



Funded by
the European Union

Call: ERASMUS-EDU-2022-CBHE-STRAND-2
Project Number: 101082860

Study program: **MARINE/LAND TRANSPORT MANAGEMENT**

2-YEAR STUDY PROGRAM Professional Diploma

Subject: **OPERATION OF TRANSPORT SYSTEMS - modern**

Sem. I (I), Year II, elective

academic year 2024-2025

Topic:

INFRASTRUCTURE FACILITIES USED IN COMBINED TRANSPORT AT TERMINALS

Reported by: Eng Drita HIMA

INFRASTRUCTURE FACILITIES FOR THE USE OF COMBINED TRANSPORT

In the combined transport system, it can be noted that in certain cases, the transport chain is temporarily divided. This is usually due to technological reasons that occur due to the change of traffic branch during the transport of goods to the recipient, but also due to the different capacities of the transport vehicles. Due to these reasons, and in order for combined transport to function, infrastructure facilities have been created, such as: terminals, hucke-pack stations, river and sea ports, aerodromes, etc., through which coordination is achieved in several branches of traffic.

HUCKE PACK STATIONS

- HUCKE PACK stations are usually built in places where road transport vehicles circulate, i.e., road and rail traffic. The size and configuration of the stations, as well as their equipment, depend on the type of handling and the type of certain transport vehicles and equipment. Very often, Hucke pack stations are combined with container terminals, especially when goods are reloaded from road transport vehicles to rail vehicles and vice versa, with the help of portal cranes. In contrast, these stations are built in cases where road transport vehicles are transported by rail vehicles (car to car). Hucke pack stations are usually located in industrial centers and ports.

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

These stations must have a sufficient number of tracks, driving roads, space for traffic and parking of road vehicles, as well as appropriate equipment and vehicles.



Fig. 4.1 Huckle Pack Terminal

ports

Ports are traffic nodes, which, depending on their technical and technological equipment, can be:

- freight traffic concentration center for wider service;
- freight terminals – carriers with various traffic branches, traffic and trade organizations of a certain region;
- shock absorbers to neutralize imbalances due to differences in capacity of some traffic branches, as well as in the placement of goods due to the mismatch between production and consumption.

Through ports, massive goods are presented in various forms of large transport-handling units, to a large number of countries, which may be intended for import, export or transit. This requires a high degree of processing of the goods that pass through most of the stages.

In this way, the port plays an important role in the transport process, connecting different branches of circulation into a single system and thereby forming a transport chain. The task of the port and the degree of processing of goods in the port depend on several factors, among which the most important are:

- Infrastructure facilities and their proportion;
- The capacity of some facilities and their capacity;
- The type of traffic involved in the port and their capacity;
- Type and quantity of mechanized vehicles and their capacity;
- Type of means of transport (road, rail, water) and their capacity;
- Water depth (gas), length of the operating shore and number of connections to them;

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

- Conditions and method of navigation;
- The way of tracking and processing information and
- Regulations and practices related to the performance of various transactions and the flow of port formalities and the handling of goods.

Given the large number of components and their importance for port operations, the port functions as a technical-technological system, transforming the movement of goods from one form of transport to another.

The Harbor as a system is based on the optimal solution, which is obtained from the conditions for changing the state of the system, where the system transitions from one form to another or phase, shifts and in connection with this forms a composite system "The Harbor as a system".



Fig. 4.2 Ship moored at the port for container reloading

THE PORT AS A SYSTEM AND ITS ROLE IN THE COMPREHENSIVE TRANSPORTATION SYSTEM



Funded by
the European Union

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

The port as an operational unit, given its basic tasks, is to carry out the activity of moving goods from one transport vehicle to another, as well as storing goods, within the framework of the transport process.

If the coves are viewed in this way, then it can be assumed that they consist of more subsystems, which have mutual action.

DEFINITION OF THE HARBOR AS A SYSTEM

The port as a system fulfills its role within the framework of the transport process by providing services during the movement of goods from one means of transport to another, in which all facilities have a clearly defined purpose, and the capacity of the port is sufficient to carry out a range of complex operations.

Internal factors are in function of designing the structure of the system, which include various facilities and their capacity, terminals and handling equipment, ship management systems and sea depth, etc.

External factors are the transportation system and its capacity, the mobile transportation capacities of different traffic branches, the intensity of traffic flows and the dynamics of the arrival and departure of goods.

All these factors, interconnected, represent a dynamic system.

MAJOR PORT INFRASTRUCTURES

Because the port is a complex and dynamic system, with a clearly defined purpose and a defined technological process, it must have at its disposal several facilities with large capacities. The division and name of these facilities should be according to their form and function. Given this, the port infrastructure can be divided into several elements, and they are: an operational quay with a certain number of trains, a ship berth, a storage area with covered and open warehouses, roads (road and rail), which are adapted to the technological process of the port. All these infrastructure facilities are very expensive, require large initial investments, which can be beneficial only with a large volume of cargo traffic and in conditions of a high degree of cargo processing. These expensive facilities greatly increase the costs of port services during a small volume of cargo.

OPERATIVE COAST

One of the important facilities without which cargo handling cannot be imagined is the operating shore with its means, equipment and connection systems. The operating shore is located between the water surface and the land as an operating surface, which must be of an open type and free from a

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

large number of stations and objects, which will hinder the functioning of the operating shore. Due to these reasons, the position and shape of the shore in relation to other elements has a great influence on their capacity and turnover in a certain period, taking this into account, the shore can be of different types.

Frontal type (frontal) is simpler and very large. It is characterized by a wide frontal manipulative space. Road transport connections are distributed in a row, one after the other to enable quick and easy change of ships. This type of quay is more suitable for monotonous bulk cargo, because it allows the use of reloading equipment of the same type and their operation along the length of the quay.



Fig. 4.3 Coastal front type

Type of shore gat1 It is also very large and is considered more economical and has a greater flow, but the opening to the land is limited. It is characterized by a greater flow than the frontal type, because it allows the concentration and location of port stations and reloading vehicles along the length of the coast. Then, it contains a whole system of connections along the length of the reloading coast and that in a very limited space. Two types are known, wide – European and narrow – American. The European type has a larger surface area and more connections with land transport from both sides.

These banks have large capacities, and are also suitable for handling general cargo transport.

Call: ERASMUS-EDU-2022-CBHE-STRAND-2
Project Number: 101082860



Fig. 4.4 Gat type bank

- ¹ The wharf is the place where ships of various sizes tie up in the harbor.



Funded by
the European Union

Call: ERASMUS-EDU-2022-CBHE-STRAND-2
Project Number: 101082860

RAILWAYS

The port as a system cannot be seen without road infrastructure, which extends deep into the port. In large ports there is a whole system of railways and stations, which are connected by connecting tracks that connect to the port. Railways are located in the port itself on the operating shore and together with the receiving-delivery and connecting roads constitute a whole system. In the port itself there is a whole system of reloading roads, which are located at the places of reloading, unloading or loading of goods. The task of individual roads is defined by the technological process of port work. However, the proportion of these roads is highly dependent on the type of shore, especially if they have to be placed in a narrow space, where it will be difficult to provide the necessary radius for the curves of the tracks. Because of this, this factor should be taken into account when building new ports. The proportion of rail stations also depends on the volume of direct reloading, then on the length of the operating bank, the location of the warehouses, the method of manipulation, the loading structure, etc.

LAND ROADS

The introduction of land routes into rivers is as important as the introduction of railways, because a large amount of cargo is still transported by river and transported by road vehicles. Land routes are particularly important when combined transport systems (RO-RO and container) are used. Inland port transport also requires land routes. In addition, land routes are of great importance in connecting highways with the interior of the continent.

Land routes can be divided into several types:

- internal,
- external,
- regional and
- HIGHWAYS

Internal land roads are inserted into the harbor itself and serve for communication of road vehicles and mechanized vehicles and for servicing the manipulative sites of the operational shore and warehouses.

Regional land roads serve to connect the port with the nearest enterprises, which are often located in coastal areas. These roads are usually located in the direction port - industrial area and port - tourist region.



Funded by
the European Union

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

External or connecting roads form a connection of the harbor through regional roads with the main roads, thus connecting long-distance traffic with the most distant regions in the country and with gravitational areas abroad.

Highways enable the distribution of the largest amount of ore from the most remote regions and the accumulation of cargo at the port of transshipment across the ocean.

This clearly shows the place and role of land routes, as well as the need for continuous development and establishment of land routes, without which the ports will be a partially semi-open system in the transport chain.

HARBOR WAREHOUSES

According to their basic role, warehouses can be defined as a space for temporary storage of various types of goods, which after a certain time will be used for sale, transport, distribution, etc. Port warehouses can perform many functions, given that they are located in larger ports.

The function of the port warehouse is particularly emphasized through indirect reloading or transfer of cargo through the port.

In fact, this arises from the differences in the transport capacity of certain traffic branches, as well as the differences in the turnover of the roads that are included in the port and together with them constitute an open system. Port warehouses have a greater impact on the use of other infrastructure and transport vehicles in the exploitation. In this way, the warehouses act as a dynamic factor in connecting the different traffic branches with production and consumption, thus performing the function of a public warehouse.



Fig. 4.5 Harbor warehouse

MECHANIZATION OF RELOADING AS A TOOL FOR WORK

Sustainable stations as infrastructure facilities, together with the recharging mechanism and vehicles, represent a dynamic circular system, which is always improving and enriching itself, undertaking a series of innovations.

For these reasons, it can be said that the reloading mechanism also represents an important component, without which the functioning of the harbor as a system would be unimaginable.

The reloading of cargo in the port with appropriate mechanization can be considered as one of the subsystems of the port. The term appropriate mechanism means a certain type and type, depending on the type and type of transport-manipulation units, which must be manipulated, i.e., moved.



Fig. 4.6 Floating crane for handling goods in the harbor

Thus, today, different mechanization is used, which can be divided into coastal mechanization and ship mechanization, and further into that with continuous action and intermittent action. Mechanization can also be divided according to the method of reloading and the type of loading units, e.g., the conventional method of reloading and reloading in the rational transport system. In the rational transport system, the mechanization of the general load is used, the mass of which is from several tons to several hundred tons. Accordingly, such reloading mechanization requires a specially constructed shore, through which the portal crane with a large load will be moved and manipulated. In special ships, there are also special cranes with different loads, such as in the LASH, SEABEE, BACAT transport systems.

"HUCKE PACK" AND "RO-LA" TERMINALS

Ro-La2 represents a technology for transporting entire road vehicles with railway wagons, its name comes from the German abbreviation that describes this combined transport technology. While Huckle Pack technology is divided into 4 types which are distinguished by what is transported, from entire road vehicles to bimodal technology.

² "Rolande straÙe", from German "Rolling Highway"

The cars in these two technologies are loaded with the help of steel ramps or with the help of mechanized handling tools, special railway cars with lowered floors, in order not to disturb the loading profile of a given track. After the cars are loaded, the driver is placed in a sleeping car and

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

travels with his transport car in which he rests. Accordingly, this technology is called “accompanied transport”, while when it comes to other types of combined transport when the driver does not travel with his own car, i.e., only a semi-trailer or trailer is transported, it is called “unaccompanied transport”.



Fig. 4.7 Method of loading entire road vehicles with Ro-La technology

This type of transport is usually used for transporting road vehicles through regions or countries that have restrictive ecological and legal measures that limit the movement of road vehicles, such as traffic bans during a certain period (from 1 p.m. to 7 p.m. and during weekends), expensive road taxes, large ecological taxes, etc. Such restrictions are more common in Switzerland, and perhaps for this reason this type of transport is mostly used to cross the Swiss Alps.



Fig. 4.8 The most frequent route in which road vehicles are transported with Ro-La technology

Terminals represent places where road and rail freight traffic merge, dedicated to the reloading, storage and temporary storage of freight units.

The Hucke Pack terminal must be equipped with designated stations for reloading, storage, parking space, but it mostly depends on what type of Hucke Pack technology the terminal is dedicated to, and for it can be found: fixed and mobile ramps, forklifts, various cranes, etc.



Funded by
the European Union

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

As for Ro-La terminals, it is important that they have excellent connections to land roads and are located in the direction of movement of loading flows in road traffic, but as for reloading vehicles, there is no need for large investments here, because only a frontal ramp (mobile or fixed) is needed.

warehouse

According to their basic role, warehouses can be defined as a space for temporary storage of various types of goods, which may be in liquid or piece form, which after a certain time will be included in the sale, transport, distribution or consumption. The task of the warehouse is to receive the products at the end of any production or transport process in places that will be suitable for temporary storage, and therefore will be included in one of the aforementioned processes more quickly and easily.

In warehouses, given their basic function, their dynamic character, the change of storage products in a continuous chain is carried out. From the aspect of the movement of goods in the production - transport - distribution chain, warehouses have an absorbing role in places where this process is interrupted for any reason. They have a special role in combined transport and that through multiple traffic branches, when they are transferred from one to another, due to the insufficient synchronization of the movement of goods and transport capacities due to the large disproportion between the capacities of some traffic branches.

In combined transport where more traffic branches participate, whose carrier capacity differs more by size, it is rationally possible to achieve combined transport only through certain warehouses, which act as shock absorbers, because they neutralize these differences.

CLASSIFICATION OF MAGAZINES

According to general characteristics, warehouses can be classified according to the following criteria:

1. *According to the shape of the goods*, in warehouses with packaged and loose goods, i.e., packaged goods;
2. *According to the nature of the goods*, in ordinary warehouses, for non-perishable products, and temperature-controlled warehouses, for products that can easily be spoiled;
3. *According to product ownership*, in warehouses for own needs and warehouses for storing products of third parties, i.e., "public warehouses";
4. *According to economic activity*, in agricultural warehouses, industrial warehouses, commercial-distribution warehouses, general warehouses and warehouses for circulation needs;
5. *According to the location of the ramps at the traffic branches*, in railway warehouses, port warehouses and inland warehouses;
6. *According to the technical exploitation criteria*, in covered, closed and special warehouses;



Funded by
the European Union

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

7. *According to the storage method*, in ground floor warehouses, multi-storey warehouses and manipulative warehouses.

The classification of warehouses, according to the presented criteria, facilitates the analytical perception of problems in the movement of goods, then the storage itself and the manipulations during storage, as well as the role of certain types of warehouses in improving the coordination of traffic and production branches.

BASIC CHARACTERISTICS OF WAREHOUSES IN THE FRAMEWORK OF THE WAREHOUSE NETWORK

Considering the basic function and classification of warehouses, each of the aforementioned types of warehouses has its place and role within the warehousing network.

Because general (goods) warehouses serve to store a wide range of products, they also require highly complex technology and reloading mechanization. They are located at traffic junctions, ports and railway depots, where they connect production, transport and distribution organizations. This warehouse should not be closely linked only to the transport process, but rather to solve trade problems (the imbalance of production and consumption). According to her, this warehouse has the role of absorbing fluctuations, and thereby regulates the market in favor of supply and demand.

Just as railway, port and inland warehouses have a wide range of goods, general warehouses also have a wide range of goods at their disposal. They require a high level of technological manipulative means for products, which must be complex and diverse. The requirements and needs of these warehouses are more closely related to combined transport.

Warehouses for loose materials, such as coal, coke, ore or concentrate, have a narrow range of products and do not present a particular problem in the technical rationalization of transport exploitation. This usually occurs in combined transport and special mechanization is provided, which is suitable for working with these materials.

Because special warehouses, such as grain and cement silos, are more specifically designed for storing materials that are transported by a larger number of traffic branches, they are located at points where traffic branches with greater capacity meet. In addition, warehouses also have a role as distribution warehouses, and especially silos, which are an important factor in coordinating rail and river transport or rail and sea transport. Therefore, these facilities are usually built in harbors, where more traffic branches meet, and at least two.



Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

From this it can be concluded that in addition to the properties and type of packaging of certain types of goods, the organization of work also has a great influence on turnover. In addition, it is necessary to establish such an organization of work that will ensure optimal use of the area and volume of the warehouse, and especially of the operational part, because in this way space is saved, and at the same time the costs per unit of work, i.e., manipulation, are reduced.

THE ROLE OF MAGAZINES IN THE DISTRIBUTION PROCESS

The circulation of materials in any form (raw material, semi-finished product, finished product), can be seen in the logistics chain, which connects and includes various facilities and activities such as production, transportation, storage, circulation, which in fact represent distributive goods from the moment of departure of the raw material until the moment of final use of the final product.

According to her, warehouses are found in various traffic organizations with requirements for as short or as long a period as possible to store goods until the moment of their re-inclusion in a distribution process.

Considering that this is about the role of warehouses in the distribution process, which is linked to the process of transportation and circulation of goods, then warehouses will be treated in that way.

Within the framework of the transportation process, warehouses appear in the macro distribution sphere, and the circulation parts in the micro distribution sphere.

Within the framework of the transportation process, there are no major boundaries between the production process and transportation, which means that the logistics chain starts from the production process and ends at the consumer.

This means that warehouses located in the internal transport sector – from the production sector – already represent an element of distribution. In addition, warehouses are also necessary in the transport sector from the distribution process, whereby these two sectors complement and interconnect.

The technological requirements of the warehouses are in accordance with the following elements:

- Pallet units;
- Packaging units;
- Naturally formed pieces;



Funded by
the European Union

Call: ERASMUS-EDU-2022-CBHE-STRAND-2

Project Number: 101082860

- Shipment units;
- Small containers;
- Large containers;
- Non-packaged treatment units;
- Loose materials;
- Juices etc.

The distribution requirements of these elements are consistent with the transport carriers in the macro distribution framework.

Reference:

“Multimodal Transport Strategy 2023-2030” - https://mits.net/repository/docs/2024_05_13_195148_STMM_SHQIP.pdf

“Combined Transport” (2020) Aleksandar Karakaçanov, Trajçe Shopov, Mr. Gordan Stojić, Kire Dimanoski

Lecture Series – Eng. Drita Hima

“Funded by the European Union. Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be.”