

## Link Block Protect Taiwan Seaports with Coastal Zones Development

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**ABSTRACT:** Taiwan coast is surrounded by the Taiwan Strait and the Pacific Ocean. Sandy coasts are majority and severely scoured by North-Easterly winter monsoon and summer and autumn hurricane (i.e. typhoon). Link block (shore protection concrete block) are largely placed along the beach or vertical to the beach or even arranged offshore parallel to coast (i.e. offshore breakwater) to induce sediment behind the offshore breakwater to reclaimed the lost sand of beach (i.e. beach nourishment).

Link block protect seaport such as Taipei Commercial Port, Mialiao Industrial Port and fishery ports etc. Link block has a great function for shore protection and a good wave absorber for breakwater construction. It contributes a great potential ability to prevent wave action on the coastal zone.

However, such as commercial harbor like Taipei Port, the arm our unit of the breakwater are placed by Link Block for East Coast along the Pacific Ocean, the beach slope is very steep, therefore the toe of the coast highway (Highway No.9 & Highway No.11) need to be protected along the highway foundation to protect big waves act on the foundation and erode sand away. Link Block are then occupied largely along the shore to protect highway foundation and keep their stable and sound coast and foundation are not eroded away.

**Keywords:** Link Block; Coastal Zones Development; Taipei Commercial Port.

### I. INTRODUCTION

Taiwan's coastline is surrounded by the Taiwan Strait and the Pacific Ocean. In Taiwan's coastline has sandy coast and rocky coast. Its west coastline features a beach with a mild sandy coast (Fig. 1.), such as Kaohsiung Cheding Coast. The sandy coast is affected by the hurricane (i.e. typhoon) in the winter by the Arctic monsoon and summer and autumn, and most of them are severely affected. It is a precautionary and protective measure to place a connection block (shore waterproof concrete block) on the coastline. It is best to set up most of the connection blocks (shore protection concrete blocks) along the beach or perpendicular to the beach, and even parallel with the coast (i.e. offshore breakwater) to cause the sediment behind the breakwater to recover the beach on the beach (i.e. beach nourishment). Link Blocks can protect the Haikou and have great coastal protection and good breakwater. It helps to prevent the great potential of coastal action in the region.



Fig. 1. Beaches at Kaohsiung Cheding Coast

Western mild sandy coast  
Coastal Characteristics in Taiwan

## 2. Countermeasure Against Beach Erosion

Beach erosion is one of the most significant coastal protection issues in the world. Taiwan's coastal areas with the rapid population growth and economic development, beach erosion severity has been considerable attention. In the coastal areas, the solution implemented in Taiwan is a Link Block revetment, and the Link Block can reduce the erosion by 35% (Fig. 2.).

In Kaohsiung county Ketzeliacoast and Taitung county Taimalicoasseawall and revetment with armor blocks that are not harmonic with coastal environments (Fig. 3.-4.).



**Fig. 2.** Detached breakwater at Cheding coast, Kaohsiung county.



**Fig. 3.** Seawall with armor units in the fronting faces at Ketzeliacoast, Kaohsiung county.



**Fig. 4.** Revetment with armor units for toe protection at Taimalicoast, Taitung county

### 3. Introduction of the Link Block and construction process

The Link Block to tetrapod as the basic form, the main features of the tetrapod in the tang, cut four fins of the cone and the four disk angle instead of the four sides have a tapered hole, so that four cone through Link Block internal, the four holes can increase the porosity of the block and enhance the ability to absorb scattered wave energy, therefore, Link Block will have a greater stability and better wave effect.

The Link Block revetment construction process: the first in accordance with the needs of the revetment design 5 tons, 15 and 30 Tons of different size of the size of the Link Block, the second in accordance with the different design size of the scene assembly of steel template, the third site cast mixed soil to the design of the Link Block steel plate and conservation, the fourth. The crane lifts the Link Block to the shoreline to be protected. (Fig. 5.-13.)



The Link Block revetment construction process (Fig. 5.-13.).

**4. Empirical Case for revetment beach erosion**

Case 1. Coastal Characteristics and case (Fig 14., Table 1.)

Case 2. Conventional countermeasures against beach erosion in Taiwan (Fig 15.-16., Table 2.)



**Fig. 14.** Hualien rocky coast

**Table 1. Countermeasures against beach erosion in Taiwan.**

countermeasures	length (m)	units
seawall	392,973	—
revetment	93,382	—
dissipative material	56,051	—
groins	* 7,800	130
jetty	—	27
submerged breakwater	* 880	11
detached breakwater	* 14,720	184

Note : \* mean values , length of groins = 60 (m/unit) ;  
Length of submerged and detached breakwater = 80 (m/unit).





**Fig. 15-16.**The seawall and revetment built at south coast of Taiwan(Conventional countermeasures against beach erosion)

**Table 2** Conventional countermeasures against beach erosion in Taiwan

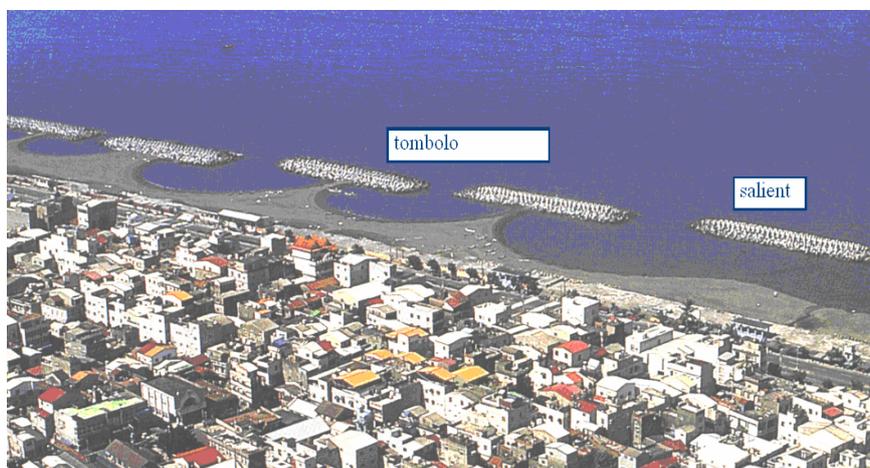
countermeasures	length (m)	unit
seawalls	392,973	—
revetments	93,382	—
dissipative materials	56,051	—
groins	* 10,080	168
jetties	—	27
submerged breakwaters	* 880	11
detached breakwaters	* 14,720	184

\*Note: mean values, length of groins = 60 (m/unit) ;  
length of submerged and detached breakwater =

80 (m/unit)

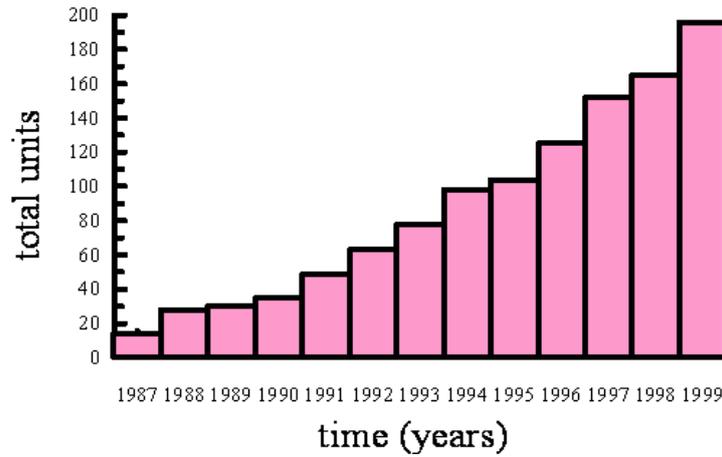
#### 4.1 contributions

Countermeasures against Beach Erosion

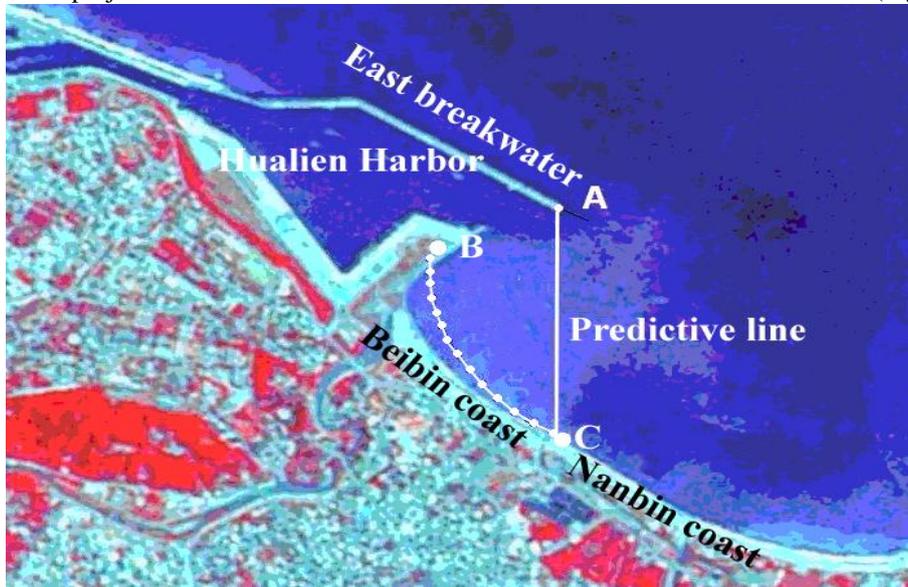


**Fig. 16.**Effectives of detached breakwaters at Cheding coast, Kaohsiung County

**Table 3.** Increase of units of detached breakwaters around Taiwan coast



The restoration project of Beibin beach at Hualien coast located in the middle east Taiwan (Fig. 17.-18.)



**Fig. 17.** Project layout with headland control combined with sand fill



**Fig. 18.** The sketch after improvement



Fig. 19.Coast Zone of Taiwan



Fig. 20.Offshore Industrial area

## II. CONCLUSIONS AND REMARKS

Such as Taiwan's Taipei commercial port, Miaoli (Famorsa Plastic) industrial port ( Fig. 20 ), and fishing ports., they are all protected by outer breakwaters with placement of one layer or two layers of Link Concrete Block. Coastal zones especially the eastern coast of Taiwan are all placed Link Block along the shoreline to prevent beach erosion and not let sand or gravel be washed down to the Pacific Ocean. The middle part of

the eastern coast. Hualien Harbour with Beibin coast is sheltered by the Eastern Breakwater. The Link Blocks are placed massively along the tip of the breakwater to form as the Headland as Fig. 17 shown will be formed Zeta shape of beach shoreline. The downstream of Hualien Harbour between Beibin coast and Nanbin coast an Offshore Breakwater built by Link Block massively and formed as Headland then both seaside beach will form as Zeta-type shore as shown in Fig. 18. Therefore hard structure such as Link Blocks are placed as Headland structure matched with sand filling, the beach improvement finally be sketched as Fig. 18 Zeta Shape beach nourishment will be reached, This is hard structure (Link Block) with river sand filling coastal zones finally reach the Zeta shape. A Soft Solution with Link Block (hard structure) makes beach improve..

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