Distr.: General
23 August 2021

English only

Economic Commission for Europe

Inland Transport Committee

Working Party on Transport Trends and Economics

Group of Experts on Assessment of Climate Change Impacts and Adaptation for Inland Transport

Twenty-first session
Geneva, 2 and 3 September 2021
Item 5 of the provisional agenda
Database on adaptation measures

Conceptualising adaptation measure database

Note by the secretariat

I. Background

1. The Group of Experts on Assessment of Climate Change Impacts and Adaptation for Inland Transport (GE.3) acknowledged the fact at its twentieth session that profiles/fact sheets of transport assets and assessed adaptation needs for the assets to retain their initial functions may present an input required to create databases on asset specific adaptation measures. GE.3 agreed therefore that demand for such asset profiles should be explored and value of availability of such profiles assessed.

2. GE.3 further requested interested experts and the secretariat to develop a concept note with considerations of types of adaptation measures databases which would bring added value, target groups for the database, and requirements for their development and maintenance.

3. Against this background, the secretariat organized a consultation in which experts from Germany, Ireland, the Russian Federation, Climate Sense, World Road Association (PIARC), World Association for Waterborne Transport Infrastructure (PIANC) discussed about various practices to create resource material/fact sheets for transport asset adaptation. Experts agreed that these practices need to be considered before any type of adaptation measures database be proposed, let alone requirements for its development or maintenance.

4. To this end, this document presents examples of resources and fact sheets for transport asset adaptation.

II. Example of resources

A. Germany

5. The BMVI Network of Experts has been conceptualising on solutions to assist adaptation of the German transport system to climate change.

6. In this process examples of simple fact sheets/profiles for various climate impacts with relevance for different transport assets have been elaborated. An example of such fact sheet is provided below:

Climate Impact	*Seal level rise, increased inflow from the catchment area*
Study area	Drainage basin – Kiel canal
Effect of adaptation	The navigability of the Kiel canal is ensured in the future through hydraulic engineering adaptation measures (new lock construction, installation of pumps) and adapted drainage management.
Type of adaptation	Construction / technical adaptation Compensation
Stakeholders	WSV, WSA, …
Approach	Modeling study (water balance model, channel balance model), sensitivity experiments, scenario assumptions (continue-as-is, Grinsted et al. 2015, land lowering).
Further Information	Report of the Federal Hydrological Institute for the Water and Shipping Administration, Final report of topic 1 within the BMVI Network of Experts (BMVI-Expertennetzwerk 2020)
Contact person within the BMVI Network of Experts	M. Zierul (WSV), A.-D. Ebner von Eschenbach (BfG), N. Schade (BSH), J. Möller (BSH)

Results:

Even an assumed sea level rise of 55 cm would already reduce the drainage potential of the Kiel canal by 40 % by the end of the century. If one also considers the current land subsidence in southwestern Schleswig-Holstein and possible higher rates of rise from assumptions on glacier melt (Grinsted et al. 2015), as well as more frequent and heavier precipitation, the drainage potential is reduced even more significantly.

Further results Schade et al. (2020) – BMVI Network of Experts (in German)

Source: Norpoth et al (2020) Project report within the BMVI-Network of Experts, doi: 10.5675/ExpNNM2020.2020.08

7. These fact sheets allow to quickly find relevant information and to decide if reading the more detailed case study is expedient.

B. PIARC

8. PIARC has been developing facts sheets to highlight national projects, initiatives and policies which are utilized by countries with the aim to make road transport more sustainable and resilient to various hazards.

9. At the time of writing of this document, PIARC Technical Committee 1.4 Climate Change and Resilience of Road Networks was working on fact sheets from international case studies on climate change adaptation and all-hazard resilience. While these fact sheets were not yet published, these aim to be structured according to other published fact sheets developed by PIARC for multi-modal freight transport policies and truck management on highways. The table below presents the components used in these fact sheet examples.

Further information on fact sheets templates being developed by PIARC Technical Committee 1.4 relating to climate change and resilience are forthcoming.

Keywords

Project description in short

Background

Elements

Related measures

Impacts and benefits

Success factors

Outlook & transferability

Contact details for more information

---

10. PIARC Technical Committee 1.4 has also undertaken an extensive survey process, where 65 case studies have been collected using a consistent template. This template covers the areas of identifying the audience/administration which the case study relates to, type of case study, scope of the case study and methods used to assess climate change adaptation and improve resilience e.g. exposure, vulnerability, risk and resilience assessments and the underpinning economic methodologies used to prioritise adaptation measures to ensure the functionality and maintenance of assets for road networks. This work builds on an International Climate Change Adaptation Framework for Road Infrastructure which was developed in 2015 and is being updated by Technical Committee 1.4. For convenience, the main elements of the survey to collect case studies are repeated in the table below:

Audience/Administration: Main audience for the case study, which administration processes the case study relates to, type of case study

Scope of case study: What is the objective of the case study, which threats are considered in the case study, definition of resilience, which aspect of resilience does the case study address, what changes towards the future are considered in the case study?

Steps and details of methodologies implemented in the case studies to improve resilience: What steps does the study focus on, which type of method is used in the case study, what is the scope of the impact analysis, which type of approaches are used to identify and prioritise interventions?

Economic assessment methodologies for adaptation prioritization

---

C. Rail Safety and Standards Board (RSSB)

11. RSSB developed fact sheets as part of its research programme on “Tomorrow’s Railway and Climate Change Adaptation”.

12. Such have been developed for three themes: (1) flooding, (2) measures for winter weather management and (3) hot weather management. The focus in the fact sheets is on how the phenomena can be managed both strategically and operationally. The fact sheets prescribe actions to be undertaken for strategic and operational management.

Key WR/CCA themes: flooding – how can flooding be managed, strategically and operationally?

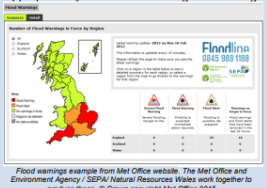
Strategic planning for flooding

Overview

Flooding affecting railway, Somerset, UK, Winter 2013/4. © Network Rail 2015

- Management of flooding requires **careful planning** and the **development of appropriate strategies** (e.g. emergency timetables, coordination with other operators, etc)
- **Strategies should be reviewed** after events, and **adapted in the light of new information**

Understand the weather hazard:
Collect appropriate weather data, and develop appropriate systems for monitoring and warning



Flood warnings example from Met Office website. The Met Office and Environment Agency / SEPA/ Natural Resources Wales work together to produce these. © Crown copyright Met Office 2015

In addition, **understand the source of the flood hazard**: surface water, fluvial (river), groundwater, or coastal.

Develop **flood hazard / flood risk maps**.

- *Many countries have developed these, including the UK, the Netherlands, Norway & Ireland.*

Understand the vulnerability:
Assess the impact of flooding on railway assets and operations

Flooded lineside equipment in Somerset, UK. © Network Rail 2015

Effective and timely maintenance **supports and enhances preparedness** (e.g. clearing debris from culverts)

Lifting track to repair drainage pipe. © Network Rail 2015

During **post-event repairs, incorporate measures to increase resilience**

Ensure any **lessons learned** after events are embedded into normal working practices

Take climate change into account when designing and siting new assets.

- *In the UK, Network Rail has updated its drainage manual to incorporate a 20% increase in the estimated present day design flow.*

Consider **relocation / re-siting** for particularly vulnerable existing assets.

- *In locations vulnerable to flooding in the Netherlands, track has been elevated. Railways have been routed away from rivers.*

Consider **different engineering solutions**, e.g.

- *Slab track: may have better flooding resilience as no erosion/washout of ballast, and drainage channels can be incorporated into the design)*
- *Pile construction: may decrease the vulnerability of buildings containing important equipment (e.g. signalling)*

Operational management of flooding

Training and personnel

- Have extra personnel on standby to help with additional duties during a flood event or to replace crews displaced by delayed/cancelled trains
- Understanding the source of the flood hazard can be relevant in responding to it

Flooded signal equipment at Maidenhead, Feb 2014. Groundwater flooding events like these result in water rising from beneath the surface rather than accumulating via runoff over the surface. © Network Rail 2015

Preparation

- Have operational flood response plans in place, which can be used to prioritise use of limited resources during flooding events
- Be ready to issue flood warnings, or act upon warnings issued by other agencies, when required
- Have flood mitigation equipment (e.g. water pumps) ready for use

Weather-proofing infrastructure

- Install or deploy flood protection measures such as flood protection walls, inflatable dams or flood gates

Inflatable dam in use, December 2013. © Network Rail 2015

System-wide factors

- In some places, the railway itself can act as a flood barrier
- Understand system interdependencies and effect of flooding on these (e.g. flood at electricity substation resulting in loss of traction power, even if the railway is not affected directly)
- Ensure that communication channels routinely support the sharing of information between industry organisations, between industry and customers (passengers and freight) – and, in extreme conditions, also with media and emergency responders

Source: T1009 fact sheet: Management of flooding risk. RSSB

D. PIANC

13. PIANC has developed four-stage methodological framework to help port and waterway owners and operators plan for improved resilience.

14. As part of the framework, PIANC developed a template for preparation of an inventory of infrastructure assets, operations and systems and associated interdependencies to promote understanding and develop ownership of climate change adaptation issues.

15. In the template the rows show examples of the assets, operations and systems that should be evaluated on their criticality and for their susceptibility to climate change. The columns in the template should include the location and details on who is responsible for each asset, operation and system and, more importantly, the results of the assessment. Snapshot of the template showing an example of the assessment results is provided below.

Maritime and inland port and navigation infrastructure				Criticality				Susceptibility to hazards causing impacts											Key facts							
																			Design data			Asset condition			Performance	
				Not critical	Unlikely	Probably	Yes	Flooding	Overtopping	Flow velocities/extreme waves	Low river flow	Changes in bathymetry	Bed or bank erosion	Fog or reduced visibility	Changes in wind	Extreme cold, ice or icing	Extreme heat, also humidity	Changes in water chemistry	Changes in biology	Design life (years)	Date of construction	Residual life	Good	Moderate	Poor	Maintenance cost	Performance against target
LAND-WATER INTERFACE; INTERTIDAL; RIPARIAN ZONE	Assets	Structures	Quay wall (i)				✓	✓	✓	✓		✓	✓	✓	✓	✓		✓		50	1994	25		✓		⇔	✗
			Quay wall (ii)				✓					✓	✓	✓	✓	✓		✓		50	2014	45	✓			⇔	✓
			Fenders			✓								✓	✓	✓	✓	✓		15	2014	10	✓			⇔	✓
			Ladders			✓								✓	✓	✓	✓	✓		15	2014	10	✓			⇔	✓
			Slipway	✓																							
		Physical systems	Cathodic protection				✓						✓			✓		✓		10	2014	5	✓			⇔	✓
		Resources	Heritage resource (Lighthouse)				✓	✓	✓	✓				✓	✓	✓	✓			N/A	1950	N/A		✓		↑	✓
			Beach nourishment			✓			✓	✓	✓	✓	✓						✓	15	2018	14	✓			⇔	–
	Operations		Pilotage				✓			✓	✓	✓		✓	✓	✓				N/A	N/A	N/A	N/A	N/A	N/A	⇔	✓
			Dredging / disposal			✓				✓		✓	✓	✓	✓					N/A	N/A	N/A	N/A	N/A	N/A	↑	✗
			Sailing / water sports events		✓																						
			Marker buoys navigation aids water sports events		✓																						

Legend	High	Moderate	Low
Increasing	↑	↑	↑
Stable	⇔	⇔	⇔
Reducing	↓	↓	↓

Source: Pianc Report N° 178, Climate Change Adaptation Planning for Ports and Inland Waterways

16. PIANC also collected case studies to illustrate some of the climate change adaptation actions undertaken in the port and navigation sector. The case studies follow a unified structure, as below:

Background – brief case study description
Scope of assessment – what types of infrastructure/operation/management activities were assessed; who was involved in the project
Motivation for considering adaptation – what was the driver for considering climate change adaptation; what adaptation issues were addressed
Climate change data used – what climatic parameters and scenarios were used; which data source were used
Results of risk assessment – how were risks assessed/what methodology was used; what were the main outcomes of the risk assessment
Identification and prioritization of adaptation measures / Monitoring
Project or initiative outcomes – what were the main lessons learned
Contact and References

17. PIANC developed a wide range of measures for adapting or strengthening the resilience of waterborne transport infrastructure. These have been categorised as physical, social or institutional adaptation measures. A whole portfolio of measures has been prepared and made available. In the portfolio, measures are listed according to the nature of the anticipated impact on the critical asset, operation or system. These measures can be consulted in the PIANC's report N° 178, Climate Change Adaptation Planning for Ports and Inland Waterways, Annex 4 – Portfolio of Measures (Pianc).

E. Climate ADAPT

18. Case studies on adaptation measures included in Climate ADAPT also follow a common structure for information input, as follows:

Case study description	Challenges
	Objectives
	Adaptation options
	Solutions
	Importance and relevance of adaptation
Additional details	Stakeholder participation
	Success and limiting factors
	Costs and benefits
	Legal aspects
	Implementation time
	Life time
Reference information	Contact, websites, sources

19. For each case study also selected climate impacts, keywords, sectors, geographic characterization and countries related to the case study are defined.

20. In this resource, nine case studies are available for the sector of transport. A number of these case studies refer to construction/design standards that need to better incorporate climate change while other studies focus on a selected asset e.g. case study on new locks in the Albert canal in Flanders, or case study on assessing adaptation challenges and increasing resilience at Heathrow airport.

III. Wrap-up

21. The examples show that similar type of information is collected by various organisations or in different initiatives.

Climate Impact	Background	Type of case study	Scope of assessment	Challenges
Study area	Project description in short	Scope of case study	Background	Objectives
Effect of adaptation	Related measures /key words	Economic assessment methodologies for adaptation prioritization	Identification and prioritization of adaptation measures / Monitoring	Costs and benefits, Life time
Type of adaptation				Solutions
Stakeholders		Audience/ Administration		Stakeholders
Approach	Elements	Steps and details of methodologies	Climate change data used/ Results of risk assessment	
Further Information	Outlook and transferability			Success and limiting factors / Legal aspects / relevance
Contact person within the BMVI Network of Experts	Contact details		Contact and References	Reference information
Results	Impacts and benefits		Project or initiative outcomes	

22. A wealth of information is available but may not be easily accessible by interested users. This information may not always be provided specifically for a selected transport infrastructure asset and thus serve as an asset profile/fact sheet with information on how the asset was better adapted to climate change. Also, not all necessary issues may be covered through asset profile/fact sheet or covered in an effective way. In this context, it is worth reiterating that PIANC addresses the adaptation issues by classifying them for assets, operations, systems and their interdependencies.

23. A unification of the structure for presentation of the existing material may be beneficial for transport professionals. At the same time, this would require additional effort to adjust the existing material to the new structure.

24. Moreover, unification of structure may require defining specifically what assets/operations/systems are for the ease of understanding by transport professionals, e.g. as developed by PIANC for waterborne transport.

25. The PIANC's portfolio of measures for waterborne transport infrastructure, with measures listed according to the nature of the anticipated impact, when expanded to other modes of transport, and when developed as a searchable database, may represent a rather simple product that transport professionals may potentially be interested in. Such database

could be updated with new measures linked to anticipated impacts when cases studied would result in identification of new measures or new anticipated impacts.