

# Reliability design method and Limit state design method for Maritime structures

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## INTRODUCTION

The software for maritime structure design consists of the reliability design method for the overall design and the limit state design method for the detailed design. The former employs probabilistic approaches. The latter calculates the three levels of design waves for the ultimate, serviceability, and fatigue limit states, and examines the safety of designed structures against these waves.

With this software, the stability and safety of the rational design of maritime structures can be achieved.

## DEVELOPMENT PROCESS

Traditional design of maritime structures ( e.g. breakwater ) has been made deterministically with the concept of safety factors. The reliability design method is based on the theory of probability and maintains the probability of failure below a certain allowable value. This method enables engineers to design maritime structures economically with sufficient margin of safety.

The limit state design method uses the three levels of design stresses under the ultimate limit state, the serviceability limit state and the fatigue limit state, which require detailed stress analysis for the safety of structures.

The software of this design method has been developed to respond to several project requests.

## KEY POINTS

Key points of design methods for maritime structures.

### Reliability design method

This method takes account of the uncertainties of actions on and resistances of the structure and evaluates the deformation and/or damage quantitatively.

\*Expected sliding distance of caisson type breakwaters

\*Relative damage of concrete armor units

### The limit state design method

Determination of three levels of design waves for three limit state conditions and the safety analysis of structures.

\*Use of the limit states (the ultimate, serviceability, and fatigue limit states)

\*Estimate the design waves \*3-D stress analysis

### Drawing the standard cross section

The standard cross sections of structures are drawn with CAD software.

## APPROVAL/CREDITABILITY

ECOH CORPORATION is continuing to promote the quality of software based on the experience and achievements of design projects for maritime structures.

## Graphical Outputs with Design software

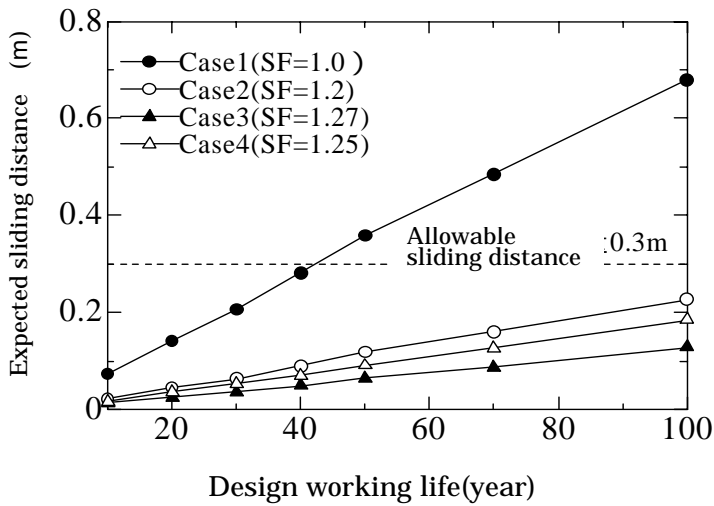


Fig. 1 Expected sliding distance of caisson breakwater designed with several levels of safety factor against design working life (Example of reliability design method)

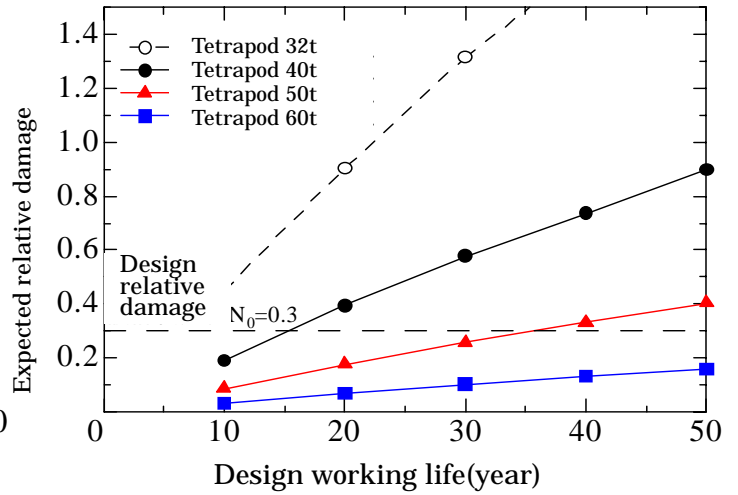


Fig. 2 Expected relative damage of Tetrapods of different sizes against design working life (Example of reliability design method)

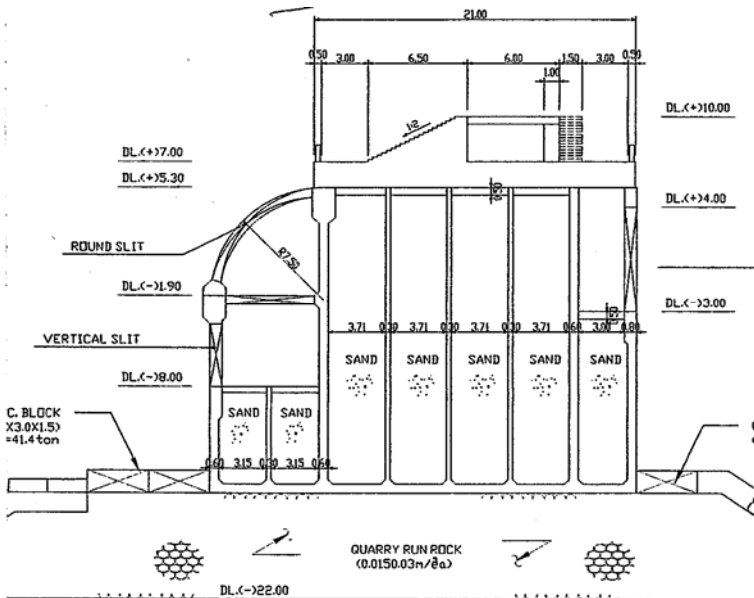


Fig. 3 Standard cross section of curved slit caisson breakwater

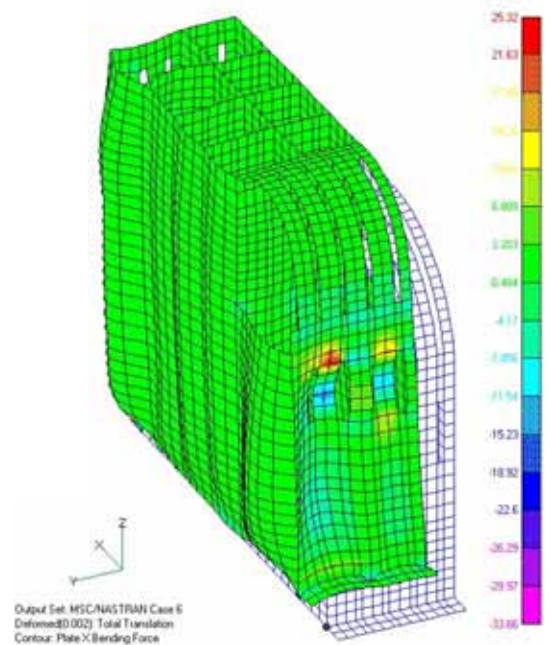


Fig4 Bending moment of structural elements of caisson (with 3D stress analysis)