EWCE 471

Coastal Engineering

Lecture 7-8: Ports and Harbors

Prepared by
Simlia Satter Songi
Lecturer
EWCE Department, MIST

Harbor

- A harbor is a water area particularly enclosed and protected from storms to provide safe and suitable accommodation for vessels seeking refuge, supplies, refueling, repair, or the transfer of cargo.



Port

- A port is a location on a coast or shore containing one or more harbors where ships can dock and transfer people or cargo to or from land.
- Port= Harbor+ Storage Facility+ Communication Facility+ Other Terminal Facility



Types of Ports

- Inland port
- Fishing port
- Dry port
- Warm-water port
- Seaport
- Cruise Home Port
- Cargo Port
- Ocean Port
- Free Port

Inland Port

- An inland port is a port on a navigable lake, river or canal with access to a sea or ocean, which therefore allows a ship to sail from the ocean inland to the port to load or unload its cargo.



Fishing Port

- A fishing port is a port for landing and distributing fish. It may be a recreational facility, but it is usually commercial.
- It is the only port that depends on an ocean product, and the depletion of fish may cause a fishing port to be uneconomical.
- In recent decades, regulations to save fishing stock may limit the use of a fishing port, perhaps effectively closing it.



Dry Port

- A dry port is an inland intermodal terminal directly connected by road or rail to a seaport and operating as a center for the transshipment of sea cargo to inland destinations.



Warm-water Port

- A warm-water port is one where the water does not freeze in the wintertime as they are available year-round.
- Warm-water ports can be of great geopolitical or economic interest.



Seaport

- A seaport is further categorized as a “cruise port” or a “cargo port”. Additionally, cruise ports are also known as “home ports” or a “port of call”. The “cargo port” is also further categorized into a “bulk” or “ break bulk port” or a “container port”.



Cruise Home Port

- A cruise home port is the port where cruise ship passengers board to start their cruise and leave the cruise ship at the end of their cruise.



Cargo Port

- Cargo ports handle very different cargo, which has to be loaded and unloaded by very different mechanical means.
- The port may handle one particular type of cargo or it may handle numerous cargoes, such as grains, liquid fuels, liquid chemicals, wood, automobiles, etc. Such ports are known as the bulk or break bulk ports.
- Those ports that handle containerized cargo are known as container ports.



Ocean Port

- Ocean port is a port of call for large ocean-going ships
- Such a port is used to be a natural or man-made port in bays, tidal estuaries, river mouths, or on a sea coast.
- Ex: Kolkata, Philadelphia, New Orleans



Free Port

- A free port is an isolated and policed area for handling cargo, manufacture, repacking, etc. for reshipping, without the intervention of customs.
- The idea is to save a lot of bother and waste of time on formalities and encourage duty-free movement for export.
- Ex: Hamburg in Germany, Hongkong, Singapore



Classification of Harbors

1. Formation

- ❑ Natural harbor
- ❑ Semi-natural harbor
- ❑ Artificial harbor

2. Functional or Usage

- ❑ Commercial harbor
- ❑ Military harbor
- ❑ Harbor of refuge

3. Location

- ❑ Sea harbor
- ❑ River harbor
- ❑ Canal harbor

Classification Based on Formation

Natural Harbor

- These harbors are formed by natural geographical features such as mountains, bays, or islands, providing protection from storms and waves.
- It is protected from storms and waves by the natural land contours, rocky out corps or islands
- The entrance to such a harbor is so formed as to permit navigation but ensure calm in the harbor
- Ex: New York, San Francisco, London



Classification Based on Formation

Semi Natural Harbor

- These harbors require some man-made structures for additional protection, typically at the entrance..
- It is protected on the sides by headlands and requires man-made protection only at the entrance.
- Ex: Plymouth, Vishakhapatnam



Classification Based on Formation

Artificial Harbor

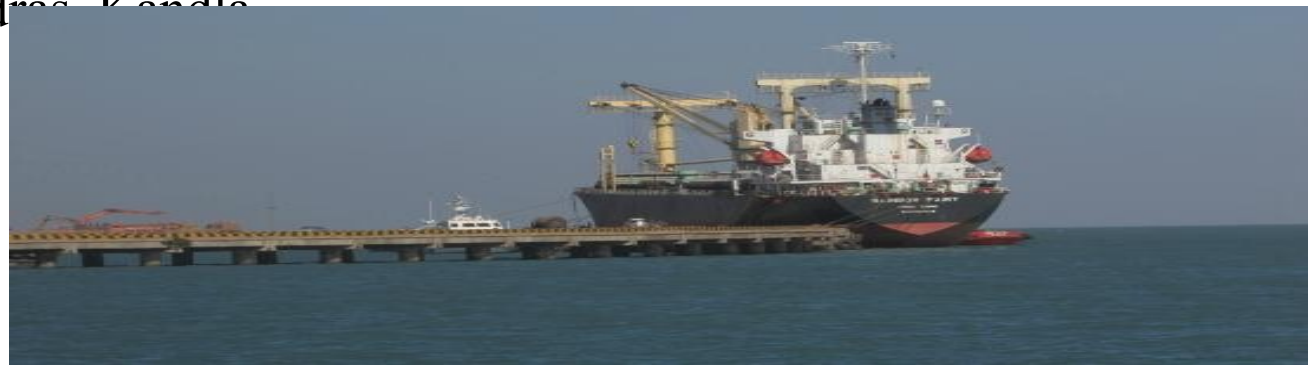
- Also known as man-made harbors. These are constructed where natural protection is insufficient. It is protected from storms and waves by breakwaters or is created by dredging.
- Ex: Hamburg, Madras



Classification Based on Function

Commercial Harbor

- Facilities are provided for **loading and unloading of cargo**.
- Commercial harbors require **larger areas** to speed up operations, and it is the busiest among the others.
- Docks and berths are available to handle cargo.
- A single-commodity harbor or terminal (e.g., oil terminal, coal port, ore port) may be developed: i. as part of a larger harbor complex, ii. as an independent unit
- Ex: Mad[illegible] Kandla



Classification Based on Function

Military Harbor or Naval Base

- Military harbors are used as **naval bases, where warships are rested** while there is no work in the sea or during repair works and serving as a supply depot.
- Some large military naval vessels can carry aircraft so, a very large area of the harbor is required because of large vessels.
- Ex: Hampton roads, pearl harbor



Classification Based on Function

Harbor of refuge

- A big region of harbors that are proper **to shelter the ships** during trouble situations like storms or any other natural calamities.
- The requirement of the harbor is **a good anchorage** and **an easy and safe access from the sea**.
- Ex: Sand bay in the USA, Madras, Visakhapatnam



Classification Based on Location

Sea Harbor

- Located **along the seashore**, these harbors are typically large and facilitate significant trade and commerce.
- They are crucial for **international shipping and logistics**.

River Harbor

- These are situated **along rivers that connect to the sea**, allowing for **navigation and trade within a country.**
- They play a vital role in **inland transportation**.

Canal Harbor

- Similar to river harbors, these are **connected to the sea via canals**, facilitating the movement of goods and vessels between inland areas and the ocean.

Port vs Harbor

Basis	Port	Harbor
Definition	A port is a man-made commercial place along the coastline that is mainly used for import and export of goods and cargo from one country to another.	A harbor is a small natural area next to the shore connecting the piece of land with a large water body that is mainly used to provide shelter to ships and other water vessels from stormy weather.
Function	It is a commercial place for docking and storage of boats.	It is a place of safety for ships.
Facilities	A port has a huge number of facilities. Like cranes and lifts to move heavy cargo, rail links and road transport for connections, facilities of restaurants, hotels, and offices, special storage facilities for chemicals and fuel, and a big area for ship repairing.	A harbor is smaller and has less commercial facilities as it is merely a place for safety and anchoring of ships.

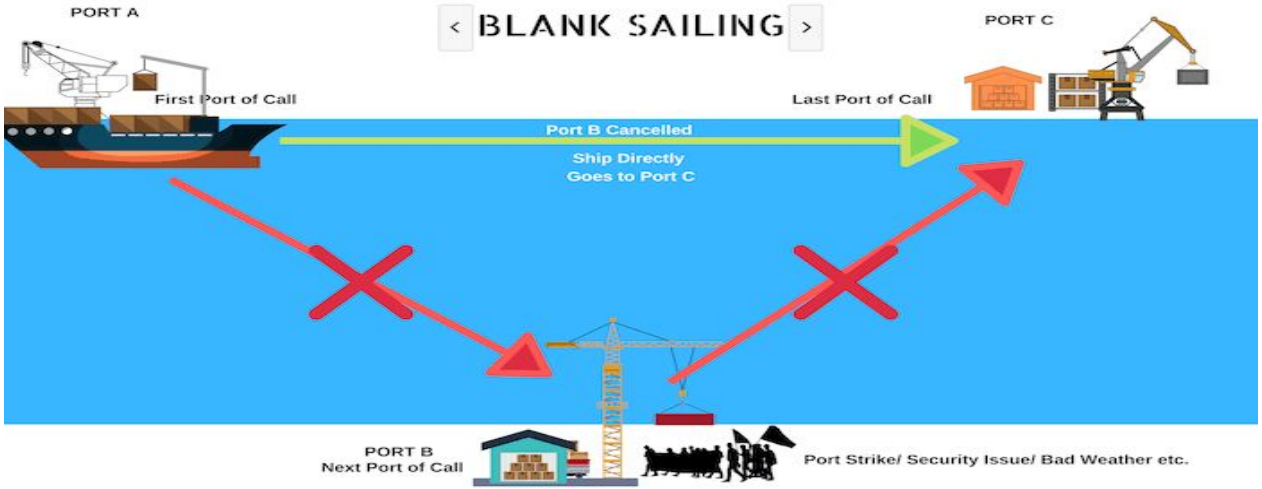
Port vs Harbor

Basis	Port	Harbor
Construction	It is always constructed by man and is well-equipped with cranes and warehouses for ease of trade and operation.	It can be natural or man-made.
Usage	A port in all over the world is responsible for trade and commerce between different countries	A harbor is a great spot to enjoy recreational facilities and water sports.
Accessibility	A port is mainly accessed through the commercial entrance and sea route. However, it may also be accessible via a canal or river if it is part of a dry port. There are rail and road links for commercial access to a port.	As a port, a harbor is also accessible but for different reasons.
Value	A port is a valuable asset to any country with a coastline and serves as a commercial enterprise	A harbor is a valuable safety place for ships and other water vessels.

Port Terms

Port of Call

- A port of call is an intermediate stop for a ship on its sailing itinerary. At these ports, cargo ships may take on supplies or fuel, as well as unloading and loading cargo while cruise liners have passengers get on or off ship.



Port Terms

Marine terminal

- It is a part of a port providing docking cargo handling and transit storage facilities.
- Depending upon the cargo or the purpose, it is further classified a passenger terminal or oil terminal.



Port Terms

Offshore terminal

- It is an arrangement to work a ship in deep waters by providing an island structure or a single mooring point when it is not feasible or economical to construct a land-connected berth or a protected harbor. Bulk cargo in such cases is transported to or from the ship by pipeline or by trestle conveyor.



Site Selection for Ports

Factors considered:

- ❑ Sea approach and marine condition
- ❑ Sea bed, subsoil, and foundation conditions
- ❑ Transport and communication links
- ❑ Seaborne traffic potential
- ❑ Natural protection from winds and waves
- ❑ Industrial infrastructure and industrial development or potential in the hinterland
- ❑ The agricultural base of the hinterland and also is mining sources
- ❑ Electrical energy and freshwater supply
- ❑ Availability of cheap land and proximity of construction materials

Features of Harbor

1. Harbor Entrance

- The entrance of the harbor is more exposed to waves as compared to the harbor itself. The depth and width required at the entrance are more than those required in the channel.
- The width of the harbor also depends upon traffic, the number of entrances, navigational requirements, and the degree of protection. It should not be too wide to increase wave height within harbor.



Features of Harbor

2. Approach Channel

- The terminology approach channel is used for the dredged fairway through which ships proceed from the open sea to the harbor basin.
- A channel with sufficient depth and width must be dredged to provide for a passage of ships between the harbor entrance and docks.
- The alignment and the dimension of the channel are determined by considering factors in channel design.

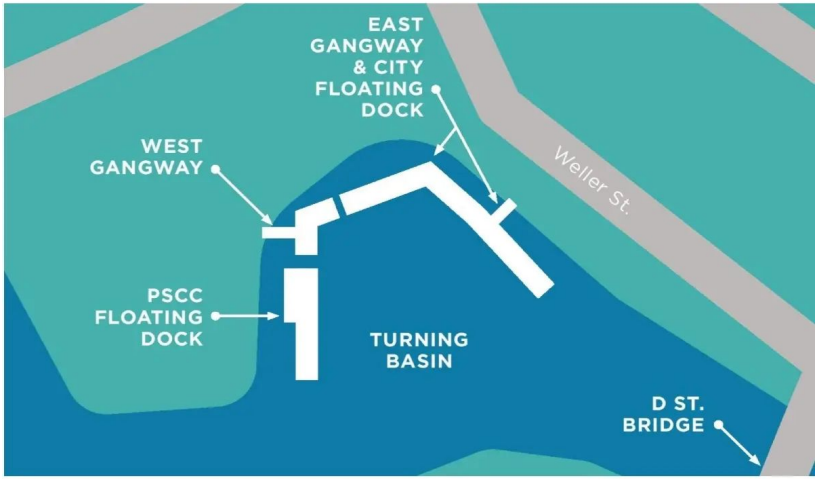
2. Approach Channel



Features of Harbor

3. Turning Basin

It is the area required for maneuvering the ship when it goes to or leaves the berth. The size of the turning basin primarily depends on the design vessel.



4. Sheltered Basin

It is the area protected by shore and breakwaters.



Features of Harbor



Ludington Harbor, Michigan

Features of Harbor

5. Wharves and Quays

- Quay and wharf are both structures built along the water's edge to facilitate the loading and unloading of ships and boats.
- A quay is typically a solid, stone or concrete structure that extends out into the water, providing a stable platform for vessels to dock alongside. On the other hand, a wharf is usually a wooden or metal structure built parallel to the shore, allowing ships to tie up and unload cargo directly onto the platform.
- While both serve the same basic function, quays are often more permanent and sturdy, while wharves are more flexible and can be easily moved as needed.

Features of Harbor

6. Jetties and Piers

These are solid or open type of structure with a wide platform on top to permit cargo, working of vessel berthed alongside.



7. Locked Basin

A locked basin is an enclosed area where several vessels can be berthed and has an entrance that is controlled by locked gates.

Features of Harbor

8. Dry docks and slipways

These are essentially provided for maintenance repairs and construction of ships. A dock for construction of ships is termed as building dock. They can be kept dry, for easy working.

9. Ancillaries

These will include locating moorings, anchors, buoys, lights, transit sheds and warehouses, fire protection to weirs and other service units as may be necessary

Features of Harbor

10. Breakwater

- These structures are constructed to protect harbor from storm waves.
- They are generally stone masonry.



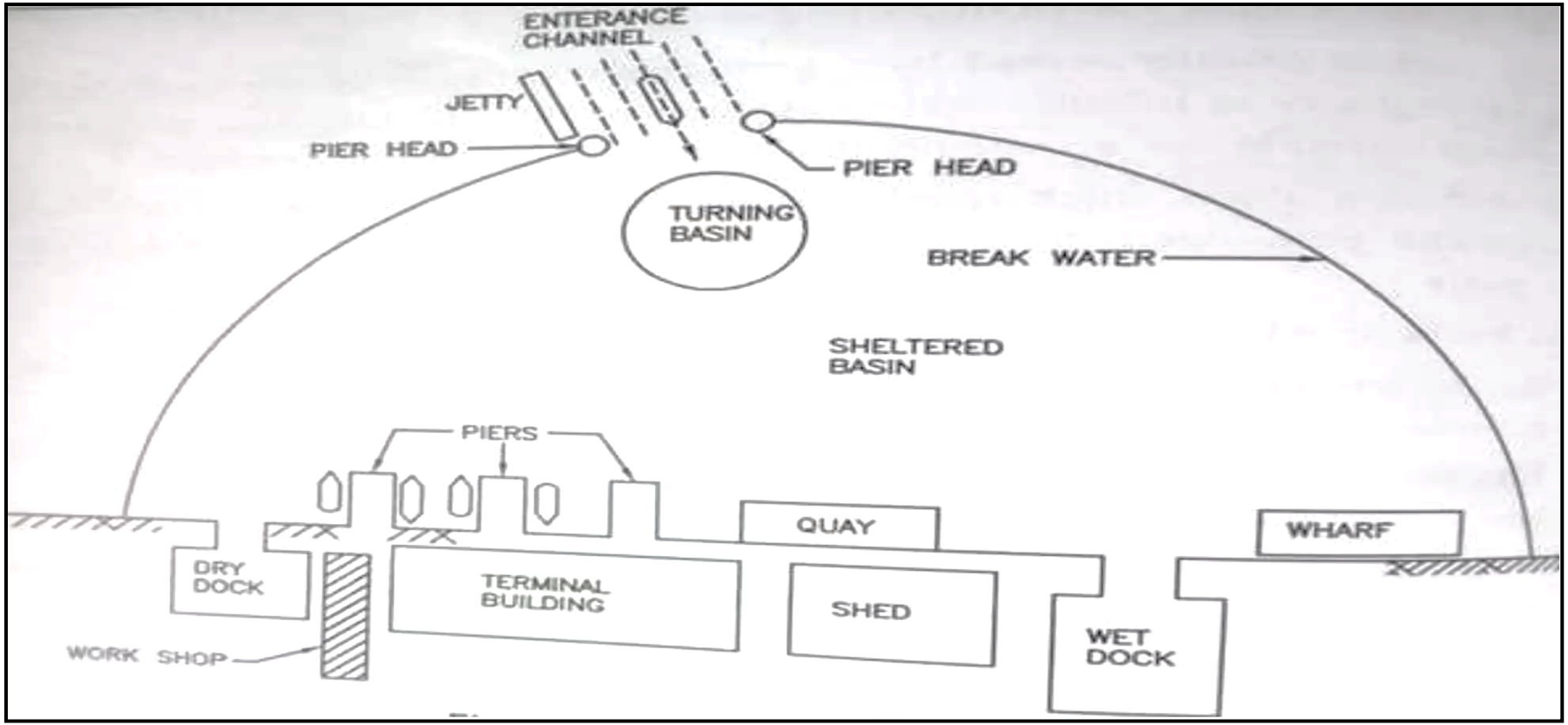
Features of Harbor

Harbor layout

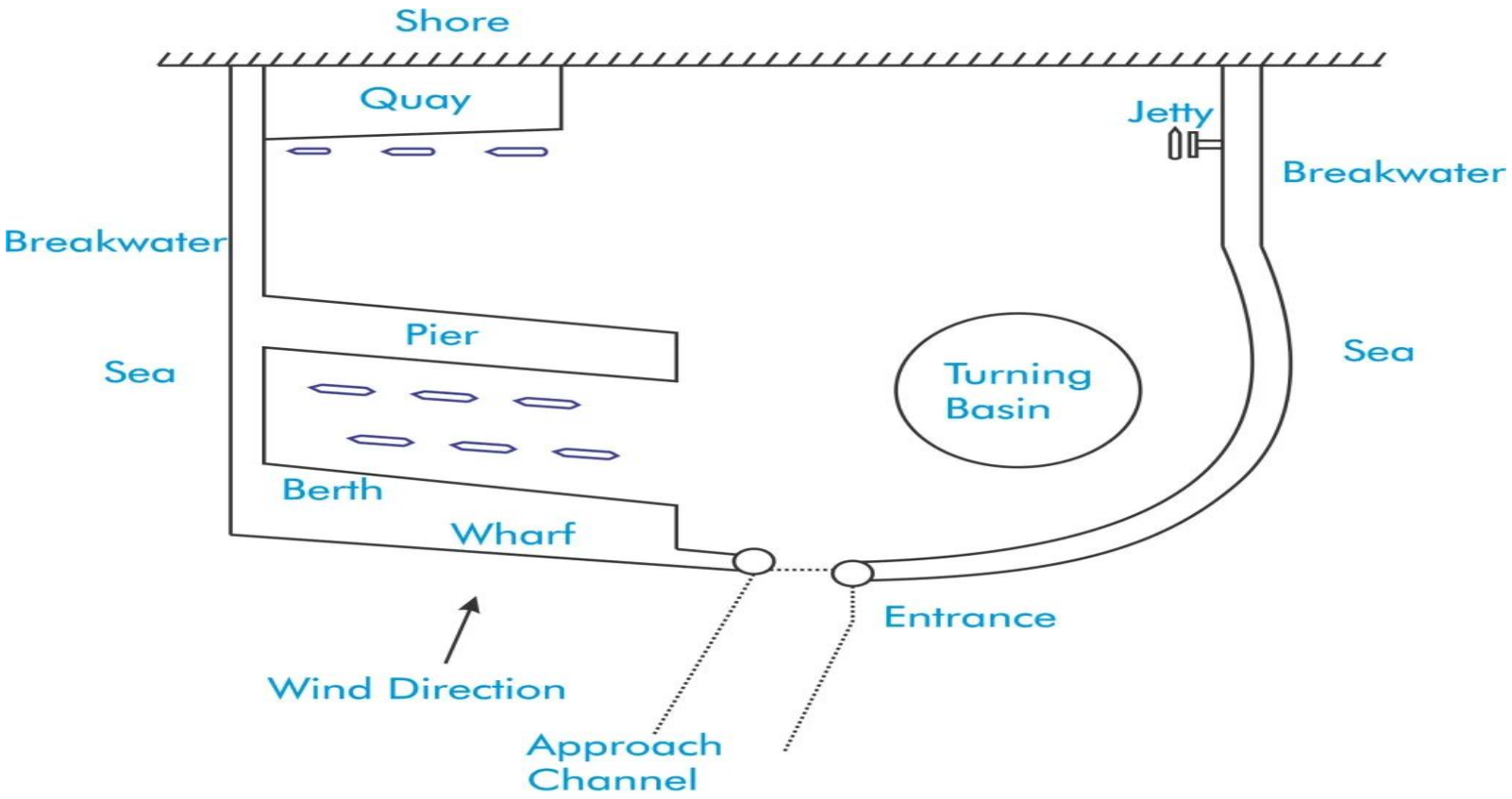
Factors to be considered-

- Littoral drift (transport of sediments like sand, silt, gravel, pebbles along the shoreline due to the combined action of waves and currents.)
- Protection from the storm waves
- Size and shape of harbor
- Layout of wharves and jetties
- Effect of submarine waves

Components of Harbor



Components of Harbor



Requirements of a Good Harbor

- The depth of a harbor should be sufficient for every type of visiting ship.
- The bottom of the harbor should provide secured anchorage to hold the ships against high winds.
- To prevent destructive wave action, breakwaters are provided.
- The entrance of a harbor should be wide enough to provide the easy passage of ships.


THANK YOU