4.2 PLANNING AND DESIGN OF HARBOURS

The planning and design of harbor is an important engineering phenomenon with both major commercial and social implications. The literature suggests that various approaches for harbors design of harbors such as fishing, commercial and refugee harbors. The aim of this paper is to present a general guidance for the planning and design of harbors. There are a number of general requirements which has to be fulfilled while designing the harbors but also there are some specific requirements for each of them. Furthermore, the different types of foundations such as shallow water foundations, deep water foundations and pile foundations, as well as breakwaters such as permanent breakwaters and temporary breakwaters, and finally caissons are submitted for the design of harbors. The equations, formulae and specifications for the design of the essential components of harbors are also given.

Due to the incremental growth in the world population and the current trend of globalization, there is a significant interest for harbor development whether this includes constructing new harbors or existing ports that need to improve or grow their ability. A harbor is a position of security and solace, a little bay or other shielded piece of a zone of water, generally very much ensured against high waves and solid streams, and sufficiently profound to give dock to ships and other specialty. It is likewise a place where port facilities are given such as convenience for ships and cargo dealing facilities. Harbor construction activities include installing anchor piles, constructing jetty, mooring and berthing dolphins which are designed to safely moor vessels alongside offshore structures and quay wall renovation which might be required to reinforce existing quay walls to enable heavier materials and equipment to be handled. Harbors can be classified into three categories which are natural, semi-natural and artificial harbors

Major Types of Harbors Considering their benefit and situation, harbors are separated into three types as refugee harbors including naval bases, commercial harbors connected with ports and fishery harbors

Harbors of Refugee Including Naval Base

A harbor of refugee is a secured water region utilized exclusively as a sanctuary for ships in a tempest or a part of a commercial harbor with satisfactory space for a different dock zone that does not meddle with the commercial traffic.

Commercial Harbors Connected With Ports

A commercial harbor is one that has docking facilities comprising of piers, wharves, or dolphins at which ships berth while loading or unloading cargo. Huge numbers of extensive commercial harbors in urban communities are municipal, or government-controlled, harbors operated by port authorities.

Fishing Harbors

A fishing harbor contains multifunctional facilities that provide sufficient requirements for the capture of fish and its consumption. Large fishing vessels and huge number of fish creates a demand for well-bred maintenance and repair facilities not only for the vessels but also for the equipment as well.

Design Requirements for Harbors

Before designing a harbor, there are two major activities which have to be done. These activities are 'Collecting the necessary information' and 'Identifying the area required'.

Collection of the Necessary Information

To carry out the planning of a harbor, the first step is that the collection of necessary information of the existing properties of the suggested site. The following important facts should be investigated first:

- To perform a complete investigation of the neighborhood including the foreshore and depths of water in the vicinity
- To study the nature of the harbor (if it is refuge or not)
- To study the existence of sea insects which could give damage the foundation

- To study the problem of silting or erosion of coastline
- To ascertain the character of the ground borings and to take the soundings
- To identify the probable surface conditions on land and borings on land
- To study the natural metrological phenomenon at site with respect to frequency of storms, rainfall, range of tides, maximum and minimum temperatures, direction and intensity of winds, humidity and also direction and velocity of currents

Identify the Area Required

The area of the harbor depends upon the following factors:

• Size and number of ships to be accommodated in the harbor at a time

• Length and width needed for movement of ships to and from berths

• Type of cargo carried

General Requirements of a Harbor

Following are the requirements of a good harbor:

- The ship channels should have sufficient depth for the draft of the visiting vessels to the harbor
- The bottom of the harbor should provide secured anchorage to hold the ships against the force of strong winds
- The land masses or breakwater must be provided to protect against the destructive wave action
- The entrance of the harbor should be wide enough to provide the ready passage for shipping and at the same time it should be narrow enough to restrict the transmission of excessive amount of wave energy in time of storms.

Requirements of a Harbor of Refugee Including Naval Base

Following are the requirements of a harbor of refugee:

- Facilities which obtain repairs and supplies
- Safe and convenient anchorage against the sea
- Ready accessibility from the high seas
- Spacious accommodation as damaged ships will need immediate shelter and quick repairs
- Accommodation for naval vessels

Requirements of a Commercial Harbor

Following are the requirements of a commercial harbor :

- Storage sheds for cargo,
- Good and quick repair facilities to avoid any delay,
- Long and large quays to make loading and unloading of cargo and facilities for transporting easier and quicker,
- Sufficient accommodation for the commercial marine,
- Large accommodation for the commercial marine,
- Well and enough sheltered conditions for loading and unloading.

Requirements of a Fishing Harbor

Following are the requirements of a fishing harbor:

- The harbor should be continuously available for arrival and departure of fishing ships
- Loading and unloading facilities along with quick dispatch facilities for the perishable fish catch such as railway sidings and roads should be there,
- Freezing compartment stores with sufficient storing space for keeping the fish safe.