A New Eco-Friendly Wave-Dissipating Concrete Block and Verification of Its Effectiveness from Field Observations

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ABSTRACT

In recent years, the importance of the having a good natural environment in harbors and coastal areas is widely recognized. The formation of seaweed beds and fish gathering are desirable in a wave dissipating concrete block. Reduction of construction cost is also important. We decided to develop a superior wave dissipating block to effect both "eco-friendliness" and an economic solution. The block has high stability and a wave dissipating function as good as any conventional wave dissipating block. Field observations were carried out on to confirm its "eco-friendly" effective.

KEY WORDS: wave dissipating block; seaweed bed; fish shelter; eco-friendly; construction cost; hydraulic model test; field observation

INTRODUCTION

In recent years, the importance of a good natural environment in harbors and coastal areas is widely recognized. Not only stability and wave dissipating function against waves but also a consideration of the environment and biota are essential when harbors, fishing ports and coastal structures are constructed. Construction cost reduction is required in addition to function in a structure due to economic situation changes.

It is known from experience that seaweed beds often form after wave dissipating concrete blocks settle underwater. Seaweed beds provide an important function to support ecosystems, for example in primary production depending on photosynthesis, nurseries of young marine life, and carbon dioxide fixation. An additional asset for value in wave dissipating concrete blocks, is the formation of seaweed beds. Conventional wave dissipating concrete blocks are developed from the viewpoint of engineering, and do not function as substrata for seaweed or habitations for sea creatures. In response to this, a new type wave dissipating concrete block was developed. This displays promotion of seaweed bed formation and reduction of construction costs. This paper describes the basic characteristics of this new type eco-friendly wave dissipating block. Application started three years ago and we have investigated the biota around the blocks and verified their effectiveness for eco-friendliness. The results are shown herein.

DEVELOPMENT OF NEW WAVE DISSIPATING CONCRETE BLOCKS

Examination of the Shape

In Japan, kelps such as Laminariaceae in Hokkaido, northeast coast of Honshu, Eisenia bicyclis and Ecklonia cava in Honshu and Sargassaceae and Galidiaceae in some local area in Honshu and Shikoku Islands are all main components of seaweed beds in the littoral zone. It is known that Laminariaceae easy attaches to ridgelines of concrete blocks or projections on rocks (Hirose and Aota, 2011, Kawashima, 1992). Sunlight is necessary for growth. When the ridgeline of the substrata is sufficiently long, there is an advantage for attachment of seaweeds. We formed a long ridgeline along the whole block.

We focused on porosity between blocks to attract marine life and reduce cost. Fish species use the interstices between the blocks as a good habitat. It is thought that a high porosity and complex spaces are suitable for the habitation of various fishes. Porosity also reduces the construction cost. Porosity is created by arranging projections on the head and limbs of structures. In addition, stability against waves attack was realized.

The new eco-friendly wave dissipating concrete block named “Tetraneo” was developed after many examinations. The shape of it is based on Tetrapod as shown in Figure 1.

Figure 1. New wave dissipating concrete block “Tetraneo”

Stability

Calculation of the required mass of wave dissipating block is generally