DI04006071: Railway, Harbour & Tunnel Engineering

Lecture 4.26: Classification and Types of Harbours

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Civil Engineering

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Introduction to Harbours I

A harbour is a partially enclosed body of water that provides a safe anchorage for ships, shielding them from wind, waves, and currents. Harbours serve as crucial nodes in maritime transportation networks, facilitating the transfer of cargo and passengers between ships and shore. They are engineered to ensure calm water conditions necessary for safe navigation, mooring, and loading/unloading operations.

Key Points

- Definition and Primary Function
- Importance in Maritime Trade
- Basic Engineering Requirements

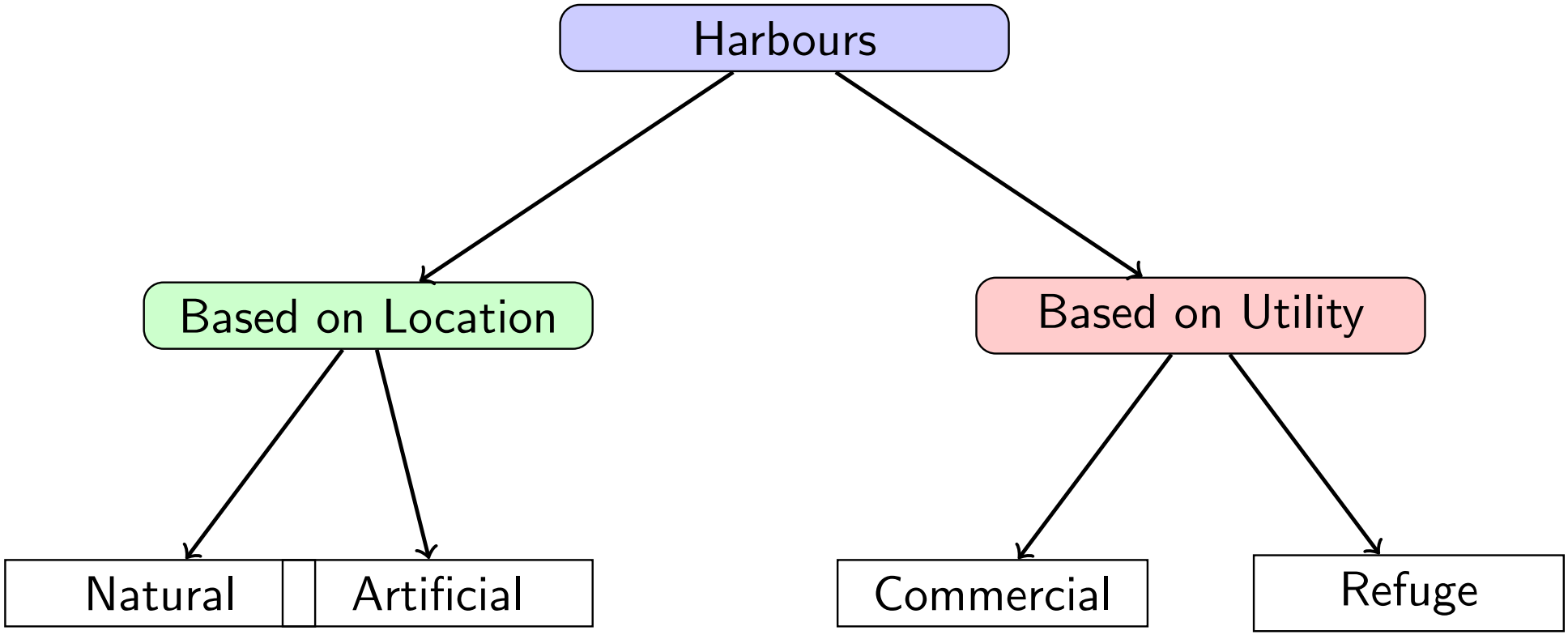
Broad Classification of Harbours I

Harbours are broadly classified into two main categories: based on their location (or natural features) and based on their utility (or purpose). Location-based classification considers the geographical and topographical characteristics, such as natural bays or artificial breakwaters. Utility-based classification focuses on the primary function the harbour serves, such as commercial trade, military operations, or fishery.

Key Points

- Classification by Location (Natural, Semi-natural, Artificial)
- Classification by Utility (Commercial, Refuge, Military, Fishery)
- Interdependence of Location and Utility

Classification Hierarchy I



Classification Hierarchy II

Key Points

- Hierarchical structure of harbour classification
- Primary division into Location and Utility
- Sub-categories for each primary division

Location-Based: Natural Harbours I

Natural harbours are formations where the geographical features of the coastline provide a sheltered area for ships without the need for extensive artificial protective structures. These typically occur in deep, navigable bays, estuaries, or inlets protected by headlands. Examples include Sydney Harbour and San Francisco Bay. They require minimal dredging and breakwater construction but may still need navigational aids and wharves.

Key Points

- Shelter provided by natural topography
- Deep and navigable waterways
- Minimal requirement for artificial breakwaters
- Examples: Sydney, San Francisco, Mumbai

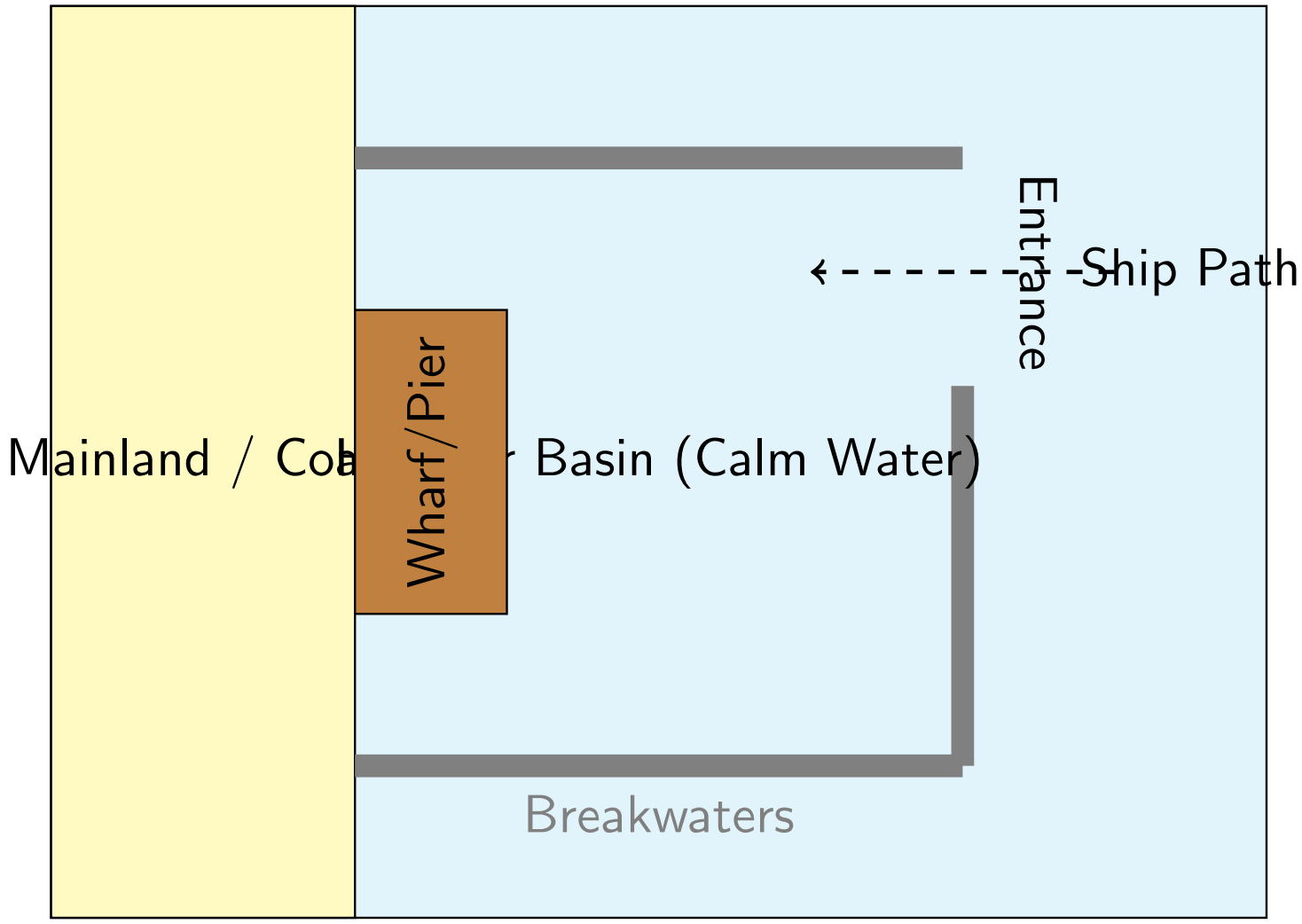
Location-Based: Artificial Harbours I

Artificial harbours are constructed in locations where natural shelter is either absent or inadequate. They require the extensive construction of engineering structures, primarily breakwaters, to create a tranquil basin. The planning involves significant capital investment for dredging, breakwater construction (rubble mound or vertical wall), and continuous maintenance to prevent siltation. Examples include the Port of Los Angeles and Chennai Port.

Key Points

- Constructed on exposed coastlines
- Dependence on artificial breakwaters
- High initial capital and maintenance costs
- Examples: Chennai, Los Angeles

Typical Layout of an Artificial Harbour I



Typical Layout of an Artificial Harbour II

Key Points

- Breakwaters protecting the basin
- Narrow entrance for vessel access
- Wharves and piers on the sheltered mainland side
- Creation of a tranquil harbour basin

Utility-Based: Harbours of Refuge I

Harbours of refuge are designed primarily to provide a safe haven for vessels during severe storms or emergencies. They may not have extensive loading or unloading facilities. Key features include a wide and safe entrance channel, excellent anchorage grounds, and deep water. They are strategically located along hazardous coastlines to minimize maritime disasters.

Key Points

- Emergency shelter during storms
- Wide entrance for easy access in rough seas
- Good anchorage with strong holding ground
- Minimal commercial infrastructure

Utility-Based: Commercial Harbours I

Commercial harbours are the most common and complex type, designed for the rapid handling of general or bulk cargo and passengers. They require extensive infrastructure including deep-water berths, transit sheds, warehouses, cargo handling equipment (cranes, conveyors), and excellent multimodal transport connections (rail, road) to the hinterland.

Key Points

- Designed for cargo and passenger transit
- Extensive land-side infrastructure
- Need for efficient cargo handling equipment
- Strong connectivity to the hinterland

Comparison of Harbour Types I

| Feature | Commercial | Refuge | Military | Fishery | |—|—|—|—|—| | **Primary Goal** | Cargo/Passenger transfer | Safety during storms | Strategic naval base | Fish landing/processing | | **Infrastructure** | Cranes, warehouses | Anchorage area | Dry docks, high security | Ice plants, auction halls | | **Location** | Near industrial hubs | Hazardous coastlines | Strategic locations | Near fishing grounds | | **Draft Required** | Very deep | Moderate to deep | Extremely deep | Shallow to moderate |

Key Points

- Comparing Commercial vs. Refuge vs. Military
- Highlighting infrastructure differences
- Understanding design priorities

Utility-Based: Military and Fishery Harbours I

Military or Naval harbours are designed for the strategic accommodation of naval vessels. They require high security, deep drafts for submarines and large carriers, and specialized repair facilities like dry docks. Fishery harbours are tailored for fishing vessels, requiring facilities for fish landing, auction halls, ice plants, and cold storage, often located closer to fishing grounds.

Key Points

- Military: High security, deep draft, dry docks
- Fishery: Fish processing, ice plants, auction halls
- Specialized infrastructure for specific vessel types

Summary I

Harbours are fundamental maritime structures classified broadly by location (natural, semi-natural, artificial) and utility (commercial, refuge, military, fishery). Natural harbours utilize geographical features for shelter, whereas artificial ones rely on engineered breakwaters. Utility dictates the internal layout and infrastructure, ranging from simple anchorages for refuge to complex multimodal hubs for commercial activities. Proper classification guides the engineering planning, design, and financial investment.

Key Points

- Location dictates structural protection needs
- Utility determines infrastructural layout
- Engineering design integrates both aspects for optimal function