computer program

BREAKWAT 3
Tool for conceptual design of coastal structures

applications

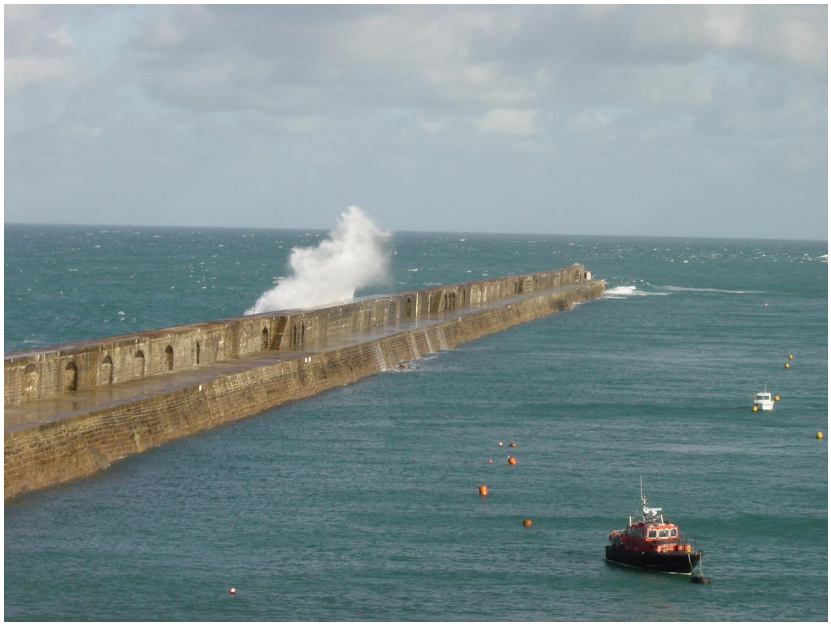
BREAKWAT 3 is a conceptual design tool for several types of coastal structures that are subjected to waves. Rubble mound breakwaters with armour layers of rock material or concrete units, berm breakwaters, vertical caisson structures, reef type structures and near-bed structures can be designed using BREAKWAT 3 up to a conceptual design stage.

The first version of BREAKWAT has been released at the end of the 1980's. Since then BREAKWAT has been widely used by a large group of users at contractors, engineering companies, universities, research institutes, etc. throughout the world. New developments in the design of coastal structures, as well as software developments in general have been incorporated in BREAKWAT 3. In the future, BREAKWAT will be updated with new design formulae based on recent and future laboratory and field research.

BREAKWAT 3 uses modern design formulae to perform calculations of the hydraulic response:
- wave height distribution
- wave run-up
- wave overtopping (empirical formulae and neural network)
- wave transmission

and of the structural response:
- stability of main armour layer of rock material
- stability of main armour layer of concrete units
- stability of rear side
- wave forces on caisson structures

of several types of structures:
- rubble mound breakwaters
- berm breakwaters
- reef type structures and near-bed structures
- vertical (caisson) breakwaters



Wave load on vertical breakwater

for whom?

BREAKWAT 3 will be useful for everyone who, even if occasional, is involved in the conceptual design of coastal structures, for example by teaching (universities), designing (consultants), testing (research institutes) or constructing (contractors).

BREAKWAT 3 is an ideal tool for those who wish to apply the results of the latest research and development and wish to do this quickly and efficiently.

general features of BREAKWAT 3

BREAKWAT 3 is a Microsoft Windows based product. The general features of BREAKWAT 3 are:

- flexible set-up, easy to implement new modules and formulae
- report-ready graphical presentation of results
- input and output files in ASCII format
- possibility to calculate and compare several calculation scenarios
- possibility to copy data to and from clipboard
- export options to text editor or Microsoft Excel
- 'hard' and 'soft' limits for validity of design formulae
- extensive digital help function (user manual and technical background)

appearance of BREAKWAT 3



Figure 1. Start window of BREAKWAT 3 with overview of program structure

The program starts by displaying the window in Figure 1. Hydraulic and structural responses can be calculated for several types of coastal structures. These structure types are a subdivision of the main classifications in the program structure, which are rubble mound structures and vertical (caisson) structures.

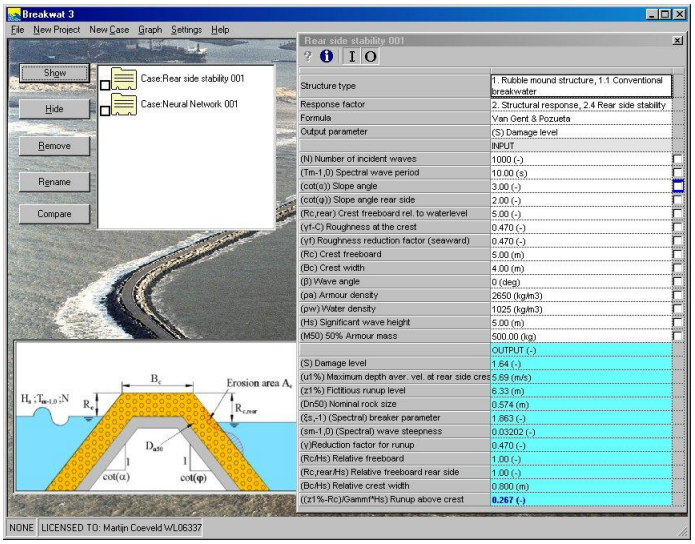


Figure 2. Example of an input/output window and a definition sketch

After selecting a certain hydraulic or structural response, an input/output window appears and a definition sketch, see Figure 2. For some cases it is possible to choose between several conceptual design formulae to perform the calculation.

Once the required input for the calculations, consisting of values for the various input parameters, is specified, the output is directly calculated and presented. In some cases it is possible to specify a range of values for certain input parameters in input tables, see Figure 3.

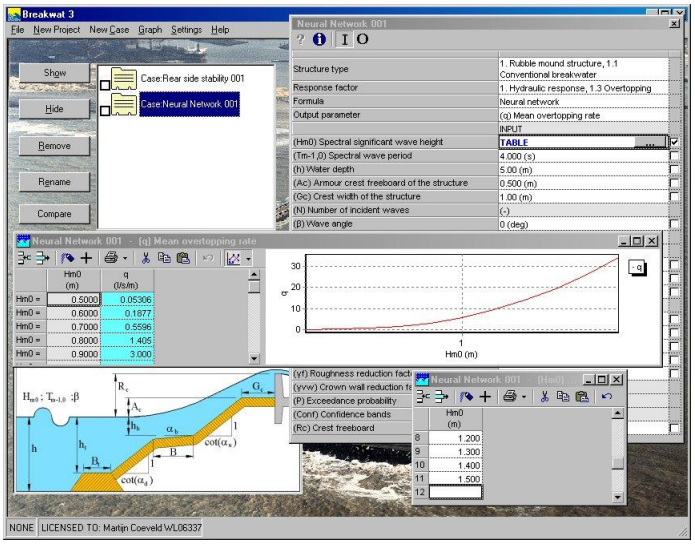


Figure 3. Example of an input/output window where input is specified an in input table

The output consists of values for several output parameters, a range of values for certain parameters or a graph. If input parameters are specified with input tables, the output can be displayed in a graph. Other output ranges can be added to an existing graph and the appearance of a graph can be adjusted with a graphical editor (compare Figure 3 and Figure 4). It is also possible to compare the output of several cases with drag-and-drop facilities.

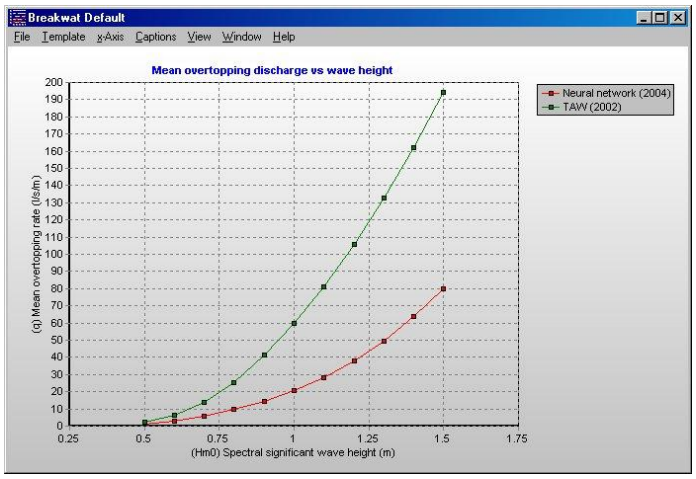
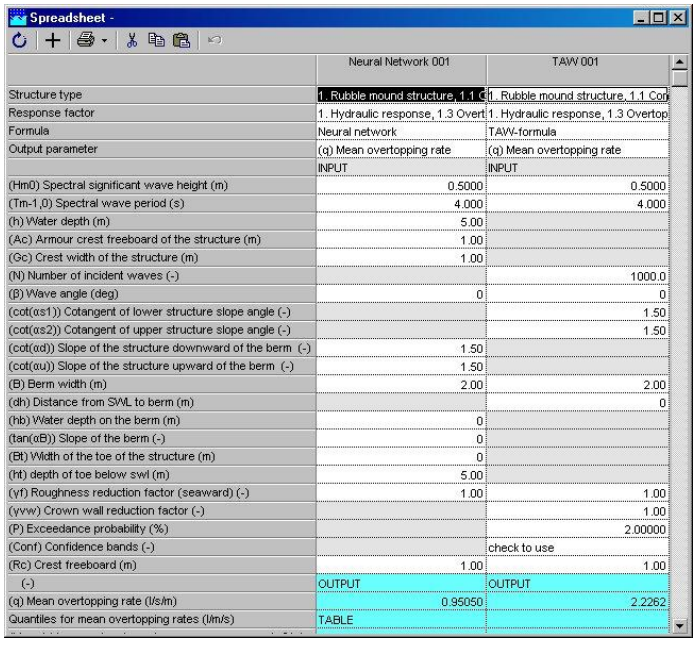


Figure 4. Example of an input/output window where input is specified an in input table

The results of calculations can be saved in ASCII format for future use. It is also possible to print the results to a text editor or to Microsoft Excel to further process the data.



	Neural Network 001	TAW 001
Structure type	1. Rubble mound structure, 1.1 C	1. Rubble mound structure, 1.1 Cor
Response factor	1. Hydraulic response, 1.3 Overt	1. Hydraulic response, 1.3 Overtop
Formula	Neural network	TAW-formula
Output parameter	(q) Mean overtopping rate	(q) Mean overtopping rate
	INPUT	INPUT
(Hm0) Spectral significant wave height (m)	0.5000	0.5000
(Tm-1,0) Spectral wave period (s)	4.000	4.000
(h) Water depth (m)	5.00	
(Ac) Armour crest freeboard of the structure (m)	1.00	
(Gc) Crest width of the structure (m)	1.00	
(N) Number of incident waves (-)		1000.0
(β) Wave angle (deg)	0	0
(cot(αs1)) Cotangent of lower structure slope angle (-)		1.50
(cot(αs2)) Cotangent of upper structure slope angle (-)		1.50
(cot(αd)) Slope of the structure downward of the berm (-)	1.50	
(cot(αu)) Slope of the structure upward of the berm (-)	1.50	
(B) Berm width (m)	2.00	2.00
(dh) Distance from SWL to berm (m)		0
(hb) Water depth on the berm (m)	0	
(tan(αB)) Slope of the berm (-)	0	
(Bt) Width of the toe of the structure (m)	0	
(ht) depth of toe below swl (m)	5.00	
(γf) Roughness reduction factor (seaward) (-)	1.00	1.00
(γvw) Crown wall reduction factor (-)		1.00
(P) Exceedance probability (%)		2.00000
(Conf) Confidence bands (-)		check to use
(Rc) Crest freeboard (m)	1.00	1.00
(-)	OUTPUT	OUTPUT
(q) Mean overtopping rate (l/s/m)	0.95050	2.2262
Quantiles for mean overtopping rates (l/m/s)	TABLE	

Figure 5. Comparison of different design formulae to calculate wave overtopping

help in BREAKWAT 3

The help function can be activated at any time in BREAKWAT 3. The help function gives access to a digital document in PDF format, which consists of an extensive user and technical manual. The document includes hyperlinks to enhance the efficiency, see Figure 6.

The user manual supports more experienced users of BREAKWAT 3, as well as first-time users. In this manual some program-specific terms are defined, such as the program structure, the general screen layout, the graphical capabilities and the I/O procedures. An example calculation is also given, including a tailor-made graphical presentation of the results.

The technical manual describes the technical background of all the items included in BREAKWAT 3 and provides guidance on the use of the design formulae.

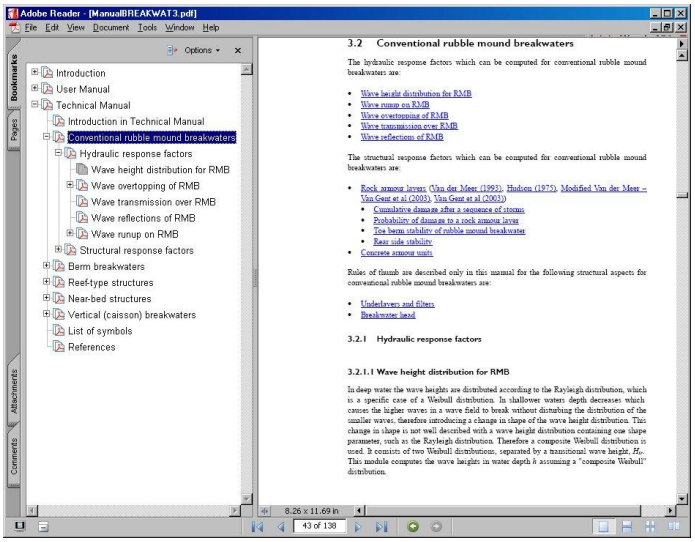


Figure 6. Comparison of different design formulae to calculate wave overtopping

PC requirements

BREAKWAT 3 runs on the following operating systems:

- Microsoft Windows 95-98-ME-2000-NT-XP

The minimum required hardware is:

- Pentium III processor, 500 MHz
- 512 Mb internal memory
- 100 Mb free space on hard disk



Figure 7. Example of calculation of profile development of berm breakwater

selection of references

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WL | Delft Hydraulics

Decisive advice: from multidisciplinary policy studies to design and technical assistance on all water-related issues.

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