STABILITY OF ARMOR BLOCK FOR HEAD OF RUBBLE-MOUND BREAKWATERS

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The rubble-mound breakwaters are suitable for nearly all types of foundations and any economically acceptable water depth. They have the longest construction history among various types of breakwaters and have been most widely used in the Republic of Korea. Recently, some serious damages for the rubble-mound breakwaters are reported frequently and the damages are concentrated on the head parts of breakwaters. In general, the breakwater head is probably most important part in a whole breakwater. However, the head is most vulnerable to incoming water waves. If waves are forced to break over a roundhead and it leads to large velocities and huge wave forces. For a specific wave direction, only a limited area of the head is highly exposed. The main damage is located at about 120° to 150° from the wave direction.

In this study, a series of stability tests for the rubble-mound breakwaters has been carried out in an elaborately controlled laboratory facility. The basin is 42m long and 36m wide. A uni-directional spectral wave generator is installed in one end of the basin and is used to generate irregular waves with equivalent significant wave heights and wave periods.

The stability of breakwaters is investigated in detail for changes of wave heights, wave periods and incident angles of waves. When analyzing the stability of breakwaters, N_s, the stability number in the Hudson's empirical formula is applied. The empirical formula suggested by Hudson is given by (CERC, 2001)

$$M = \frac{\rho H^3}{N_s^3 (S_r - 1)^3}, \quad N_s = (K_D \cot\alpha)^{1/3}$$

In which M is weight of armor unit, ρ is unit weight of armor unit, H is design wave height, $S_r = \rho / \rho_{water}$, K_D is stability coefficient and α is angle of structure slope.

If the angle of an incident wave for the breakwater is less than 45°, the stability of the trunk section of the breakwater is similar to that of a normally incident wave. N_s for head section is about 65% of trunk section.

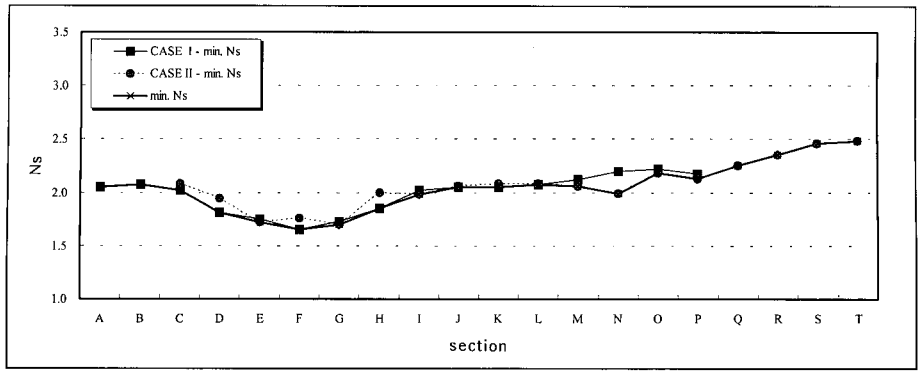

Fig. 1 The minimum N_s for all wave conditions
(wave height, wave period and incident angle)

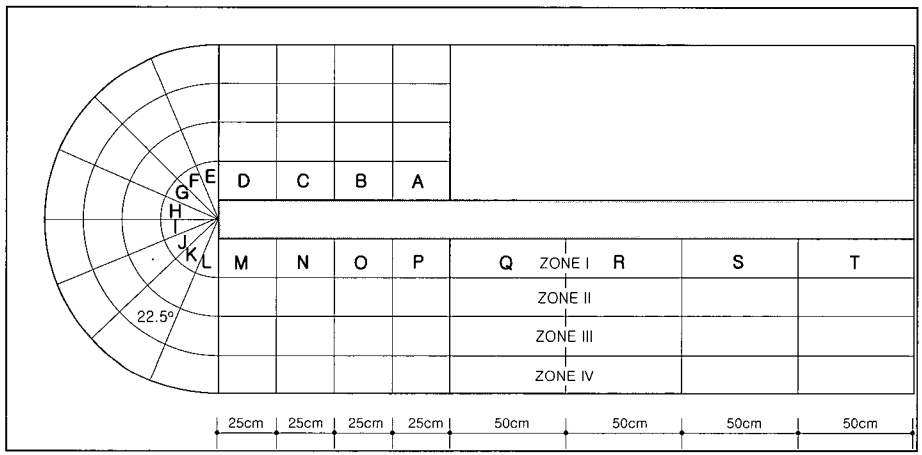

Fig. 2 Partition of a breakwater for laboratory experiments and analyses

REFERENCES

CERC(Coastal Engineering Research Center), US Army Corps of Engineers (2001). Shore Protection Manual.