PIANC
The World Association for Waterborne Transport Infrastructure

PIANC
MarCom WG 232

METOCEAN-RELATED RISKS DURING THE CONSTRUCTION OF MARINE WORKS

Terms of Reference

1. Historical Background

Waterborne Transport Infrastructure is frequently subject to the effect of maritime climate action both in service and during construction. This is typically the case for dredging works, breakwaters, open sea jetties and dolphins, as well as undersea pipelines and cables, offshore wind farms and other offshore elements. The many aspects of sea-soil-structure interaction in this hostile environment add specific risks to those usual in civil construction.

Marine climate is primarily defined by winds, tides, waves and sometimes ice. Sea climate actions in service are usually analysed in detail at the design stage both for ultimate and serviceability limit states as well as for operational performance. However, conditions during construction have a great impact on cost and construction schedule and can be the source of major delays and cost overruns with complex contractual implications. These affect risk sharing between the different agents and to the definition and application of downtime and *force majeure* clauses.

Other natural hazards such as earthquakes and tsunamis are less likely to be determinant during construction although in areas with high seismic activity need to be considered, taking into consideration the duration of the construction stage.

2. Objectives of the Working Group

This Working Group will provide a guidance document on marine climate risks and risk management directly related to the construction stage of projects in the marine environment.

3. Scope

The Working Group is expected to cover the following topics:

- Sources of uncertainty
- Risk analysis: climate analysis, risks of damage or failure of the works in progress, impact on construction tolerance and downtime and on Safety and Health.
- Tools for assessment:
    - Available data on sea climate
    - Hazard analysis related to the construction period
    - Climate forecast for the construction stage

    - Sea-soil structure interaction analytic, numerical and physical models.
    - Simulations of construction processes for analysis
- Design strategies: consideration of construction risks at the design stage. Resilient design facing construction risks.
- Mitigation strategies at the construction stage:
    - Implementation of accurate sea climate forecast procedures during construction
    - Digitization: connected sites with sensors related to wave climate, equipment and soil and structure response including temporary elements and during all construction stages. Real time data analysis is required for achieving efficiency, safety and reliability
    - Review of design improving resilience and reducing damage probability
    - Selection of appropriate equipment
    - Selection of best available construction technologies, seasonal construction, etc.
    - Use of statistical simulation techniques in advance to real construction in order to support the best technical options and assess the impact of different scenarios on potential cost and delays as well as the efficiency of mitigation measures. Scenarios can cover variable climate scenarios and alternatives for construction schedule, equipment and technologies
- Contractual framework based on appropriate and transparent risk sharing and a reliable risk management program
- Impact on insurance
- Integrated management of marine climate risk during construction through the implementation of specific operational integrated systems
- Case studies

4. Existing documents to be reviewed

PIANC MarCom Reports to be reviewed include:

- WG 31-2001 Life-Cycle Management of Port Structures - General Principles
- WG 103-2008: Life Cycle Management of Port Structures, Recommended Practice for Implementation
- WG 196-2016: Criteria for the selection of Breakwater types and their related optimum safe levels
- Finished and ongoing WGs on specialized and multipurpose terminals
- Ongoing WG 194 A Framework for Early Contractor Involvement in Infrastructure Projects

Other bibliography and Congress papers related to the topic should also be analysed, including

- Construction Risk in Coastal Engineering, published by Thomas Telford, London, 1988.
- Construction Health and Safety in Coastal and Maritime Engineering, Thomas Telford, London, 2005.

5. Suggested product of the Working Group

The suggested product of the Working Group will be a guidance document with recommendations for best practice for construction risk management and case studies related to sea climate, for owners, designers, contractors and insurance companies.

6. Desirable Disciplines of the Members of the Working Group

The WG should ideally include owners and concessionaries, engineering consultants, contractors and dredging companies, insurers, and experts in risk analysis.

7. Relevance for Countries in Transition

The report will be valuable for the development of port infrastructure in countries in transition helping in mitigation of construction risks and their undesired effects.

8. Climate Change Considerations

The probability and magnitude of extreme events during the construction stage cannot be estimated only on the basis of conditions during previous decades, and should allow for the tendency for future extreme events to be more severe even in the short term. Nevertheless major relevant features of climate change such as sea level rise, increased storminess, more severe precipitation events and higher temperatures are generally related to a much longer time frame than the construction stage and will not necessarily be relevant.

9. Relevance to UN Sustainable Development Guidelines

The guideline will contribute to the Sustainable Development Goals (SDGs) approved by the United Nations in 2015, particularly the development of quality, reliable, sustainable and resilient infrastructure (SDG9).