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Coastal Erosion and Coastal Structures in Clifton Hill Beach, Point Fortin, Trinidad

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ABSTRACT

This paper deals with the study of coastal erosion along the Clifton Beach, Point Fortin, Guapo, the southwest coast of Trinidad. It also deals with the effectiveness of coastal structures that have been built along the beach. In spite of the coastal structures that were built one after the other, erosion could not be prevented; only the area of erosion has been shifting along the coast in the northeasterly direction.

Keywords: Coastal erosion, coastal structures, revetment, crib wall.

INTRODUCTION

Erosion is observed in many beaches along the coast of Trinidad. The present study is along the Clifton Beach, Point Fortin, Guapo, Trinidad. Till a decade ago, there was a wide beach with a resturant and recreational facilities and was attracting a good number of people. Now it has become very narrow, there were no visitors and the restorant has been abandoned.

Geological Setting

The Caribbean Island of Trinidad forms north-easternmost extension of the South American Continent. Physiographically, it is a part of eastern Venezuela. Its approximate geographic point is 10^0 30'N and 61^0 15'W. To understand the coastal features and the reasons for the day to day changes that are taking place, the geology and geomorphology of the country are reviewed briefly. The larger geomorphologic features coincide well with geological units of the country. Geomorphologically, the island is divided by three mountain ranges separated by undulating land, plains and swamps. The Northern Range fringes the Caribbean Sea. The Central Range bisects the island obliquely and the Southern Range forms the rim of the Island. Thus the country can be divided into five geomorphic regions and they are: 1) the Northern Range, 2) the Northern Basin, 3) the Central Range, 4) the Southern Basin and 5) the Southern Range (Suter, H.H, 1960).

All the three kinds, viz. igneous, metamorphic and sedimentary rocks are found in this country. Igneous rocks occur only as a small patch in San Souci. The Northern range consists of metamorphic rocks; they are phyllites of varying grades of metamorphism and also limestones. At some places phyliites are well metamorphosed and found hard; in other places they are as soft as clays when they are wet. The Central and Southern Ranges consist of soft sedimentary rocks. And the northern and southern basins consist of only loose sediments. So along the

coast, promontories represent hard rocks and the embayments with beaches between the headlands occupy the areas where soft phyllites and loose sediments and exist. This part of the beach chiefly consists of fine sand which can easily be eroded. The study area is shown in the figures1 and 2.

Figure 1 – Map of Trinidad

Figure 2 – Aerial image of Clifton Beach, Point Fortin (source: Google Earth)

Coastal Eeosion and structures:

Initially, on the southwestern part of Cifton Beach, Point Fortin erosion was obserevd during 2002. A stone revetment of 460m was undertaken during March 2003 and November 2004 (fig. 3) in that area to prevent erosion. The basalt stone required for the revetment was brought from St. Lucia. By the time of compltion of the revetment, it was found that erosion shifted further northeast of the revetment. It continued for five years. The

old existing road was totally damaged and in its place a steep cliff with a height of around10m from the water level formed (fig 4). The old road that was boght down can be seen at present on the beach (fig.5). The original slightly convex (towards the sea) road has become concave. The retreat of the beach was up to 15 to 20m.

Figure 3 – 460m long stone revetment

Figure 4 – Erosion at Clifton Beach, Point Fortin,

Figure 5 – Old collpsed road and stone revetment for a distance of 460m.

As it had been severly eroding, first a break water (fig.6) was taken up to facilitate construction of protective structures to protect further erosion. At the time of constructing the breakwaters, the water depth was more than 2m, but now the area has been silted. The sheet piling and a crib wall supported by stone revetment (fig.7) was completed in November 2008. The crib wall is to a length of nearly 200m. And a new road was laid after these protective measures were taken. The sructures could serve their purpose as expected.

Figure 6 – Cribwall and a breakwater

Figure 7 – Sheet piling (shown with an arrow) and crib wall

But erosion on the beach could not be stopped. It only shifted to further northeast as can be seen in the fig.8. The backshore with vegetation is cut and the height of the berm is about a meter.

Figure 8 – beach erosion

Plans are on the anvil to take up some structures like groyns in the inshore to protect this part of the beach too. Even after this stretch beeing protected, it cannot be assured that erosion will totally stop.

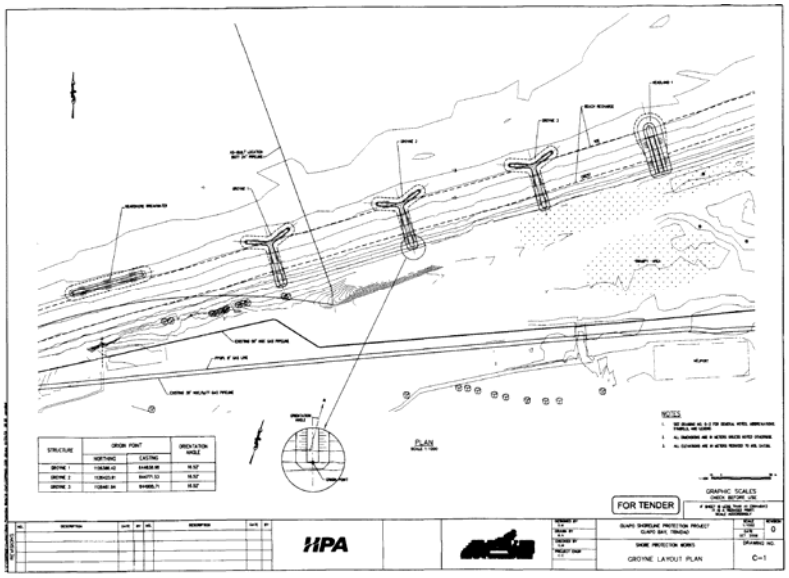

Figure 9 – Proposed Structutes

Also southwest of the stone revetment, erosion was observed (fig.10). A steep cliff of nearly 12m height formed here because of erosion of land in front of it. There was 5m wide stretch of land in front of it before the construction of revetment took place and erosion was not noticed at that time.

Discussion:

Most coasts of the world are relatively stabilised with a stable sand budget. Changes on the beach are due to change in the nearshore wave and current climate. Change in wave and current environment is caused either naturally or artificially by interference along the coast. Natural disturbances are due to formation of rigdges, barriers, uplift or sinking of the coastal areas, change in sea levelss, etc. Man made are due to contructional activities like breakwaters, piers, jetties, etc. It is a common obseravtion that beaches around the world are facing erosion because of some reason or other.

Singh, B and A.El Fouladi (2003) observed that the rate of erosion is 1 to 2m a year along the coasts in Trinidad. According to Komar (1983) one of the more likely consequences of sea level rise in small islands, like the Caribbean, is coastal erosion and or inundation, especially where the geology is favorable. Aubrey et al., (1988), opined that, in the particular case of Trinidad, land subsidence was taking place because of extensive underground extraction of petroleum and asphalt mining, especially in the oil belt in the southern part of the island

South of the beach two refinies exist and some structures were taken up on the bech for the shipment facility of their petroleum products. The beach experirnced erosion, understandably, after these establishments took up structures along the coast. Vasudeu Kanithi (1984) observed that the Visakhapatnam Coast, South India faced erosion because of breakwaters in connection with a harbour.

Singh, B and A.El Fouladi in their study of 'Coastal erosion in Trinidad in the Southern Caribbean: probable causes and solutions' observed that the rate of erosion is 1 to 2m a year along the coasts in Trinidad. According to Komar (1983) one of the more likely consequences of sea level rise in small islands, as in the Caribbean, is coastal erosion and or inundation, especially where the geology is favorable. Aubrey et al., (1988), opined that, in the particular case of Trinidad, it is because of extensive underground extraction and petroleum and asphalt mining, land subsidence may be taking place, especially in the oil belt in the southern part of the island.

South of the beach two refinies exist. It seems the beach experirnced erosion after these establishments took up some structures along the coast. It is also possible that erosion is taking place in this part of the coast because of structures that are built in connection with the transportation of petroleum products by companies situated

southwest of this coast. The beach along Visakhapatnam, east coast of India experienced erosion when break waters were built in connection with an inland harbour in late thirties. The port trust has taken up the responsibility of artificially nourishing the beach (Vasudevu, K, 1982).

Conclusion:

The natural environment on the Clifton Beach, Point Fortin, Guapo, southwest coast of Trinidad had been disturbed by the structures taken up in the nearshore in connection with the oil industries. Along the coasts, longshore currents prevail and accordingly the sediment drifts along the shore. If the balance in sand budget is lost and the beach erodes continuously, preventive measures can only shift the place of erosion, but cannot totally stop. This is what is happening in this part of the beach. In the name of progress planners interfere with coastal environment and the consequence is damage to the coast. If the coastline consists of hard igneous rock, the rate of erosion is slower and the damage is lesser, but if softer rocks occur along the coast, the damage is faster and more pronounced.

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