POSTER

Fourth Oil Berth at Butcher Island, Bombay

Installation de chargement de pétrole à Butcher Island, Bombay

Die vierte Verladestelle am Butcher Island, Bombay

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1. GENERAL FEATURES

The Fourth Oil Berth at Butcher Island in Bombay harbour caters to oil tankers of 125,000 DWT berthing in deep waters. The mooring face consists of 11 circular caissons and is connected to land through a 1.8 Km long jetty. About 380 m of the jetty is with an earthen bund and the remaining length is on pile bents. The tidal range in the area is about 4.5 m, water current has speeds upto 2 m/sec. and water depths range upto 20 m. The project is notable for the construction techniques adopted to suit the difficult site conditions.

2. CAISSONS

There are totally 11 circular RCC Caissons having diameters upto 17.6 m and about 25 m height. They were precast with a raft base slab in a dry dock about 7 Km away and brought to site towed by tugs over sea. At the location a rubble mattress was prepared beforehand by dredging the sea bed, dumping graded rubble and levelling it using a screeding beam. Once the caisson was at the location, water was filled up inside for ballasting and the caisson sunk in position followed by filling up inside with sand for stability. The superstructure is then built-up in-situ. The caissons include pier-head, berthing, approach and mooring caissons. The various caissons are connected by steel trusses supporting walkways.

3. PILED JETTY

For the jetty hollow precast concrete piles as well as M.S lined piles were used. Piles of 0.95 m and 1.4 m diameters socketed into rock and of length upto 25 m were adopted. The two-pile bents are generally at 12 m centres. "Strong-points" were created at regular intervals with more closely located fixed-base piles and the other piles were treated as hinged- base piles. Precast pile muffs were placed on top of the piles which were temporarily braced together till final geometry was achieved and the joints concreted in-situ. Precast longitudinal girders were simply supported between the pile muffs and the deck slab was cast in-situ. Two different sets of equipment were used for piling - a Piling Pontoon for use in deep waters and a Piling Platform for proceeding from the shore in shallow waters supported on the completed piles.

4. CONCLUSION

A project of this magnitude involving precasting and placing in position in sea large elements and installing a large number of piles in sea demonstrates the competence of Indian Construction Industry adopting indigenous technology in marine field.

The owners of the project are Bombay Port Trust and the contractors were M/s. National Building Construction Corporation assisted by M/s. Christiani Nielson. M/s. STUP Consultants Limited provided design and construction consultancy to the contractors.

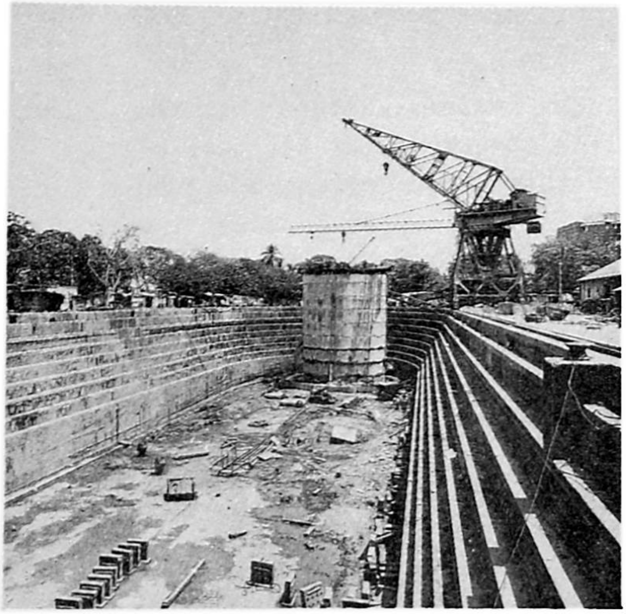

Fig.1 Caissons precast in dry dock

Fig.2 Caissons being towed in sea

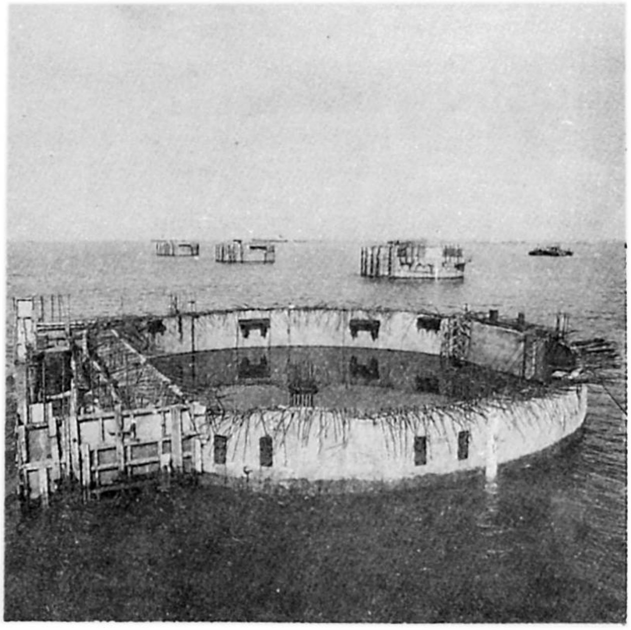

Fig.3 Caissons in position

Fig.4 Piled Jetty

Offshore Structure Stabilization under the Surface Wave Effet

Stabilisation des plates-formes marines sous l'action des vagues

Stabilisierung maritimer Plattformen unter Welleneinwirkung

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The surface waves are one of the major factors of the external influence on the supporting structures of the type of the offshore fixed structures. In this case offshore fixed structures undegro intensive dynamic effect. As a result the supporting structures suffer the considerable dynamic loads decreasing their supporting power.

The offshore fixed structure stabilization under the surface wave effect can be realized by means of the surface wave destruction and the absorption of the part of the energy. On this purpos the obstacle can be settled on their way-before their interaction with the offshore fixed structures. This obstacle presents a peculiar type of constructions that may be called breakwaters. The effectiveness of such breakwaters is determined by the part of the surface wave absorbed energy.

An elastic circular plate-that may be closed or sectional-is presented in the given paper as a specimen of a breakwater. This plate is freely floating on the water surface and is flexibly fastened to the framework of the offshore fixed structure. The width of the elastic plate on the wave beam, i.e.its chord and its thickness depend on the calculated parameters of the surface wave.

The flexible connection of the plate with the supporting structure is sufflied with the additional source of the system oscillation energy absorption to increase the effectiveness of breakwater. The circular pontoon, partly submerged by means of filling it with the water ballast, can be used to increase the flexing rigidity of the plate on its surface. The material consumption is minimal here.

In course of theoretical analisis of the interaction of the flexible elastic plate with the travelling surfase wave due to Stoker-Phillips theory three cases are investigated: a freely floating plate, a rigidly fastened plate and suppoting structure interaction values ave investigated,where the plate may be regarded either as rigidly fastened or as freely floating, from the point of view of wave suppressing effect.

The optimum values of the plate parameters under which the effectiveness of the surface wave energy absorption reaches 20-80 % are also indicated.

The original structure of a wave suppressing device is presented in this paper. The device can be mounted in the boundary area of wate-wetting of sea latticed supprting structure elements.The considerable part of surface wave energy is reflected and absorbed by the device itself because of its constructive peculiarities. The remained energy is transfered directly to the joints of the space latticed structure. Besides the above mentioned,another extremely effective device is presented here, that performs the functions of the hydrodinamic damper of the floating structure oscillations.

The new ideas and structures on the offshore fixed structure stabilization under the surface wave effect presented in the paper make it possible to prolong the service eife and to increase the flexibility of the offshore fixed structures. At the same time they don't disturb the comfort of the personnel and don't break the environment including the surronding fauna and flora.

Abrasion of Concrete Structures by Ice

Usure par la glace de structures en béton

Widerstand von Beton gegen Abrasion durch Eis

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1 INTRODUCTION

In arctic sea regions a concrete sea structure in subjected to heavy mechanical loads near the water level due to the moving ice sheet. Moving ice sheets load protruding aggregate stones, and the loads are considerably greater than the compressive strength of ice as determined in uniaxial compressive tests. This is due to the triaxial compression stress in the ice surrounding the stone surface.

Also, recurrent freeze-thaw cycles in the concrete wetted by waves and the tide expose the concrete to damage if it has not been designed to resist recurrent freezing in marine conditions. Temperature changes that exceed the approximate value $\Delta T = 40$ °C also deteriorate the bond between the cement stone and the stones and increase cracking in the cement stone between the aggregate stones.

This paper deals with the abrasion problem. The abrasion depth and resistance of concrete in arctic sea conditions can in practice be determined by calculations and laboratory tests.

2 ABRASION STUDIES

In a Finnish study the determination of abrasion of concrete in arctic offshore structures was based on four different methods:
- laboratory tests
- tests with an icebreaker
- abrasion studies on Finnish lighthouses
- computer calculations.

An abrasion machine was developed for laboratory use. The abrasion resistance of different concretes can be studied with the abrasion machine so that the concrete will have under gone cyclic freezing-thawing tests before the abrasion tests.

The abrasion resistance of similar concrete mixes was also studied at sea with an icebreaker. In icebreaker tests the specimens were fastened onto the bow of the icebreaker at water level. The abrasion of the concrete specimens was measured at the end of the tests.

The abrasion of Finnish lighthouses was measured at four lighthouses in the Gulf of Bothnia.

The abrasion and fracture of the concrete were also studied with computer calculations. The ice pressures against small areas such as aggregate particles that are protruding from the surface of a concrete structure were measured with laboratory tests. Also the bond strength between aggregate particles and cement stone was measured in tests. These values were needed in the computer calculations. On the basis of the calculations, using the calculation model, the abrasion of concrete was estimated as the function of ice sheet movement.

3 COMPARISON OF TEST RESULTS AND COMPUTER CALCULATIONS

In Fig. 1 a comparison of the abrasion (max. and min. values) of concrete is presented as the function of the compressive strength of concrete in laboratory abrasion tests during 10 minutes, in icebreaker tests, for ice field movements of 40 km, 100 km and 1000 km according to the abrasion calculations and in Finnish lighthouses during one year.

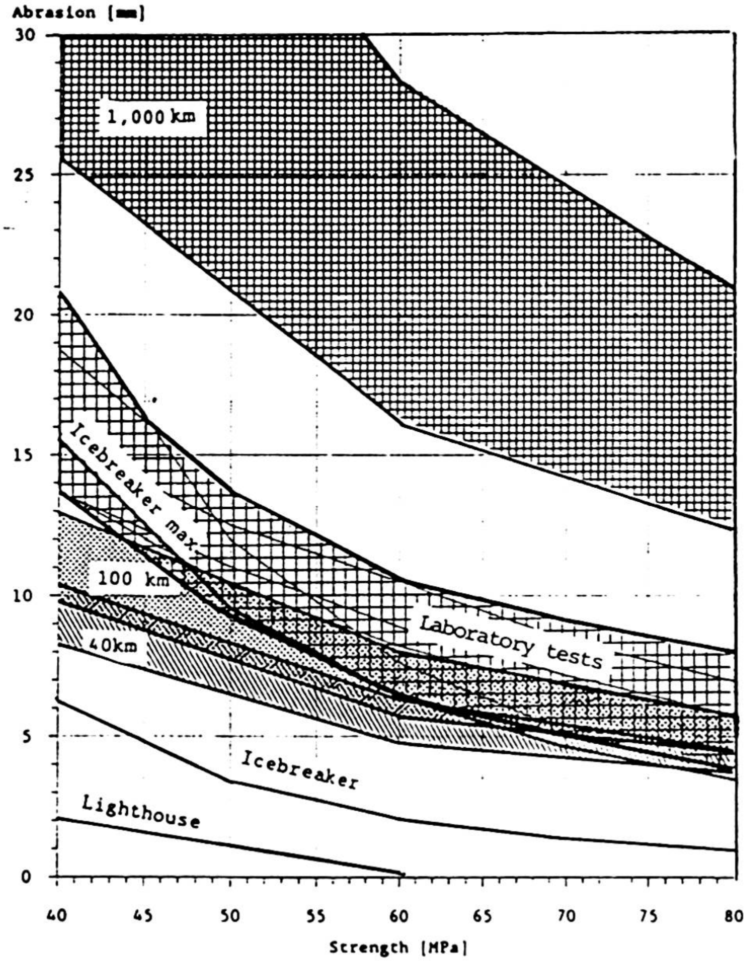

Fig. 1. Abrasion of concrete as the function of compressive strength.

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