Climate change adaptation guidance for ports and inland waterways
A PIANC good practice guide

Jan Brooke
World Association for Waterborne Transport Infrastructure (PIANC)

Presentation to Adaptation Futures Conference, 2018
Navigating a Changing Climate

➢ A Marrakech Partnership ‘Global Climate Action’ Initiative
➢ Partners:
  • The World Association for Waterborne Transport Infrastructure (PIANC)
  • International Association of Ports and Harbors (IAPH)
  • International Harbour Masters’ Association (IHMA)
  • International Maritime Pilots’ Association (IMPA)
  • Smart Freight Centre (SFC)
  • European Dredging Association (EuDA)
  • European Sea Ports Organisation (ESPO)
  • Institute of Marine Engineering, Science and Technology (IMarEST)
  • Inland Waterways International (IWI)
Navigating a Changing Climate

Objectives

• To **improve sector-wide awareness** of climate change challenges and opportunities

• To **create and facilitate knowledge networks** to share experiences and good practice on mitigation, adaptation and integrated solutions

• To develop **technical good practice guidance**, training opportunities and web-based resources

PIANC WG 178 Adaptation

• To provide a **coordinated, global focal point** to support the owners, operators and users of waterborne transport infrastructure in building the capacity needed to navigate the changing climate

• See our **Action Plan** or sign up as a **supporter** at [http://navclimate.pianc.org](http://navclimate.pianc.org)
PIANC WG 178 guidance comprises a **four stage methodological framework** to help the user understand:

- **the context and objectives**
- **climate-related hazards and impacts**
- **vulnerabilities and risks**
- **climate change adaptation and resilience measures**

Also covers case studies; the role of monitoring and data management; and the importance of stakeholder engagement.
Stage 1
Context and objectives

**STEPS**

**Engage with** relevant internal and stakeholders (e.g. via a meeting or workshop)

- Develop **climate change adaptation goals**
- Compile an **infrastructure inventory**, identifying critical assets, operations and systems, and highlighting their current status e.g. design life, residual life
- Establish adaptation **roles and responsibilities**
- Set specific adaptation and resilience **objectives**, recognising boundaries, constraints and possible opportunities
Stage 1: engage with stakeholders, develop goals, prepare inventory of critical infrastructure, establish roles and responsibilities, set objectives

DON’T FORGET!

• Climate change could affect onward transport, utilities, services, local communities, etc. – internal and external collaboration can help to identify mutually beneficial solutions and thus reduce adaptation costs

• Criticality can relate to business continuity; network connectivity; threshold exceedances; health and safety requirements; social needs; etc.

• The status of an asset or system will influence its future adaptive capacity: monitoring and awareness are vital in decision making

• Objectives should reflect the ‘acceptable’ level of risk

• Adaptation may mean modifying an asset, operation or system to strengthen its resilience or enable it to cope with future changes
Stage 2
Climate hazards and impacts

STEPS
Work with stakeholders to develop an understanding of projected changes in relevant climate-related parameters ...

• Highlight climate parameters and processes (hydro-meteorological or oceanographic) to which each critical asset, operation or system is sensitive

• Consider thresholds: is asset or operation already affected?

• Identify and review projected future changes in parameters and processes using global or regional information; refer to locally-relevant downscaled data if these exist; acknowledge any uncertainties and data inadequacies

• Understand how the projected changes could impact on critical infrastructure (i.e. identify the climate hazard)

• Implement monitoring to understand local trends in key parameters and processes and to inform future decision making
Stage 2: understand projected changes and critical asset sensitivities, refer to relevant projections, understand possible impacts, implement monitoring

DON’T FORGET!

• The planning horizon matters! If this is more than 10 years, analysis of historical data alone will not capture the future climate accurately ...

• In addition to projected trends in weather-related, hydro-meteorological or oceanographic parameters, take account of increases in the frequency or severity of extreme events, and possible joint occurrences

• To reduce the risk of maladaptation develop and use a range of plausible climate change scenarios; include ‘most likely’ and ‘worst case’ scenarios
Stage 3

Vulnerabilities and risks

**STEPS**

Work with stakeholders to **identify and assess the potential risks** to critical infrastructure assets, operations and systems ...

- Is the critical asset, operation or system **exposed**?
- Is the critical asset, operation or system **vulnerable** if climate parameters or processes change?
- Is there existing and future **adaptive capacity** adequate or is there is a need to **strengthen resilience**?
- What are the financial/economic, environmental and social consequences of each scenario; the potential **costs and consequences of inaction**?
- **When** might these consequences be expected?

Carry out **risk assessment** to understand climate change impacts likely to affect critical to assets, operations and systems.
Stage 3 Key considerations

Stage 3: identify and assess risks, exposure, vulnerability, adaptive capacity, costs and consequences of inaction, timing of impacts, overview of risks

DON’T FORGET!

• Risk assessment can be simple or complex
• Change in climate parameters can have a range of consequences
• Adaptive capacity is a function of (i) redundancy in the system e.g. design overcapacity or operational flexibility; (ii) residual asset life; (iii) level of exposure and (iv) availability of alternatives
• Without adaptation action, future costs could include repair or replacement, disruption or downtime. Awareness of such costs and consequences helps inform adaptation decision making
• Presentation matters! A colour-coded matrix, highlighting the main risks, can be a useful aid to decision making
Stage 4
Adaptation measures

STEPS

Work with relevant stakeholders to **identify, evaluate, implement** and then **monitor** measures to strengthen resilience or adapt ...

- Identify possible short-term/interim and long-term measures: refer to the **portfolio of measures** [http://pianc.org/climatechangeadaptation.php](http://pianc.org/climatechangeadaptation.php)
- Screen a long list of potential options to focus in on a **shortlist** for more detailed evaluation
- Develop, agree and apply option **evaluation criteria**
- Prepare an **adaptation** plan, strategy or programme (**pathway**) for implementation: adaptation is likely to be a **phased** exercise
- Develop **monitoring** programmes and effective **data management** to inform decisions on **when** action is needed
Portfolio of measures

Measure types

• Physical (structural): engineered, technological, service-based)
• Social (people): educational, information-related, behavioural)
• Institutional (governance): economic, laws and regulations, policy and programmes)

Climate-related impacts addressed include:

• Frequency, severity or duration of flooding
• Extreme, high or low river flow or wave conditions
• Sediment or debris transport, erosion, deposition
• Visibility
• Wind
• Air temperature change
• Water chemistry, acidity, salinity
• Biological temperature induced changes
<table>
<thead>
<tr>
<th>Impact</th>
<th>Measure 1</th>
<th>Measure 2</th>
<th>Measure 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea level rise leading to increased flooding of certain berths</td>
<td>Modify berthing arrangements or schedules</td>
<td>Monitor asset condition and performance</td>
<td>Depending on residual life of berth, retrofit or replace with elevated structure</td>
</tr>
<tr>
<td>Increased frequency of extreme wave and wind conditions exacerbating erosion</td>
<td>Strengthen legal protection for remaining vegetated shorelines</td>
<td>Educate local communities in role of marsh or mangroves</td>
<td>Habitat restoration and re-planting projects; create breakwaters (e.g. using dredged material filled geo-tubes)</td>
</tr>
<tr>
<td>Increased storm frequency impacting breakwater integrity</td>
<td>Retrofit asset to maximum affordable protection</td>
<td>Prepare disaster risk reduction plan</td>
<td>Educate workforce, local community about risks and risk reduction plan</td>
</tr>
</tbody>
</table>
Stage 4: **identify, screen, evaluate, implement** and **monitor** measures, prepare an adaptation strategy, manage data effectively

**DON’T FORGET!**

- Climate change adaptation needs **innovation**: as well as more traditional structural, physical or technological options, think about **operational change**, educational or governance measures, or **nature-based solutions**
- **Win-win** or **low-regrets** measures can be cost-effective
- Retrofitting can be costly and complex; understand **adaptive capacity**
- Use the **business case** to justify the incremental cost of climate-resilience
- Option evaluation can be **simple or complex** – but be aware that conventional methods may not be the most appropriate for use in climate change decision making (e.g. return periods, discounting …)
Role of monitoring

Develop **monitoring** programmes and effective **data management** to inform decisions on *when* action is needed.

**DON’T FORGET!**

- **Monitor** asset condition also **operational performance**
- Collect data and where relevant develop **real-time** monitoring and **early warning** systems for local weather and hydro-meteorological conditions
- Record impacts and damage costs/losses of extreme events and weather-related disruption to **support business case**
- **Monitoring** does not need to be sophisticated; must be **fit-for-purpose**
- Effective data management is critical to **just-in-time** decision making
- Prioritise **maintenance** to maximise resilience, improve adaptive capacity
- **Adaptive management** can help deal with uncertainties but requires data; temporary or interim measures can ‘buy time’
Thanks for listening!

http://navclimate.pianc.org/
jan@janbrooke.co.uk