# Features of Topography and Distribution of Coastal Plants of Two Artificial Beaches in Hakata Bay, Fukuoka, Japan

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# 1. Introduction

Global sea level rise and increased human activity in recent years have eroded 70 percent of the world's sandy beaches and 90 percent of the United States' beaches.

In order to meet the needs of human life and urban construction. There has been a great deal of land reclamation in recent years. To stabilize man-made coasts and protect them from waves. Therefore, artificial methods were used to build artificial beaches on some coasts, and artificial structures such as breakwaters were built on the offshore side to protect the coast. The sand used to fill the beach has been washed away by the waves for a long time and has no natural way to replenish it, so it is easy to lose sand, especially in artificial beaches.

Beach erosion mainly refers to the loss of beach material under the action of waves, which is mainly manifested as beach narrowing and slope increase. Global sea level rise and increased human activity in recent years have eroded 70 percent of the world's sandy beaches and 90 percent of the United States' beaches. At the same time, with the construction of large and medium-sized reservoirs and DAMS, the amount of sand flowing to beaches has decreased significantly.

The purpose of this survey is to observe the topographic changes of artificial coast and to discuss the erosion status of artificial coast.

# 2. Pre-investigation of survey sites

The research sites of this survey are the Atagohama Coast and Najima Coast (FIG. 1) in Hakata Bay, both of which are artificial coasts constructed near landfill sites. The total length of Atagohama Coast is 1.1 km, and offshore embankments are set around the coast. Under the influence of tidal current (FIG. 2), sand drift occurs in the offshore embankments. The Najima Coast is 0.23 kilometers long, and it is a semi-open bay facing Hakata Bay with breakwaters at both ends. The Najima Coast is greatly affected by tidal current. A preliminary survey of tidal current direction and coastal erosion in the area where the coast is located. According to various factors and the nature of the coast itself, the measurement points of the terrain are selected. There are altogether 5 survey lines on the Atagohama Coast and 3 on the Najima Coast (FIG. 3).





Provenance: Fukuoka City Environment Bureau FIG.2 Tideway in the Hakata Bay



FIG.3 Measuring location

### 3. Surveys of the survey sites

#### 3.1 Surveys of the Atagohama coast

The survey conducted two topographic surveys in September and December. Select a representative area and set the measurement area from the timberline to the bank protection junction. Observation points are set up every two meters to observe changes in coastal topography and coastal erosion.

According to the survey data of the Atagohama coast, it can be found that due to the influence of the offshore embankment outside, the offshore embankment inside formed a relatively stable sea area. The overall sand loss of the beach is not obvious. The internal change of the beach is relatively clear, and the main influence is from the opening of the offshore embankment. Influenced by the tidal current of Hakata Bay, the phenomenon of coastal sand drift occurred in the interior of the offshore embankment. The slope from west to east coast, resulting in accumulation at the easternmost beach (FIG.4). The most obvious place to be affected by waves is at the opening of the embankment. The two surveys were conducted at high tide and low tide, due to changes in wave direction at high tide and low tide. The change of slope surface under impact is also very obvious.



FIG.4 The Atagohama Coast topography changes

#### 3.2 Surveys of the Atagohama coast

The Najima coast had just been repaired during the survey in September, which made it easier to observe the loss of sand. After finishing work on the Najima coast. With no protection from the shore, the sand of the beach is constantly lost, which stabilizes after a few months. The changes caused by the impact of waves are generally the same in all areas of the coast (FIG.5).



FIG.5 The Najima Coast topography changes

### 4. Conclusion

The measures taken by the two artificial coasts against coastal erosion are not the same. It can be seen from the above results that there is almost no coastal plant distribution in Atagohama. Because of the existence of the offshore embankment, it can effectively prevent the sand from flowing outward, but it will cause the phenomenon of sand drift inside. The sand loss of Najima is very serious after the completion of shore repair. In the Najima coast, the height and slope of the beach almost reach equilibrium after a certain time. There will be no particularly severe erosion in one area.

This can be seen in the topography of the artificial coast. The sand that is buried in the process of shore repair actually belongs to excessive landfill. This part of sand will be quickly lost in a short time, unable to form a stable ecosystem. The large amount of sand flowing into the sea can also affect the coastal environment around the coast. Therefore, the amount of sand buried should be estimated to avoid the occurrence of this phenomenon.

After observing the artificial coastal construction with different measures, we can summarize better methods in the future coastal construction and maintenance. It also reduces labor costs and impacts on coastal ecosystems while protecting the coast.