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A database of major breakwaters around the world

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A DATABASE OF MAJOR BREAKWATERS AROUND THE WORLD

by N.W.H. Allsop[1], S Cork[2] and H J Verhagen[3]

1. INTRODUCTION

This paper introduces a co-operative project to develop, populate, and then to apply a database on all major breakwaters around the world. It builds on, and revives, similar initiatives that originate in the late 1970s. The paper describes the objectives in developing the database, the structure and content fields of the initial database and presents key examples from the work to date. The paper then discusses a number of potential uses of the database and plans for its future development. Data were initially entered for four structural types and the initial creation of the database categories was based on the main structural parameters and key aspects of design and construction.

Figure 1: Locations of Breakwaters currently on database

2. DATABASE DEVELOPMENT

Populating the database initially used available in-house data, but it then became substantially more difficult to obtain the depth of information required for other structures. Most data are inherently partial (they have been collected by a sectional interest), dated (owners seldom up-date data), limited (almost no data are given on performance), and buried (requires substantial effort to uncover). Many sources often only relate to a single structure. Lastly, data are not maintained (so information that was available to some people in the past has "evaporated" and is no longer found).

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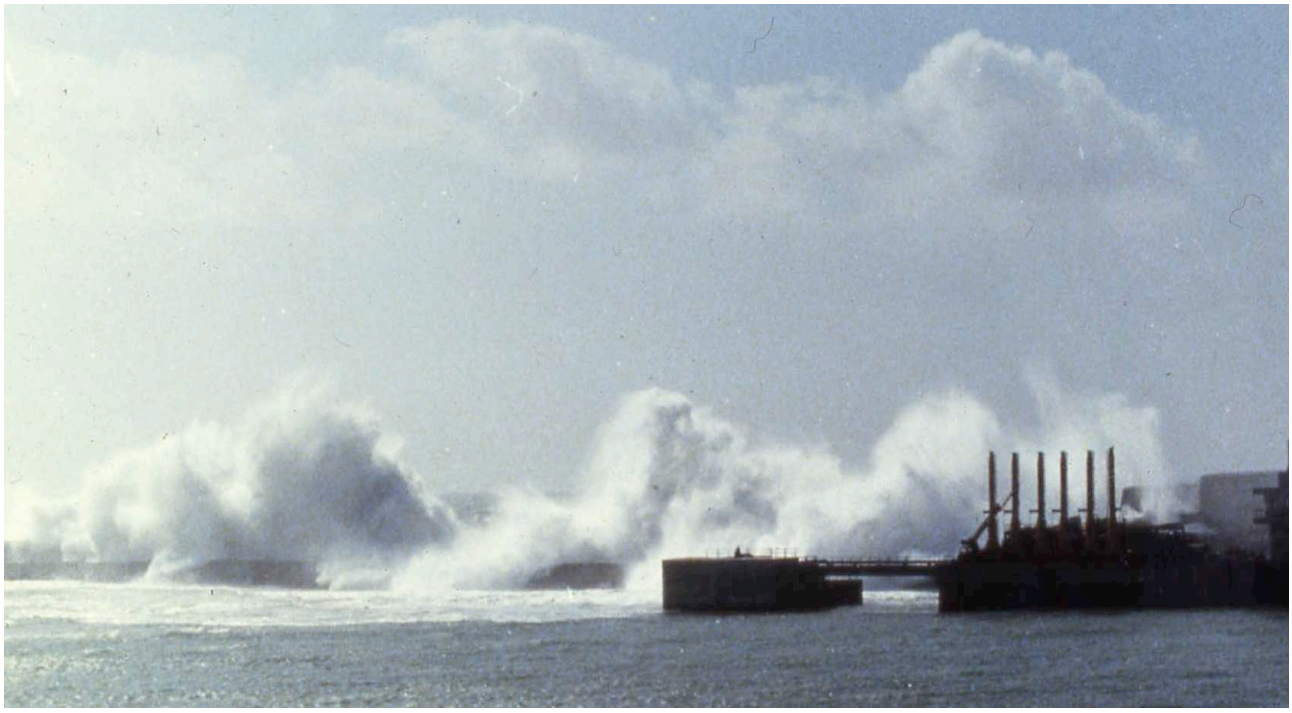
An unfunded international group of experts has contributed to the informal development of the database to date, but progress has consequentially been slow and somewhat sporadic. That said however, significant data have been assembled, and co-operation with this wider international group has identified ways to widen coverage geographically and in technical detail.



3. DISCUSSION

The most frequently adopted breakwater designs are simple rubble mounds armoured by rock, but these are not much discussed in technical literature. Where rock armour is not available (size or durability), the most frequent solution is a steep rubble mound armoured by patented armour units. More details are available on concrete armour units because licensees keep records, so available data are biased towards such solutions. Berm breakwaters are generally confined to owners who are more familiar or are advised by specialised consultants. Caisson breakwaters are much more common in Japan than elsewhere, but examples of vertical walls are also found in UK, Italy and Spain, some of considerable age.

In considering the prevalence of any particular structural type, it is important to be aware of historical events which will have influenced designer / owner choices.

Of particular importance would be the (apparent) increase of damage to large rubble breakwaters in the late 1970s, epitomised by the substantial damage at Sines (Portugal), Arzew (Libya), San Ciprian (Spain), Diablo Canyon (USA), Gioia Touro (Italy), and Tripoli (Libya). Some of these have been analysed in some detail, particularly Sines, but data or analysis on other failures are far less complete or publically available.

Fewer data are available on damage to rock armoured mounds and berm breakwaters. Most rubble mounds settle slightly in early life, but generally then move or damage very little. Some rock will however deteriorate in time, and this may be exacerbated if the structure is subject to more armour movement than envisaged. These are however seldom reported formally.

In contrast, reports of damage to caisson breakwaters, often widely known in Japan, may not receive the same dissemination outside of Japan, thus perhaps skewing designer opinions.

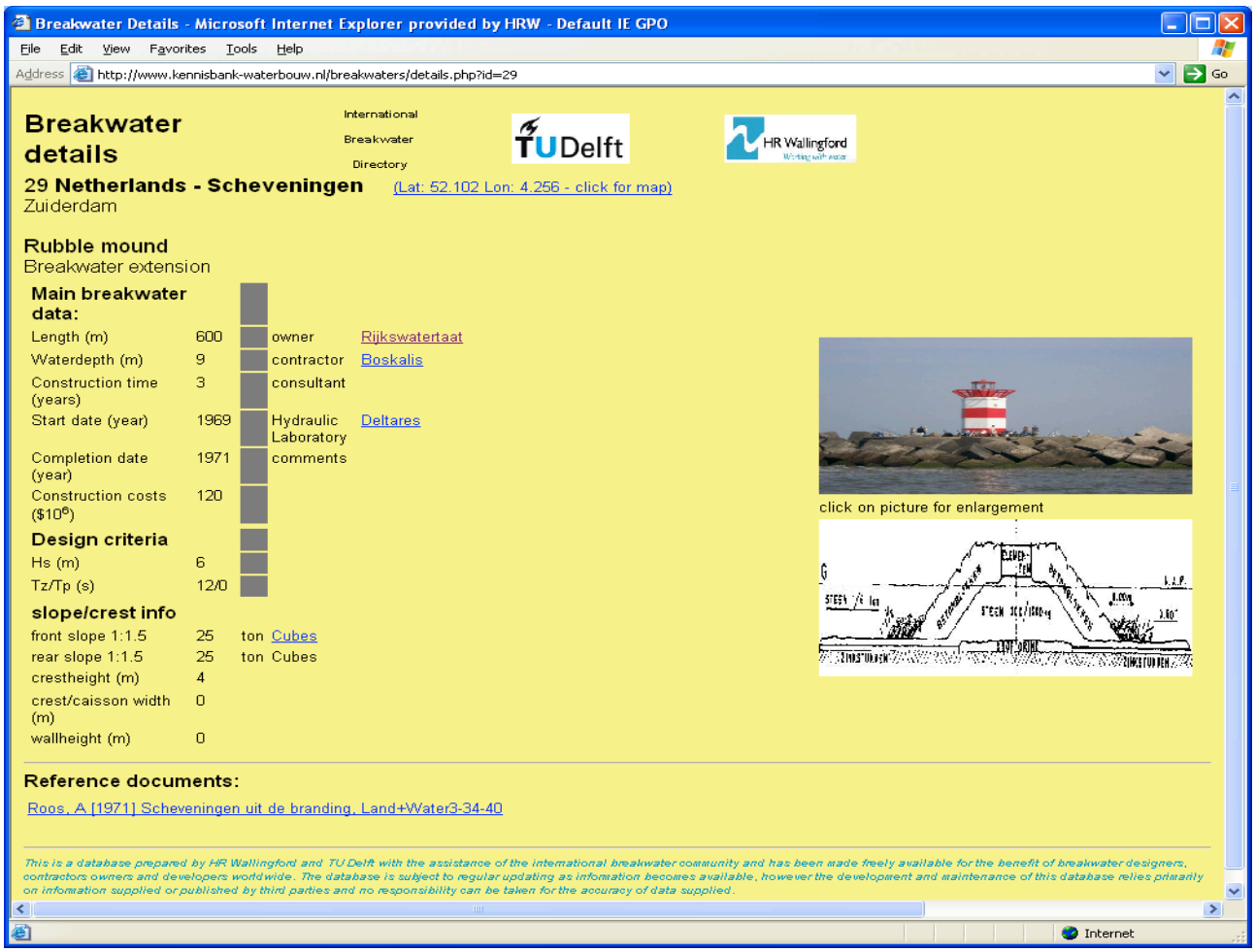


Figure 3: Example of database entry

4. FUTURE APPLICATIONS

The initial database, prepared by HR Wallingford, is currently being extended with breakwater data from, USA, Spain, Japan, South Africa, and France. Advanced methods to hold and search data are proposed, and links to the USACE ECID database are being explored. The database is currently accessible via http://www.breakwaters.nl and the presentation at the PIANC MMX conference will give the world navigation community the opportunity to support and develop this initiative.

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