CHAPTER 67

A FLOATING BREAKWATER

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The breakwater consists of a floating slab of breadth comparable to the length of the wave to be obstructed. Performance is improved by various arrangements of slots and mass-damping. The breakwater acts primarily by inhibiting the vertical component of orbital motion; there is a secondary action of energy dissipation by wave-breaking and eddy-making; there is also a degree of reflection. Mooring forces are small; it seems that on an exposed ocean coast, forces of the order of 0.5^{T} per ft. lin. should be catered for. The following series of tests have been carried out; the basic measurements being of wave reduction and mooring force; typical results are shown in diagrams.

1) On models of lengths 3'-4' in the Southampton University tank using wind generated waves.

2) Do. Do. Using paddle generated waves of lengths up to 8'. Series (1) and (2) comprised observations on some forty different configurations.

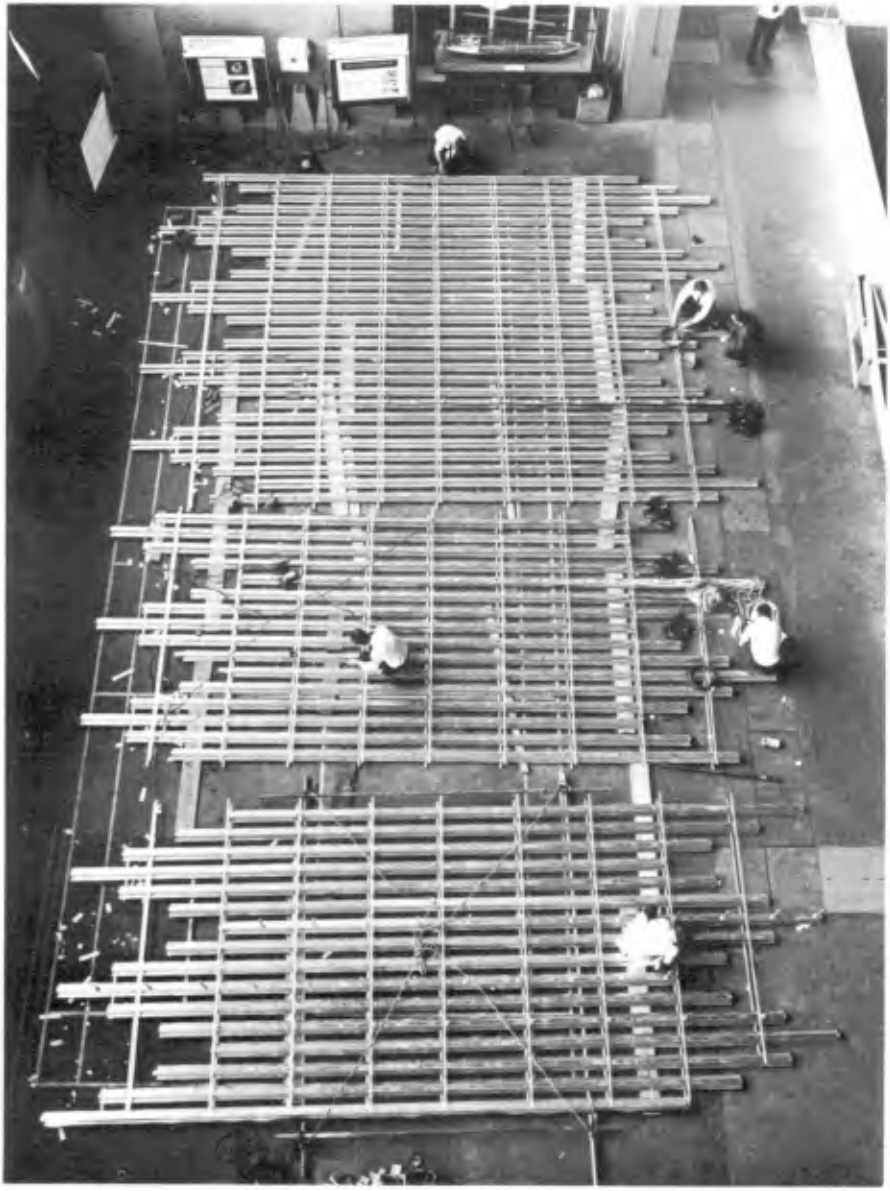
3) In the National Physical Laboratory tank using a model 42' x 30' overall and waves of lengths up to 35'. Bending strains and vertical displacements were measured.

4) A model has been installed in Queen Mary Reservoir, Staines of 100' x 47' overall; gale force winds are awaited which are expected to produce waves of the order of 40' l.

5) A 1/100 scale model has been installed in a harbour model at the Franzius Institute, Hanover, where the effect of the breakwater in a scaled-down natural site has been investigated.

6) Tests in development of (1) and (2) above are being carried out at the laboratories of Messrs. Taylor Woodrow Ltd. at Southall, London.

MODEL UNDER CONSTRUCTION FOR TESTING AT N.P.L.



WIND GENERATED WAVE TEST AT SOUTHAMPTON UNIVERSITY

The following conclusions have been drawn.

a) Performance is most sensitive to the area of solid slab per foot length of breakwater, but is sensitive to a lesser degree to overall breadth i.e. with a given area performance is improved if it be expanded over a larger breadth. The area per foot length has in consequence been chosen as the principal parameter; moreover, this value is closely related to cost. It will be referred to as solid breadth.

b) Proportional reduction of wave height is independent of wave height.

c) Mass damping either by structural mass or by enclosed or entrained water improves performance.

d) Mooring forces are at their maximum in the range wavelength/solid breadth = 1.0 - 2.0. The upper limit of the design range is likely to fall within these values. Beyond 2.0, the forces diminish abruptly; on certain models a tendency to move to seaward has been detected. This aspect is important from the point of view of security.

e) Mooring forces are impulsive and the force at a real anchor will result from the interplay of energy of wave, location and magnitude of vertical surfaces, mass of breakwater, length and flexibility of mooring cables, etc. Cables in all tests were effectively inextensible and weightless.

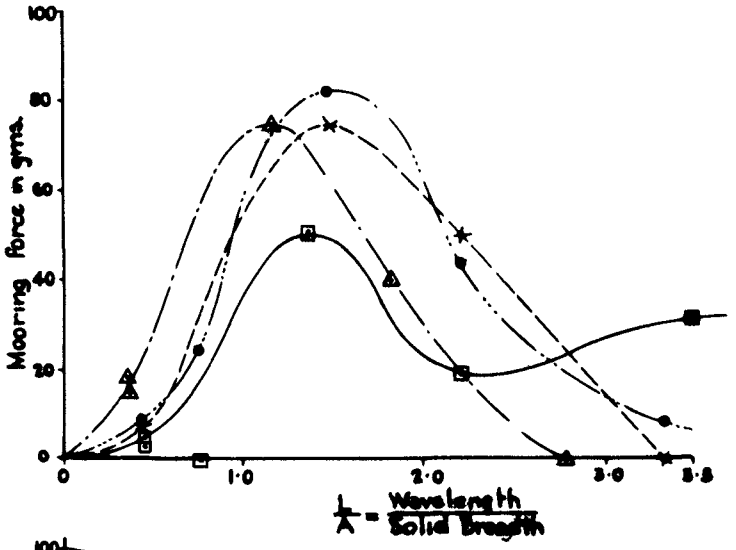
f) Mooring forces are affected primarily by the sum of vertical surfaces facing the waves.

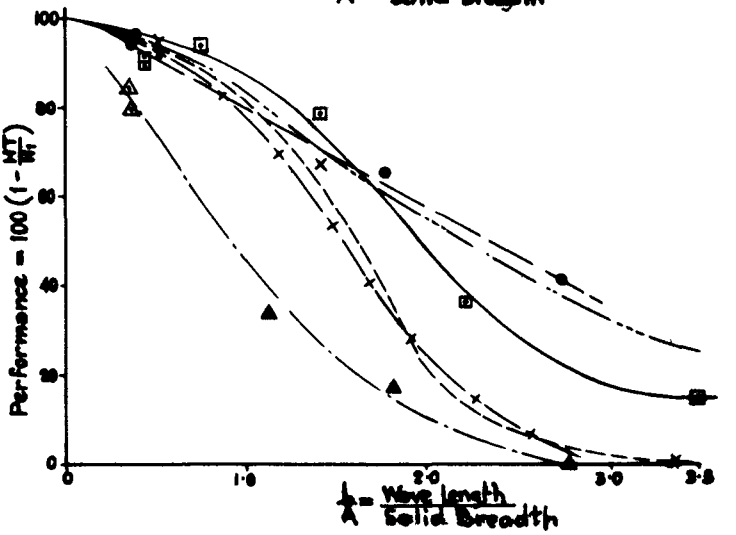
g) Performance is not affected by variation in the stiffness of the mooring system.

h) Performance is not greatly affected by stiffness of structure. A drop in proportional stiffness from 1000 (effectively inflexible) to 1 (very flexible) gave a reduction in performance of approximately 50%.

i) The indications are that bending stresses do not increase with waves longer than the solid breadth but tend rather to diminish.

j) Performance is also improved by a high value of the ratio of depth of flotation to height of freeboard.





NOTATION :-

	DIMENSIONS	SOLID B
—— —— —— Solid slab, FIXED	36"ℓ x 12"b.	36"
—·—·— Solid slab, FREE	36"ℓ x 12"b	36"
– – – – Folded duckboard, FREE	36"ℓ, 4 No.s 2½" slabs	30"
——— Closed folded duckboard, FREE	36"ℓ, 2 No.s 5" slabs	30"
—··— ·· Duckboard damped at rear	36"ℓ, 4 No.s 2½" slabs	30"
—+—+— Mean curve of N.P.L. results		

GRAPHS OF PERFORMANCE & MOORING FORCE

The following matters are now under investigation:

i) Closer estimate of mooring forces.

ii) Optimisation of slot shapes.

iii) Optimisation of structure for various employments e.g. temporary protection for contractor's works; incorporation in permanent harbour works; transportable protection for mineral extraction, etc.

iv) Closer examination of effect of mass damping on performance, mooring forces and structural bending.

Patent protection has been applied for.