IKHENOBA ELIZABETH AMANDA

15/ENG03/016

COASTAL ENGINEERING

1. What strategies can be used to reduce the effect of coastal erosion.

Options for combating coastal erosion are traditionally twofold, namely hard structural/engineering options and soft structural/engineering options. These solutions have at least two hydraulic functions to control waves and littoral sediment transport (Kawata, 1989); in applying the solutions, their underlying principles should be well-understood, otherwise they will fail. A combination of hard and soft options has become more popular recently for optimum results because they have weaknesses when used singlely. Many schemes have failed and resulted in environmental and socio-economic problems owing to improper design, construction and maintenance, and were often only implemented locally in specific places or at regional or jurisdictional boundaries, rather than at system boundaries that reflect natural processes (Kamphuis, 2002).

Hard structural/engineering options

Hard structural/engineering options use structures constructed on the beach (seawalls, groynes, breakwaters/artificial headlands) or further offshore (offshore breakwaters). These options influence coastal processes to stop or reduce the rate of coastal erosion.

Soft structural/engineering options

Soft structural/engineering options aim to dissipate wave energy by mirroring natural forces and maintaining the natural topography of the coast. They include beach nourishment/feeding, dune building, revegetation and other non-structural management options.

2. Describe how coastline can be protected from coastal erosion

Groyne

A coastal structure constructed perpendicular to the coastline from the shore into the sea to trap longshore sediment transport or control longshore currents. This type of structure is easy to construct from a variety of materials such as wood, rock or bamboo and is normally used on sandy coasts. It has the following disadvantages:

- Induces local scour at the toes of the structures.
- Causes erosion downdrift; requires regular maintenance.
- Typically more than one structure is required.

Seawall

A seawall is a structure constructed parallel to the coastline that shelters the shore from wave action. This structure has many different designs; it can be used to protect a cliff from wave attack and improve slope stability and it can also dissipate wave energy on sandy coasts. The disadvantages of this structure are:

- It creates wave reflections and promotes sediment transport offshore.
- Scour occurs at the toes of eroded beaches.
- It does not promote beach stability.
- It should be constructed along the whole coastline; if not, erosion will occur on the adjacent coastline.

Offshore breakwater

An offshore breakwater is a structure that parallels the shore (in the nearshore zone) and serves as a wave absorber. It reduces wave energy in its lee and creates a salient or tombolo behind the structure that influences longshore transport of sediment. More recently, most offshore breakwaters have been of the submerged type; they become multipurpose artificial reefs where fish habitats develop and enhance surf breaking for water sport activities. These structures are appropriate for all coastlines. Their disadvantages are:

- They are large structures and relatively difficult to build.

- They need special design.
- The structure is vulnerable to strong wave action.

Artificial headland

This structure is constructed to promote natural beaches because it acts as an artificial headland. It is relatively easy to construct and little maintenance is required. The disadvantages are:

- It is a relatively large structure.
- It can cause erosion downdrift of the protected length of coastline.
- Has poor stability against large waves.

Beach nourishment

The aim of beach nourishment is to create a wider beach by artificially increasing the quantity of sediment on a beach experiencing sediment loss, improving the amenity and recreational value of the coast and replicating the way that natural beaches dissipate wave energy. Offshore sediment can be sourced and is typically obtained from dredging operations; landward sources are an alternative, but are not as effective as their marine equivalents because the sediment has not been subject to marine sorting.

This method requires regular maintenance with a constant source of sediment and is unlikely to be economical in severe wave climates or where sediment transport is rapid.

It has been used in conjunction with hard structural/engineering options, i.e. offshore breakwaters, headlands and groynes to improve efficiency.

Dune building/reconstruction

Sand dunes are unique among other coastal landforms as they are formed by wind rather than moving waters; they represent a store of sand above the landward limits of normal high tides where their vegetation is not dependent on the inundation of seawater for stability (French, 2001). They provide an ideal coastal defence system; vegetation is vital for the survival of dunes because their root systems bind sediment and facilitate the build-up of dune sediment via wind

baffle. During a storm, waves can reach the dune front and draw the sand onto the beach to form a storm beach profile; in normal seasons the wind blows the sand back to the dunes. In dune building or reconstruction, sand fences and mesh matting in combination with vegetation planting have successfully rgenerated dunes via sediment entrapment and vegetation colonization. The vegetation used should be governed by species already present, such as marram, sand couch grass and lyme grass.

Coastal revegetation

Based on studies and scientific results, the presence of vegetation in coastal areas improves slope stability, consolidates sediment and reduces wave energy moving onshore; therefore, it protects the shoreline from erosion. However, its site-specificity means that it may be successful in estuarine conditions (low energy environment), but not on the open coast (high energy environment). In some cases, revegetation fails because environmental conditions do not favour the growth of species at the particular site or there is ignorance as to how to plant properly given the same conditions. It is also possible that anthropogenic influences have completely altered the natural processes in the area. The most obvious indicator of site suitability is the presence of vegetation already growing. This can be extended by other factors such as the slope, elevation, tidal range, salinity, substrate and hydrology.

3. Suggest why some coastal areas needs protecting from the impacts of coastal erosion.

Some coastal areas need protecting from the impacts of coastal erosion in order to;

a) Prevent increasing coastal erosion and flooding due to altering sea levels.
b) To protect homes and businesses from being damaged and even destroyed by coastal erosion or flooding.
c) To prevent severe economic and social effects, especially along coastlines which are used for tourism and industry (pretty much all of them).
d) Help protect natural habitats