

XXVIIth WORLD ROAD CONGRESS

Prague, 2-6 October 2023

“Prague 2023 – Together on the road again”

Call for Papers and PIARC Prizes 2023

Contributions are invited only on the topics described below. Authors are invited to submit an abstract using the online facility before 26 August 2022 at:

<https://abstracts-prague2023.piarc.org/>

The papers should present case studies, research results and/or practical experiences related to the topics of this call.

About PIARC

PIARC (World Road Association) is a non-political and non-profit making Association, established in 1909 to promote international cooperation on issues related to roads and road transport. In 2022, PIARC has 125 member governments.

Since 1908, PIARC has organized a World Road Congress every four year. The aim of the Congress is to provide a forum for professionals from all over the world, in every facet of the development, management and operation of roads and road transport, in order to give them an understanding of the progress being achieved in different countries, to discuss current issues and the future challenges faced by the road sector, as well as share knowledge.

Prague 2023

The XXVIIth World Road Congress will be held in Prague, Czech Republic, from 2 to 6 October 2023. It will include around 50 sessions, a large exhibition, technical visits and social activities.

For more information, please refer to the congress website:

<https://www.wrc2023prague.org/>

The official languages of the Congress are **English, French, Spanish** and **Czech**.

Call for papers

PIARC is calling for individual contributions on selected topics in order to enrich and broaden the views and work of its Technical Committees and Task Forces.

The papers should present case studies, research results and/or practical experiences related to the topics of this call.

Papers will be reviewed by the Technical Committees and Task Forces. The papers will be evaluated on the originality of the content, the technical interest and the applicability and transferability of the results.

Papers that are accepted will be published in the Congress proceedings and will provide input into the Congress sessions.

All authors of accepted papers will present their work and results at interactive poster sessions.

Some outstanding contributions will be selected for an oral presentation during the Congress.

Publication of the accepted papers is subject to the registration of at least of one of the co-authors to the Congress.

PIARC Prizes 2023

By submitting a paper in response to the present call for papers you will automatically be entered in the PIARC Prizes competition and be in contention to win one of the prizes. The prize for the best paper in each category will be awarded by an international jury.

For each paper selected for a prize, PIARC will pay travel expenses (economy class), accommodation (hotel - intermediate category) and registration fees to the Congress for one of the co-authors of the paper. Each selected paper will be published in *"Routes/Roads"*, the quarterly magazine of the Association.

The following are the Prize categories for our 2023 Congress:

- Young professionals (under 35 years of age)
- Authors from LMICs (low and lower-middle income economies)
- Road design, construction, maintenance and operation
- Road Safety
- Climate Change and Resilience
- Sustainable mobility
- Best innovation
- Organisation and Administration

Information for authors

Content: All papers must be original work available to be released for publication. Material that has been previously published will not be accepted. Any reference of a political, commercial or advertising nature must be excluded from the papers. The indication of a brand name should be excluded in the title and in the abstract.

Language: Abstracts must be written and submitted in English, French and/or Spanish (English is highly recommended for evaluation and dissemination purposes).

Length: The abstract should not exceed 400 words.

Submission: Abstracts should be submitted using the online facility from the dedicated website:

<https://abstracts-prague2023.piarc.org/>

TIMELINE

Deadline for submission of abstracts	26 th August 2022
Notification of acceptance of abstracts	15 th November 2022
Deadline for submission of full papers	31 st January 2023
Notification of acceptance of full papers	15 th May 2023
XXVII th World Road Congress (Prague 2023)	2 nd -6 th October 2023
papersprague2023@piarc.org	



TOPICS FOR THE CALL FOR PAPERS

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1. Understanding the journey of your customers’ experience

Research continues to show that when public agencies offer a better customer experience, they deliver measurable and positive impacts across multiple priorities. When it comes to measurement approaches, whatever the basis and frequency of the measurement, it is evident that whilst the results are reflective of community sentiment, they are not necessarily reflective of the entire customer journey in respect of the various services offered by road and transport agencies.

On that basis it could be argued that leadership teams and management are not necessarily getting the full picture in respect of customer experience. This does not diminish the value of the information that is being collected but it does reflect the difference that we may need to consider when looking at the services we provide to the community and citizens as compared to the services that we offer and provide to customer and stakeholder groups.

PIARC invites the submission of papers on how Road and Transport administrations can address this issue, measurement of the entire customer journey experience, quoting existing examples and case studies or by hypothesizing methodologies that could be adopted and trialed based on existing academic research or experience from other industries.

2. Concepts, roadmaps and practical challenges of developing the transport agency of the future

Transport agencies today face one of the most unprecedented periods of change in the history of mobility. Provision of physical infrastructure funded or underwritten by public sector budgets is being disrupted by new technologies and service models, digital transformation, generational shifts in consumer preferences, and private sector innovation and financing, to name a few.

The vision of many transport agencies and their functions, processes and structures are rooted in the 20th Century and are ill-suited to rapidly evolving mobility landscapes and stakeholder networks. The impact of COVID-19 only accelerates the pressure for change. There is a need to re-imagine the services which transport agencies deliver, how they regulate complex mobility concepts, how they operate internally and coordinate external stakeholders, and how they set and deliver their vision in the short, medium and long-term.

PIARC invites the submission of papers on the “transport agency of the future,” how it functions, its organizational form and processes and how we might get there. Key themes include drivers of change, innovation in the broadest sense, organizational transformation, strategic framework for progressive adaptation to the future of mobility, manpower planning, stakeholder partnerships and changes to culture and mindset which may be required.

Papers may consider organizational models, theories of change, policy and regulatory approaches, human resource planning, as well as case studies of how agencies conceive or are progressing future service delivery and strategic approaches to address most likely scenarios of the future of mobility.

3. How transport administrations manage the transition to a more diverse workforce and the need for new skills and competencies in a changing transport sector

Organizations across the world are increasingly concerned with matters of diversity, whether it’s focused on gender, ethnicity, culture, disability, language, age, religion, sexual orientation, political ideas or ideology or other factors perceived to

represent disadvantage in achieving personal and community opportunities.

Societal trends such as digitalisation, automation, electrification and increased awareness of climate change and the environmental impact of the transport sector will create new and different transport systems. These trends along with disruptive technologies are expected to bring about complex chains of events and societal changes in the medium to long term and a reasonable assumption is that the transport sector will be facing change in the years to come. Even though predicting the exact skills and competencies required by the transport sector under these dynamic conditions is difficult, the need for talent with new skillsets is undeniable.

PIARC invites the submission of papers on how Transport Administrations must plan and manage the transition to a more diverse workforce, including relevant approaches by the Transport Sector (public agencies, industry and academia), and on how to utilize the need for new skills and competencies to increase diversity within their workforce.

4. Innovation and new approaches for the study of mobility of people and goods

Transport modelling and traffic forecasting are the backbone of road planning and road investment decision. The sector is experiencing a fast evolution due to innovation in many areas of research and their application to the planning procedures of the National Road Agencies or Administrations (NRAs).

The research is encouraged in three areas:

- Innovation in a broad sense in traffic forecasting and modelling: what research and applied techniques have achieved in the last 4-6 years
- New approaches to the study of the mobility of people, based on enhanced tools and data bases such as internet, big data and other recently exploited sources of information
- Transport modelling applied to freight transport, bi-modal and multimodal transport, including the metropolitan context and the theme of intermodal hubs and optimal urban logistics

The topics of the papers could focus either on theoretical aspects or on applied researches and case studies.

5. Sustainable mobility planning

Sustainability in transport network planning is related to the way the trips are carried out, to the group of users of the road facilities/network, to the environmental balance of the mobility flows. Papers should focus on the current trends in mobility planning, based on the principles of climate transition. This includes the policies aimed at increasing the resilience of the road network (adaptation) as well as the activities aimed at reducing GHG emissions (mitigation).

The research is encouraged in the following areas:

- Current trends in mobility planning, based on the principles of climate transition
- Identification of the constraints/opportunities for road planners and operators related to sustainable mobility planning
- Role and relevance of the road in contributing to the climate transition in the transport sector
 - * Contributors are also encouraged to focus on special issues vis-à-vis the sustainable transport plans and planning process:
 - * Decarbonisation (in broad terms as well as in the specific application by the Agency/administration)
 - * Mobility-impaired users and active mode users (groups and ways of transportation)
 - * Access to services with high impact on social needs (instruction, health, markets) from rural areas and related planning implications
 - * Consequences of e-commerce on logistics (which new guidelines for mobility planning, based on new concepts of logistic hubs)

6. Economic and social effects of investment and operation in the road sector

This area of research covers a wide range of contributions, related to the impact of roads on the economic system. Recent developments of the research and the activity of NRAs in assessing road projects are in two areas:

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- Wider economic effects of road transport (both in the investment and the operation phase): techniques, methodologies, cases in calculating the additional impact of road on the structure of the economy
- Social impact analysis of road transport (both in the investment and the operation phase): in addition to the effects captured by the transport model, or in some cases in alternative to it, calculation of the specific impacts on employment, social groups, operators, markets

Papers are also encouraged in the area of innovation in cost benefit analysis, ex-ante, in itinere and ex-post analysis and monitoring of the effects of a road project.

7. New possible forms of public-private partnership to boost the road infrastructure sector

The post-COVID-19 recovery plans can be an opportunity to boost investments in road infrastructure projects. As highlighted by the OECD *“The short- and medium-term impact of public infrastructure investment on jobs and economic growth is what matters for recovery from the effects of the Covid-19 pandemic, as the economy needs a stimulus that will work quickly”*. However, procuring authorities lack appropriate resources to launch such kind of investments and are not inclined to take the risks related to them.

In this scenario public-private partnership (“PPP”) could represent the right tool as it involves a higher degree of commitment of the private operator who prepare the project, the business plan and bear some risks related to the realization of the investment.

However, many experience of PPP in various sector have not been successful and this also because of the pandemic which impacted on the business plans of the relevant investments.

Therefore, there is the need to redesign this instrument also taking into account the effects of the long-term implications of COVID-19 and now of a changed international scenario where supplies and production factor are less available and at volatile prices.

The Practice Note on PPP Legal Frameworks Post-COVID-19 released by the World Bank’s Infrastructure Finance, PPPs & Guarantees group (IPG) provides an analysis of many factors that have prevented the success of PPPs and highlights the importance of properly designed PPP legal frameworks.

Taking into account the short considerations above, PIARC is inviting the submission of papers on new possible forms of public-private partnership to boost the road infrastructures sector.

Papers may propose new solution under the existing legal frameworks or new legal frameworks that better support the success of PPPs.

8. How post-Covid recovery funds are allocated to the development of road infrastructures

The huge amounts of money that recovery plans made available to national government have already been allocated and many State have started to spend them. While the focus is mainly on the energy and digital transitions, infrastructures investments cover a crucial position in stimulating the post-pandemic recovery. It is likely that the government who will invest more in infrastructures will benefit longer of the investment opportunities created under the recovery scenario.

PIARC invites papers on how post-Covid recovery funds are allocated to the development of road infrastructures. Papers should include an analysis of the amount of money that the various government decided to allocate on road infrastructures investments and, if publicly disclosed, a short description of the most important road infrastructures planned in this context.

9. How sustainability requirements are reflected in road infrastructures procurement

Green procurement is a public sector obligation since years but, in many cases, it has been fulfilled in a mere formal way. The construction sector is, indeed, still characterized by a high carbon footprint and public procurement can be a driver in the sector decarbonization process.

As highlighted by the Australian Transport Authorities Greenhouse Group (TAGG), in 2013 in its Greenhouse Gas Assessment Workbook for Road Projects, Reduction of greenhouse emissions can be pursued already at the road design stage, therefore it is not only a matter of tender requirements.

It seems that procurement authorities still show a low degree of awareness of the carbon footprint of road projects and there is no preliminary assessment and calculation of the GHG emissions of these projects. Therefore, the “green procurement” label, many times, is linked to the sustainability policies of the contractors selected through a public tender and it has nothing to do with the low carbon features of the project awarded.

PIARC is inviting the submission of papers on how sustainability requirements (so-called “green procurement”) are reflected in road infrastructures procurement.

10. Practical studies to increase the resilience of the road network

Road organizations in several countries have implemented climate change adaptation projects to increase resilience of road networks. These actions already have results after their implementation, where road organizations can evaluate the effectiveness of the actions taken.

These studies to evaluate the effectiveness have baseline information (before the implementation of the adaptation project) and results of the monitoring of the adaptation measures (after the implementation of the adaptation project).

The monitoring of adaptation project makes it possible to identify the best practices for the road sector, which can be replicated by other countries and thereby increase the resilience of the road network. The objective for this topic is to identify successful practical studies on adaptation projects that have monitoring studies to assess their effectiveness, with measurable and verifiable results.

11. Climate change adaptation actions for road infrastructure

Road organizations have implemented and designed specific actions and measures for the adaptation of road infrastructure to climate change (engineering, regulations, frameworks/methodologies, etc.).

The objective for this topic is to identify those actions and measures that are easily reproducible for low- and middle-income countries, and that, due to their originality, are innovative for the road sector.

The measures designed and implemented must not only consider the mitigation of potential climate impacts (severe storms, floods, etc.), but must also have an analysis based on climate change scenarios that reduce future risks.

Additionally, it is sought that the actions and measures have a special focus on critical and strategic infrastructure, through criticality assessments.

12. Cross-cutting issues of resilience and climate change

Resilience is a complex concept often identified as a continuous cycle involving preparation, prevention, protection, response/recovery and adaptation. As such, resilience can be presented at different levels as a complex system (large-scale resilience), transport sector specific (medium-scale resilience) and resilience of infrastructure (small-scale resilience).

In this current PIARC cycle, it was identified that resilience is a cross cutting issue involving a number of PIARC Technical Committees, and there is a need to coordinate an understanding of the key definitions and

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approaches between related Committees. This session will comprise presentations to identify how these issues are currently being handled within institutions, overview of definitions and parameters of resilience, tools, methodologies and frameworks, and will provide an opportunity to share best-practice approaches. It will include an opportunities to share the definitions, terminology and approaches, case studies and report outcomes and collaboration on the cross-cutting issues of resilience.

The objective for this topic is to illustrate case studies on how resilience as a cross-cutting issue is being addressed across other parts of the road transport sector such as bridges, tunnels, earth structures, pavements, and common definitions, approaches and strategies that could be applied in high and low-middle income countries.

13. Societal resilience involving disaster

The occurrence of disasters involves a series of activities and actions carried out by different actors such as officials, road administrators, technicians, road users, road administrations, etc. who must be trained, coordinated and informed, according to the function that corresponds to them, during every phase of a disaster management (mitigation, preparedness, response and recovery). We live in a society in which roads and road networks are required to be resilient in the event of a disaster; however, road infrastructure alone does not respond to this need and it is necessary that society also act in a resilient manner. In other words, a resilient road network should be supported by an equally resilient social network.

Well-trained personnel, well-informed users, well-coordinated organizations, efficient use of communications within the highway administrations and their associates, should be crucial in determining a significant reduction in the impact of the disaster. These matters are cross-cutting issues to the organizations and they are not necessarily directly related to new technical solutions, or technological innovations.

In this call we will collect case studies on how road administrators or other organizations are addressing the societal resilience on each phases of disaster management, and identify common strategies that could be applied in low income and middle income countries and also in high income countries.

14. Lessons learned from extreme natural events: how experience improves resilience

Natural disasters are often random and sudden events that cannot be predicted. However, in order to be prepared for extreme events and to protect themselves as far as possible from losses, road administrations should draw up intervention plans whose effectiveness can be assessed according to what is expected to happen. This is why the lessons learned from past events play a key role in disaster management: while they can be the driving force behind new management strategies and development of new structural intervention or monitoring techniques, they are also the test case to evaluate the effectiveness of what has been put in place. In this sense knowledge sharing among road administrations, as well as practical experience, is crucial.

The papers in this call should illustrate the effectiveness of technical interventions for better reconstruction or the use of new technologies as well as managerial or financial tools (business continuity plans, disaster insurance, international financing), which could guarantee a substantial reduction of economic, human and time losses in the event of a natural disaster.

Keywords: Risk Control, Financial Risk Reduction, Build Back Better, Business Continuity plans, Cost and Benefits Analysis, Loss Mitigation, Enhancing Resilience

15. How information technology can improve socio economic resilience

As the socio-economy becomes more globalized and more complex, large-scale disasters have an impact on the socio-economy, not only through direct damage to road networks and facilities, but also through damage to supply chains. In the case of great earthquakes, many factories are forced to shut down due to the earthquake and tsunami. In addition, related factories that procure materials from them are also shut down in a chain reaction. This negative chain impact is spread rapidly over the territory, reaching a national level and sometimes impacting other countries, leading to a major economic stagnation.

Thus, in addition to safety as a structure, roads and road networks must also take into account the stability of their function as supply networks for socioeconomic activities added to structural stability. In other words, it is important to ensure road functions with limited resources while also considering measures such as «temporary and planned road function restrictions. Under these circumstances, the role of information and communication in disaster management is becoming increasingly important.

This topic will discuss the development of innovative information and communication technologies expected to bring revolutionary solutions to such disaster response.

This topic also really welcomes the experience of socio-economic resilience supported by information and communication management during the COVID-19 pandemic.

16. Well-prepared projects as a strategy to face uncertainty and to deliver better transportation solutions

The world is changing and all countries have to deal with uncertainty and the difficulty to anticipate the future. In the face of such challenges, well-prepared projects represent a good strategy to take into account the past and the present to draw up a project that will offer the best option for the future to solve a problematic situation. As guidelines, we favour three issues, not to the exclusion of others:

- stakeholder management
- risk management and
- communication management.

In this call for papers, we invite contributions from all countries, including those which have participated in the PIARC Task Force on well-prepared projects, to present their innovative process in the preparation of projects with illustrative case studies.

We also have a special interest for papers addressing the specific challenges in the preparation of projects in the lower-income countries. Finally, academic papers are welcome when oriented towards practical applications in the context of transportation projects.

17. Urban mobility for a better urban environment

Achieving a sustainable and reliable transport system is among the key challenges that contemporary cities face; this topic foresees new tools, design guidelines and participative approaches for a better urban mobility and a better urban environment for the immediate future where different users coexist in safe & healthy mobility scenarios.

In order to have a strong positive-impact on city liveability, efficiency and smartness the topic focuses on new models and tools to evaluate the externalities produced (i.e. congestion, noise, pollution, heat island effect, etc.). Nowadays, urban environments are reaching a make or break moment that depends on whether there are investments on infrastructures or not. Urban mobility projects are too often short-sighted and do not fully consider all the users and stakeholders' instances and, along with potential NIMBY syndromes, they are also subject to reduced safety, increased carbon footprint and poor management of public funds.

Above all, urban areas should be seen as living spaces where people move, interact and gather on a day-by-day basis. This topic asks for innovative research that consider designing, constructing and managing the urban environment of the future in a holistic manner. The new idea is putting people, their health and their needs at the centre of the urban mobility design. Some attempts to start this process from different points of view come from completed or on-going project.

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Papers shall deal with the following topics:

- New tools and design guidelines for urban mobility for a better urban environment
- new models and parameters to evaluate the externalities produced
- accessibility as design criteria.
- healthy streets and healthy mobility
- application of new maps and models to increase the value of the urban space and mobility livability and reduce social costs.

18. Multimodal transit center and mobility hubs – better integration between different mode of transport

Road networks are essential for the movement of people and goods particularly for so-called first and last miles. In urban areas, however, congestion in major corridors often impedes the performance of road networks. With capacity limit of road networks, it is important to integrate road networks with other modes. There are several types of integration. Some case studies involve multimodal transit centers (MTCs). MTC plays a role of connecting several transport modes with different characteristics in order to realize a seamless and continuous movement of people from its origin to destination

Papers shall deal with the following topics:

- MTCs that connect bus lines suited to medium density areas with mass rapid transit lines (e.g. railways) which have high carrying capacity and go into the urban center through densely populated areas.
- Small MTCs (mobility hubs) where people can easily find mobility options other than private cars with coordinated planning and in some cases with advanced ITC technology.
- Better integration between different use of Road area: optimizing the capacity of existing road networks in terms of passengers traveling by means of new bus lines, bus priority, carpooling, HOV/HOT measures or park and expressway bus (or BRT) ride.
- Road space reallocation and construction of new roads for active modes.

19. Evaluating impacts and challenges of new mobility in urban and peri-urban areas

New, intelligent mobility combines classical mobility with the use of so-called modern technologies, mainly the benefits of the Internet and the use of mobile devices such as smartphones. This topic focuses on the shift in urban mobility made possible by the emergence and confluence of multiple new transportation technologies, including vehicle automation, electrification, data connectivity, and digital methods of sharing.

Papers shall deal with the following topics:

- Autonomous driving;
- Innovative contracts and sharing systems;
- MaaS (Mobility as a Service) platforms;
- Smart-cities, using ICT (Information and Communications Technologies) and/or ITS (Intelligent Transportation Systems);
- Active users (e.g. pedestrians, cyclists, ...);
- Persons with disabilities;
- Etc.

20. Challenges and solutions for rural roads

A very large part of the world's population lives in rural areas. This includes both low- and middle-income countries where their level of development means that a large part of the population is rural, as well as high-income countries where there are rural mountain areas with difficult access, or small towns that have suffered depopulation due to the exodus to large cities.

Rural roads are often the only via of access, and they must guarantee accessibility and mobility in all these areas. However, they face various problems, such as: the existence of geometrically tight routes and the circulation of different types of vehicles and users that circulate at various speeds (cars but also agricultural or heavy mining vehicles, trucks, bicycles, pedestrians...). An additional characteristic in many regions is the ageing of the rural population. Many of those roads are not paved and are therefore more vulnerable to climate events.

But without a doubt, the greatest challenge for rural roads is the lack of economic resources for construction and maintenance, because road administrations or local communities do not have adequate resources. This can result in inadequate or unsafe traffic, especially in adverse weather conditions.

All this leads to the need to study measures to improve road safety on rural roads, paying particular attention to vulnerable users, which can be developed with reduced budgets.

Papers shall deal with the following topics:

- Strategies and measures to improve road safety on rural roads
- ITS contribution to rural road safety
- Enhancing public transport for better mobility in rural areas
- Technical solutions for construction and maintenance of paved and unpaved roads.

21. Freight: monitoring and regulation to reduce overloading and associated road network damage

Overloaded trucks, poor vehicle conditions, driver fatigue and speeding remain a big challenge in road freight transport, especially also in Low-Middle-Income Countries (LMIC). These issues can cause severe road safety problems, substantial damage to the road infrastructure and environmental impacts. Different approaches have been implemented or are under development to improve the regulation compliance using WIM for preselection of overloads (commonly used all around the World) and direct enforcement (e.g. in Czech Republic, Hungary, Belgium, and now coming in France, Germany, Poland, etc.), performance based standards and Intelligent Access Program or Smart Infrastructure Access Policies (e.g. in Australia, Canada, South Africa and now coming in the EU), and advanced heavy vehicle inspection centers (e.g. in Switzerland and other countries). From these approaches, positive impacts are expected like a fairer competition on the freight market, a better compliance with regulations, an increase in road safety and less damages to the infrastructure.

Papers should address good practices, already implemented or under investigation, to reduce truck overloading and to improve the compliance with transport regulation. Papers should highlight the approach and technologies used, impacts, costs and benefits, success factors, implementation process, user acceptance and the role of the government. Also papers dealing with newest developments and application of advanced technologies are very welcome.

22. Greening freight transport

Transport contributes today to about one quarter of energy-related global GHG emissions and about one fifth of energy use. The share of road freight transport is increasing and at the same time road freight transport is heavily depending on fossil fuel. The need to reduce greenhouse gas emissions is a dominant issue in the debate over how the transport system should be further developed. There are increased demands from various stakeholders that the climate impact from the transport system should be reduced and fossil fuels phased out. Also, pollution and noise are important issues, especially in urban areas. Tougher policy instruments are seen as a precondition, but it is hard to get political consensus. Reducing greenhouse gas emission will remain a huge challenge mid and longer term and therefore also related strategies and measures. This will include technical, logistical, infrastructural, regulatory, etc. measures. The emerging technologies of Electric Road System (ERS) are among the promising solutions (see call on Electric Road Systems).

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Papers should address successful strategies and good practices for greening freight which have been implemented or are under investigation. Papers should highlight the elements of the solution, impacts, costs and benefits, success factors, implementation process, user acceptance and the role of the government. Also papers dealing with approaches reducing the demand of freight transport are very welcome.

23. Application of emerging technologies in freight transport and logistics

Technology trends as self-driving-vehicles, internet of things, 3D-Printing, cloud logistics and robotics create new ways in doing logistics business and in managing the freight transport system. Higher degrees of automation in logistics and freight transport will lead to new types of decision support and services. Digitalization and automation will also have a substantial potential to increase the productivity, reliability and flexibility of logistics and transport services and reduce costs. Also, positive impacts on safety and the environment can be expected. The development and application of new technologies is moving forward, such as research projects and field trials regarding platooning, implementation of high capacity vehicles, applications using big data. or ground drones on sidewalks. Framework conditions are needed to ensure that the use of the new technology contributes to the objectives of the transport policy and that the barriers for implementation are reduced.

Papers should address the application of promising emerging technologies which have been implemented or are under investigation. Papers should highlight the elements of the solution (especially the innovation), opportunities and barriers, impacts, costs and benefits, success factors, implementation process, user acceptance and the role of the government.

24. The role of road operators for MaaS development

Road Network Operators (RNO) can play a key role in the development of MaaS services. They have the potential to have an impact on the way services are delivered to transport and road users and should take a more active role in MaaS developments at the local level especially in countries where the road system is closely interlinked with other means of transport and roads are the basic means of moving people and goods along the transport network.

Papers should address case studies and applications related to:

- MaaS implementation put in place by Road Operators and Road Authorities
- Governmental framework for MaaS development that involve Road Operators
- How Smart Road, ITS and C-ITS can enable MaaS services from an RNO perspective
- The role of autonomous vehicles within the MaaS ecosystem
- Case studies and applications of knowledge sharing and upskilling experiences

Experiences and experiments that have been designed and put in place quickly and purposely during the COVID-19 pandemic and that are related to this specific topic can be submitted as well, taking into account that the (positive) impact of the pandemic on such processes should be presented with its proper specifications (i.e. KPI, concrete results).

Keywords: MaaS, RNO, Strategic guidelines for new road mobility

25. C-ITS across the globe: How cooperative intelligent transport system are shaping the future of road mobility

Cooperative Intelligent transportation systems have the potential to transform the road mobility ecosystem: they aim at significantly improve safety, reduce congestion and improve the environmental performance and economic efficiency of road transport.

As outlined by several Governments and transport bodies around the world in their ITS Development Plan and/ or Sustainable and Smart Mobility Strategy, C-ITS, as smart digital solutions, present new opportunities to make transport safer, more efficient and sustainable taking into account both the needs of Road Network Operators and Road Users.

Papers should present case studies and applications related to the development of C-ITS across the world and they should highlight the following key aspects:

- Opportunities and technical challenges presented from new technologies
- Management of innovation in terms of implementation, experiments and partnership
- Economic trade-offs and constraints
- Issues related to technology and the digital transition
- Case studies and applications of knowledge sharing and upskilling experiences

Keywords: Decision making through ITS, C-ITS, users' needs, Data, New Technologies for ITS, COVID-19 ITS applications

26. Data as an enabler for road operators and C-ITS: The journey to better decision making and road network management

Users' needs and expectations are one of the major driving forces around the development of more relevant and sustainable transport systems. Road authorities and operators are continuously considering these aspects in the process of decision making, while dealing with the need of optimization of road network operations and of enabling better solutions.

In this context, data and Big Data are the real game changer. With the help of AI and machine learning, or in the context of C-ITS that allow for communication to improve information exchange with users, data can bring new useful services.

Papers should address case studies and applications of Big Data and/or the use of data strictly related with ITS and C-ITS solutions that are aiming at matching both users and road operators needs. Decision making systems and all algorithms built up upon on the use of data can be considered. Case studies that can demonstrate capabilities of a road operator to use data variety as a lever are of great interest.

Experiences and experiments that have been designed and put in place quickly during the COVID-19 pandemic and that are related to this specific topic can be submitted as well, taking into account that the (positive) impact of the pandemic on such processes should be presented with its proper specifications (i.e. KPI, concrete results). Papers can also present case studies and applications of knowledge sharing and upskilling experiences on this topic.

Keywords: Decision making through ITS, C-ITS, users' needs, Data, New Technologies for ITS, COVID-19 ITS applications

27. New mobility and its impact on infrastructure

It is expected that connected and automated vehicles (CAVs) will significantly improve mobility and will also enable direct interaction of automated vehicles with infrastructure and other vehicles to maximize understanding of the environment while minimizing crash risk.

PIARC has set up a Task Force with the objective to analyze the impact that new vehicle capacities and new forms of mobility have on roads and transport, and to draw up recommendations on the best strategies for road safety, maintenance, operation and traffic management in the face of the new reality on roads and transportation.

We expect papers addressing the impact of CAV deployment and new forms of mobility, especially on the following themes :

- Road safety
- Road maintenance and performance
- Traffic management
- Specific road design, road planning, road equipment considerations, expectations and requirements

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28. Electric Road Systems, a contribution to free the transport system from the use of fossil fuels

The road transport system must contribute to reducing emissions of carbon dioxide it has to be transformed from a system driven by energy from fossil-based energy to a fossil-free system. There is a few fossil-free alternatives available for the market of the transport sector to address the objective of zero emission transport, Biofuels, hydrogen, and electrofuels are among them, but with some limitations. Electricity is the most promising solution, mixing the use of batteries with either stationary and/or dynamic charging. The systems for dynamic charging of vehicles during the journey is referred to as Electric Road Systems (ERS), and may have great advantages to ensure a large range of road vehicles without embarking a huge mass of batteries. PIARC has set up a special taskforce regarding ERS, which have performed analysis of how ERS can contribute, comparing the main technologies, the business models and how removing the remaining technological locks. This will be presented.

Papers should address the development and tests of technologies, report experiences from demonstrations and pilots of different ERS solutions. Papers should also address NRAs’ National or Regional strategies, policies and plans for electrification by ERS. Papers can also address TCO (total cost of ownership) of vehicles using ERS, business models and socioeconomics analyses, and different stakeholders’ role and contributions.

29. Road safety management practices and processes

Road crashes continue to be a leading cause of death and serious injuries worldwide, which in turn leads to significant economic and societal impacts for countries of all sizes. Yet, the approach to solving road safety problems are different based on the contexts and needs for a given roadway type or function. In lower- and middle-income countries (LMIC) road safety of vulnerable road users is a particular interest given the over representation of fatalities and serious injuries for these road users. While some countries see potential uses of vehicle automation reducing crashes in the nearer term not all will see quick implementation within the vehicle fleet, therefore road safety management continues to be of interest.

Papers shall deal with the following topics:

- Approaches to dealing with road safety issues for LMICs
- Road safety audit and assessment applications for countries of all sizes and income
- Applications for road safety inspections on existing roads
- Proven safety countermeasures
- Insights and application of connected and automated vehicle systems and advanced technology management systems
- Safe System approach

30. Knowledge sharing on road safety

Road safety is a major concern for road administration and operators worldwide. While the details of safety implementation and activities differ from country to country, the lesson learned are invaluable to road safety professional regardless of borders. This is why PIARC has made Safety a cross-cutting issue that is taken into account by all its Committees and Task Forces. This call for papers is intended to foster knowledge sharing between countries and to identify case studies and best practices that will illustrate all aspects of road safety from planning, design and operation.

Papers should deal with the following topics, but other topics will be consider:

- Implementation of the Safe System approach
- Approaches to analysis and evaluation of road safety problems
- Integrating Human Factors into road design and operations

31. New technologies in winter service

Matter of particular interest is the development of spreading techniques in different countries, especially the application method of pre-wetted salt and brine. Around the world, scientific projects and practical approaches concerning de-icing agents and application are conducted. Among the different projects, two main findings have been made independently. Brine, either in form of pre-wetted salting or brine application has been a success and preventive treatments have become standard in many countries. Best practices and special developments might be different and give a reason for further analysis in more details.

Apart from spreading techniques, there has been development in mobile sensors for winter maintenance application. Such sensors have been developed to measure information's critical for winter maintenance such as temperatures, road state and water/ice film thicknesses. With accurate measurements from a sensor network, it would also be possible to give this information to road users using different communication channels.

Papers should address:

- New salting/spreading techniques
- Snow clearing
- Usage of mobile road state sensors in winter maintenance
- Road design to ease winter service

32. Winter maintenance in urban areas

Compared to rural roads or highways winter maintenance in cities is different in many ways. The different modes of transportation, the lack of space for snow, often very narrow roads and one-way streets make planning winter maintenance very complex. Many different responsible organizations (Cities, residents, public transport companies...) lead to different service intervals and times on roads next to each other or on different parts of the road (sidewalk, bikeway, bus lane, street).

Another challenge is the lack of space for snow to be stored temporarily in urban areas. To get the snow out of public traffic areas it has to be dispatched. Some cities have restrictions for storing/dumping contaminated snow that must be removed and transported out of the city centers.

Due to the large percentage of sealed surfaces, compacted soil as well as other environment factors trees and other plants face more troubles compared to the natural soil next to rural roads. Therefore, it is even more important so use as little spreading material as possible in urban winter maintenance.

What are innovative, pragmatic, simple or advanced solutions to these problems other cities should know of?

Papers should address:

- Treatment methods, materials and vehicles for winter service on different types of bicycle facilities
- Sidewalk and pedestrian areas, manually or machine snow removal with cluttered areas
- Accessibility for those with reduced mobility (e.g. tactile paving) during winter events
- Equipment and layout of urban areas, what to do with the snow, remove or thaw? Transport and storage of removed snow
- Best practices for public transportation, access to stations and cooperation with road authorities
- Accounting for winter weather (snow) during the planning phase of roads
- Solutions to ploughing different surfaces without disadvantaging any transport mode
- How to define a standard in cities also for multimodal transport (bicycle, bus, car, pedestrian)
- Methods and technologies for environmentally friendly winter service (spreading materials and techniques, road construction or standards/regulations)

33. Implications of connected and automated vehicles on winter services

Winter service and autonomous vehicles interact in two ways. On one hand we need to know how the use of automated vehicles impact on winter service, since they could rely heavily on road markings or other types of sensors. On the other hand the item could be how to manage traffic in wintery conditions using in car sensors. Mobile sensors for winter maintenance application have been developed to measure Informations

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critical for winter maintenance such as temperatures, road state and water/ice film thicknesses. However they are usually mounted stationary or on only very few vehicles. The data modern cars create may include typical weather observations such as air and road temperature or relative humidity, but may also include vehicle-specific relevant data like wiper blade speed and Anti-lock Braking System (ABS) status. How can we use this information for automated spreading and how can you get it to use in winter service and inform the road users?

Papers should address:

- Sharing experiences between winter maintenance experts and experts on automated vehicles
- Communication in order to manage data for better winter service
- Vehicle to Vehicle and Vehicle to Infrastructure communication

34. Road infrastructure asset management: case studies, research results, practical experiences

Management of road infrastructure is the core business for road authorities worldwide. Asset management coordinates financial, operational, maintenance, risk and other activities related to an organization's assets to obtain more value from them. Current challenges for road administrations include:

- The assessment of the optimal budget level required to maintain and sustain road infrastructure taking advantage of emerging innovative technologies and international normalization.
- Incorporating resilience considerations into the asset management process to help improve the resilience of the road network
- Identify best practices and approaches of road asset management that support the renewal and modernization of aging road infrastructure, including the management of road renewal backlogs.

Papers are invited that provide examples of implemented solutions in road infrastructure asset management. The use cases which are described in the papers and which should be applied successfully in practice and should give consideration to at least one of the following topics:

- Description of an asset management framework established in a road agency that led to better decision-making or improved budget outcomes.
- Innovative approaches for collecting and analyzing asset management data.
- Data needs and analysis for improved management of road infrastructure, including incorporation of resilience and infrastructure renewal and modernization considerations.
- Innovative approaches in road asset management taking into account new demands and increasingly high expectations, in particular towards decarbonization and sustainable development

Papers that treat the situation in low- and middle-income countries are particularly welcome.

35. Air pollution and noise measurement, assessment and mitigation measures

Air pollution linked to road transport has received significant political, media and public attention since the mid 2010s. However, despite improvements in vehicle efficiencies over past decades, emissions from vehicles still contribute significantly to concentrations of air pollutants above standards in many cities around the world.

With changes in automotive technology and the rapid deployment of intelligent transport systems and automated vehicles, there is an optimistic view that the burden of traffic noise on the community will decrease. Nevertheless, since the most significant source of traffic noise is the tyre-road interface, the deployment of electric and/or automated vehicles is not expected to reduce traffic noise.

Hence, road agencies must keep on improving the measurement, assessment and mitigation measures for air pollution and noise.

Papers focusing on either theoretical aspects or on applied research and case studies that address the following topics are invited:

- Identification of traffic operation measures to minimize the health impact of vehicle emissions;
- Investigation and assessment of how road administrations could help improve air quality through a real time evaluation of pollution, use of low-cost air quality sensors, and implementation of operational mitigation measures;
- New approaches that road administrations can use for measuring, assessing and mitigating traffic noise.

36. Real-time evaluation of pollution and mitigation measures

Air pollution problems are often observed in the roadside areas of metropolitan regions, where emission sources such as factories, business offices, residential houses and vehicles accumulate. Motor vehicle emissions of NO₂, CO, HC, PM₁₀, PM_{2.5} etc. are designated as air pollutants in most countries across the world.

Roadway administrations would benefit from the preparation of a menu of various traffic operation measures to be adopted when real time values of air pollutant concentrations exceed the short-term regulation standards. Examples of case studies where these options have been used in actual sites where air pollution problems occur would be beneficial.

There are several low-cost air quality sensors being used across the world and they are different from each other depending on the air pollutants to be evaluated. Information on the use of these low-cost sensors in combination of operational mitigation measures is sought.

Papers focusing on either theoretical aspects or on applied research and case studies are invited that address the following topics:

- Identification of traffic operation measures to minimize the health impact of vehicle emissions.
- Investigation and assessment of how road administrations could help improve air quality through a real time evaluation of pollution, use of low-cost air quality sensors, and implementation of operational mitigation measures.

37. Road transport sustainability and resilience in the context of climate change and energy transition

Sustainable development of road transport is a global objective that requires consideration of resilience, a concept with which it is often confused, as well as adaptation to energy transition and climate action.

The articulation between the notions of sustainability and resilience, which has been studied in human, economic and social sciences, opens up interesting perspectives for the planning and management of road networks. These findings are likely to inform agencies in charge of the maintenance and development of road networks in a context of climate change adaptation, its mitigation through decarbonation and the accompaniment of energy transition.

Questions to be analysed include:

- How can road agencies ensure sustainable road transport development that also takes into account climate and energy objectives?
- What policies are implemented by road agencies to ensure the sustainability of road transport? What role is resilience playing in this approach? What other elements do they rely on?
- What is the place of decarbonation in road transport sustainability?
- How does sustainability relate to resilience and/or risk management?

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38. Digital and physical security for the resilience of infrastructure and transport

The all-encompassing diffusion of digital-life causes many forms of cyber-insecurities, that together with the more traditional physical ones, amplify the systemic uncertainty of our time. Other than cyber-attacks, terrorism and traditional criminality are still real threats. Damage or disruption to the construction, operation or maintenance in particular of the road infrastructure and transport may originate, among others, from malicious attacks, thefts of equipment, hazardous materials, fallout caused by disruption in other transport modes, human errors and civil protest, strikes, frauds vandalism and more recently from misinformation, electrical blackouts, Covid-19 pandemic and military and hybrid conflicts. Security management means paying attention to events that are likely to evolve or to appear in perspective, therefore unforeseen and unpredictable or scarcely foreseeable. New physical, electronic and procedural defenses are emerging together with a growing involvement of insurance companies in security risk management.

Paper shall deal with the following topics:

- road infrastructure and transport security;
- cyber security;
- road construction security;
- urban mobility security;
- technical measures to prevent crimes against people and property;
- security applications with drones or unmanned vehicles;
- dual use technologies (safety and security integrated);
- security and resilience for business continuity;
- insurance solutions for security risks.

39. Reducing the carbon footprint of road pavements

This topic welcomes papers on techniques to reduce the carbon footprint over the whole life cycle of the pavement.

The reduction of carbon footprint of the whole road network is an ongoing concern for PIARC. Of interest are techniques during construction (e.g. the use of recycled materials, warm asphalt, etc.) but, also techniques to reduce the carbon footprint during the important use phase of the pavement can be addressed. Tools to calculate the carbon footprint of a road project or a road network can also be presented.

40. Innovative maintenance methods and strategies

This topic welcomes papers on innovative maintenance methods and techniques, covering techniques which not only result in a more durable or more sustainable pavement, but also techniques which decrease the impact on stakeholders (e.g. shorter construction time, less noise or dust, ...)

Innovative construction techniques such as mechanization or robotics are also accepted. Maintenance strategies can be discussed, e.g. performance-based maintenance contracts or evaluation methods defining quality indicators, etc.

41. New or innovative pavement materials

This topic welcomes case studies or research papers related to the development or the use of innovative materials which can be used in pavement structure layers (asphalt, concrete, ...) or base layers.

This covers a broad topic such as alternative or modified binders, the use of alternative aggregates (incl. waste materials such as plastics) or different types of fibers, the development of new pavement mixes, or the use of precast pavement modules of different materials. New design aspects or the effect on the service life of these new materials can also be discussed.

42. Bridge resilience considering natural hazards

Bridge resilience to natural hazards including climate change and seismic events can be represented as a combined measure of bridge mitigation and its recovery after natural hazards. With regard to road bridges, concerns associated with climate change are the extreme variation of air temperatures, extreme wind due to hurricanes and typhoons, sea level rise, frequency and intensity of rainfall and associated flooding, and so on. In addition, seismic events have caused severe damage to road bridges in seismic areas that have resulted in closing of road networks.

For this session, papers are invited which describe the following topics:

- Bridge recovery after the occurrence of natural hazards;
- Mitigation to accommodate effects due to natural hazards for road bridges;
- Measures for increasing resilience to climate change;
- Effects of climate change on bridge design and maintenance;
- Mitigation to accommodate climate change effects;
- Definition of climate change for road bridges;
- Road Bridges damage-resilience in Seismic areas;
- Seismic retrofit techniques to enhance resilience of road bridges.

43. Advancement of inspection, repair and rehabilitation techniques / technologies

Bridge inspection, repair and rehabilitation form an essential part for the bridge management. New technologies such as remote sensing and the use of a variety of sensors have the potential to significantly improve the quality of the results of structural inspections. On the other hands, aging infrastructure with limited functional capacity pose a major problem in terms of maintaining traveling public as well as transportation. Identification of new repair and rehabilitation materials can accelerate and improve the repair and rehabilitation of bridges under traffic. In addition, new technologies and construction methods can also be applied to repair and rehabilitation of aging bridges under traffic.

For these sessions, papers are invited which describe the following topics:

- Electronic inspection techniques;
- Unmanned Aerial Vehicles (drones);
- Cable integrity in suspended and cable stayed bridges;
- Structural health monitoring;
- Bridge geometric definition and damage detection technologies such as Lidar, Radar, Thermography and so on;
- Big data analysis;
- Machine learning – AI;
- Scour monitoring;
- Application of new materials and technologies such as steel (new combinations of strength and ductility), concrete (new cement, high performance shotcrete), composite;
- BIM modeling;
- 3D printing for bridge repair.

44. Forensic engineering for structural failures

Despite modern inspection methods and approaches, there are still bridge collapses due to deteriorated materials or systems, construction defects, overloads, and poor design. When a bridge collapses, engineers investigate the cause of collapse to identify how design, materials, workmanship, and/or overloading affected structural performance. In this meaning, Forensic engineering plays an important role in improving the safety of bridges. Engineers learn from the results of the Forensic engineering investigations and make improvements to the requirements of design, construction and maintenance in order to prevent these tragedies. An

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Understanding all of this data and documentation in order to produce actionable information would be of value to the bridge engineering community and lead to the improved safety of bridges.

Therefore, papers are invited which describe the following topics:

- Current approaches to forensic engineering in order to ensure safety of the bridges and improve bridge standards;
- Management of all data and documents obtained from a failure investigation in order to produce actionable information ;
- Laboratory experimental techniques and/or computer simulations to analyze material and system failures ;
- Strategically placed cameras and data recording systems to capture failures in order to reduce the uncertainty.

45. Resilience and Innovation of earth structures to natural hazards

PIARC invites the submission of papers on the “Resilience and Innovation of Earth Structures to natural hazards”. The papers can take the form of case studies of the effect of natural hazards on existing Earth Structures and the measures used for their remediation. Alternatively, papers can outline specific measures in design and construction of Earth Structures to prevent the effect of natural hazards on their performance over their design life. Techniques and Innovation that improve sustainability of Earth Structures or reduce their vulnerability are included in this call.

Natural hazards include, but are not limited to, heavy rainfall events and flooding, wind erosion, the action of snow and frost penetration, rock falls, soil moisture deficit, earthquakes and any other effect of global climate change.

Papers are invited from any geographical location and involving any techniques that have been utilised in the past to improve Earth Structure performance irrespective of the complexity of the method employed.

46. Earthworks for the environment

PIARC invites the submission of papers on the role of “Earthworks for the Environment”. The challenges for Earthworks in the next few years will be to deal with climate change and improvements in earthworks practice to reduce carbon footprint. We suggest papers that emphasize efforts to reduce greenhouse gas emission, impact on biodiversity, landscape or ground water, or any other impacts. Case studies about the use of recycled material and new methodologies in Earthworks are welcome during this session.

Papers are invited from any geographical location and involving any techniques that have been utilised in the past to improve Earth Structure performance irrespective of the complexity of the method employed. Presentations may be part of future work for the next PIARC cycle.

47. Digitalization of road tunnel design and management

Several countries are in the process of implementing Building Information Modeling (BIM) to improve road tunnels management at different stages of a tunnel’s life cycle. Best practices on this subject need to be collected and shared internationally in order to make recommendations to support countries in realizing the benefits of BIM for management of tunnels.

The implementation of BIM or the digitalization process in the context of renovation projects, construction of new tunnels, installation of new tunnel systems and equipment, tunnel maintenance and inspections. These types of projects make it feasible to improve access to the database of tunnel design and operation information, efficiency in the design and management of tunnel assets as well as tunnel safety.

Papers should focus on the digitalization of tunnel management in the life cycle, especially on the operational stage of a road tunnel. In addition to the application of BIM, there are also other digitalization efforts of particular interest, e.g. the use of digital twins for life cycle management, the support of fast and smooth commissioning of a new or renovated tunnel and its equipment or the use of digital twins in the training of tunnel control center staff, first responders and stakeholders management.

48. Road tunnel operation and safety issues related to the usage of new energy carriers in road vehicles

The last few years have seen considerable technological advances in the field of road transport, including the emergence of new or alternative propulsion technologies. In a road tunnel environment, these new technologies have a potentially significant impact on user safety. In recent years significant research has been performed in order to investigate the impacts of incidents with NEC vehicles such as battery electric vehicles and fuel cell vehicles but also in the field of energy carriers like hydrogen and gas. This technical session will focus on the impacts of this new vehicle technology on road tunnel operations and safety.

Papers shall deal with the following topics:

- Consequences of incidents with NEC vehicles in road tunnels on users' safety;
- Consequences of this technology in safety management systems;
- Appropriate information and intervention strategies for emergency response teams;
- Impact on risk assessment methodologies for road tunnels.

49. New trends in road design

The topics of papers should be related to new trends, challenges, changes, and findings in geometric rural roads and urban streets design.

In particular, papers should be related to:

- Changes in road design standards
- Development and comparison of models used in road design standards
- Human factor in road design standards
- Implications of the new mobility in the geometric design of road infrastructure
- Impact of vulnerable road users on changes in the geometric design of road infrastructure
- The impact of new technology (autonomous vehicle, connected autonomous vehicle, personal electrical vehicle, etc.) on road design standards
- Application of Big Data with regard to the geometric design of road infrastructure
- Smart road and street design