

CHAPTER 47

SUCCESS AND FAILURE OF COAST PROTECTION WORKS IN CEYLON

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INTRODUCTION

The Island of Ceylon, which is often referred to as the Pearl of the Indian Ocean, is 25,481 square miles in extent. It lies between 0 and 10 degrees North Latitude, and between 79 and 82 degrees East Longitude. The Island is mango-shaped. Its length from north to south is 272 miles, and its breadth from east to west is 140 miles. (Fig.1).

Geologically, Ceylon belongs to what is called Peninsular India: that is India south of the Indo-Gangetic plain, an area which forms a compact tableland of a triangular shape projected into the Indian Ocean, with Ceylon as a semi-detached pendant at its apex. Owing to this salient position as regards the Indian Ocean, the coasts of India and Ceylon are constantly laved by currents resulting from the deflection of the monsoon drift against them, the more powerful currents occurring during the south-west monsoon, when the wind blows over a wide expanse of water to reach the land mass, and the weaker during the north-east monsoon, when the waters of the Arabian Sea and Bay of Bengal are blown south-wards.

CHANGES IN COASTAL TOPOGRAPHY

In the perennial struggle between sea and land, there is evidence that the frontiers of Ceylon, on the west, south-west and the south are being constantly pushed back. However, it is not possible to estimate reliably, even within the period of recorded history of the Island, to what extent the sea has encroached upon land. No comparison is possible between the earliest and present maps of Ceylon. The former were prepared when cartography was only little developed, consequently these plans lack precision that is so essential for comparative study.

Ceylon was known in ancient times as Sri Lanka Pura. It has been calculated that Sri Lanka Pura, the legendary capital of King Ravana (circa 1500 B.C.), through which the meridian of the Brahmans' passed, must have been in 75 degrees 53 minutes east longitude, whereas the present western extremity of Ceylon barely reaches 80 degrees.

In the legendary traditions of the Island are also found the extent of this country in former times. According to chronicles the original circumference of the Island was 5120 miles. It is said to have been reduced by successive inundations to 938 miles, which is not far from the present size. The first of these inundations is said to have taken place in 2387 B.C. The second in 504 B.C. and finally, the extensive submergence near Colombo, the present capital of Ceylon, in 300 B.C.

COASTAL ENGINEERING

In 1908 Commander Sommerville of the Royal British Navy whilst engaged in a marine survey discovered a submerged plateau surrounding the Island, the edge of which, he has stated, is strongly marked. He has further stated that it extends far out to sea on the west coast, and is much less prominent on the east coast. Whence it may reasonably be assumed that the west coast of Ceylon has suffered much denudation due to the erosive action of sea throughout the ages.

Within more recent times, the sea has made many inroads into land in the coastal stretch from Negombo to Weligama, and continues to do so unabated at several points on this coast-line. Due to this incursion of the sea much damage is being done to public and private property: roads and railways are threatened with destruction; parks and pleasure beaches are gradually disappearing; and many houses and coconut plantations are being obliterated. All this involves considerable loss to the national economy and diminution of the beautiful coastal scenery of the Island.

THE PROBLEM OF SEA EROSION

Although sea erosion had taken toll of the Island from time immemorial, yet it attracted serious attention of the islanders only about fifty years ago, when it started attacking works of human construction and cultivated lands. During the last century the maritime lands on the west south-west and the south have been vastly developed by the construction of roads, railways, industrial and residential buildings, and the plantations of coconut estates. In course of time the sea had advanced so rapidly that it started attacking these works of utility and national economy.

The total length of the Island's coast lines subject to extensive erosion is about 245 miles, made up as follows: north of Colombo about 100 miles; south of Colombo about 125 miles and between Trincomalee and Batticaloa about 20 miles.

In recent years a fast expanding economy of the maritime province has focussed much attention on the problem of sea erosion. It has been realized that coast protection and shore-line development should be a distinct charge under suitable administration. Accordingly, Parliament has vested the Ministry of Local Government and Cultural Affairs with authority for the protection of the coast against erosion and encroachment by the sea. What is now aimed at is to build up a Department under the Commissioner of Local Government, which would be able to amass all the necessary data on sea erosion, to study them steadily in sequence, and to deal with individual problems as an organic unit in a comprehensive scheme of coastal economy.

COAST PROTECTION WORKS

The Government which is obliged to afford protection to public and private property has spent considerable sums of money on protective works. Hitherto such works have been carried out by the Public Works Department, the Irrigation Department and the Harbour Engineer's Department. They have been executed sporadically. In the absence of organized studies and

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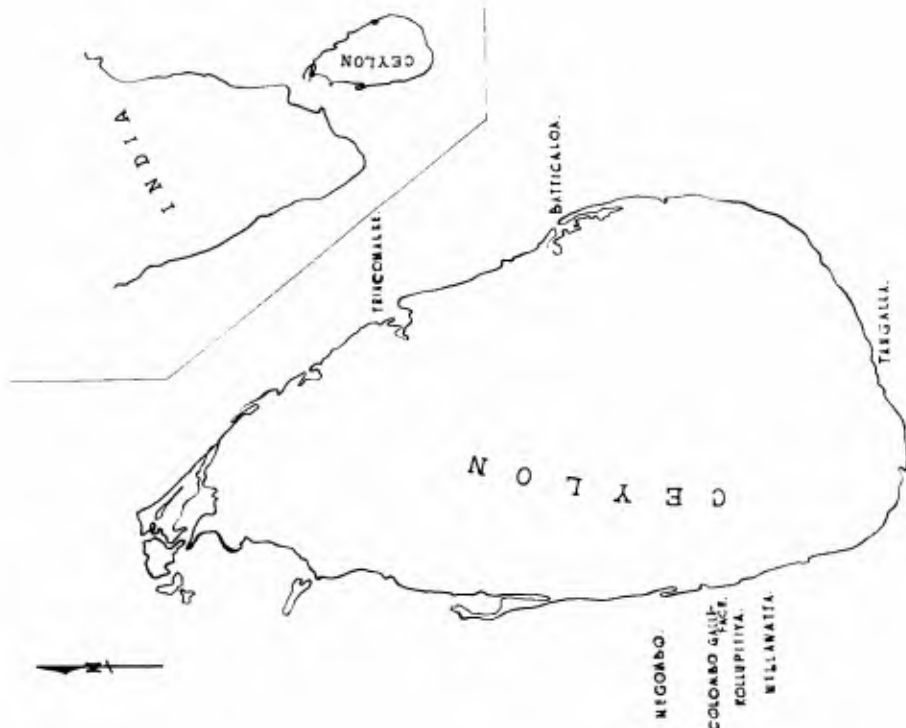


Fig. 1. Map of Ceylon and the adjacent coast of India.



Fig. 2. Southern jetty at Wellawatta Canal outlet in the process of construction. Note the absence of a sandy beach.



Fig. 3. Southern jetty at Wellawatta Canal outlet after completion. Note the beach re-claimed on the southern side.

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investigations, of the several problems of sea erosion, around the Island coast protection works were laid down by engineers on the basis of the trial and error method. Some of these works have stood the test of time, others have failed, whilst still others have created fresh problems.

In contrast with western countries, where a great variety of protective structures, representing the ideas of several generations of coastal engineers has been tried out, generally speaking, in Ceylon, the usual method of coast protection consists of the lining of the shore with tipped rock stones, each weighing from about 100 to 1000 pounds. These rock stones are gneiss of Archaen Age and are plentiful in the Island. They are very resistant to erosion by wave action and other forms of weather. The typical masonry sea-wall and coconut log revetments are the other expedients for coast protection in the Island.

In 1952, two experimental jetties, each 325 feet in length, were constructed at Wellawatta Canal out-let, in the vicinity of Colombo, (fig. 3) primarily with the object of preventing the blockade of this important flood out-let with a sand bar. Whilst these jetties now provide a bar-free out-let for the canal, the southern jetty has, incidentally, acted as a groyne in reclaiming a vast beach which was lost several years ago due to sea erosion. (fig. 3). It is significant, however, that groynes as structures for beach reclamation and coast protection have not yet been tried out in this country. In the future planning of coastal works the provision of groynes on sandy coasts will receive important consideration.

At the present time an experimental project is being considered for the protection of a sandy beach by laying a carpet of bituminous sand. It is expected that work on this will be started early next year.

STRUCTURES

Rock Stone Lining - A total length of about 30 miles of coast line has been lined with rock stones. This is an endeavour to prevent damage by wave action of roads, railway lines and buildings. Transport of rock stones to sites along the railway lines is carried out by the railway itself. At other sites they are transported either by bullock carts or lorries. Usually unloading and placing operations are carried out by workmen, but in special circumstances elephants are employed for this work. The rock stones so placed form a barrier between the sea and land. Sometimes they are placed up to heights of twelve and fifteen feet.

In certain sections where this type of protection has been provided, as for instance, along the coast-line railway from Kollupitiya to Wellawatta, a distance of about three miles, it has been effective in checking the advance of the sea, (fig. 4). The rock stones in this reach have been placed to a maximum height of about ten feet and are supported at the bottom by a coral reef. Storms sometimes displace the stones. The displaced stones are then replaced with new ones. There are a few other sections along the western coast-line where this type of protection has been effective. In all these sections the rock stones are resting on coral reefs. Of the total length of about 30 miles of coast lines provided with rock stone protection only a total length of about 8 miles can be said to be effectively protected.

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Fig. 4. Coast lined with rock stones supported at the bottom by a coral reef.



Fig. 5. Coast lined with rock stones supported at the bottom by a sandy beach. Most of the stones have disappeared under the sand.

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In all other places where the rock stones are resting on the sandy beach this form of protection has proved ineffective. (fig.5). Not long after the stones are placed on a sandy foundation the pummeling action of waves undermines the sea bed. This scour being greatly induced by the stones themselves they are gradually lost in the sand by a continuous process of sinking. With the disappearance of these stones the waves advance inland. When due notice is taken of this incursion a second line of defence is erected behind the first. Ultimately, this too disappears as before, leaving the problem of coast protection to an indefinite solution of dumping rock stones.

Rock stone lining of a coast line hinders the activities of local fishermen who require an open space to beach their boats. When a rock stone barrier is erected to prevent the erosion of a beach there is a spate of opposition from the local fishermen because their means of livelihood is thereby interfered with.

Sea-walls - There are about 3000 feet of sea-walls in the Island. The most important of all is the promenade seawall at Galle Face in Colombo. Its total length is 2200 feet, of which, 1400 feet was constructed in 1856, and consisted of random rubble set in mortar. In later years it was surmounted by a concrete cap. Quite recently the Galle Face promenade was extended and a battered cement concrete sea-wall 800 feet in length has been constructed. The base of this wall is well-proportioned and protected from scour by steel sheet piling. The entire sea-wall at Galle Face is not exposed to heavy seas as most of the wave energy is dissipated by chain of natural rock out-crops situated in the sea, close to the sea-wall almost throughout the length of the promenade.

The other sea-walls are at Dodanduwa and Tangalla. The aggregate length of these walls is about 800 feet. Both these sea-walls are of the random rubble type set in cement mortar and founded on firm ground. They have stood up to severe storm conditions and proved very efficient.

Coconut Log Revetment - The coconut palm grows abundantly along the coast line. There is a natural tendency to use the sturdy trunks of these trees to fight the intruding sea. This is evident in certain sections of the coast line where revetments of coconut logs are constructed by fishermen to keep off the sea from their door steps.

In the section to be protected a trench of about six feet in depth is excavated in the sand, parallel to the coast-line. The coconut logs, each about ten feet in length, are planted perpendicularly one next to the other. The trench is then re-filled with the excavated material. Often on the landward side of the revetment coconut logs are placed longitudinally one on top of the other, against the revetment, with a back-fill of sand. The structure is then complete.

This type of coast protection work lasts only for a few seasons. In due course the waves and currents carry away the sand from the foot of the coconut logs. The revetment is then undermined and finally collapses.

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CONCLUSION

The frontiers of Ceylon on the west, south-west and south are being constantly pushed back by the sea. The land which suffers erosion and is being submerged by the sea is for the most part valuable land. The efforts made to counteract sea forces by lining the coast line with rock stones is not a universal solution to the problem of erosion. Although this method of protection has been effective in a few places, generally, it affords only temporary relief and entails heavy re-current expenditure. Besides, the placing of rock stones along the coast line is an impediment to the fishing industry.

Almost all of the perennial rivers, with the exception of a few, enter the sea on the west, south-west and south of the Island. These rivers are a rich source of supply of beach material in the form of sand. Wave action and current forces carry away the sand from the beaches leaving the land exposed to the onslaught of the south-west monsoon. In the future planning of coast protection works, it would be necessary, therefore, to consider suitable designs to promote beach formation and its maintenance under extreme weather conditions. Little or no scientific data is available today on sea erosion in the Island. It is essential to collate information and secure systematic observations on a long term plan before planning coast protection works.

Coast protection works and their maintenance involve heavy capital and re-current expenditure. In each case it would be necessary to consider whether it is a business proposition, having regard to the works to be saved. Such saving has been done with good results along the coast line railway, where, if it had not been for the rock stone lining of the shore, not only would the railway have long disappeared, but also most of the immensely valuable building land along the Colombo South sea front.

As erosion is often in the last analysis due to bodily subsidence of land, it is impossible to say how long coast protection measures will last, but subsidence is slow and a life of many decades may be looked for which is quite worthwhile where important interests are at stake. At all events, and this is most important, coast protection is effective in saving works of human art which otherwise would be lost, even where there is no nett loss of land over a series of years, in the periodic rhythms of erosion and accretion. Such works lost in an erosive phase are not set up again by the return of accretion and coast protection, by tiding them over the erosive phases, saves them in a relatively permanent manner.