# Risk Assessment for the Climate Proofing of Infrastructure Investments

## PIEVC Engineering Vulnerability Assessment Protocol

### Enhancing Climate Services for Infrastructure Investments

The IKI global project *Enhancing Climate Services for Infrastructure Investments (CSI)* supports its partners in Brazil, Costa Rica, the Nile Basin Initiative (NBI) and Vietnam in developing and using Climate Services for climate-risk-informed infrastructure planning and management. Through pilot assessments and advisory services, CSI helps its partners in building capacities in using climate risk assessments as one key Climate Service. CRA's serve as tools for matching Climate Service user needs and provider capabilities to translate data into risk-informed infrastructure planning and management decisions. The tool used is the *PIEVC Engineering Vulnerability Assessment Protocol*. CSI provides advise to its partners in adapting the tool to become part of a climate-proof infrastructure investment cycle.

*CSI Project Video*

### PIEVC Engineering Vulnerability Assessment Protocol

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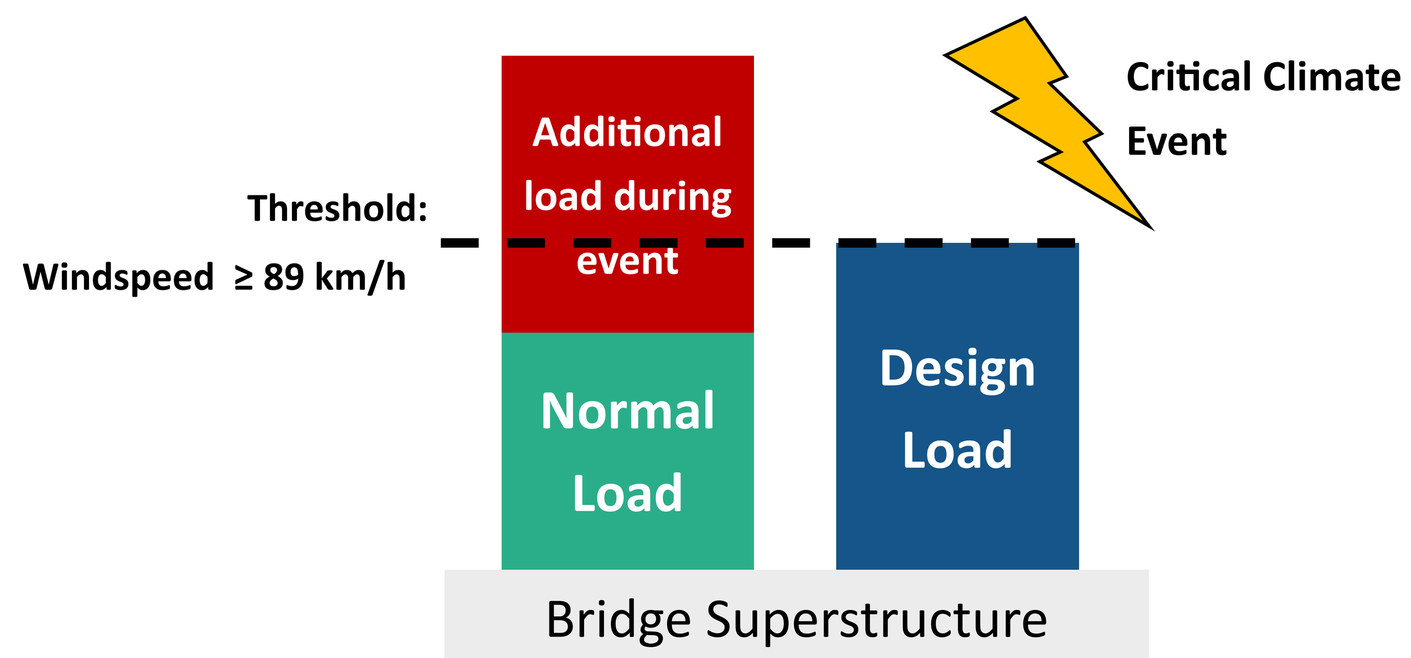
The *PIEVC Engineering Vulnerability Assessment Protocol* is a climate risk assessment tool developed by *Engineers Canada* and tailored to the needs of the infrastructure sector. Risks are evaluated based on the difference between the design loads (e.g. river discharge, storm magnitude) of single infrastructure components (e.g. pillar of a bridge) vs. expected future duty loads under the conditions of climate change. This threshold-based approach is especially well-suited to inform infrastructure planning and management decisions. Evaluation decisions are reached in a consensus-seeking multi-stakeholder process. Expert judgements from the assessment team of engineers, climate scientists and infrastructure operators augment existing data, allowing assessments under circumstances of limited data. This way, quantitative data and expert knowledge are translated into qualitative risk evaluation outputs based on which adaptation measures can be identified and prioritised.

*PIEVC webpage with further information and case studies*

### Threshold-based Risk Assessment




**STEP 1: Scoping**

Approach: Focus on a single infrastructure or infrastructure system

**1)** Selection of infrastructure to be assessed based on MCA (*Step 0*)

**2)** Identification of physical components, their functionality and the operational procedures of the infrastructure

**3)** Identification of relevant climate variables, including combined events (e.g. heavy rain + strong winds)

**STEP 2: Risk Assessment & Evaluation**

Approach:

1) **Exposure** assessment of components by analyzing component-climate variable pairings.

2) **Vulnerability** assessment: Definition of impact thresholds for critical components based on forensic analysis of past events, building codes, engineering analysis, climate monitoring data etc.

3) **Climate (hazard)** assessment (defining critical climate events):

- Translation of impact thresholds into climate indices (Intensity—Duration)
- Calculating probability of climate indices (based on thresholds) for the past and the projected future occurrence of events and customized projections
- Development of scoring system for probability based on team consensus

4) **Impact (Severity) analysis**: Developing impact chains and scoring of degree of severity of impact.

5) **Overall risk calculation** for each component:

R (risk) = P (probability) x S (severity)

6) **Risk evaluation:**

- Define different risk levels (e.g. high, medium, low) and define the range of risk values assigned to these levels.
- Evaluate which of the components to be assigned to which risk level and discuss findings.
- Evaluation of tolerability

Additional info on impacts necessary?

**STEP 3 : Engineering Analysis (optional)**

Approach: Especially for medium risks, more information on potential impacts may be collected in the context of an engineering analysis, e.g. by studying how a given material may react to a temperature extreme.

**STEP 5: Adaptation Assessment**

Approach: Based on risk tolerance, identification and assessment of adaptation options (MCA, CBA, CEA etc.). Depending on the decision-making context and scope of the risk assessment, the scope and type of the available adaptation options may vary.

**STEP 6: Implementation**

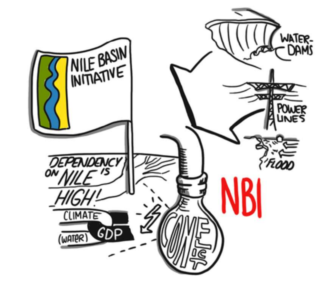
Approach: Given the longevity of infrastructure, as part of adaptive management, some of the adaptation options may be implemented in later stages throughout the lifecycle of the infrastructure. Responsibilities for the implementation may be spread among various stakeholders.

**STEP 7: Monitoring and Evaluation**

## PIEVC at a Glance

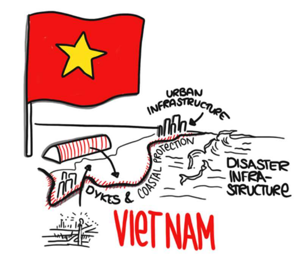
- ⇒ **Scope:** Infrastructure object or infrastructure system tied to processes of infrastructure investments
- ⇒ **Threshold-based vulnerability assessment and Climate Services**
- ⇒ **Semi-quantitative method**
- ⇒ **Bottom-up, participatory approach**
- ⇒ **Flexible approach, adaptable to circumstances** (step in infrastructure planning cycle, data availability etc.)


**Sectors:** Energy & Transport (ports)
**Infrastructures:** Transmission Lines & Itajai Port, Santa Catarina State
**Owners:** Electrosul & Itajai Port
**Stage in Investment Cycle:** Operation
**Decision-Making Context:** Inform risk management of infrastructure owners
**Institutionalisation:** Results to feed into GIS database and into broad scale risk assessment




**Sector:** Water
**Infrastructure:** Irrigation Infrastructure
**Owner/ Target group:** Nile Basin Initiative
**Stage in Investment Cycle:** Project Development
**Decision-Making Context:** Development of bankable projects
**Institutionalisation:** Infrastructure planners are enabled to conduct climate risk assessments as part of the development of bankable projects in the future


**Sector:** Transport (Roads and Bridges)
**Infrastructure:** Guardia Bridge, Guanacaste Province
**Owners:** Ministry of Public Works and Transport (MOPT ) & National Council for Roads and Bridges (CONAVI)
**Stage in Investment Cycle:** Operation/ Project Identification
**Decision-Making Context:** Decision between retrofitting and rebuilding
**Institutionalisation:** Development of own climate risk assessment protocol as part of climate proofing process to become mandatory part of infrastructure investment process




**Sector:** Water
**Infrastructure:** Cai Lon—Cai Be Sluice Gate, Mekong Delta
**Owners:** Ministry of Agriculture and Rural Development (MARD)
**Stage in Investment Cycle:** Project Development (Basic Design)
**Decision-Making Context:** Climate-proofing of infrastructure design
**Institutionalisation:** Development of own climate risk assessment protocol as part of climate proofing process to become mandatory part of infrastructure investment process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On behalf of: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
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