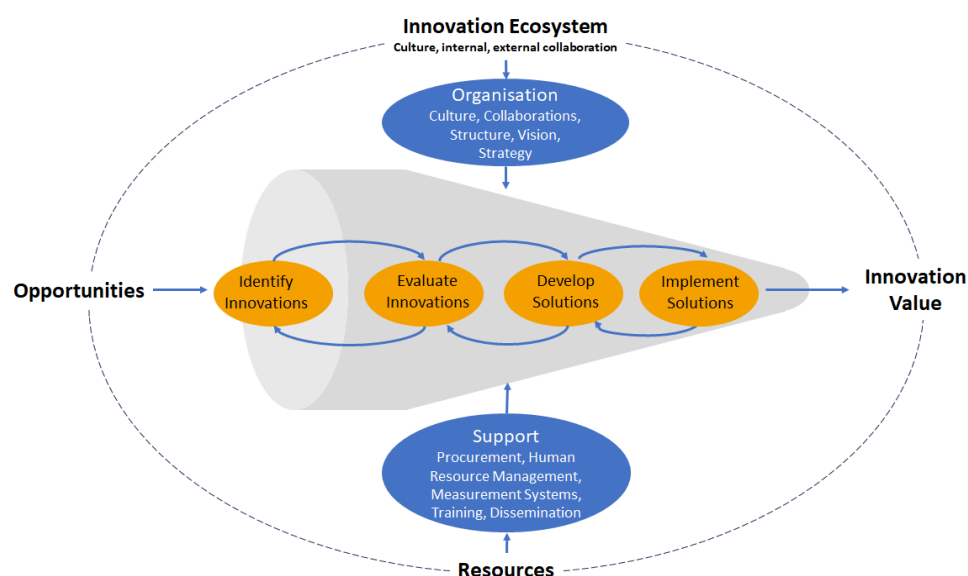


Figure 2.8 – Innovation as a Process

In summary the Special Project identifies how innovation is evolving in road and transport agencies and gives many examples in the way in which agencies innovate around the world. Viewing innovation as a process has proved useful, as it focuses thinking on the inputs and outputs, and policies and procedures, around innovation; how the organisation can structure itself to encourage and support innovation; and how it can support innovation through various support processes particularly around human resource management and procurement. Even language learning positively from 'failure' is important, and can permeate many different parts of the process, including in HR policies and procedures.

The report also identifies some key challenges to innovation. These include funding, regulatory barriers, scaling up, tracking and measurement of grassroots innovations, resistance to new technology, and a 'too busy to innovate' attitude.

Many of the findings and recommendations around creating an environment that encourages and supports collaboration, creative thinking, and the development of new ideas, products, processes and services, will be key to building proposals for the Transport Agency of the Future. The Report can be accessed from the PIARC website at [2023SP03EN](#).

Lessons for the Transport Agency of the Future

The PIARC research on innovation in the road sector from 2023 suggests that the Transport Agency of the Future should:

- *Seek to actively create a culture of innovation which encourages and nurtures the identification, development and application of new and improved ideas to a range of strategic and everyday problems and challenges;*
- *Additionally consider innovation as a process with clear inputs, outputs, policies and procedures, requiring strong leadership and management;*
- *Consider specific functional forms, such as a business unit or portfolio management office, to structure, drive and track innovation within the organisation;*
- *Assess a wide range of potential innovations in terms of their technical feasibility, operational effectiveness, practicality and value for money in order to filter and prioritise which ones should be taken forward, when and under what conditions;*
- *Consider open innovation approaches, including active collaboration and harnessing of external entities and the wider supply chain in the innovation process;*
- *Integrate, and foster innovation through different internal functions, including Human Resources, funding and resourcing, risk management and frontline delivery;*
- *Seek strategies to assess maturity and readiness of ideas within the organisation.*

A second Special Project is currently under way which will explore similar issues specifically in relation to enabling Artificial Intelligence in the Road Sector which will report in late 2024.

2.6. FINAL REMARKS ON PREVIOUS PIARC REPORTS

Previous PIARC Technical Reports published by the predecessors to the current TC 1.1 have produced a wide range of evidence, conclusions and recommendations, overall and on points of detail, which may be applicable to the Transport Agency of the Future. Indeed, the topic was explicitly considered in the last 2020 – 2023 Cycle and gave rise to the Terms of Reference for the current research exercise. The evidence from previous PIARC research remains valid and valuable in providing key insights into the way forward for transport entities across the World.

3. EVIDENCE FROM PREVIOUS EVENTS

3.1. OVERVIEW

Aside from the previous Technical Reports described in Chapter 2 above, the Transport Agency of the Future has formed an explicit topic of discussion and focus via a range of recent workshops and seminars sponsored by PIARC itself, or in collaboration with other bodies such as TRB and TRA. These originated from discussions within the former TC 1.1 during the 2020 – 2023 Cycle, as well as parallel deliberations within TRB and AASHTO, for example through the NCHRP, on how US DOTs should develop in the future, and both helped to inform the current Terms of Reference on the topic as well as prompting engagement events in their own right.

Of particular note are the following:

- The World Road Congress in Prague (October 2023);
- TRB Annual Meeting in Washington (January 2024);
- Transport Research Arena (TRA) in Dublin (April 2024);
- TRB Online Webinar (August 2024); and
- International Conference on Highway Engineering (iCHE) in Bangkok (September 2024).

Each event, the key speakers and presenters and main points raised, are summarised in turn below.

3.2. PIARC WORLD ROAD CONGRESS – PRAGUE (OCTOBER 2023)

Overview

The arrival of the 4th Industrial Revolution and the rapid development and fusion of multiple disruptive and innovative technologies are changing the behavior and the expectations of customers and stakeholders all over the world. At the same time demographic, economic, development, environmental, technological, and other trends are changing the demand for moving people and freight; the mobility options available to serve customers; and the capacity of transport agencies to carry out their mission.



This Workshop, in two parts focused on defining the vision and putting it into practice, brought together the work of PIARC's TC 1.1 (Performance of Transport Administrations) as it relates to the vision of the "Transport Agency of the Future"; AASHTO's NCHRP 20-24(138) Moonshot Project on the development of a vision framework for the future of transportation and to develop in the next phase tools that US State DOTs can use to implement individual and collective actions to advance

the vision framework; and TRB's NCHRP 08-127 Project on the impacts of disruptive technologies on the performance of transportation agencies. It also provided a global perspective on the vision of the Transport Administration of the future by inviting representatives from other parts of the World to share their perspective and vision for the future of transport agencies.

Of particular interest was the perspective on the "North Star" of transport agencies as it relates to serving customers and creating public value; the transformational approach needed as a result of the new technologies and business models; and the significance of the Transport Agency of the Future in addressing issues of equity, diversity, and inclusiveness in developing the workforce of the future.

Presenters and panelists included members of TC 1.1 and delegates from AASHTO/TRB representing the United States, ERTICO (Europe), and IATR, IBTTA, and UITP representing different global perspectives. The Workshop also presented examples from other nations including perspectives from Australia, South Africa, Sweden, the United States, as well as presented the challenges faced by LMICs in facing these same issues and opportunities.

The panel discussion addressed the following questions:

- The future is an ecosystem of multiple players; who are these players going to be and what is their role? What do we want this ecosystem to look like in 2030 or in 2050?
- What would the agency of the future itself look like? What would the agency's North Star be? What is the role of public authorities in the transport ecosystem?
- How do we engage our people and empower them to see this vision through? How would you create lines of sight to different levels within the organization so that this vision is embraced?
- What is the regulatory role and framework of these agencies? Is there a regulatory framework to support a systems approach in transport?
- How is the negotiation for the use of urban space among stakeholders impacting the Transport Agency of the future?
- What are the critical actions that need to be taken now to achieve the goals of the Transport Agency of the Future?
- What are the specific challenges and opportunities that the Transport Agency of today must meet and how should it evolve to address them?
- Interaction with local communities, and how this interaction and strategic partnerships can be created and linked via ongoing dialogue?

The Workshop identified the following challenges and opportunities for transport agencies moving forward.

Challenges:

- Increasing demand for transportation services across multiple modes;
- Aging infrastructure and asset deterioration;
- Rising costs of transportation;
- Environmental impacts, including climate change mitigation and adaptation; and
- Increasing volumes of data and analytical tools, including Artificial Intelligence, requiring structured management to derive meaningful information and outcomes.

Opportunities:

- New technologies, such as self-driving cars and drones, with the potential to improve efficiency, safety and customer experience;
- New business models, such as ridesharing and car-sharing, with the potential to provide more affordable transportation options and more efficient use of available transport assets; and
- Data analytics and its use to improve traffic planning and management, customer information, coordinate demand and support delivery of wider economic, social and environmental goals.

Technical Findings

Highlights from the workshop from key speakers were as follows:

Part 1: Describing the Vision – The Transport Agency of the Future

- *Jonathan Spear (UK)*: The basic road-based mobility paradigm has not changed in over a century, but it is about to change dramatically. So, what got you here, won't get you there. There is a need to focus on a North Star for guiding the future of transport structured under people/society, prosperity/economy, and planet/environment.
- *Nazir Ali (South Africa)*: Evolution and changes of road administrations point to a game plan that supports funding priorities, flexibility, innovation, and systems thinking.
- *Alan Colegate (Australia)*: COVID-19 brought the focus that agencies are not just delivering transport, but societal benefits and protection. It's all about achieving a vision – customer centric that is safe, reliable, and sustainable.
- *Susanne Nielsen (USA)*: Customer focus, climate change, new technology, new generations, and changed security situation will all inform the transport agency of the future.
- *Carlos Bracerias (USA)*: To look forward, you have to look back. US DOTs are no longer agencies that move cars, but ones which move people the way they want to be moved.

Part 2: From Vision to Actions – Implementing the Vision for the Next Era of Transportation

- *Carlos Bracerias (USA)*: The NCHRP “moonshot” project suggests a new vision for community centered transportation; set aspirational goals that can be adopted by individual agencies at whatever level which works.
- *Christina Anagnostopoulou (Greece)*: Agility and flexibility of data to produce meaningful information should be included in a holistic approach to mobility and transport planning.
- *Matt Daus (USA)*: The focus should be on public and shared transport, including reconciling taxi and ride share, and focusing on proportionate regulation, including various forms of self-regulation, for transport and mobility operators, many of which will be in the private sector.
- *Emanuela Stocchi (Italy)*: To address the challenges faced ahead, transport agencies of the future must prioritize investing in young professionals, addressing diversity, equity and inclusion, boosting innovation and promoting sustainable mobility. It is also important that they develop international cooperation so that good practices can be shared.
- *Patrick Mallejacq (France)*: Coordination is complicated, such as how local strategies should be aligned with national goals and frameworks. Exciting topics and technologies, such as driverless cars and urban air mobility are interesting for the future, but can distract from

important work in the here and now. Whilst keeping the future in mind, it is still important to focus on the day job and get the basics right, perhaps with an 80:20 rule.

- *Sylvain Haon (Belgium)*: There is a need for anticipation, resiliency and capacity if agencies are going to be able to deliver. Agencies will need to understand, anticipate and manage complexity and change, and be ready to address customers' reaction to change. They will also need organisational and managerial resiliency since the ability to adapt is fundamental for agencies to deliver on their objectives. They will need capacity, building a workforce across multiple roles and skillsets ready for a changing labour environment as well as one that represents society with all its multi-level diversity.

Recommendations for Decision Makers

The workshop concluded with several recommendations distilled and to be communicated to PIARC, its members and key decision makers from global transport agencies across the World.

Part 1: Describing the Vision – The Transport Agency of the Future

- Agencies need to plan for uncertainty and look at alternative futures in multiple dimensions, for example through scenario planning;
- Agencies may need to pick topics to tackle which make the most noise/bubbling to the surface in terms of political and public discourse and test to see if they can make a difference;
- There is a need to reflect a diverse society with young people and new generations having different priorities than older ones, and agencies having to listen and act on a range of interests;
- There is a need to encourage experimentation, including with budgets and resources, pilots, proof-of-concept trials or testbeds, as well as learning from failure as well as success;
- Having focus on leading people rather than merely managing them, providing a positive and inspiring vision and engaging in active rather than passive leadership; and
- Agencies should promote internships and other methods of mentoring, awareness raising and engaging the workforce of the future, integrating these into the organization.

Part 2: From Vision to Actions – Implementing the Vision for the Next Era of Transportation

- Irrespective of assets, technologies and goals, people need to be central in terms of movement and serving communities. The starting point should be the customer, shifting from managing transport networks and services individually to moving people on a whole journey basis;
- There is a need to see data, technology and technological innovation as key future enablers;
- Agencies should recognise and encourage diverse talents to achieve balanced outcomes for all. Diversity increases the range of experience, pool of ideas and practical thinking available and should therefore support better and broader outcomes aligned to the needs of customers.

Recommendations for PIARC and Transport Agencies

To address the challenges ahead, the workshop recommended that transport agencies should be:

- Committed to the creation and the maintenance of public value;
- Clear about purpose, mission and functions and how these are changing;

- People-centric, listening to people to harness their power and using the information and feedback from them to move decision makers to invest, manage and support appropriately;
- Flexible and agile to respond to evolving demands (customers, workforce, and partners) and external factors (socio-economics, climate, etc.), constantly adapting tactics to meet the need;
- Comfortable with uncertainty, prepared for a range of plausible futures and using scenario planning, back casting and other methods to minimise regret;
- Harnessing modern communicators to help media understand what is needed and why;
- Shifting from infrastructure and asset managers to mobility managers, conveners and regulators to deliver an enhanced seamless experience to its customers;
- Innovative in attitude, culture, methods and tactics; and
- Diverse on multiple levels, celebrating and utilizing difference.

The workshop was a major success within the context of the World Road Congress, with diverse perspectives and viewpoints shared at the macro and micro-scale, as well as laying an excellent basis for further deliberations on the Transport Agency of the Future in the next PIARC Cycle.

3.3. TRB ANNUAL MEETING – WASHINGTON DC (JANUARY 2024)

A Special Workshop Session was held at the TRB Annual Meeting in Washington DC in January 2024, aiming to elicit the key elements going into the design and makeup of the Transport Agency of the Future, with a specific focus on US DOTs and the work currently being done by TRB and AASHTO on critical issues in transportation and collective and individual actions by DOTs to secure recognised goals and aspirations.



That workshop featured two panels – one led by *John Kaliski*, Vice-President of Cambridge Systematics, and the other by *Shailen Bhatt*, Administrator at the Federal Highway Administration – which featured both current and former State DOT leaders from across the United States as well as international speakers, including the Secretary-General of PIARC. The notes below were provided by TRB to reflect the key points made.

“This is a topic I am particularly passionate about,” noted *Victoria Sheehan*, TRB’s executive director and a past president of the ASHTO from New Hampshire. “The key is putting people at the centre of this conversation about mobility needs of the future.”

She said that several “future focus” efforts have been initiated in parallel at the federal, state, and even some cases at the local level across the USA. “We are seeing a lot of recurring themes across the guiding documents of each group developing these roadmaps for the future; it is uncanny how

similar the graphics are,” Sheehan noted. “We also need to educate others about the criticality of our transportation systems and the funding decisions that will impact how we invest in them to achieve our goals.”

Kirk Steudle, President of the Steudle Executive Group, expressed “excitement” about how all of the “transportation agencies of the future” planning endeavours at the federal, state, and local levels were converging. “So many plans that started independently are now coming together,” explained Steudle, a past AASHTO president from Michigan.

“From the State perspective, it is all about community-centred transportation – and forming partnerships between State DOTs and other public, private, and civic organizations to make the transportation system safe, accessible, affordable, reliable, and sustainable into the future,” he explained. “It places a focus on the customer, with technology and data as key enablers. Partnerships are extremely critical, too, with multiple small solutions adding up to big changes, with individual and collective actions moving things forward.”

Christos Xenophontos, Assistant Director for Administrative Services for the Rhode Island Department of Transportation, noted that in the past, “incremental steps along the way” are what led to transportation changes. “But now a revolution is taking place – we are electrifying transportation, automating and connecting systems with artificial intelligence,” he said. “We are also looking at ‘megatrends’ such as climate change, migration, globalization, urbanization, and shared economies – how all this impacts transportation and how we should proactively respond.”

Xenophontos added that placing people and society at the “core of our activity” as transportation agencies, representing a new North Star, is part of the recognition of the important role mobility infrastructure plays for individuals and society as a whole. “We have to stop defining transportation agencies by the assets we own and, instead, by the services we offer,” he stressed, “because if we do not manage change, change will manage us.”

Deanna Belden, Director of Performance, Risk, and Investment Analysis at Minnesota Department of Transportation – added that agencies need to attract into their operations the diversity that exists in the societies they serve as a whole.

“We need to reinforce the purpose, dignity, and culture of our workforce and the work we conduct for both movement of people and goods,” she said. “We have to anticipate complexity and change – especially customer reaction to change. That means prioritizing investments into young professionals; into diversity, equity, and inclusion programs; and find ways to boost innovation and sustainable mobility. We also have to recognize that the goals we want to achieve are not all within our sphere of influence – we will need to coordinate with different partners to reach those goals.”

Meghan Haggerty, Chief Administrative Officer for the Highway Division at the Massachusetts Department of Transportation, stressed that the other challenge faced by mobility leaders going forward is how to balance the “daily firefighting” that goes in running a transportation system, while maintaining a focus on the future.

“I for one, don’t do all of it,” she explained “I am big fan of having someone focused on the crisis on the moment, and then someone else focused on where we need to go in the future. Myself, I am going to spend 20 to 30 percent of my time on the issues of the day and then focus on the top issues of the future: dealing with workforce capacity; attracting eager, younger, and diverse workers into our agency; and leveraging new technology.”

Jannine Miller, Director of Planning at the Georgia Department of Transportation, noted that as part of the “transformation for the future,” State DOTs need to make sure they are “living, breathing” organisations able to adapt to daily operating needs as well as future planning needs.

“It is about having the right people – and that includes the people outside our organization,” she noted. “Our external advisers, our consultants, play a key role. It is all about finding the right people to match what you want to achieve, who have a record of achieving what you want to achieve, and a firm understanding of the final end goal that we all want to achieve together. That requires clarity of purpose and mission, flexibility, and then empowering people who work within those structures. It is also important to think, work, and collaborate on all of this in a non-partisan way, because we are all aiming for the same objectives.”

The workshop was a major success, overlapped with many conclusions of the previous workshop held at the World Road Congress and looks set to inform further research through NCHRP, TRB, PIARC and other channels, especially around workforce planning and ensuring that clarity around high-level vision and goals is matched by practical approaches to delivery and monitoring effectiveness.

3.4. TRANSPORT RESEARCH ARENA – DUBLIN (APRIL 2024)

AASHTO, PIARC and TRB teamed again in the successful organization of a Host Session on the Transport Agency of the Future during the Transport Research Arena Conference (TRA) 2024 held in Dublin, April 15-18, 2024. The two-part session was co-organized in collaboration with Transport Infrastructure Ireland, host agency for TRA 2024 and featured many propositions heard in Prague (World Road Congress) and Washington (TRB Annual Meeting) as well as a number of new perspectives.



The objective of the Host Session was to continue the discussion that began at PIARC’s 2023 World Road Congress and TRB’s 2024 Annual Meeting on the Transport Agency of the Future and the need for Transport Agencies to embrace transformative visions that require a change of mindset and adoption of collaborative and open innovation not only in the movement of people, goods and services, but also in internal structures, processes and resources, as well as coordination within stakeholder networks. The two-part Host Session started with a look into the challenges and drivers shaping the future of the transport sector and how transport agencies across the world are planning to address these through refocusing their mission and vision on societal values, envisioning their future operating models, organizational structures, workforce and cultures and continued with a discussion on work undertaken by various agencies across the world to address these challenges and to move the vision forward.

Part 1 – The Challenges Faced by Transport Agencies

Part 1 was moderated by Victoria Sheehan, Executive Director for TRB, and featured a keynote presentation by Shailen Bhatt, Administrator for the US Federal Highway Administration on his vision for the future, the challenges faced, and the path forward to address them. There was a presentation by Ms. Sheehan on the Critical Issues in Transportation for 2024. The multi-modal panel discussion that followed, included Ms. Maja Markovčić Kostelac, Executive Director of the European Maritime Safety Agency (EMSA), Mr. Sylvain Haon, Senior Director for Strategy and

Transformation for UITP, Mr. Hugh Gillies Director of Roads for Transport Scotland, Mr. Kenny Jacobs Chief Executive Officer for the Dublin Airport Authority, and Mr. Brendan Walsh, Chief Operating Officer for the Road Safety Authority of Ireland.

In his keynote, Mr. Bhatt noted that while we are working on the vision for the future, we also have to balance that work with the Agency we have to run today and addressing today's immediate challenges. The "day job" is uniquely challenging and cannot be neglected. He raised the importance of ensuring that our transportation choices are both sustainable and inclusive.



He also shared his agency's guiding principles of Delivery, Resilience, Innovation, Values, Equity, and Nation (DRIVEN). In looking at future issues, he highlighted a number of items, including Reconnecting Communities, Electric Vehicles, Safe Systems, Mobility Choices, Freight & Supply Chain, Climate Resilience, and Workforce Development.

He stressed that identified solutions need to be part of a system in order to avoid unintended consequences. With Safety as the number one priority, it is important that we work on safe systems that are designed and provide mobility for everyone. He closed with a reminder that we cannot use the same playbook from the 20th century to achieve acceptable and optimum results in the 21st.



Ms. Sheehan followed with a presentation on the Critical Issues in Transportation for 2024 and Beyond a recent publication by TRB that makes the case that research and development must account for the multi-faceted issues and interactions among the foundational factors and policy drivers, their transportation influences, and the achievement of societal goals will inform better policy choices to increase transportation's contributions to a thriving society. She highlighted the need to keep people at the heart of the conversation and that a thriving and inclusive society must be the focal point of our work.

Each panel member provided a brief presentation on the greatest challenges faced by their organizations. Following is a summary of the points raised during this discussion.

Maja Markovčić Kostelac, Executive Director of European Maritime Safety Agency (EMSA)

- The focus is how we support and remain relevant in the future.
- We should develop knowledge sharing and innovation hubs within and between organisations.
- Whilst focusing on the future, we should also be efficient service providers in the present.

- There should be human centric implementation of the green and digital transition.
- We should do more with less resources through collaboration and working together.
- Safety and security are priorities over and above and in addition to other policy challenges.
- There needs to be integration and joint working across organisations in development of new knowledge.
- Organisations and service delivery should remain human centric even while going digital.
- Agencies need to be attractive as employers to new generations with different attitudes, skillsets and values.

Sylvain Haon, Senior Director for Strategy and Transformation for UITP

- Agencies should anticipate and leverage AI and other technology concepts for internal processes and external service delivery.
- Agencies should focus on resilience, for example being resilient in terms of climate adaptation.
- Capacity is vital, including addressing the challenges of recruiting, retaining and getting the best out of diversity of talent.
- Of all the policy agendas, a top priority is the call to members to embark on climate adaptation and resilience.
- All agencies from the road, public transport and other mobility sectors face a common theme on workforce planning and management.

Hugh Gillies, Director of Roads for Transport Scotland

- Whatever the key attributes of the Transport Agency of the Future, initiatives should be scalable, within and between organisations.
- In common with other speakers, climate change is a huge driver for change, both in terms of reducing transport emissions, but also heightened adaptation and resilience capacity.
- A key focus is also securing a more efficient transport system, with services to match policy and strategy ambitions.
- Again, there is agreement on the need to attract talent, retain and get the best out of a diverse range of skills to plan and manage future transport networks and mobility services.

Kenny Jacobs, Chief Executive Officer for the Dublin Airport Authority

- Airports are major transport hubs, involving buses, taxis and trains, as well as airplanes, and will continue to shape economic and social prosperity of the cities and countries they serve.
- A priority remains on improving connectivity, including surface access through integrated transport networks across all modes.
- Whilst planning for the future, and the pressures this will bring, there is a need to still focus on running operations in the present and doing so efficiently, effectively and sustainability.

Brendan Walsh, Chief Operating Officer for the Road Safety Authority of Ireland

- A key current priority is Vision Zero towards road and transport safety so we can change the sector of today to meet the needs of the future. The transport network of the future must be, above all things, safe.

- We need to engage with Gen Z (and subsequent generations), both as customers, employees and members of the wider community, and we need to understand how their tastes, preferences and values are changing from previous generations.
- Irrespective of technology, we need to remain customer based and customer focused, and deliver what people want or expect. This may also require a focus on the customer journey across all networks, modes and mobility services.
- We must address transport inequality and seek to ensure fair and balance access to opportunities for all members of the community irrespective of income, class, background, ethnicity, religion or other measures of diversity. We must leave no one behind.

The Changing Mission of Transport Agencies

Kenny Jacobs

- All agencies must work together to focus on the needs of passengers.
- The energy transition is important to achieve net zero, with more focus on digital systems and data in the management and use of electricity.
- We must plan and incentivise the next generation of airplanes to reduce GHG emissions.

Maja Markovčić Kostelac

- Agencies must concentrate on smart systems and new technologies. This includes cybersecurity which will be a key challenge.

Hugh Gillies

- Adaptation, flexibility and agility are key.
- Services are being overwhelmed right now and this is the critical path rather than a theoretical longer-term future.

Shailen Bhatt

- To future proof yourself you need to be ready for change in multiple dimensions, not only in the field of technology.
- Data volume and complexity is changing, including using the potential of sensors mounted in each vehicle, and we need analytical tools and techniques to produce meaningful information and levers for management.
- COVID-19 demonstrated that the role and mission of transport agencies can change overnight in response to foreseen and unforeseen crises and events.

Brendan Walsh

- Future roles should include regulation, which needs to anticipate and catch up with private sector efforts to develop new transport infrastructure, mobility products and services.
- Policy makers need access to comprehensive, accurate and reliable information on which to base investment and management decisions.

Partnerships, Engagement and Systems

General Discussion from All

- Transport and health, including reducing transport emissions, will be a key focus in the future.
- In some cases, we need to undo the harm done in the past. In previous years, transportation was just done and given to the people. Now we have to do it with people and include their views in our planning, design and delivery. It is vital to take public opinion with you and invest in inclusive and effective community and stakeholder engagement.
- The Transport Agency of the Future needs to think about systems of systems approaches and how different parts of the transport network, different assets, services and expectations fit together. Integration is therefore a key principle.
- Safety remains the core priority, irrespective of other policy goals, with people in the centre.
- In future, agencies need to do more to manage demand as well as supply for transport. Reducing single occupancy trips by car is a priority in many cities through a range of carrot and stick policies.

Part 2 – Ongoing Research

The second session opened with a brief introduction by the moderator, Patrick Mallejacq, Secretary General of PIARC, followed by two presentations on on-going research related to the topic:

- Patrick Mallejacq, Secretary General of PIARC, on the Association's ongoing work and key lines of enquiry on the Transport Agency of the Future; and
- Patrick McKenna, Director of the Missouri DOT, on NCHRP's 20-24(138) Collective and Individual Actions for State Departments of Transportation Envisioning and Realizing the Next Era of America's Transportation (The AASHTO Moonshots Project).

The panel discussion started with each member giving a brief presentation on the current work of their organisation as it relates to the lines of enquiry and was followed by a roundtable discussion on the specific questions from the lines of enquiry as follows:

- How should Transport Agencies evolve to meet changing customer needs and what are the barriers to this evolution?
- How can Transport Agencies leverage technology and innovation?
- Which "levers of change" are most important for Agencies?
- What actions are most important to get started?
- What research, capacity-building, or collaboration activities should research organizations and industry associations pursue to continue to advance the transport agency of the future?

The following sections outline panellists' reactions to these questions.

Patrick Mallejacq, PIARC

- A revolution is taking place in mobility, for example around connected autonomous and shared mobility.
- Irrespective of the technology and its maturity, there needs to be social acceptance of concepts, products and services.

- There is a need to include people in how Agencies develop solutions and to be guided by a north star of values, objectives and principles aligned with public value.

Patrick McKenna, Missouri DOT and NCHRP

- In considering the Transport Agency of the Future, there has been an evolution of research from AASHTO, TRB and PIARC, as well as growing collaboration and partnership.
- The NCHRP Moonshot Project (NCHRP 20-24 (138)A) is examining trends and in the transport sector in coming years and developing high-level aspirational goals for US DOTs which can then be locally contextualised.
- In the debate around the future, there is a need to listen to a diverse network to create constructive challenge, including non-traditional partners from outside of the transport sector.
- There is an emerging shared vision framework- customer and community centred transportation.
- The NCHRP Moonshot Project (NCHRP 20-24 (138)A) is asking direct questions. What if we:
 - Make aggressive progress towards vision zero?
 - Increase access to opportunity for financial insecure households?
 - Deploy intelligent infrastructure along our major highways?
 - Provide free transit for all in urban areas?
 - Focus on the customer in all the relevant dimensions?
 - Use technology as a key enabler?
 - Exploit the critical role of partnerships?
 - Invest in a diverse portfolio of big and small solutions, as well as individual and collective action?
 - Drive internal change within agencies, impacting management and workforce?



Rachel Cahill, Director at Transport Infrastructure Ireland

- A period of significant change has just gone with the COVID-19 Pandemic, and we can anticipate more major events, foreseen and unforeseen in the future.
- Agencies should focus on sustainable transport infrastructure and services, aligned with climate change and the need to respond to this in multiple dimensions.
- Decarbonisation is a key priority, including encouraging active transportation, Electric Vehicles and associated charging networks.
- Whilst we should anticipate future changes, we need to manage day-to-day issues now. As well as new infrastructure, we should also protect legacy assets.
- People will be vital, alongside technology, new processes and systems.



Brian Cronin, USDOT ITS Joint Program

- A priority is innovation, in its own right and through collaboration.
- Integrating vehicles and infrastructure is a key opportunity, for example through V2X, C-ITS and its various applications.
- Streets may need to be reconceptualised, redesigned and managed differently across all user groups, for example through such concepts as Complete Streets.
- Whatever we do we need to articulate it to public and stakeholders and take them with us. Technology must have a human face, and Agencies must be open to engagement and debate.

Anne Graham, National Transport Authority, Ireland

- Agencies should ask themselves how they should evolve to track, understand and meet changing customer needs.
- Agencies should focus on delivery for the customer which means focusing on mobility of people instead of vehicles.
- More needs to be done to reallocate road space for other modes, exploiting shared services and using technology to provide seamless end-to-end journeys.

Andreas Boschen, SESAR

- Agencies should be policy and mission oriented and consider their high-level goals for example resilient, safe, secure, scalable and the like.
- Innovation is vital and should be accelerated wherever possible.
- A priority is sustainability, including decarbonisation, climate adaptations and net positive gains in key criteria.

Angelos Amditis, ERTICO

- Clear principles need to be set for the Transport Agency of the Future, even though the concept may take some years to develop and roll out.
- There is a need for a systematic (systems of systems) view across transport networks and their associated assets, corridors, routes and nodes.
- A comprehensive and multimodal approach is needed to moving people and goods, as well as increasingly data and information.
- The Transport Agency of the Future needs to be data-led and take decisions based on robust and consistent evidence and thinking.

Questions and Discussion

The Panel further discussed the key drivers of change on Transport Agencies into the future. Key items raised included the following:

- Technology, including Artificial Intelligence, although objective-led and linked to policy goals and clear benefits to society.
- Carrying out robust pilots and trials of technology and innovation prior to scaling and widespread roll-out.
- People, processes and systems, including the need for confidence and trust in these dimensions.

- Collaboration between organisations and across the transport sector, as well as cross-cutting work with other sectors such as energy, land use planning, health and wellbeing, environmental sustainability and net zero.
- Conducting activity with customers, public and stakeholders, and seeking their participation, rather than doing things to them and provoking mistrust and opposition.
- Agility and flexibility in decision-making in the face of uncertainty and different scenarios of the future.
- Safety and security, in all its dimensions, as an overarching priority.
- Reallocation and management of capacity within the transport system to produce the greatest net benefit for all users, society and stakeholders.
- Considering air quality and local emissions, with implications for public health, alongside decarbonisation as a vital environmental agenda.

The panel then discussed what actions are important to get started and what research or capacity building is needed to advance the Transport Agency of the Future. Key items raised included:

- Imagination and a willingness to experiment and do things differently.
- Thinking big and taking on difficult challenges, doing things not because they are easy but because they are hard.
- Focusing on actions and deployment rather than just strategizing, as well as having a clear roadmap of actions from now to the future.
- Working with others, trusting partners, including collaboration across the public, academic and private sectors, including working out the clear and distinct roles for each partner.
- Experimenting and learning as much from (measured) failure as from success.

In conclusion, the TRA Session on the Transport Agency of the Future further developed and expanded the conversations from Prague and Washington, prompted in-depth discussion amongst key practitioners on some key issues and produced some highly relevant findings for incorporation into the TC 1.1 evidence base in the 2024 – 2027 Cycle. It also highlighted the value of collaboration between PIARC, AASHTO, TRB and other organisations such as UITP in considering the poignant lines of enquiry together and developing further joint initiatives moving forward.

3.5. TRB ONLINE WEBINAR (AUGUST 2024)

This online webinar, hosted by TRB, continued the focus on multiple research studies including those from TRB, AASHTO, and PIARC are pointing to the changing mission and role of transportation agencies and the actions transportation agencies can take to prepare for the future. TRB hosted the webinar on 7th August 2024 to further extend the circle of practitioners able to participate in the conversation about this change. Presenters shared three ongoing research initiatives: TRB's Critical Issues in Transportation 2024 and Beyond, AASHTO's National Transportation Vision Framework (Moonshot Project) and PIARC's research on Envisioning the Transport Agency of the Future (ETAF). Presenters highlighted the findings of these studies regarding the changing role of transportation and discussed how individual agencies can apply these concepts. This webinar was sponsored by TRB's Executive Office, National Cooperative Highway Research Program, and the Standing Technical Committee on Strategic Management.

The webinar was centred on the following three topics and speakers:

- TRB - Critical Issues in Transportation: Victoria Sheehan;
- AASHTO – Collective and Individual Actions to Envision and Realise the Next Era of America’s Transportation Infrastructure – Moonshot Project: Roger Millar; and
- PIARC – Transport Agency of the Future, Jonathan Spear.

The following sections details the key points made in each presentation and the subsequent question and answer session.

Presentations

Victoria Sheehan, TRB – Designing the Transportation Agency of the Future

- TRB are looking at a strategic framework for the transport agency of the future. Mobility, sustainability, resiliency, inclusivity are key features with people and society at the heart of the discussion.
- TRB published its view on critical issues in transportation in 2023 with a circular module showing that each priority is equal, and a lot of decisions made in transportation are interdependent.
- The TRB is aligned with a number of high-level societal goals. These are safety, economy, equity, climate change and public health, with investment in transport infrastructure and mobility services needing to be designed, and show their ability, to deliver on these goals.
- TRB working on critical issues found that movement of people and goods as well as infrastructure systems are the foundation of a thriving society.
- The transport agency of the future requires a new structure and degree of collaboration, must think of the needs of the system as a whole (system of systems approach) and anticipate changes that will happen and keep in mind jurisdictional challenges.
- TRB has presented its work to its various committee chairs and has started promotions of goals, as well as launching a website that is user friendly and allows information to be easily digestible.
- TRB has found funding challenges for transport agencies as well struggles to recruit and retain good staff with the right skills and aptitudes when looking at critical issues.
- Individual efforts are being made at federal and state levels, but various other frameworks are remarkably similar with people, their safety and welfare, at the centre.
- New structures and increased collaboration will create a need to anticipate changes, address jurisdictional, challenges and funding. In addition, the key is an effective and fit-for-purpose workforce, its skills, diversity and the ability to identify and address knowledge gaps moving forward

Roger Millar, AASHTO and Washington State DOT

Collective and Individual Actions to Envision and Realise the Next Era of America’s Transport Infrastructure

- The NCHRP Moonshot Project is in its second phase with a vision of community centred transportation that will be delivered as a partnership between State DOTs and other public and private sectors.
- Seven moonshot concepts have been formulated: making aggressive progress towards vision zero, reducing mortality, reducing households that cannot meet basic survival costs,

marketplace for customers to pay for mobility they need at any time, transforming transportation energy, nationwide digital infrastructure, rethinking connecting communities and regions, putting communities at the centre.

- The final project entails creating a spectrum of actions/ levers of change that DOTs can implement. At least 20 states will be involved in initial deployments.
- Through this project, DOTs have learned that technology is an enabler, partnerships are critical, there is need to focus on small projects such as bike lanes and affordable access as well as major infrastructure schemes, and there is a need for internal change with DOTs, including leadership and culture, governance structures, policies and regulations and human resources.
- Next steps entail working with initial deployment states, building spectrums of individual and collective actions, engaging in challenge network, sharing results, and continuing coordination.

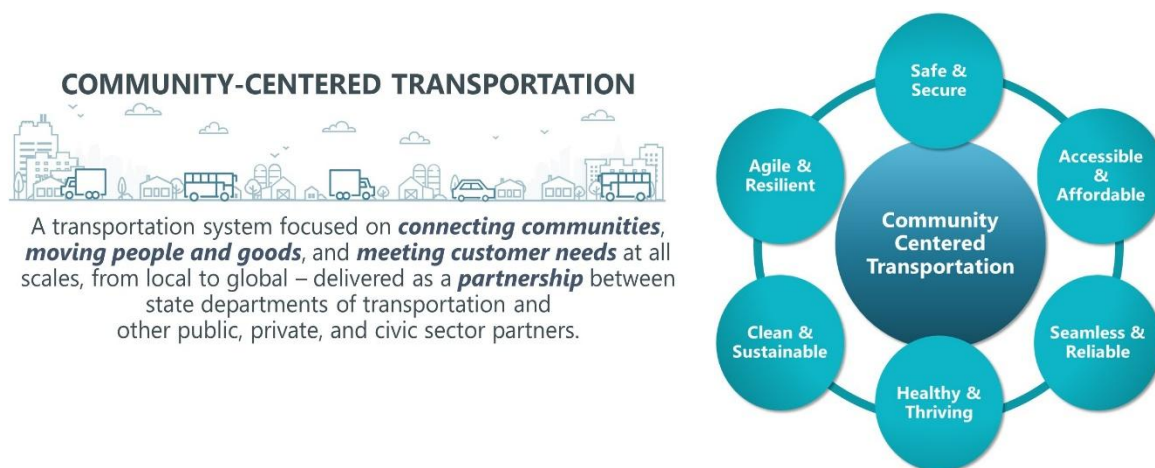


Figure 3.1 – AASHTO/NCHRP Vision and Aspirational Transportation Goals

Jonathan Spear, PIARC Technical Committee 1.1

Envisioning the Transport Agency of the Future

- PIARC's interest in the Transport Agency of the Future grew out of its 2020 – 2023 research on disruptive transport technologies and the conclusion that agencies needed to anticipate, adapt to and shape a broader set of challenges linked to public policy goals.
- The basic road-based mobility paradigm has not changed in over a century (fossil fuels, human driven). The road-based mobility of the future is connected, autonomous, electric, and shared, offering a fundamental change.
- PIARC TC 1.1 is focusing on six specific areas in its 2024 – 2027 research, including megatrends and drivers for change, planning for uncertainty, mission and purpose, future operating model, technology and digital transformation, and stakeholder ecosystem and engagement.
- TC 1.1 is also addressing wider workforce planning issues, centred particularly on diversity and skill requirements for the future.
- As demonstrated through the COVID-19 Pandemic, agencies need to be ready for the unexpected and look at future scenarios against a range of critical issues, whilst also keeping in mind the potential for innovation and doing things differently.

- As an initial hypothesis, TC 1.1 believes the Transport Agency of the Future should be clear about purpose mission and functions, committed to the maintenance of public value, flexible and evolving, people-centric and diverse on multiple levels.
- A key theme is “What got you here won’t get you there” and transport agencies need to anticipate and proactively respond to a range of change drivers, necessitating reform to their basic mission and purpose, internal organisation and relationship with a range of external stakeholders from the public, academic and private sectors.
- The research is ongoing to 2027 against a defined programme. PIARC welcomes ideas, responses to surveys and proposals for case studies from AAHSTO, TRB and State DOTs.

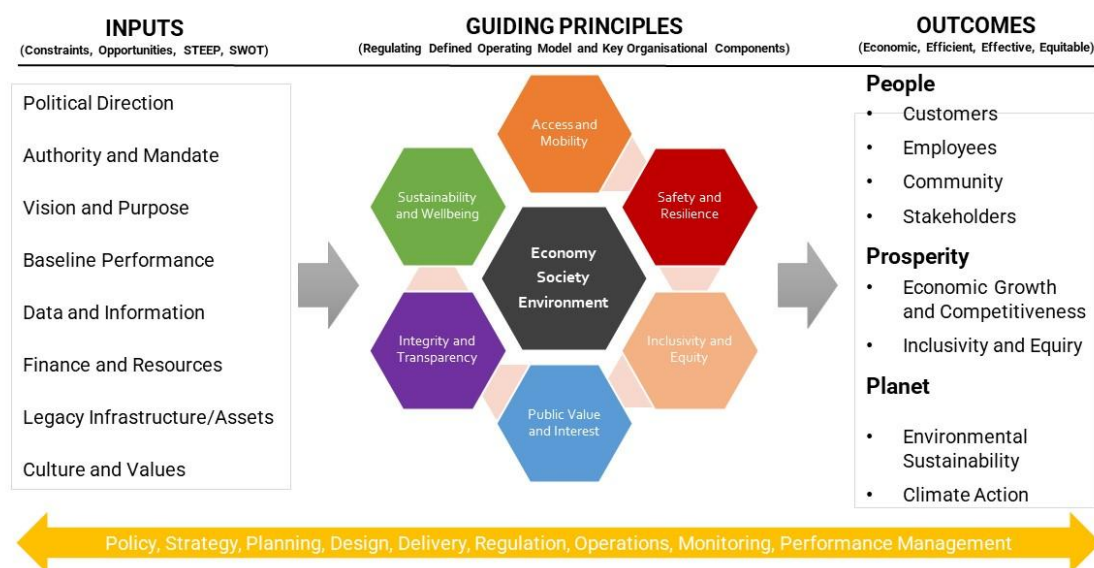


Figure 3.2 – PIARC Overarching Framework (North Star) for the Transport Agency of the Future

Questions, Answers and Discussion

As you look across the 3 research efforts from TRB, AASHTO and PIARC, what do you see as the common themes, and how can we continue to collaborate to advance these topics?

- **Victoria Sheehan:** Change in how the conversation is framed. Focusing on users and supporting societal goals not only helps set priorities but also helps communicate to customers what the goal is and about emerging options in transportation. It is also important to focus on collaboration to articulate the role of transport in society, as well as engaging with all customers directly.
- **Roger Millar:** If you don’t do things with people, they assume that you are doing things to them which may attract opposition or anxiety. You must ask people’s opinions on things that affect them.
- **Jonathan Spear:** We must ask why are we doing this? We are doing this to meet the needs of the customers, promote sustainability, inclusivity etc. rather than narrow technical specifications or outputs. These very high-level objectives are the common themes and ultimately should inform everything we do.

What workforce skills will the agency of the future need as you focus on these new topics?

- **Roger Millar:** All the technical skills of the past, but there is a renewed importance in the relationship towards transportation and land use - having a team that has expertise in land use

and community development with strong communication skills. Having representation of underserved communities is also critical.

- **Jonathan Spear:** The future workforce will need new technological skills, for example around digital infrastructure, Artificial Intelligence and the automation of key planning, design and service specification processes. Some new technologies may present ethical issues which need to be studied carefully. Finally, a more diverse workforce in all the dimensions that implies is needed to be more reflective of the customer base and society as a whole as well as increasing the gene pool of ideas for solutions. This drives innovation.
- **Victoria Sheehan:** Workforce implications of technology will mean cybersecurity specialists, system engineers- Changes to the education system will both inspire young people to want to work in our industry but also to ensure they have the right skillsets.

Each speaker spoke about moving toward a vision focused on customers, communities, and society. If we were not doing that in the past, what were we focusing on??

- **Jonathan Spear:** Customers should have always been at the heart of decision making, but for various reasons, for example a focus on technical standards and performance, often they haven't been.
- **Roger Millar:** The focus has been on narrow technical standards and outputs for infrastructure. Transportation systems were focused on operations and not on what is best for, or wanted by, the customer. In the past USDOT was focused on implementing the vision of the interstate system, focused on construction, now the focus is on being a transportation steward. There are also instructive differences between public and private sectors. The public sector needs to learn from the private sector; it is focused on customers because firms go bust if they are not.

The Webinar was considered a success and laying the basis for further collaboration between TRB, AASHTO and PIARC, both within the context of the Transport Agency of the Future and more widely.

3.6. INTERNATIONAL CONFERENCE ON HIGHWAY ENGINEERING – BANGKOK (SEPTEMBER 2024)



On 4th and 5th September 2024, PIARC TC 1.1 held an International Seminar in association with the 5th International Conference on Highway Engineering (iCHE), Future-Proofing Roads in Asia and Beyond, a major event organised with the Ministry of Transport and Department of Highways in Bangkok, Thailand. This included combined meetings of TC 1.1 and 3.1 (Road Safety), the formalisation and signing of Thailand becoming a member of PIARC, keynotes from PIARC General Secretary and the Strategic Theme 1 Coordinator, and wide-ranging presentations and discussions on issues of road safety, resilience, transport technologies, road management, maintenance and other key topics across Thailand and Southeast Asia.

Workshop on Envisioning the Transport Agency of the Future

The full Proceedings of the Conference are under preparation and reported elsewhere. However, the agenda included a PIARC Workshop on 5th September on Envisioning the Transport Agency of the Future. This Workshop further progressed the discussion which began at the PIARC World Road Congress continued through the additional TRB and TRA events cited above. It explored the need to embrace transformative external outcomes in the transport sector with a changed mindset and innovation in the movement of people, goods and services, but also to consider the essential need for changes in internal institutional structures, processes and resources.

The Workshop was one of three sessions covering the topics of TC 1.1 in the 2024 – 2027 PIARC Cycle around (i) Workforce and Skills (ii) Public Value and (iii) Envisioning the Transport Agency of the Future. Key points, with the exception of those which were made in previous events, presented by various speakers are summarised below.

Jonathan Spear (United Kingdom) – Envisioning the Transport Agency of the Future – Early PIARC Work and Findings from the 2024 – 2027 Cycle

This presentation largely covered points made in previous workshops, seminars and presentations on The Transport Agency of the Future at WRC, TRA and TRB. It was emphasised that despite the many successes of transport agencies in driving change in the past “what got you here, won’t get you there” and entities will be judged by their continued ability to adapt to, and shape, the future rather than their previous actions and achievements. Agendas such as climate action, AI and generational shifts in customer needs and expectations were cited as presenting significant areas for changed policy and practice.



The 2020 – 2023 PIARC work programme for the topic was presented, alongside Key Lines of Enquiry and a working hypothesis for characteristics of future agencies. A link was made to Public Value as the externally-facing proposition that agencies should deliver (“above the line”) as well as the need to develop various internal operating models and governance arrangements (“below the line”).

Comments were also made on developing future workforce such as managing technology, embedding a culture of innovation, developing new skills sets, and succession planning from the current generation to new generations with new skillsets, values and behaviours.

Punya Chupanit (Thailand) – The Future of Transport in Thailand

Thailand faces various challenges (e.g. geopolitics, war, COVID-19) and opportunities (e.g. Tourism, Economic Development) impacting the transport sector. The Ministry of Transport and its agencies are developing plans to meet key economic, social and environmental goals.

A key focus is on major infrastructure investment. For example, there are plans for a number of new or expanded international airports, as well as rail upgrades and new high speed rail links (e.g. to Laos and China), logistics hubs and cruise terminals. There is also a proposal for a Landbridge as an alternative to sending ships through the congested Melaka Strait.

This major infrastructure investment will require appropriate planning and design approaches, special zones, new economic activities and appropriate funding and financing models. Thai transport agencies at the national and regional level will need to be equipped to deliver the future infrastructure programme; this will require appropriate capacity building.

Thailand looks to learn and share best practice through PIARC and other international and regional groupings to improve its capacity to plan, deliver and operate transport infrastructure and services and do so in line with the principles of sustainable development.

Pattharin Sarutipand (Thailand) – Refocusing from Roads to People

This presentation focused on the road network and associated challenges in Thailand.

Across the World, over \$1 trillion is lost to traffic congestion annually with over 1.2 million road accident fatalities. Motor vehicle and road centric development creates multiple challenges. This may require a rethinking of future transport systems to provide more multimodal choice – e.g. new high-speed railways, logistics hubs and corridors and urban public transport networks. City bypasses should also be built around key centres to provide operational and environmental relief and for new urban transport policies to be implemented.



There is also a need to shift to more sustainable transportation strategies – including zero-emission and autonomous vehicles, concepts such as streets for people and rolling out road safety schemes. There needs to be a shift to people-centric transport policies and practices.

The future of transport within the Department of Highways in Thailand is seen as focusing on:

- Better planning and development;
- Improved operation and maintenance;
- Traffic safety;
- Good governance through skills development; and
- Innovation and technology to achieve green and sustainable transport.

As the previous speaker remarked, the Department will need to further develop its organisational chart, skills, processes and other governance aspects to deliver this more complex agenda as well as collaborate more widely with other public entities and stakeholders.

Mark Henry Rubarenzya (Uganda) – Adapting to Change: Transformative Solutions for Transport Agencies in LMICs

Much policy development, and consideration of transport agency development and capacity building, focuses explicitly or implicitly on High Income Countries (HICs). Yet the vast majority of people (85% of global population) live in Low- and Middle-Income Countries (LMICs) which also constitute almost two-thirds (63%) of total countries in the World.

Transport agencies in LMICs are struggling with many current challenges today before they start to think about the future. There is a need to meet basic requirements efficiently and effectively in the present. To some extent, thinking far into the future is a “luxury” which is often not practical or a priority, especially for countries on the lowest incomes and stages of development. Nor are future options often directed by senior politicians or decision makers who may be focused on their own immediate political prospects or need to deliver now.

There is also great heterogeneity between LMICs. The challenges and responses vary hugely by stage of development, climatic or physical environment, maturity of the transport network, political and cultural dynamics and local drivers within the labour market and jobs sector.

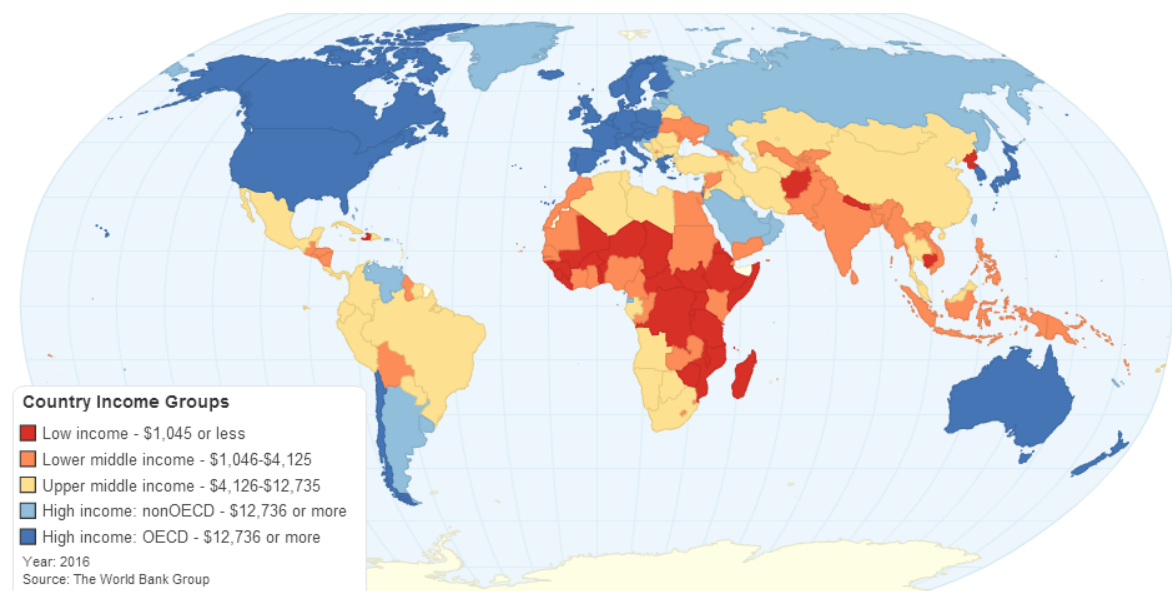


Figure 3.3 – Country Income Groups according to World Bank Classification

Nevertheless some high-level messages can be developed and communicated. Common transport-related challenges for LMICs include:

- Rapid urbanisation and high rates of population growth;
- Accessibility of rural areas and populations, including constraints in providing basic road infrastructure;
- Demographic and economic growth which often runs ahead of the capacity and ability of transport infrastructure, across all modes, to support it;
- Lack of or inadequate maintenance standards, procedures and budgets to ensure infrastructure continues in a good state of repair and level of service;
- Increased vulnerability to climate change, extreme weather or disasters, posing risks to resilience, often to a greater extent than HICs;

- Limited funding and resources, both for capital investment and ongoing operational expenditure, including organisational development and running costs; and
- Different dynamics between public and private sectors, including the significance and need to harness the potential of the informal sector for jobs and services.

In addition, many road-related road and transport challenges – e.g. road safety, climate resilience, congestion – are often more problematic in LMICs because public agencies have fewer resources, established processes and adaptive capacity to deal with them. They may be externally influenced through Multilateral Development Banks (MDBs) through the Sustainable Development Goals which is improving the situation in many countries. However, there remains much to do, especially in the face of growing volatility in the physical environment and natural ecosystems.

The way forward for transport agencies in LMICs might be:

- Getting the basics right now and ensuring the integrity of key planning and delivery processes and systems;
- Agile, but lean, restructuring to address current and emerging challenges, especially on the transport supply side and ensuring future-proofing and resilience of infrastructure networks;
- Appropriate and context-sensitive development and deployment of technology solutions, with a focus on enabling infrastructure to host and run new applications (e.g. communications networks, 5G, power grid resilience);
- Strengthened governance to support informed and transparent decisions, as well as the promotion and maintenance of integrity as a guiding principle;
- Stronger stakeholder collaboration, including MDBs, NGOs and the wider development support sector to achieve common socio-economic and environmental goals, aligned with the Sustainable Development Goals; and
- Capacity building to integrate new technologies and sustainability practices, as well as appropriate and context-sensitive digitisation and data management.



Recommendations for PIARC in respect of LMICs might be:

- Investing in more structured strategic planning and delivery in LMICs, but with flexible and agile mechanisms which can reflect, anticipate and respond to future needs and uncertainties in context;
- Promoting adaptive capacity to promote appropriate and effective innovation, track and provide resilience to major social and environmental drivers;
- Plan for the future, but not losing sight of doing the job today since this is what agencies will be judged on now.

Matt Daus (USA) – The Mobility Agency of the Future

This presentation introduced the International Association of Transport Regulators (IATR) and its ongoing collaboration with PIARC which has been in place since 2020.

Transport regulators themselves represent a diverse group of organisations, ranging from small taxi or transit licensing units to large multimodal agencies such as Singapore's Land Transport Authority or Transport for London. Their challenges, needs and adaptive capacity therefore vary enormously.

Looking ahead, IATR believes in a unified leadership and governance system for multi-modal transport that allows innovation, agility and resilience to future disruption, appropriate and proportionate planning, regulation and delivery across all mobility networks and linking policy making directly to implementation and customer services.

IATR is itself developing its own Mobility Agency of the Future Project and looking to have conclusions by early 2025. These will be shared with PIARC as well as incorporating TC 1.1's research on The Transport Agency of the Future to date. IATR also looks forward to supporting further PIARC research for the remainder of the 2020 – 2027 Cycle.



Workshop on Creating a Stronger Future Focused Workforce

This Workshop, led by TC 1.1's Working Group 3, discussed a range of issues related to future skills and workforce of Transport Agencies. Because the issues raised are of direct relevance to the objectives of WG1 and the adaptive capacity of the Transport Agency of the Future, they are summarised here.

Karen Bobo (United States) – Creating a Future-Focused Workforce: Where Are We and Where We Hope to Go

New skills and competencies will be needed within transport agencies in the future. It is difficult to define precisely what these will be at this point, but it is clear that multi-disciplinary working will be an area for development. There will also need to be skills in a fast-developing technological landscape, for example Big Data, AI and various new forms of connected and autonomous mobility.

There needs to be a culture of organisational and employee learning and talent development. In addition, the workforce of the future will be more diverse in multiple dimensions, and this should be positively encouraged and nurtured.

There needs to be a process of mentoring and knowledge transfer from the current generation of employees, who are current directors and managers, to new joiners and junior staff who will lead and manage transport agencies in the future. Succession planning is therefore a key element of organisational resilience.

Alan Colegate (Australia) – Using Infrastructure Investment to Create Employment Opportunities

Emphasis should be placed on creating employment within the roads sector and projects which will benefit the community, drive and distribute wealth, support capacity building and contribute to public health and welfare outcomes.

This broadens the range of objectives and outcomes which road and transport projects have traditionally had to deliver. This adds to project costs but is worth the investment. A case study of a road project from Western Australia was presented.

In developing future staff capacity, emphasis should also be placed on soft alongside technical skills such as staff management and mentoring, including bringing on marginalised and disadvantaged members of the communities.

Piyadit Atsavasirisuk (Thailand) – Strategies for a Future-Ready Workforce

The infrastructure construction sector in Thailand is facing a number of current and future challenges. For example, the population is not growing as rapidly and is now ageing, whilst it remains difficult to attract good school and university graduates into the sector.

There are seven proposals for developing a future-ready workforce:

- **Education and training** – Invest in robust training programmes that focus on technical, management and soft skills.
- **Enhance road and transport industry appeal** – Improve the ability of the sector to attract younger talent – including overcoming the perception that construction is dirty, dull and dangerous (3Ds) and offers exciting and dynamic career development.
- **Adopt new technologies** – Encourage widespread adoption of cutting-edge technologies which add value across the industry and leverage human capability.
- **Emphasise and maintaining safety protocols** – including through advanced safety processes and measures.
- **Promote lifelong learning** – Ensuring that employees remain adaptable and skilled in the face of industry changes, new challenges and requirements.
- **Enhance collaboration** – Encourage collaboration amongst contractors, designers, academia and public agencies in skills development, training and capacity building.
- **Maintain government support** – including investment in schools, universities and other training to provide and recognise the right skills for the roads and transport sector.

Panel Discussion



Topics covered in the subsequent panel discussion by the speakers above included the potential of technology to enhance and improve certain tasks and elements of job descriptions, the need for strong links and collaboration between transport agencies to make best use of scarce skillsets, the potential and need for new jobs in the roads sector and developing new courses and interactions with students in universities. The importance of gender, and other forms of, diversity was discussed as an inclusion agenda in its own right as well as broadening mindsets, the range and generation of ideas to drive innovation, creative thinking and solutions more attuned to customer needs and expectations.

Future employee qualities were identified as recognising the need to pivot from previously learnt skills, flexibility and agility, creating a hunger for change, positivity, integrity, inquisitiveness, innovation and openness to new ideas. Soft skills around collaboration, people management, creativity were seen as important alongside technical competencies.

3.7. FINAL REMARKS FROM WORKSHOPS AND SEMINARS

The workshops and other events summarised in this Chapter show a remarkable degree of convergence between research by TRB, AASHTO, PIARC, IATR and others and consensus on some key issues relating to the Transport Agency of the Future. Whilst the first event at the World Road Congress in Prague set out many of the key issues and areas for change, these points were significantly rearticulated, discussed in further detail and expanded in scope and dimensions through the subsequent workshops in Washington, Dublin and Bangkok.

For example, there is considerable overlap in aspirational goals across economy, society and environment and the need for Transport Agencies to define their mission and purpose in these terms, many of which are aligned with concepts of Public Value. There is a recognised need to focus on these as well as the direct needs of customers and stakeholders as a development from narrow technical and operational standards which have often determined agencies' policy and investment priorities in the past and should dictate action in future planning. Some goals will also assume greater importance in coming years, including climate action, resilience, supply chain management and innovation.

These aspects are public-facing “above the line,” as well as how transport agencies justify their actions to senior decision makers, stakeholders and communities. However, internal factors “below the line” are vital ensure the aspirations are understood, delivered and tracked. In this, there is agreement on the importance of internal governance structures, skills, workforce capacity, leadership and culture if agencies are to remain relevant, effective, aligned with customer needs and supported by their constituencies. The concept of “Target Operating Models” may be useful for structuring reforms in this context. This is not merely an issue for the future; there is agreement on the need to focus on the “day job” here and now, but to leave enough time and space (perhaps through an 80:20 rule) for projecting and meeting future agendas and strategies.

A consistent theme is the importance of a future-ready workforce with the skills, aptitudes, motivations, training and mentoring to face emerging challenges, innovate around pressing problems and turn strategy into delivery on the ground. It is important that the road sector, and transport agencies, promote themselves and a career in transportation to talented school leavers and graduates relative to other career paths and opportunities in the private sector. This extends to attracting, identifying and nurturing the transportation leaders of the future, able to steward, promote and safeguard the sector moving forward.

There is also agreement that transport agencies do not exist in a vacuum or fulfill their goals by their own actions alone. Collaboration is vital since agencies must work with a wide range of other public entities, private sector, academic and civil society organisations to fulfil their mandates.

It is clear that work to date has an implicit focus on High-Income Countries, with more to be done to capture concepts and practical actions for LMICs. This work is aligned with the Sustainable Development Goals, but recognising the smaller and more basic skills, capacity, supporting systems and resources available in many parts of the World. There is also a need to align with work on Public Value as a key *raison d'être* for Transport Agencies and with others on the importance to develop a suitably skilled, fit for purpose, effective, diverse and inclusive workforce.

Given the above, the evidence in this Chapter provides invaluable existing knowledge into WG1 as it develops its ideas, thinking and concepts over the 2024 – 2027 Cycle, as well as collateral for further discussion within PIARC and in collaboration with other organisations in the meantime.

4. EMERGING CONCLUSIONS FROM PREVIOUS EVIDENCE

4.1. OVERALL CONCLUSIONS

A substantial body of evidence already exists to support the Transport Agency of the Future. This evidence has either considered TC 1.1's questions directly, especially through workshops and seminars over the past year, or can be adapted to support key conclusions or recommendations based on consistent research, including that conducted through PIARC itself over successive cycles.

It is the role of WG1, over the present 2024 – 2027 Cycle, to both disseminate the evidence which has been gathered date as well as identify gaps, challenge key issues and further develop the topic against the defined Key Lines of Enquiry.

4.2. UPDATE TO WORKING HYPOTHESES FOR THIS PROGRAMME

Based on previous evidence from reports and events summarised in this Report, WG1 has derived, and continues to develop, a working hypothesis for further debate, challenge and articulation.

This hypothesis is based on an expanded set of 12 key principles which will be further challenged, developed, re-ordered and expanded as the current Cycle progresses. The hypothesis is that the Transport Agency of the Future should be conceived, planned, designed and managed to be:

1. Clear about **purpose, mission and function** and how these are changing over time.
2. **Flexible and agile** to respond to the **evolving demands of people** (customers, workforce, and partners) and **external factors** (demographics socio-economics, climate, politics etc.), constantly adapting tactics to meet the need.
3. Committed to the creation and the maintenance of **public value**, including proportionate level and appropriate models for regulation of the private sector and civil society in respect of transport and mobility services.
4. **Comfortable with and resilient to uncertainty**, prepared for a range of plausible futures and using scenario planning, back casting and other methods to minimise regret in decision making.
5. **Multimodal and integrated**, taking a whole journey approach required by customers, either in terms of internal structure, processes and mindset, or in relation to external relations and governance networks with the relevant stakeholders in the public and private sectors.
6. Expanding from a narrow infrastructure management role to one focused on a structured and coordinated **Systems of Systems approach to mobility**, with awareness, understanding and integration of planning, design and operation of multiple infrastructure, asset, service, information and other dimensions simultaneously to produce anticipated outcomes.
7. **People-centric**, listening to, and working with, people to harness their power, as customers, employees or stakeholders, and using this engagement to move decision makers to invest, manage or communicate appropriately.
8. **Open to exploring new technologies and service models**, especially those which look set to disrupt the transport and mobility sector, trialing and experimenting with new concepts and looking to see how practically and commercially viable proposals can be initially deployed and scaled over time.
9. **Innovative** and imaginative in attitude, culture, methods and tactics, but channeling, filtering and prioritising ideas in terms of technical feasibility, implementation practicality and overall

value for money whilst also accepting that a constructive approach to failure, as well as celebrating success, may produce meaningful lessons for future progress.

10. **Capable of harnessing modern communicators and technology** to gain traction, help media and popular culture understand what is needed and why.
11. **Shifting from narrow provision of transport infrastructure and assets to a broader role of mobility policy setting, management, convening, integration and regulation** to deliver an enhanced experience to customers irrespective of direct provider in partnership with multiple stakeholders within a broad supply and value chain across public and private sectors.
12. **Diverse on multiple levels**, celebrating and utilising difference of employees, customers and stakeholders, to broaden perspectives on current performance, potential change options and how agencies can provide for the whole of society, leaving no one behind.

We would add that numerous practitioners have commented that as well as anticipating and planning for strategic repositioning and restructuring of governance arrangements, internal operating models and stakeholder networks in light of the above factors, it is vital to **focus on the “day job”** and continue to get **the basics right in terms of service delivery in the present**. An approximate 80:20 rule might be applied with most effort and focus going on immediate service delivery and problem solving, but leaving significant time for forward planning.

Alongside these shifts, we expect the particular high-level policy objectives for the Transport Agency of the Future, or more likely the balance and priority between them, to be highly context and location-specific. Nevertheless, the TRB and AASHTO work, for example on Critical Issues for Transportation and NCHRP’s 20-24(138) Collective and Individual Actions for State Departments of Transportation Envisioning and Realizing the Next Era of America’s Transportation (Moonshots Project), as well as the broader seminar, workshop and webinar discussions reported in preceding Chapters, provides some early thinking which can be set out for further discussion, challenge and revision at the global level. These objectives include:

1. Connectivity and integration;
2. Safety and security;
3. Economic growth, competitiveness and development;
4. Quality of life, health and wellbeing;
5. Social inclusion, accessibility and equity;
6. Environmental sustainability and climate action (mitigation and adaptation); and
7. Future-proofing and resilience.

Supported by three over-arching principles:

8. Informed and enabled, but not led by, innovation, technology and data;
9. Meeting the diverse needs and expectations of customers; and
10. Action based on public and stakeholder feedback, support and collaboration.

These themes will be further discussed and developed as our work programme progresses.

4.3. NEXT STEPS

This Report is up to date to late October 2024, following the conclusion of TC 1.1's meeting and participation in the International Conference on Highway Engineering in Bangkok, Thailand.

Following this Report, the next steps for Working Group 1 are:

- Completion of the planned Task 2 Literature Review;
- Combination of Task 1 and 2 into a combined secondary evidence base; and
- Commencement of preparations for primary data collection on the key topics, specifically a Questionnaire Survey and In-Depth Case Studies, to be undertaken by TC 1.1 in 2025.

Working Group 1 will continue to promote, disseminate and undertake constructive engagement on the key findings and conclusions highlighted in this Report through online material, summary content and participation in key roundtables and events as appropriate. This includes further collaboration with TRB, AASHTO as well as others such as IATR and UITP as appropriate.

5. GLOSSARY

Term	Definition
AASHTO	Association of American Society Highway and Transportation Officers
AI	Artificial Intelligence
CAV	Connected and Autonomous Vehicle
C-ITS	Connected Intelligent Transport System
DOT	(United States) Department of Transport
EDI	Equality, Diversity and Inclusion
EV	Electric Vehicle
HIC	High Income Country
IATR	International Association of Transport Regulators
LMIC	Low- and Middle-Income Country
MaaS	Mobility as a Service
MDB	Multilateral Development Banks
NCHRP	National Cooperative Highways Research Programme
PIARC	World Road Association
SDG	Sustainable Development Goals
TRA	Transport Research Arena
TRB	Transport Research Board
UITP	International Association of Public Transport
WRC	(PIARC) World Road Congress



Copyright by the World Road Association. All rights reserved.

World Road Association (PIARC)

La Grande Arche, Paroi Sud, 5e étage, F-92055 La Défense cedex