

Research Trends and Results

Stability Review Procedure for Artificial Reef Armored Blocks --- First Step to Revising the "Artificial Reef Design Guide" ---

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1. What is an artificial reef?

Sea waves can be expressed as a sine wave in the offshore but become non-linear in shallow water and ultimately break. Since wave breaking converts the wave energy into various forms, wave energy and wave height decrease. Using this phenomenon, an artificial reef is constructed as a mound structure submerged farther out than the point where waves normally break in order to break waves and decrease (absorb) the energy of the waves that reach the protected area. (Photo 1). An artificial reef features an armored mound for structural stability and a wide crown to raise the efficiency of wave attenuation. It was developed in Japan in the 1980's and has been used since then, but less used outside Japan.

2. Background of revision

The "Artificial Reef Design Guide" was first issued in March 1992 and revised in March 2004, mainly to stipulate standard performance and expand the weight calculating method. As of 2004, 956 artificial reefs, totaling 143 km, had been constructed. This number increased to 1287 reefs totaling 175 km in fiscal 2013. During this period, there was also technical development, including a shift from offshore breakwaters to artificial reefs, and the emergence of different types of blocks (e.g. armored blocks of high stability and blocks with wave absorbing features).

Nonetheless, there are unresolved issues remaining, including no general method for selecting armored blocks or concepts on performance setting. To provide a reasonable selection method, it would be helpful to standardize performance assessment procedure and indication method (how to indicate performance values, damage condition, etc.) for each block brand, while to enable performance setting, techniques for evaluating the effect of erosion control measures are advised in particular.

Therefore, the Coast Division decided to prepare a "Stability Review Procedure for Artificial Reef Armored Blocks" and "Application Assessment Manual for Artificial Reefs with Topographical Changes," as core components of the second revisions to "Artificial Reef Design Guide."

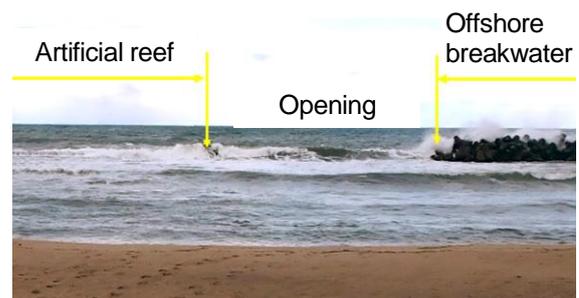


Photo 1: Wave Absorption by Artificial Reef (Kaike Coast)

3. Characteristics of "Stability Review Procedure for Artificial Reef Armored Blocks"

The key revisions to this procedure include standardized test conditions in order to facilitate performance comparisons among blocks, standardized review determinations, tests simulating site conditions, and the utilization of numerical calculation as support or substitution for empirical tests. A particular note in the review determination is that the causes of scattered blocks when hit by irregular waves and the end state of scattered chains will be checked also.

We plan to exchange opinions with block manufacturers in the course of formulating the procedure, and release the procedure in the summer of 2014.

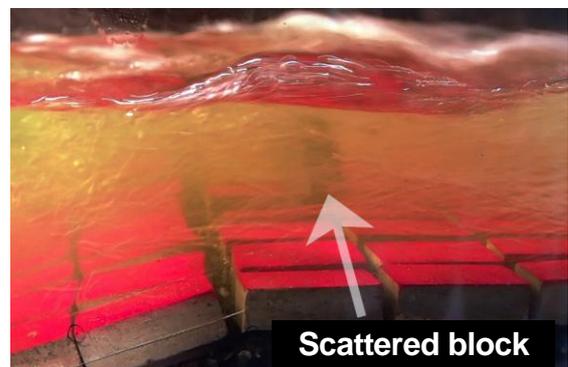


Photo 2: Test for Investigating Causes of Block Scattering

[Reference]

"Artificial Reef Design Guide" (revised version), 2004, supervised by Coast Division, River Bureau, MLIT and Coast Division, NILIM.