Ad Hoc Expert Meeting on

Climate Change Adaptation for International Transport: Preparing for the Future

16 to 17 April 2019

World Road Association

Presentation by

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Secretary General
World Road Association (PIARC)

Exchange
knowledges and techniques
on roads and road transportation

WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE
AIPCR PIARC

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UNCTAD Ad Hoc Expert Meeting on
Climate Change Adaptation for International Transport
Geneva, 16 April 2019

World Road Association - PIARC

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About PIARC

PIARC's Four key missions

- Be a **leading international forum for analysis and discussion** of the full spectrum of transport issues related to roads and related transport;
- Identify, develop, and disseminate **best practice** and **give better access to international information**;
- Consider within its activities the needs of **developing countries and countries in transition** fully; and
- Design, produce, and promote **efficient tools for decision making** on matters related to roads and related transport.

- The Association mobilizes the expertise of its members
- Through operations guided by a **4-year Strategic Plan**

Extensive membership base

- **122 National governments are members of the Association**

- **Members from a total of 140 countries**
  - **National governments**
  - **Regional authorities**
  - **Collective members - public or private, e.g. companies, research institutes…**
  - **Individual members**

- **More than 1 200 experts are currently mobilised in our working groups**

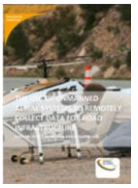
PIARC and Low and middle income countries

- One of our key missions is:
  - *Consider within our activities the needs of developing countries and countries in transition fully*
- **This is part of our "DNA"**
- Several processes are implemented:
  - Include possible specific needs of low and middle income countries (LMICs) in the terms of reference of the Association (Strategic Plan)
  - Involve experts from LMICs in the activities of the Technical Committees
  - Organise International PIARC seminars in low and middle income countries (LMICs)
  - Establish regional working groups
- Budget support is available from PIARC

2016 – 2019 Strategic plan

A. Management and finance	B. Access and mobility	C. Safety	D. Infrastructure	E. CC-Environment - Disasters
A.1 Performance of transport administrations A.2 Road transport system economics and social development A.3 Risk management	B.1 Road Network Operations / ITS B.2 Winter services B.3 Sustainable multimodality in urban areas B.4 Freight	C.1 National road safety policies and programs C.2 Design and operations of safer road infrastructure	D.1 Asset management D.2 Pavements D.3 Bridges D.4 Rural roads and earthworks D.5 Road tunnels operations	E.1 Adaptation strategies / Resilience E.2 Environment considerations in road projects and operations E.3 Disaster management
A.1 Innovative financing A.2 Coordinating National and Subnational adm.	B.1 Road design & infrastructure for innovative solutions B.2 Automated vehicles: challenges and opportunities for road operators and road authorities	C.1 Infrastructure security		

Special Projects



- **Two 2017 Special Projects: published**
  - Use of Unmanned Aerials Systems (Drones) in Road related issues (USA)
  - Unpredicted Infrastructure Failures – Best Practices (Québec/UK)

- **Two 2018 Special Projects:**
  - Electric Roads (Sweden): published
  - Contribution of road transport to sustainability and economic development (TC A.2): ongoing

- **New 2019 project:** Positive Energy Roads (Canada-Québec)

Key Activities in 2018

- Success of the XVth PIARC **International Winter Road Congress** in Gdansk (Poland)
- PIARC **International Conference on Road Tunnel** Operations and Safety in Lyon (France)
- Australia held the 8th **Symposium on Pavement Surface Characteristics** (SURF2018)
- PIARC involvement in 10 high-level **international events of partner organisations**
- **48 publications** under preparation, they will be presented at the World Road Congress in 2019
- 2 **webinars** brought together more than 1,000 people online from more than 40 countries
- 60 articles have been published in **Routes/Roads magazine**
- Special project on "**Electric Roads Systems**"
- Our international **1,200 experts** have met on all 5 continents
- + 3 new National Committees: Bulgaria, Côte d'Ivoire and Tanzania. Total: 45 NCs
- + 1 new Member Country: Botswana. Total: 122 Countries are members of PIARC

Our work on climate change adaptation

Impact on Road Authorities

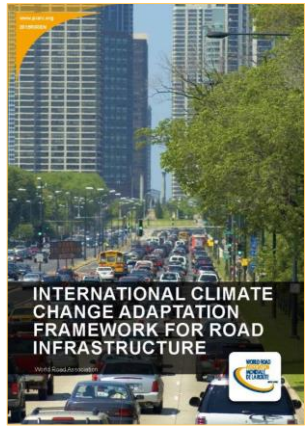
Projected climate change **will**:

- Pose strategic organisational and operational risks
- Impact the design, construction, operation and maintenance of road infrastructure
- Threaten the ability of road infrastructure to provide access to and the delivery of critical infrastructure and services
- Have a knock-on impact on national, regional and local economies, communities and environments

PIARC Adaptation Framework

The framework guides road authorities through the process of increasing the resilience of their networks and assets through the following stages:

- **Stage 1** - Identifying scope, variables, risks and data
- **Stage 2** - Assessing and prioritising risks
- **Stage 3** - Developing and selecting adaptation responses and strategies
- **Stage 4** - Integrating findings into decision making processes



Risk Scores and a Risk Register

Risk = Impact Probability x Impact Severity

	Severity				
Likelihood	**1**	**2**	**3**	**4**	**5**
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Impacts can be rated and prioritised for action according to their overall 'Risk Score' and used to develop a Risk Register.

Prioritising risks in this way will subsequently aid the development and prioritisation of adaptation responses and strategies.

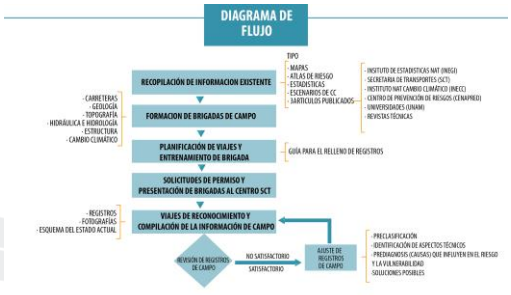
Adaptation Responses and Opportunities

- Examples:
  - Raising road levels
  - Road realignment
  - Installation of flood defences
  - Re-siting of critical infrastructure
  - Increasing drainage capacity
  - Using heat resistance materials
  - Slope stabilisation and reinforcement
  - Development and implementation of emergency response plans
  - Staff training and stakeholder engagement

In Mexico: SCT Actions

International Framework for the Adaptation of Road Infrastructure to Climate Change. World Road Association (PIARC) .

The process applied in Mexico comprises three stages: 1) Identification and assessment of the vulnerability of network sites; 2) Risk assessment for each site; 3) Identification and prioritization of adaptation actions.



Adapting pavements to climate change 1/4

Pavements in the future **must consider changes in the variables that influence their design**, such as temperature and precipitation, and include variables such as wind, atmospheric pressure, humidity and evapotranspiration.

Preventive actions **to reduce risk** in pavements include:

- **Updating of the design standards according to the new climatic thresholds** that allow to adapt the pavements to the changes of the climate.
- An **increase in the frequency of maintenance of drainage works** to ensure sufficiency despite changes in rainfall intensity.

Adapting pavements to climate change 2/4

- Ensure that the **running surface is in good condition to prevent water from penetrating** into the different layers of the pavement.
- **Efficiently remove water from the pavement by modifying the pumping** on the carriageway.
- In order to **avoid moisture in the layers**, the appropriate degree of compaction must be guaranteed in each layer.
- **Include all necessary underground drainage** in the pavement to prevent water from entering the pavement layers.
- Maintain **strict adherence to quality control of the asphalt mix**, to ensure the quality of aggregates and asphalt, and thereby achieve high performance pavements.

Adapting pavements to climate change 3/4

- An **adequate design and materials according to the climatic zone**, can help a good performance in spite of temperature changes.
- The **use of additives such as hydrated lime improves the bond between asphalt and aggregate**, preventing detachment and therefore loss of wearing course quality.
- In asphalt pavements, **high modulus mixes (EME) are an effective approach to mitigate traffic deterioration** by decreasing deformations and fatigue and increasing permeability.
- **Materials with better hydraulic performance** should be used in the base or foundation layers.

Adapting pavements to climate change 4/4

- **Temperature risks can be avoided by incorporating better technology to improve asphalt performance**, there are currently many modifiers that help against the problems of climate change.
- **Modify the working hours in summers** that will be warmer to ensure good health to workers.
- There are **technologies to extract heat from the pavement and thus avoid deformations**, but they are still expensive, so it is recommended to apply only in special cases.
- The **placement of layers of coating to the pavement that allow to refract the solar rays**, avoiding the overheating of the pavement.

Our work on resilience

Building Resilient Infrastructure Systems

- Transportation and energy infrastructures are increasingly being classified as “critical infrastructures” (European Programme for Critical Infrastructure Protection)
- Global investments needed for roads are estimated to US$ 34 trillion between 2016 and 2040 while the current trend of investments for this period does not exceed US$ 26 trillion (Global Infrastructure Hub, G20)
- Environment-related risks account for three of the top five risks (by likelihood) and four of the top five risks (by impact) threatening mobility infrastructures (World Economic Forum, 2019)
- Over the last 20-years, the reported economic losses due to extreme weather events has risen by 151% compared to the 1978-1998 period, reaching USD2,25 billion (UNISDR, 2017)
- For example between 2010-2013, *El Niño* and *La Niña* combined effects caused major damages to Queensland road network in Australia. 8,741 km of the state-controlled network required full or partial reconstruction, with a reconstruction budget of approximately USD 4.58 billion (Queensland Government 2016)

Resilience: a defining issue

- **Resilience of road infrastructure and networks:**
  - There are many threats
  - This is a multi-faceted issue
- **For example:**
  - Adequate planning and financing
  - Proper funding for asset management
  - Maintenance strategies
  - Road Safety
  - Security vs man-made attacks
  - Future-proofing vs new uses and demands
  - Climate change and extreme weather
  - Structural aging of infrastructure
- This leads to question how to mitigate negative impacts and how to adapt and improve the resilience of transport systems
- **PIARC recognizes the need for a uniform and holistic approach to resilience**

Resilience - Characteristics

A resilient system shows:*

- reduced failure probabilities,
- reduced consequences from failures, in terms of lives lost, damage, and negative economic and social consequences,
- reduced time to recovery (restoration of a specific system or set of systems to their "normal" level of functional performance)

* *Bruneau. M.; Reinhorn, A.- Exploring the Concept of Seismic Resilience for Acute Care Facilities*

Recommendations 1/2

- Develop resilience strategies for infrastructure and transport systems
  - Develop strategies at State level for resilient (road) transport systems that could make a significant contribution to solutions in the future, such as to create the foundations for a proactive and holistic resilience engineering/resilience management.
  - Introduce educational initiatives that focus on comprehensive resilience-centered operation, maintenance and adaptation of (road) infrastructure including risk-based elements and cost-benefit analyses.
- Establish policies and mechanisms for exchanging knowledge and experiences related to the resilience efforts for the infrastructures and transport systems
  - Assist LMICs in the long-term strategic planning of road infrastructure and in the implementation of efficient and cost-effective road development and maintenance measures, through their taking part in knowledge sharing measures and through actual implementation of remedial measures on roads.
  - Develop a strategy to monitor and coordinate policies and initiatives with regard to resilient transport systems, regarding the international conference agenda

Recommendations 2/2

- Promote a socio-political based approach to resilience in order to facilitate the acceptability of infrastructure projects at local and global scales
  - Advocate the need that transport infrastructures be closely tied with territories and address more than functionality.
  - Encourage the development of some sort of “knowledge-sharing Academy”, with inputs of engineers, architects, urban planners, economists, social and human scientists.
- Set up common methodology for measuring resilience success
  - Establish mechanisms for the collection and evaluation of efficient and cost-effective solutions.
  - Improve interaction between policy makers and owners and operators of road infrastructure in order to raise awareness with regard to resilient road infrastructure.
  - Encourage the adaptation of existing technical guidelines and standards in order to integrate resiliency to infrastructures (design, building, operation, maintenance).

Examples of our specific work so far

- Report on Climate Change Adaptation Framework
- Report on Importance of road maintenance
- TC E.1 - Committee on CC and Resilience
- Many more reports on our website
- Seminars in Cuba (2016), in Brisbane, Australia (2017), in Beijing (2018), Session at TRB Annual meeting (2019)

Dedicated Technical Committee

Committee E.1 - Adaptation Strategies/Resiliency

Issue E.1.1 Adaptation strategies to increase resiliency	
Strategies	***Outputs***
To investigate and disseminate information about current adaptation strategies to increase the resiliency of road infrastructure.	Report based on case studies
Issue E.1.2 Climate Change Adaptation Framework	
Strategies	***Outputs***
Refinement of the Climate Change Adaptation Framework (based on the Special Project developed in the 2011-2015 cycle) and follow-up of its implementation.	Report based on case studies

Conclusion

Conclusions

- **Compelling case for action.**
- PIARC Framework can be used irrespective of geographical, climatic, economic and environmental condition, locality, level of preparedness, and data availability.
- Universal, accessible framework developed though extensive literature review and consultation with international road authorities.
- Guidance provided on: identification of climate change impacts, potential risks and vulnerabilities, effective responses to risk and the integration of assessment findings into wider decision-making.
- Life cycle approach from inception to management and monitoring.

World Road Congress 2019

- **Strategic Session** - The progress of climate change adaptation and mitigation actions in the Transport Sector
- **Foresight Session on Resilience** - with TRB, AASHTO…
- **PIARC Committee Sessions:**
  - Adaptation Strategies / Resilience
  - Disaster Management
  - Security
- **Best presentations from our International Call for papers**

PIARC CONGRESSES
Save the dates!

- **26th World Road Congress**
  - Abu Dhabi, United Arab Emirates
  - 6 – 10 October 2019
  - www.piarcabudhabi2019.org

#PIARCWRC2019
#PIARCIWRC2022

- **16th International Winter Road Congress**
  - Calgary, Canada
  - 8 – 11 February 2022
- **27th World Road Congress**
  - Prague, Czech Republic
  - September – October 2023

Échanger connaissances et techniques sur les routes et le transport routier / *Exchange knowledge and techniques on roads and road transportation*

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Thank you for your attention

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