
**Actions from waves and currents on
coastal structures**

Effets des vagues et des courants sur les structures côtières



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.



COPYRIGHT PROTECTED DOCUMENT

© ISO 2007

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Contents

Page

Foreword.....	iv
Introduction	v
1 Scope	1
2 Terms and definitions.....	2
3 Symbols	9
4 Basic variables for actions from waves and currents	9
4.1 Water levels	9
4.2 Waves.....	10
4.3 Currents	13
5 Wave and current action on structures	13
5.1 Wave action on mound breakwaters	13
5.2 Wave action on vertical and composite breakwaters	16
5.3 Wave actions on coastal dykes and seawalls	17
5.4 Wave and current action on cylindrical members and isolated cylindrical structures	20
5.5 Wave interaction with floating breakwaters.....	21
5.6 Wave action on wave screens	22
6 Probabilistic analysis of performance of structures exposed to action from waves and currents.....	23
6.1 Examination of uncertainties related to wave and current action.....	23
6.2 Reliability assessment of structures	24
Annex A (informative) Water levels	25
Annex B (informative) Wave action parameters.....	27
Annex C (informative) Currents	41
Annex D (informative) Wave action on rubble mound structures	43
Annex E (informative) Wave actions on vertical and composite breakwaters.....	63
Annex F (informative) Wave action on coastal dykes and seawalls	68
Annex G (informative) Wave and current actions on cylindrical members and isolated structures	76
Annex H (informative) Wave interaction with floating breakwaters	93
Annex I (informative) Wave action on wave screens	97
Annex J (informative) Probabilistic analysis of performance of structures exposed to action from waves and currents	102
Bibliography	112

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 21650 was prepared by Technical Committee ISO/TC 98, *Bases for design of structures*, Subcommittee SC 3, *Loads, forces and other actions*.

Introduction

This International Standard, which deals with the actions from waves and currents on structures in the coastal zone and in estuaries, is the first of its kind. Waves and currents and actions from waves and currents on structures in deeper water, especially structures for the petroleum industry, are dealt with in ISO 19901-1 and ISO 19902, ISO 19903 and ISO 19904-1. Some of the structural elements for deeper water structures and coastal structures are the same, especially elements with cylindrical shapes. There will thus be, to some extent, an overlap between this International Standard and other ISO standards on the wave and current actions on cylindrical structural elements. There is though, a difference in wave conditions and wave kinematics between coastal waves and deeper water waves.

Actions from waves and currents on coastal structures

1 Scope

This International Standard describes the principles of determining the wave and current actions on structures of the following types in the coastal zone and estuaries:

- breakwaters:
 - rubble mound breakwaters;
 - vertical and composite breakwaters;
 - wave screens;
 - floating breakwaters;
- coastal dykes;
- seawalls;
- cylindrical structures (jetties, dolphins, lighthouses, pipelines etc.).

For the rubble mound structures it is not possible to determine the forces on and the stability of each individual armour unit because of the complex flow around and between each armour unit. But there are formulae and principles to estimate the necessary armour unit mass given the design wave conditions. Coefficients in these formulae are based on hydraulic model tests. Since the rubble mound structures are heavily used, they are included in this International Standard, although they may not be treated exactly in accordance with ISO 2394.

This International Standard does not include breakwater layout for harbours, layout of structures to manage sediment transport, scour and beach stability or the response of flexible dynamic structures, except vortex induced vibrations.

Design will be performed at different levels of detail:

- concepts;
- feasibility;
- detailed design.

This International Standard is aimed at serving the detailed design.

It is pointed out that the annexes are only informative and are not guidelines/manuals. The annexes have no regulatory power.

Wave and current conditions vary for different construction sites. It is very important to assess the wave and current conditions at a given site. Assessment procedures for these conditions and for their uncertainties are included.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

- 2.1 actions**
force (load) applied to the structure by waves and/or currents
- 2.2 anchors**
units placed on the seabed, such as ship anchors, piles driven into the seabed or concrete blocks, to which mooring lines are attached to restrain a floating object from excessive movements
- 2.3 annual maximum method**
method of estimating extreme wave heights based on a sample of annual maximum wave heights
- 2.4 armour layer**
protective layer on a breakwater, seawall or other rubble mound structures composed of armour units
- 2.5 armour unit**
relatively large quarry stone or concrete shaped unit that is selected to fit specified geometric characteristics and density
- 2.6 astronomical tide**
phenomenon of the alternate rising and falling of sea surface solely governed by the astronomical conditions of the sun and the moon, which is predicted with the tidal constituents determined from harmonic analysis of tide level readings over a long period
- 2.7 breakwater**
structure protecting a shore area, harbour, anchorage and/or basin from waves
- 2.8 buoyancy**
resultant of upward forces, exerted by the water on a submerged or floating body, equal to the weight of the water displaced by this body
- 2.9 chart datum**
CD
reference level for soundings in navigation charts
- 2.10 core**
inner portion of a breakwater, dyke and rubble mound structures, often with low permeability
- 2.11 crest**
1. highest point of a coastal structure
2. highest point of a wave profile
- 2.12 crown wall**
concrete superstructure on a rubble mound