13th UIC Sustainability Conference

VIENNA 2016

Considerations from the road sector

by the World Road Association

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Considerations from road sector

- The World Road Association
  - founded in 1909, 122 government members
  - more than 900 experts worldwide
- 22 Technical Committees and Task Forces
  - grouped in 5 Strategic Themes:
    - » ST A - Management and Finance
    - » ST B - Access and Mobility
    - » ST C - Safety
    - » ST D - Infrastructure
    - **» ST E - Climate Change, Environment and Disasters with 3 respective Technical Committees**

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- COP 21 - Strategy of the World Road Association
  - Adopt a new Strategic Plan for 2016-2019
    - with a specific strategic theme to consider climate change issues
  - Develop and publish a Framework Document
    - on adaptation to climate change
  - Monitor its implementation and relevance in various countries
  - Deliver a toolbox to manage the risk of natural hazards
  - Provide Guidance and undertake actions in
    - adaptation of the road infrastructure
    - increasing the resiliency of the road transport system
    - reduction of the carbon footprint of the road transport system
    - mitigation of negative impacts of road transport on climate change

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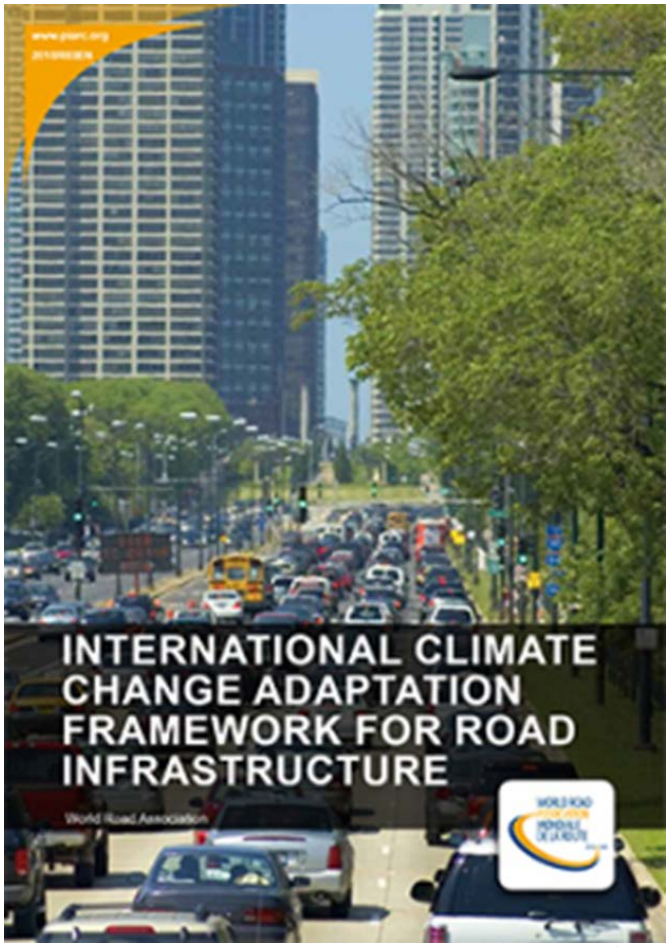

Aim of the study

- Identify the state of the art by collecting and detecting good practice examples used in the member states worldwide
- Formulate a toolbox and provide guidance for road authorities and agencies

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Countries involved

- Canada-Quebec, China, Japan, Malaysia, Mexico, New Zealand, Norway, Romania, United Kingdom, Transport Scotland, US Federal Highways, Tanzania, Asian Development Bank

The framework consists of 4 stages

- Identifying scope, variables, risks and data
- Assessing and prioritising of risks
- Developing and selecting adaptation responses and strategies
- Integrating findings into decision making process

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Identifying scope, variables, risks and data

- Questions to be addressed first
  - What climatic effects have already led to impacts upon your network
  - Which assets, locations and operations are deemed the most important/valuable
  - What do you want to achieve as a result of an assessment
- Key aim and driver of the actions is to ensure and enhance the resilience of the network,but this may include
  - to meet national climate change adaptation laws or formal policies
  - to understand how asset design standards need to be adapted
  - to understand the network vulnerability (exposure and sensitivity) and adaptive capacity
  - to have a good level for understanding by senior managers and decision makers
  - to support the development of a business case to obtain financial support
  - to assess climate change projections and scenarios (geographical location, data, future conditions)

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Assessing and prioritising risks

- Risk can be seen as a function of probability and severity of impacts
  - Impact probability relates to the likelihood of an impact occurring within a given timeframe
  - Severity could be scored by means of a severity scale and the set of criterion taylored to the respective network
  - The assigned overall Severity Score should be that corresponding to the highest rated criterion
  - Establishing risk scores and risk register might be a useful tool to achieve an overall assessment

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- Example of a Risk Score Matrix (US Agency for International Development, 2013)

TABLE 6 - RISK SCORE MATRIX					
Likelihood	**Severity**				
	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

TABLE 7 - RISK CATEGORIES AND RESPONSES	
Extreme ≥ 20	• Extreme risks demand urgent attention at the most senior level and cannot be simply accepted as a part of routine operations without executive sanction. • These risks are not acceptable without treatment.
High ≥ 12	• High risks are the most severe that can be accepted as a part of routine operations without executive sanction but they are to be the responsibility of the most senior operational management and reported upon at the executive level. • These risks are not acceptable without treatment.
Medium ≥ 5	• Medium risks can be expected to form part of routine operations but they will be explicitly assigned to relevant managers for action, maintained under review and reported upon at the senior management level. • These risks are possibly acceptable without treatment.
Low < 5	• Low risks will be maintained under review but it is expected that existing controls will be sufficient and no further action will be required to treat them unless they become more severe. • These risks are can be acceptable without treatment.

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Identifying and selecting adaptation responses and strategies

- Identification of measures
  - Design measures, Maintenance measures, research measures
    - Depending on the kind of impact:
      Sea level rise and storm surges, reduction in rainfall and increased drought, increase in percipitation, increased wind strength, increasing temperatures, changes to snowfall, permafrost and ice coverage
- Selection and prioritisation by
  - Cost-benefit analysis
    - The benefit of an adaptation response can be measured by the reduction in the climate change induced cost of damages between now (with no adaptation) and a time in future (with implemented adaptation response)
  - Multi-criteria analysis
    - Including non monetary environmental and social impacts

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Identifying and selecting adaptation responses and strategies

- Development of an Adaptation Action Plan or Strategy
  - An Adaptation Action Plan should provide details relating to adaptation measures and the timescale the measures should be delivered, including
    - details of the action, what it is trying to achieve, possible risks
    - organisation scheme and time frame for the action
    - estimated costs and funding sources and
    - the priority of the specific action compared to other measures within the network

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Integrating findings into decision making process

- Incorporating recommendations and requirements into programmes, processes and investments
  - National infrastructure plans and policies
  - Asset management plans and policies
  - Hazard mitigation plans, emergency and risk management processes
  - Investment plans for infrastructure
  - Design standards and specification

Box B1 - US Federal Highway Administration's (FHWA)
'Extreme Weather Vulnerability Assessment Framework'

The framework outlines a process for conducting an assessment of the vulnerability of road infrastructure to extreme weather events and climate change, and provides guidance on how to incorporate the results of an assessment into decision-making. The assessment results can also feed into the development of adaptation strategies, asset management programmes and transportation system planning. The guidance stresses the importance of identifying and setting goals and objectives at the beginning of the vulnerability assessment process as this will assist in determining the level of detail and data required for conducting a successful assessment. The assessment framework approach is shown below.

Step 1: Define scope
- Identify key climate variables
- Articulate objectives
- Select & characterise relevant assets

Step 2: Assess vulnerability
- Collect & integrate data on assets
- Develop climate inputs
- Develop information on asset sensitivity to climate
- Incorporate likelihood & risk (optional)
- Identify & rate vulnerabilities
- Assess Asset Criticality (Optional)

Step 3: Integrate into decision making
- Incorporate into asset management
- Integrate into emergency & risk management
- Identify opportunities for improving data collection, operations or designs
- Educate & engage staff & decision makers

The framework also offers examples of climate change vulnerability and risk assessment pilot projects across individual States.

Box 13a - Example of an Adaptation Action Plan

Below is an excerpt from the Adaptation Action Plan as part of their review of climate change impacts on their highway network policies and standards.

Policy/ Standard Area	Adaptation Response Number	Adaptation response information	Timescale
Bridges and Other Structures	AR1	Carry out a risk assessment to identify which structures are most at risk from climate change. Identify the nature and frequency of changes that are needed to the inspection and maintenance regimes of bridges and other structures.	Immediate
	AR2	Increase the number and frequency of maintenance works carried out to increase the BCI values for bridges assessed as liable to risks from climate change. Ensure all strengthening and repair work that is outstanding for failed or below standard bridges is carried out.	Immediate
	AR3	Carry out flood studies with the help of other authorities and organisations	Immediate
	AR4	Ensure all data (new and historical) is transferred into a single system to make assessments of maintenance and repair priorities and needs, more effective.	Immediate
Drainage	AR5	Invest in asset management and location reviews, carry out drainage surveys, improve the knowledge of drainage assets, hydraulic capacity and ownership, and carry out flood studies with the help of other authorities and organisations.	Immediate
	AR6	Undertake a risk assessment to determine vulnerable areas and establish a prioritised scheme for maintenance	Immediate

Box 13b - Example of an Adaptation Action Plan

Below is an excerpt from Scotland's Climate Change Adaptation Framework's Transport Sector Action Plan

Task/ Action	Delivery	Timescales	Deliverables
Review and adapt procedures and maintenance regimes so that transport networks and emergency responders can react effectively to unexpected events.	Owner of the transport asset along with emergency responders and the Scottish Government Emergency Planning.	Short-term	Enhance existing processes and review existing standards – end 2012.
Review the various transport network maintenance regimes so that works to prevent subsidence are dealt with as a priority, and comprehensively, where financial resources allow.	Transport asset owners	Ongoing	Transport Scotland to produce progress report – end 2012
Learn from organisations further south what changes may be required to materials for road surfaces in order to cope with warmer temperatures.	Transport Scotland and local authorities	Medium-term	Discussion at the UK Roads Board - 2020
Support the development of freight and non-freight driver education programmes and learner training to cover how to drive in extreme conditions.	Transport Scotland leading development to Scottish Guidance	Short-term	Guide on driving in bad weather to be updated – end 2012

Impact of climate events on the socio-economic system
(adapted from MacCraken, 2009)

Some examples out of the PIARC Report on International Climate Change Framework for Road Infrastructure (bibliographic references are mentioned there)

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Conclusions

- there will more than one strategy to be used
- first identify scope, vulnerability and risks
- define measures and priority
- estimate costs
- take into account impacts on the whole socio-economic system
- make a ranking of your projects
- integrate it into your policy, plan or program

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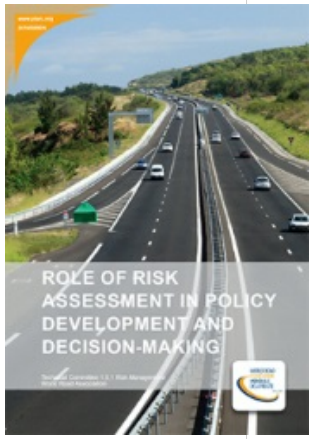
Publications at www.piarc.org



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Publication sheet

International climate change adaptation framework for road infrastructure

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Actions undertaken to mitigate the negative effects of climate change on road networks have varied from one country to another. They include legal, regulatory and institutional measures; promoting other transport modes; introducing new, green technologies; undertaking permanent supervision of embankments and slopes to reduce risks of collapse, accidents and interruptions of service, as well as developing new methodologies and analytical tools to identify, assess and mitigate risks and thus reduce the vulnerability of the road infrastructure.

Despite all these efforts, dealing with the effects of climate change is still a new topic and there are no easily accessible references to help transport and road decision-makers to cope with the problem and manage it systematically and efficiently. While some countries have made progress on this subject, others are yet to start their own efforts. In recognizing this situation, the World Road Association has completed this "International Climate Change Adaptation Framework for Road Infrastructure" to help member countries adopt a consistent approach to analyze the effects of climate change on their road networks and thus help them identify, propose and prioritize the most appropriate measures to mitigate risks associated with extreme weather events.