



SEISMIC DESIGN GUIDELINES FOR PORT STRUCTURES

Terms of Reference

1. Background

Seismic design methods have been continuously developed, particularly after several large earthquakes. Techniques had been conventionally based on a force-balance approach, where structures are designed to resist a static horizontal force. However, after the 1995 Kobe, Japan earthquake which caused a tremendous amount of damage to port and harbour structures, the limitations of force-balance approach were recognized and performance-based design was introduced. The existing PIANC seismic design guidelines (Seismic Design Guidelines for Port Structure WG34-2001, hereinafter referred to as PIANC 2001 Report) reflect lessons obtained from the 1995 earthquake and was "the state of the art" report at that time. However, new codes and standards reports have been published over the following 18 years, including the Japanese standards (Technical Standards and Commentaries for Port and Harbor Facilities in Japan, 2007 & 2018 (both in Japanese)) and the American standards (ASCE Seismic Design of Piers and Wharves, 2014, hereinafter referred to as ASCE Seismic Design) which include new useful information. It is now appropriate to update the existing PIANC report taking into account newly published codes and standards and related technical information.

2. Objectives

The objectives of the proposed Working Group (WG) are to review recently-published technical information related to seismic design of port structures including codes and standards, literature, case study documentation, and then incorporate useful information to the existing PIANC report when appropriate. The WG will especially focus on technical information published after the current version of the PIANC report. Lessons learned from recent damaging earthquakes including the 2011 Tohoku earthquake will also be reviewed and incorporated.

3. Earlier Reports to be Reviewed

Seismic Design Guidelines for Port Structures, Report of Working Group No.34 of the Maritime Navigation Commission, PIANC, 2001

Seismic Design Guidelines for Port Structures, Working Group No.34 of the Maritime Navigation Commission, PIANC, Balkema, 2001

ISO23469, Bases for design of structures -- Seismic actions for designing geotechnical works, 2005

Technical Standards and Commentaries for Port and Harbour Facilities in Japan, 2009 and 2018(in Japanese, to be translated)

Mitigation of Tsunami Disasters in Ports, PIANC Report 112, 2010

Seismic Design of Piers and Wharves, ASCE/COPRI 61-14, 2014

Tsunami Disasters in Ports due to the Great East Japan Earthquake, PIANC Report 122, 2014

4. Scope

The PIANC WG34 (2001) Report introduced the concept of performance-based design, and emphasized the importance of viewing the port structure as a soil-structure system. These important points are basically shared by the Japanese technical standards and ASCE Seismic Design. Therefore, it will not be necessary to substantially change the PIANC 2001 Report. However, useful new information is included in the Japanese technical standards and ASCE Seismic Design. For instance, Japanese technical standards introduce a sophisticated method to evaluate design ground motions, based on the analyses of strong motion data. In the ASCE Seismic Design, detailed information is supplied about piers and wharves from experiences of damage to batter piles by earthquakes in the United States. Careful considerations on pile-to deck connections are also very informative. In addition to these reports, technical information from all over the world related to seismic design of port structures will be reviewed by the WG. Furthermore, technical information published in conferences and academic papers will also be reviewed. Codes and standards under development will also be considered if available. Then, the WG will consider incorporating new useful information to the existing PIANC report. Lessons learned from recent damaging earthquakes including the 2010 Haiti earthquake, the 2010 Maule earthquake and the 2011 Tohoku earthquake will also be reviewed and incorporated. The revision of the book published by Balkema will not be included in the scope of the WG. The WG will not carry out new basic research. Tsunami resistant design will not be included in the scope of the WG; however, appropriate links to PIANC tsunami reports (reports of WG112 and WG122) will be added.

5. Intended Product

The intended product is the revised version of the PIANC 2001 Report. The new report will be produced within two years of the formation of the WG.

6. Working Group Membership

To maximize the usefulness of the report, the WG should include experts on the issue of seismic design of port structures such as marine consultants. Members who can volunteer technical information such as case study documentation and reports on past earthquake damage will be welcome. Members who can volunteer information about the background of existing codes and standards will also be welcome.

7. Relevance to Countries in Transition

The contents of the report will also be useful for countries in transition with high seismic risk. In particular, the Japanese standards suggest the use of microtremor measurement for locating important berthing facilities in port planning, which will be useful in countries in transition. Microtremor measurement can also be used for simplified evaluation of design ground motions.

8. Climate Change Considerations

The activities of the working group will not be related to climate change.

9. Relevance to 17 Sustainable Development Goals of U.N.

The contents of the report will be related to the 9th goal, "Industry, Innovation and Infrastructure." Investments in infrastructure, including the marine transport sector, are crucial to achieving development. The report will deliver knowledge to improve seismic design and will enable the building of resilient marine infrastructure.