



**ALL HANDS ON DECK**  
EUROPEAN WORK HERITAGE IN SHIPWRIGHT FOR PRESENT AND FUTURE



Co-funded by the  
Erasmus+ Programme  
of the European Union

## Module 13 – Buildings & Structures

Topics of the module:

- Importance of ports through centuries
- Knowledge on the coast geography
- Navigation Structures, Harbours, Natural and Artificial.
- The Port as hub
- Safety on board

# Introduction to the module 13

## Buildings & Structures



1. European Harbors



2. Coastal geography



3. Natural and Artificial Harbors



4. Discovering the port structures



5. General safety requirements



# 1. European Harbors

## Historical prominence

*“Ports have been, for centuries, focal points of local, regional, national, and international economic development and **social change**. Its projection to the hinterland (...) led seaports history to become a significant field of research to support the study of evolving trade networks, as well as technological and industrial development and social and urban changes.*



# 1. European Harbors

## Historical prominence

*“Seaports are no longer studied exclusively as infrastructures or economic centres, but as a **complex system**, resulting from economic, political, social and cultural forces; the **gateways between land and sea**, between the hinterland and the vorland, a nodal axis with repercussions on the territorial, economic, social and mental structures.”*

*“Ports are also active agents in the process of modernization and change, having a role to play in the fields of **technological innovation** and in the urbanization process.”*



# 1. European Harbors

## Innovation throughout centuries

*The role played by European seaports in the early modern period seems undeniable. They were essential for **structuring economic spaces**. Their functioning was critical to the efficiency of shipping. The definition of networks of trade and **maritime routes**, the increasing tonnage of seagoing vessels, the definition of a world economy, everything worked to increase the importance and prominence of maritime activity and the importance of seaports.”*



# 1. European Harbors

## Society and urban space

*“Seaports became crucial to structure political and economic spaces and essential **junctions in supra-regional spaces**. The mastery of new nautical techniques, and the **building of maritime empires**, have also consequently increased the importance and prominence of maritime communication routes, from the coastal to the **trans-oceanic circuits**.”*

*“The **strategic centrality of ports**, especially seaports, [in the Early Modern Age](#), has given rise to specific historic phenomena and dynamics that claim for more accurate studies. The world economic context, the concentration of population, plus the centripetal nature of these maritime complexes, certainly generated demographic, social, and mental phenomena that clearly set port zones apart from inland areas.”*



# 1. European Harbors

## Modern role

The industrial revolution triggered several changes on port activities. Quays were expanded and jetties were constructed to handle the growing amounts of freight and passengers as well as larger ships.

Shipbuilding became an activity that required the construction of docks. States started to integrate the rail lines with port terminals. Port-related activities expanded to include industrial activities. This, expansion mainly occurred downstream.



## 2. Coast Geography

### Political geography

Today, the **international sea law** governs relations between States in the maritime sphere. For many centuries this branch of international law has been characterized by the "***freedom of the seas***" regime and, therefore, the absence of rules.

This served the commercial and strategic interests of the major European maritime powers, especially at the time of the colonization of overseas territories.

In the second half of the nineteenth century, the phenomenon of the progressive extension of the jurisdiction of the coastal State on the adjacent seas began to manifest itself.

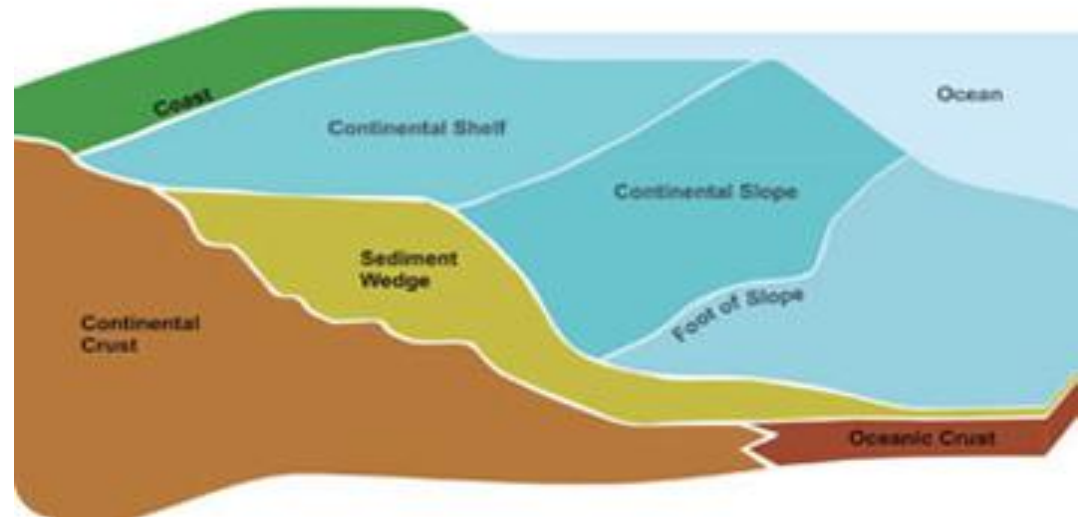




## 2. Coast Geography

### Political geography of coastal and maritime areas

Thanks to the Montego Bay Agreement, The **UN Convention on the Law of the Sea (UNCLOS)**, treaty that establishes a legal framework for all marine and maritime activities), from 1982 we've got a standardized definition of:



1. **Continental Shelf:** the natural prolongation of the land territory to the continental margin's outer edge, or 200 nautical miles (370 km) from the coastal state's baseline, whichever is greater. A state's continental shelf may exceed 200 nautical miles (370 km) until the natural prolongation ends.



## 2. Coast Geography

### Political geography of coastal and maritime areas

- 2. Internal waters:** all water and waterways on the landward side of the baseline. The coastal state is free to set laws, regulate use, and use any resource. Foreign vessels have no right of passage within internal waters.
- 3. Territorial waters:** In an area of sea adjacent to its coasts, the State exercises full sovereignty as on its land territory. Sovereignty extends to the air space above, to its bottom and to its subsoil. Within **twelve miles of the baseline**, each coastal state may determine the extent of its **territorial waters**. The twelve-mile measure is the result of a compromise between States traditionally in favour of extensive freedom of trade and the developing countries in favour of exclusive exploitation of marine resources.



## 2. Coast Geography

### Political geography of coastal and maritime areas

4. **Exclusive Economic Zones (EEZs):** These extend 200 nmi (370 km; 230 mi) from the costal baseline. The coastal nation has sole exploitation rights over all natural resources. The EEZs were introduced to halt the increasingly heated clashes over fishing rights, and oil extraction.
5. **High seas:** begins beyond the limits determined by the areas over which coastal States exercise their sovereignty or jurisdiction (art. 86 UNCLOS). On the high seas, all States exercise the freedoms provided for in international law on an equal basis.



## 2. Coast Geography

### The coastline



The coast (**coastline** or **seashore**) is the area between the mainland and the sea, intended as an area partly submerged and partly emerged, generally sinuous, in which act the wave motion and the tides.

Because coasts are **constantly changing**, a coastline's exact perimeter cannot be determined; this measurement challenge is called the **coastline paradox**. The term **coastal zone** is used to refer to a region where interactions of sea and land processes occur.



## 2. Coast Geography

### Coastal areas

The coast is divided into 3 **significant areas**:

**Backshore** or back beach: is the area from the shore line until a net change in flora or physiological conditions occurs;

**Nearshore:** is the area that goes from the shore line to where the cracks begin to occur.

**Offshore:** from the end of the break zone to the edge of the continental shelf.



## 2. Coast Geography

### Coastal areas

The **Nearshore** is divided in turn into 3 layers:

- **Breaker zones:** where breakdowns begin to occur
- **Surf zone:** the surf zone is narrow and close to the shoreline in a gentle wave climate and can be very wide under storm conditions, extending from the seaward boundary of the upper shoreface to the dunefoot.
- **Swash zone:** the nearest area to shore



## 2. Coast Geography

Different kind of coast. Natural and artificial.

- **Rocky coasts:** living and dead cliffs
- Submerged coasts: rias
- **Low coasts:** beaches, coastal dunes, lagoons, coastal ponds
- Coastal plains
- **Marine terraces**
- Submerged morphology
- **Coastal defences** (seawalls)



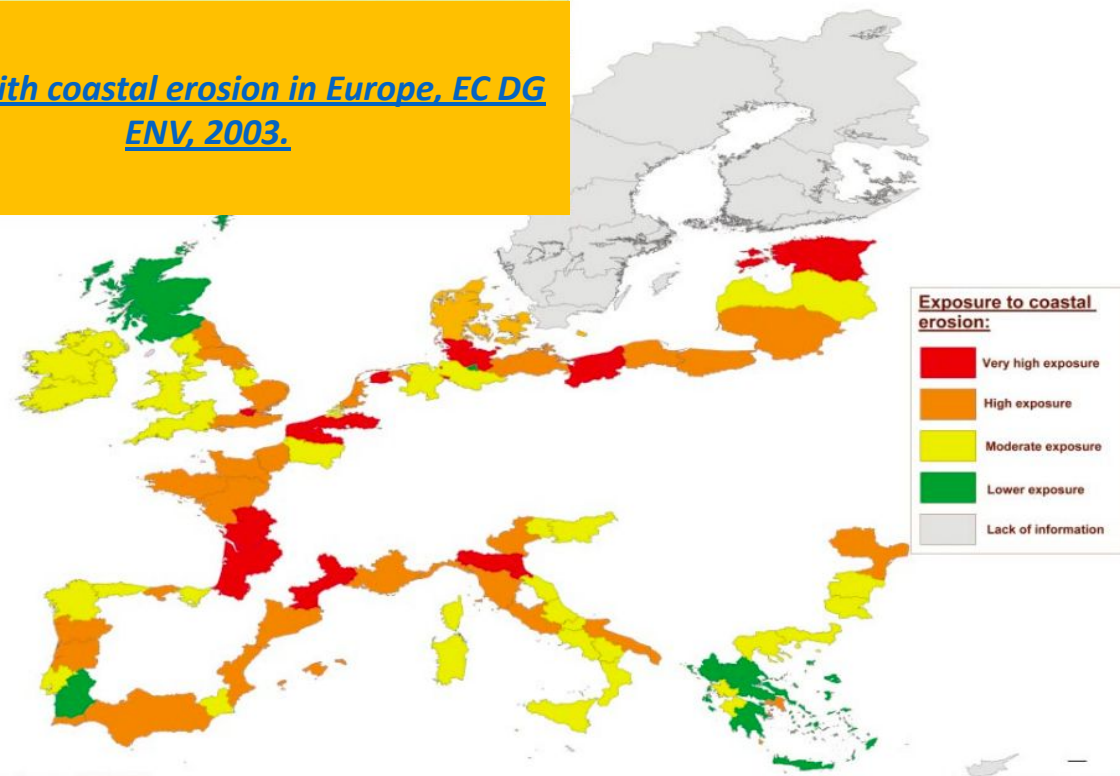
## 2. Coast Geography

### Erosion: coastal shaping.

The shoreline, being the meeting point between the land and the water, is an environment in which continually occur **erosion processes** (removal of material, due to waves and tides, coastal currents and wind) and sedimentation (supply of material from rivers or neighbouring stretches of coastline).

#### Exposure of European regions to coastal erosion

[Living with coastal erosion in Europe, EC DG ENV, 2003.](#)





## 2. Coast Geography

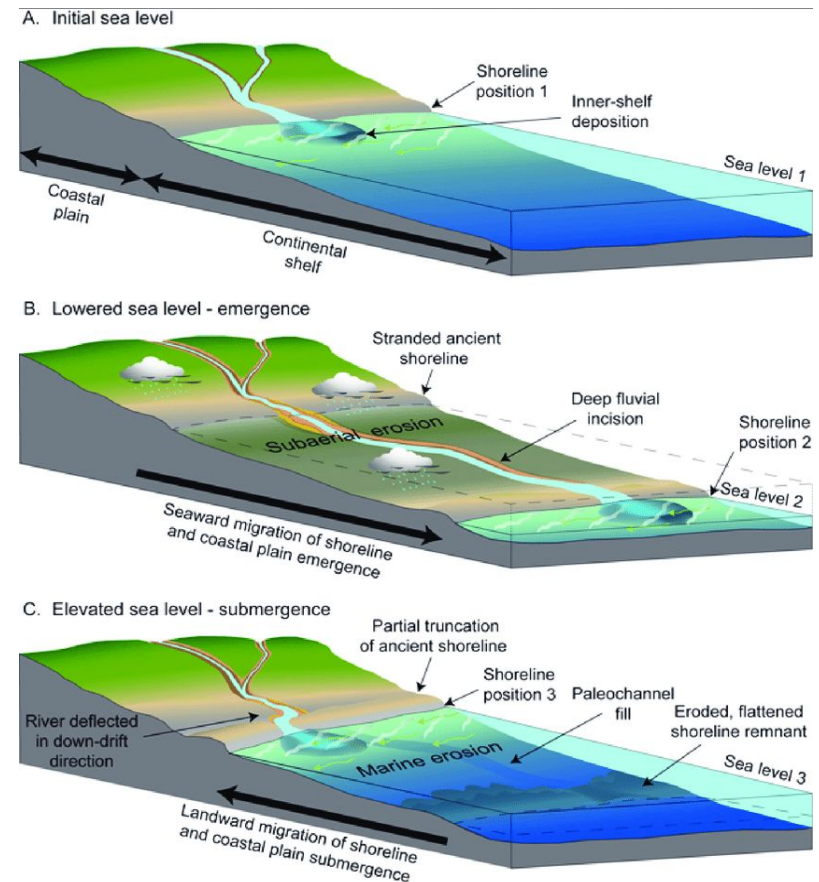
### Erosion: coastal shaping.

The sum of these processes is the sedimentary balance of the coast. The **sedimentary balance** heavily affects the shape of the coast:

if the balance is **negative**, the erosion is prevalent, the coast will be high, characterized by cliffs;  
if the balance is **positive**, depositional phenomena are prevalent, the coast will be low.

In this case we can also distinguish different possibilities:

- **open shorelines**, when there is a clear and linear separation between water and land;
- **protected shorelines** when other bodies of water more or less connected to the sea open after a first line of land emerged (this is the case of the lagoons).



## 2. Coast Geography

Erosion: coastal shaping.

- [\*The State of the World's Beaches\*](#), by Arjen Luijendijk, Gerben Hagenaaars, Roshanka Ranasinghe, Fedor Baart, Gennadii Donchyts & Stefan Aarninkhof (Nature, 2018) discusses about the issue of coastal erosion worldwide, stating that the majority of the sandy shorelines in marine protected areas are eroding, raising cause for serious concern, mainly because coastal zones constitute one of the most heavily populated and developed land zones in the world.



## 2. Coast Geography

### Seawalls

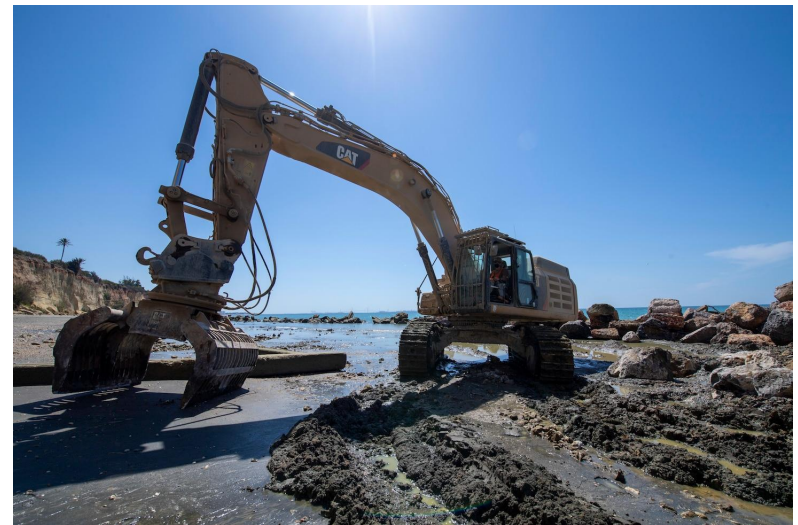
- When coastal buildings or roads are threatened, usually the first suggestion is to "harden" the coast with a **seawall**.
- Seawalls are structures built of concrete, wood, steel, or boulders that run parallel to the beach at the land/water interface. They may also be called **bulkheads** or revetments.
- They are designed to **protect** structures by stopping the natural movement of sand by the waves. If the walls are maintained they may hold back the ocean temporarily.



## 2. Coast Geography

### Seawalls

- The construction of a seawall usually displaces the open beach that it is built upon. They also **prevent the natural landward migration** of an eroding beach.
- But the **strong impact** of defensive structures (as seawalls) on the coastal landscape and on the **sedimentary balance** of adjacent beaches has led to the search for softer solutions.



## 2. Coast Geography

### Seawalls



Many of the solutions consist of both submerged works and from the **artificial feeding of the shorelines** with sediments taken from land or submarine quarries, up to the adoption of **systems of drainage** of the beach that limit the ebb currents.

Unfortunately, these works are not reported in cartography, it becomes increasingly difficult to draw information on the dynamics of the coast from the simple reading of topographical maps.



## 3. Natural and Artificial Harbors

### Different kind

- **Natural harbors**, formed naturally they are protected from the sea/ocean's fury by bays, fiords, mountains, but are still subject to tidal and wave energy.
- This causes water mixing and circulation.



## 3. Natural and Artificial Harbors

Different kind

- **Semi-Natural harbors**, also formed naturally, but integrated with artificial structures to make protections from waves stronger and facilitate the entrance of boats and ships.



## 3. Natural and Artificial Harbors

Different kind



- **Artificial harbors** have been constructed by building a series of breakwaters and jetties. When an artificial harbor is built in an area that is subject to high-energy **wave action**, it will invariably interrupt the longshore flow of sand. This will cause **serious downdrift erosion**. Stagnant artificial harbors are easily polluted by boating activities: paint, oil, grease, garbage and illegally dumped sewage. These wastes can poison the living creatures that swim in these waters.





## 3. Natural and Artificial Harbors

### Types of Harbor

Check this [video](#) out to go deeper into the classification of Harbors.



## 3. Natural and Artificial Harbors

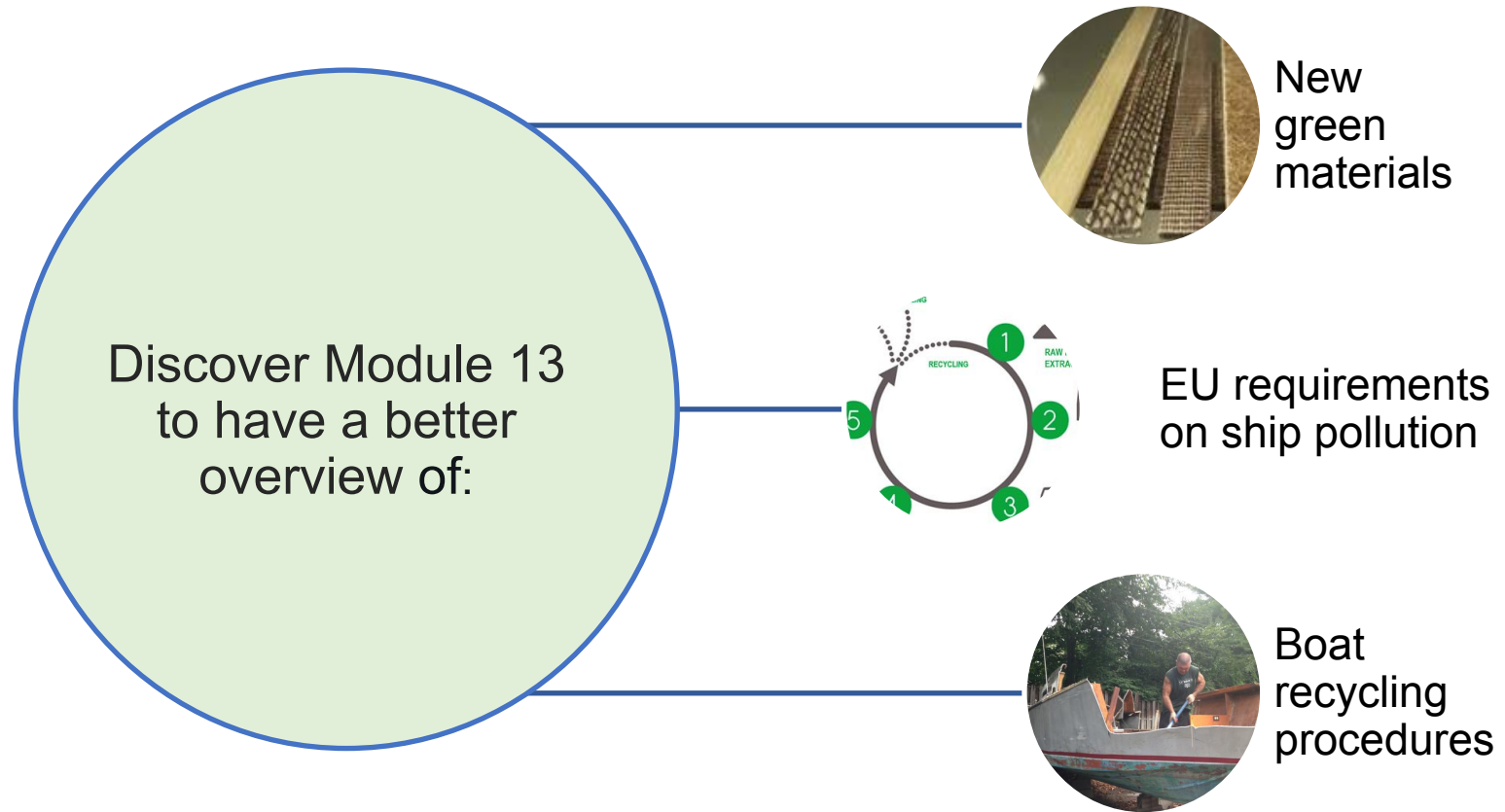
### Environmental threat

- Some harbor designs force the longshore current to make a 90-degree turn towards the ocean. This causes a large **rip current** that may carry sand offshore that might otherwise remain in the surf zone. This will have the effect of completely **changing the shape of the ocean bottom**.
- An artificial harbor mouth can act as a trap for the longshore sand transport causing it to clog up with sand, which makes **costly periodic dredging** projects necessary.



# 3. Natural and Artificial Harbors

## Environmental threat



## 4. Discovering the Port

### Introduction

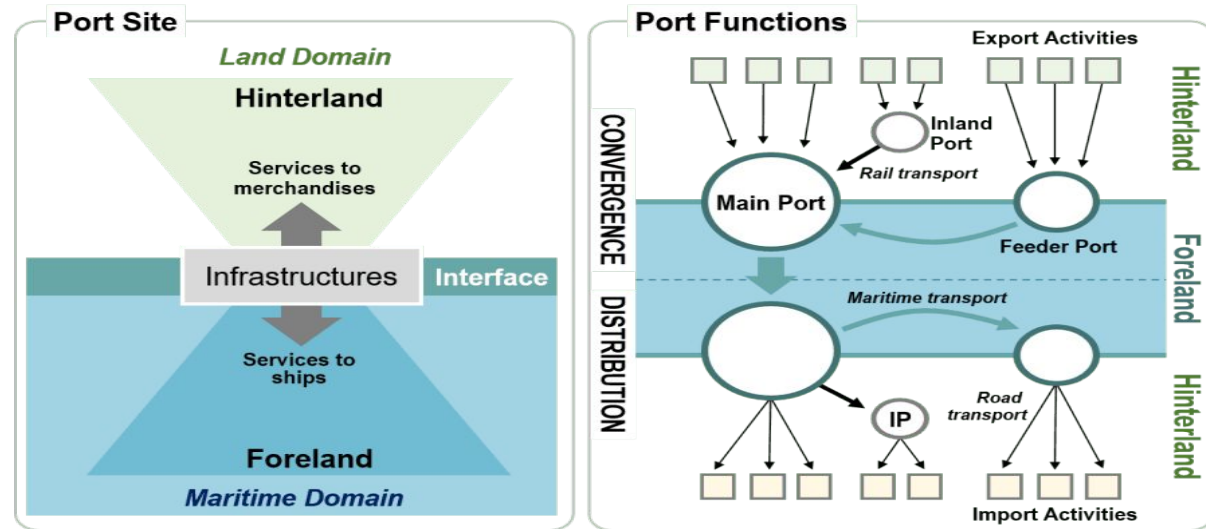


The structures around a boat can be different, the place where we can find all or almost all of them is in the **port**. A port is a natural or artificial structure placed on the sea coast or on the shore of a lake or a watercourse, designed to allow the landing and mooring of boats and ships, and their **protection** from adverse conditions of the waters. A port is usually located near an estuary, in a bay, lagoon or protected by a fiord.



## 4. Discovering the Port

### Infrastructure and Buildings



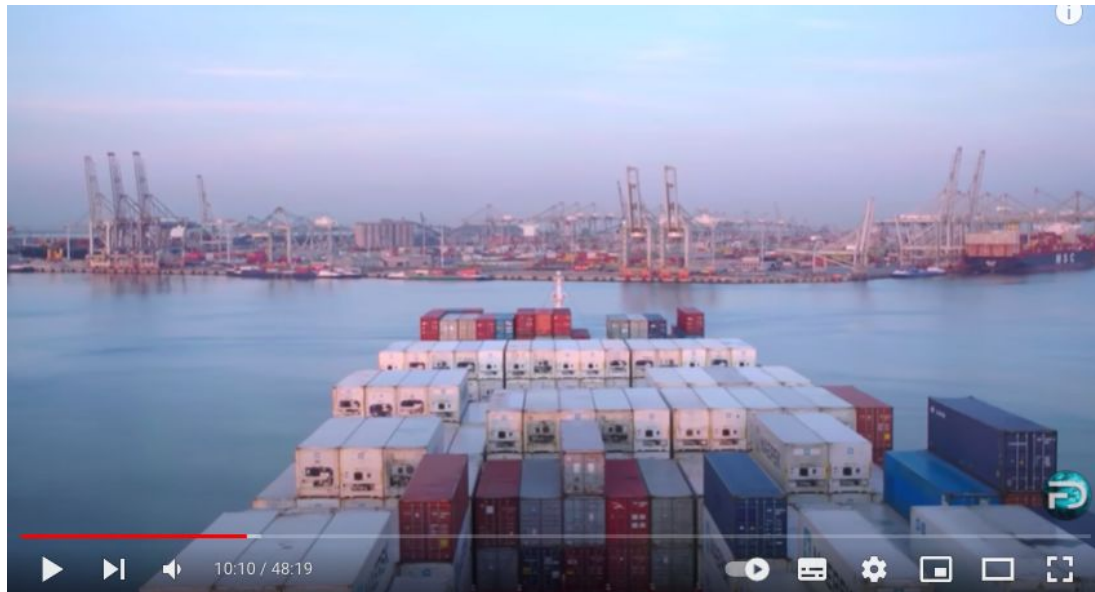
The primary function of a port is **to supply services to freight (warehousing, transshipment, etc.) and ships (piers, refueling, repairs, etc.)**. It allows and facilitates the loading and unloading of goods and people. Besides of being the link to maritime access and infrastructure development, ports are the gateways of continental distribution systems. In this view, containerization has substantially changed port dynamics.



## 4. Discovering the Port

### Infrastructure and Buildings

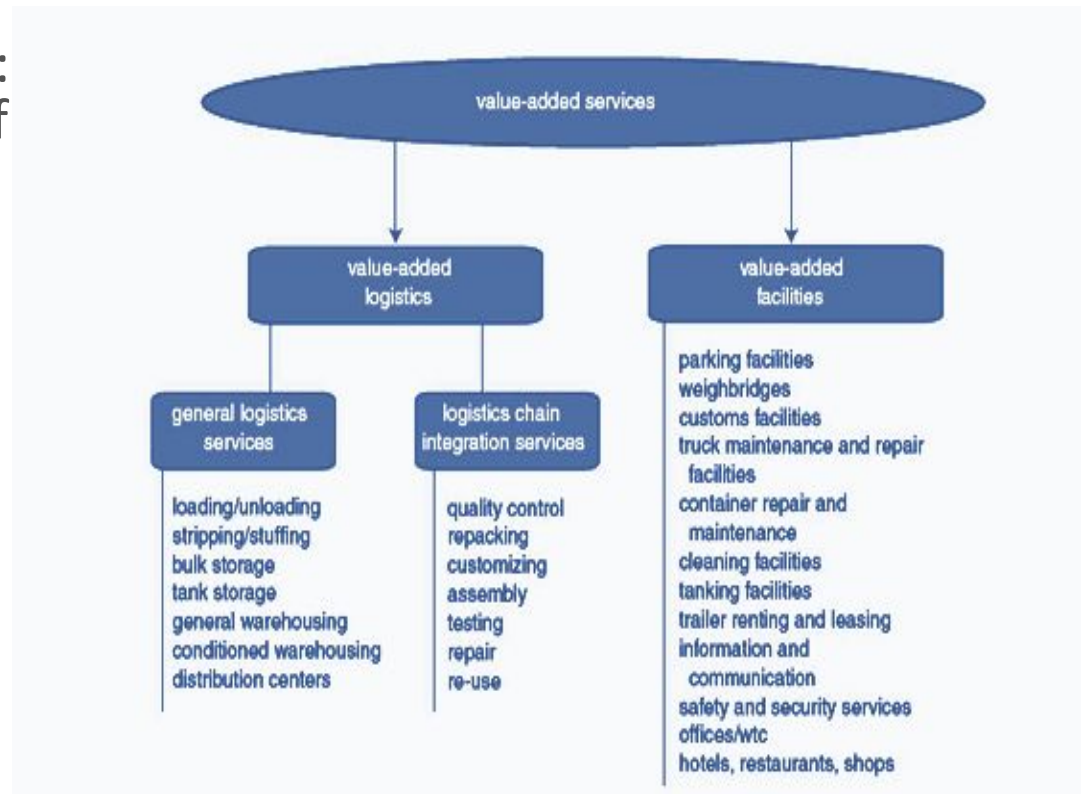
This [video-documentary](#) will bring you inside the Port of Rotterdam one of the biggest and most important logistics hub of Europe.



## 4. Discovering the Port

### Types

- **Monofunctional** ports: Transit a limited array of commodities, most often dry or liquid bulks. Composed of specialized piers.
- **Polyfunctional** ports: Several trans-shipment and industrial activities are present. Variety of specialized and general cargo piers.



## 4. Discovering the Port Structures

- **Breakwater/seawall:** a wooden or stone wall that extends from the shore into the sea and is built in order to protect a harbor or beach from the force of the waves
- **Fender:** a plastic cylinder, tyre, piece of old rope or matting, etc., hung over a ship's side to protect it against impact.





## 4. Discovering the Port

### Infrastructures and minor maritime buildings

- **Quay:** a structure built parallel to the bank of a waterway for use as a landing place.
- **Bollard:** a short, thick post on the deck of a ship or a quayside, to which a ship's rope may be secured.
- **Pier/Jetty:** a structure (such as a breakwater) extending into navigable water for use as a landing place or promenade or to protect or form a harbor. It may also refer more specifically to a walkway accessing the centre of an enclosed waterbody.



## 4. Discovering the Port

Physical capacity of the port to accommodate ship operations.

- **Tidal range:** difference between the high and low tide. Ship operations cannot handle variations of more than 3 meters.
- **Channel and berth depths:** very important to accommodate modern cargo ships. (e.g.) **Panamax ship:** (65,000 deadweight tons) requires more than 12 meters (40 feet) of depth. Many port sites are unable to handle modern maritime access.
- **Maritime interface:** amount of space that is available to support maritime access. Related to the amount of shoreline. Guarantee its future development and expansion.



## 4. Discovering the Port Facilities

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**Berth / mooring availability:** always check mooring places available

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**Port Authority / Harbor Office:** a governmental commission empowered to manage or construct port facilities.

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**Customs house:** a government building or office, as at a seaport, for collecting customs, clearing vessels, etc.

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**The Harbor Master:** the officer who executes the regulations respecting the use of a harbor.

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**Water charger**

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**Gas & Oil station**

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**Warehouses and containers**



## 4. Discovering the Port

### EU internal market Competition rules

Ports are interested in European Commission action on Competition. In May 2016 the Commission published the Notice on the notion of State Aid of the preceding, which gives guidance on when public investments do not involve State aid.

An [Analytical grid for ports infrastructure](#) was published on 2 December 2016 to provide further guidance on the rules and case practice applicable in the port sector.



## 4. Discovering the Port

### EU internal market Competition rules

Among the multitude of possible measures to tackle adverse environmental impacts of maritime operations, ‘Port pricing’ or ‘environmental charging’ has been receiving increasing attention in the last few years, having generated a considerable maritime transport economics literature, as well as a number of concrete, bottom-up initiatives voluntarily implemented by port managing bodies (e.g. *the Environmental Ship Index, Clean Baltic Sea Shipping, Green Award*, etc.).

Check also the Cogea and EC [Study on differentiated port infrastructure charges to promote environmentally friendly maritime transport activities and sustainable transportation](#) to discover more on the issue.



## 5. General safety requirements

### Obligations at the port

- A boat entering or transiting to a port must follow rules that, with some exceptions, are international standards worldwide accepted.
- In the following slides of section 5, we present some of the most important ones.



## 5. General safety requirements

### Behaviour into the port



**1. Departure from the port**  
Before leaving the berths, it is a good idea to safely store items and clothing that could hinder manoeuvre operations. To better understand the departure procedure, it is useful to take as an example a common **mooring in windward** (a boat perpendicular to the dock with the stern on the ground), two mooring cables on the ground, and one or two also on the side of the channel (trap).



## 5. General safety requirements

### Behaviour into the port



#### 2. Releasing the mooring cables

To break free from the ropes that bind the boat, it is important to find out **where the wind comes from**. Then, we will proceed by releasing the downwind cable before the others. The remaining cables will still hold the boat steady enough until they're loose. In the absence of wind, it is preferable that the last cable to be dropped is the bow one, so as to avoid that the stern can hit the dock.

If your crew is large enough, you can release all the mooring cables at the same time.





## 5. General safety requirements

### Behaviour into the port



#### 3. Transit through the port

In port you must advance slowly, without raising annoying waves for the boats moored. The allowed **speed limit** is set by the competent Maritime Authority by territory (usually 2 or 3 knots).

Inside ports and canals, you keep the starboard. It is very important to observe the movements and intentions of others, making sure that they do the same. If, for example, a boat is going to get in the way of our journey, we must immediately slow down and stop at a safe distance. If necessary, the audible warning device can be switched on during the manoeuvre to attract attention. **Prudence**, understanding, and mutual respect are never excessive in port.



## 5. General safety requirements

### Behavioural tips

#### 4. Boat leaving the port

Generally, outgoing units take precedence over incoming units. Therefore, both inside and in the vicinity of the port, it is necessary not to hinder in any way the manoeuvres and the transit of large ships, from which it is obligatory to **keep a proper distance**.

Leaving the port you can pick up the fenders and put them in a locker or below deck so that they can not be an obstacle.



## 5. General safety requirements

### European Union Regulation

At EU level the [Regulation \(EU\) 2017/352 of the European Parliament and the Council of Ministers establishing a framework for the provision of port services and common rules on the financial transparency of ports](#) defines the conditions under which the freedom to provide port services applies; for instance the type of **minimum requirements that can be imposed for safety or environmental purposes**, the circumstances in which the number of operators can be limited and the procedure to select the operators in such cases



# 5. General safety requirements

## Useful tips



Pay attention to the weather forecast, take into account **winds and sea conditions**

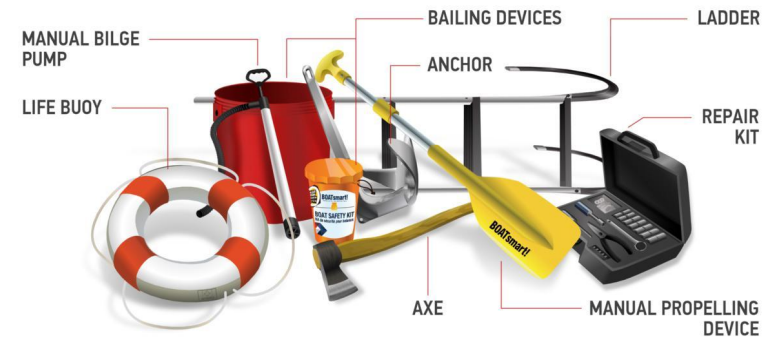


Plan the sea route carefully, and in due time



Make sure boat **safety tools** (visual/sound signalling devices, towable/waerable flotation devices, axe, ..) work correctly

### BOAT SAFETY EQUIPMENT



Check this [video](#) out!

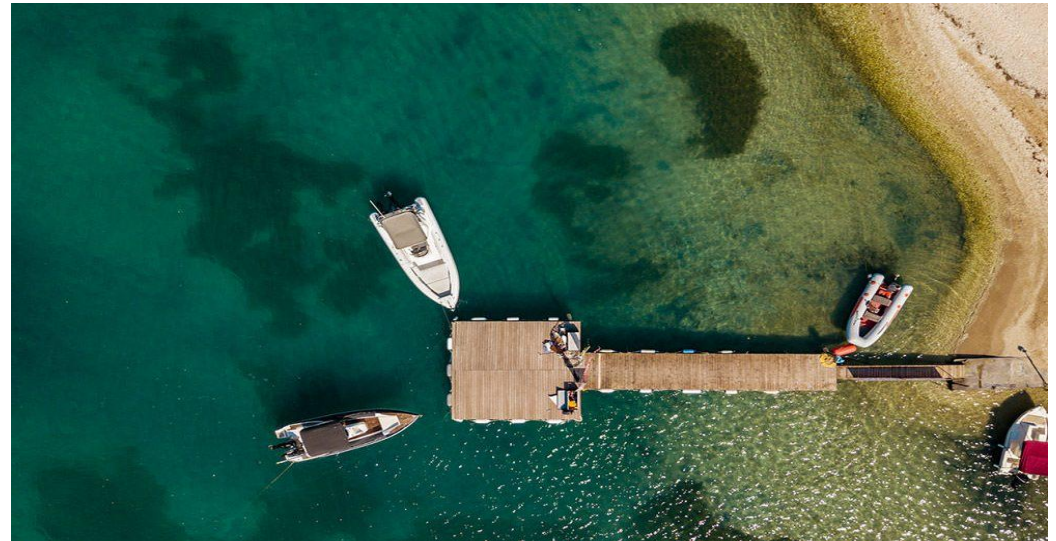


## In conclusion

### Summary of the contents

**This is the end of  
Module 12.**

Now take your time to  
complete the  
evaluation test  
concerned.



# Bibliography

- *European seaports in the Early Modern Age: concepts, methodology and models of analysis*, Amélia Polónia, Cahiers de la Méditerranée, 2010.
- *The State of the World's Beaches*, Arjen Luijendijk, Gerben Hagenars, Roshanka Ranasinghe, Fedor Baart, Gennadii Donchyts & Stefan Aarninkhof, Nature, 2018
- *Regulation (EU) 2017/352 of the European Parliament and the Council of Ministers establishing a framework for the provision of port services and common rules on the financial transparency of ports.*
- [https://transport.ec.europa.eu/transport-modes/maritime/ports\\_en](https://transport.ec.europa.eu/transport-modes/maritime/ports_en)
- [https://ec.europa.eu/competition/state\\_aid/modernisation/grid\\_ports\\_en.pdf](https://ec.europa.eu/competition/state_aid/modernisation/grid_ports_en.pdf)
- **Compulsory reading:**
- *Living with Coastal Erosion in Europe*, EC - DG ENV study, 2004
- *Study on differentiated port infrastructure charges to promote environmentally friendly maritime transport activities and sustainable transportation*, Cogea and European Commission, 2017.





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