



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

Study program: MANAGEMENT OF LAND/MARITIME TRANSPORT - MTDT

2-YEAR STUDY PROGRAM Professional Diploma

Subject: **VEHICLE PARKS AND ROAD SAFETY** – new

Sem. II (summer), Year I, compulsory

academic year 2024-2025

Reported by: Drita HIMA

ELECTRIC VEHICLE INFRASTRUCTURE FACILITIES USED IN COMBINED TRANSPORT AT TERMINALS

May 2025

Combined Transport at Terminals

Combined transport, also known as multimodal transport, is a transport system that combines different modes of transport (land, rail, sea and air) to achieve the efficient transfer of goods and passengers. At the terminals of this transport, infrastructure is vital to ensure a smooth connection between the different modes of transport and to improve the efficiency and speed of operations.

This type of transport is particularly efficient in international terminals, as it enables the connection of different modes of transport and improves the efficiency of the supply chain and transport. In combined transport terminals, the infrastructure and technology are designed to ensure fast and secure connections between different modes of transport, as well as to optimize the management of goods and passengers. Combined transport terminals are designed to enable a rapid transition of goods between different modes of transport, such as:

- **Seaports** that connect maritime transport with rail and road transport.
- **Railway Terminals** that enable the transfer of goods from trains to trucks or ships.
- **Airport Terminals** for air transport related to roads and railways.
- **Road Terminals** that connect road transport with rail transport, ports or airports.

Infrastructure Facilities Used in Combined Transport at Terminals

Infrastructure facilities at intermodal terminals are key to the smooth and sustainable operation of the supply chain. Improving and modernizing these facilities ensures a continuous flow of goods and helps meet the growing demands for efficient and sustainable transport.

Main Categories of Infrastructure Facilities at Combined Transport Terminals

1. Loading and Unloading Spaces

- **Seaports:** Specialized areas for loading and unloading containers from ships. They include heavy-duty port cranes for handling large cargo.
- **Railway Platforms:** Space for transferring containers or goods between trains and road vehicles.
- **Road Terminals:** Space for loading and unloading goods from trucks or trailers.

2. Loading and Unloading Equipment

- **Port and Railway Cranes:** Powerful equipment for transferring containers and goods from one means of transport to another.
- **Reach Stackers:** Used for lifting and moving containers within the terminal.
- **Automatic Conveyors:** Automated systems that move goods over short distances within the terminal.

3. Storage and Depot Areas

- **Container Warehouses:** Special areas for temporary storage of empty or loaded containers.
- **Storage Spaces for Packaged Goods:** Used for short-term storage of goods in transit.
- **Thermally Controlled Warehouses:** For storing goods that require specific temperature conditions, such as food or pharmaceuticals.

4. Infrastructure for the Transfer of Goods Between Vehicles

- **Tracks for Multimodal Interconnection:** Specialized routes that connect different modes of transportation (e.g., ports with railways or roads).
- **Sliding Ladders or Platforms:** Used to move goods from one level of transportation to another.

5. Technology and Automation Systems

- **Tracking and Monitoring Systems:** Technological equipment to track goods and manage operations within the terminal in real time.
- **Terminal Management Systems (TMS):** Software for planning and coordinating the loading/unloading and storage of goods.
- **Automatic Gates and Electronic Load Control:** Systems that ensure automatic control and recording of inputs and outputs.

6. Areas for Supporting Infrastructure

- **Vehicle Parking:** Space for parking trucks, trailers and other transport vehicles waiting for loading/unloading.
- **Customs Control Area:** Spaces dedicated to customs procedures for goods at international terminals.
- **Repair and Maintenance Equipment:** Location for maintenance and repair of transportation vehicles or terminal equipment.

7. Interconnection Networks

- **Railway Infrastructure:** Tracks directly connected to terminals for the transfer of containers or freight wagons.
- **Connecting Roads:** Road infrastructure that provides direct access for vehicles arriving at the terminal.
- **Maritime and Water Connections:** Piers and ports for anchoring ships carrying goods or containers.

8. Security and Control Equipment

- **Cargo and Container Scanners:** For security control and compliance with customs regulations.
- **Surveillance Cameras (CCTV):** Provide continuous supervision of the terminal.
- **Access Security Systems:** Ensure that only authorized personnel have access to critical areas of the terminal.

9. Infrastructure for Specialized Goods

- **Liquid Terminals (Tanker Terminal):** For goods in liquid form such as oil, gas and chemicals.
- **Heavy Goods Terminals:** For the transfer of industrial equipment, large machinery and construction materials.

Seaports: Function and Importance in Combined Transport

Seaports are key points for combined transport, as they connect maritime transport with other modes of transport, such as road, rail and air. They are an integral part of supply chains and play an important role in managing and connecting international and domestic goods.

Seaport Function

Seaports provide several fundamental functions in the global transportation system:

1. Loading and Unloading of Goods

- **Loading and unloading of ships** is the main process of a seaport. Here, goods, including containers, grains, oil, chemicals, and other commodities, are transferred from ships to other means of transportation, such as trains, trucks, and planes, or vice versa.
- **Container Terminals** are specialized in loading and unloading containers, which are one of the most common forms of international freight transport.

2. Warehouses and Deposits

Seaports provide facilities for the storage and management of goods while they await onward transport. This includes:

- **Container warehouses** and storage spaces for packaged goods or for goods that require special storage conditions (such as specific temperature or humidity).

3. Customs Control and Security

Seaports are also points where goods are cleared through customs, a process essential to the security of international trade. Customs checkpoints ensure that goods comply with international rules and regulations.

- **Security checks** are also important to prevent illegal trafficking of goods and to ensure that no means of transport harms the environment.

4. Connection with Other Modes of Transport

Seaports provide direct connections to road, rail and air transport. This helps to:

- **Unloading and loading of goods** from ships to trucks, trains or planes to continue their journey.
- **Connections between container transport** and other freight transportation options to create sustainable and efficient logistics chains.

Seaport Categories

Seaports can be classified according to the typology of goods they handle, including:

1. Container Ports

- **function:** They specialize in loading and unloading containers. They enable a fast and efficient transfer of goods between sea and rail or road transport.
- **eXAMPLES:** The ports of Rotterdam (Netherlands), Shenzhen (China), and Los Angeles (USA).

2. Bulk Cargo Ports

- **function:** Used for goods that are transported in loose forms such as grain, fuels, minerals and chemicals.
- **eXAMPLES:** Ports of Mumbai (India) and Banjul (Gambië).

3. Heavy Goods Ports and Industrial Projects

- **function:** For goods that require special handling, such as large machinery, construction equipment or industrial materials.

- **eXAMPLES:** The ports of Rotterdam and Houston (USA), which have terminals for heavy goods.

4. Liquid Cargo Ports

- **function:** They are used for transporting liquids, such as oil and other chemicals, and have infrastructure for loading and unloading tanks.
- **eXAMPLES:** The ports of Basra (Iraq) and Kuwait.

Equipment and Technology in Seaports

Seaports use advanced equipment and modern technology to improve the efficiency and safety of their operations. Some of these equipment include:

- **Cranes and Port Cranes:** Used for loading and unloading goods from ships.
- **Chairs and Reach Stackers:** Used for moving containers within terminals.
- **Automatic Loading and Unloading Systems:** Using automation to reduce the time goods spend in the port and increase productivity.
- **Goods Tracking Systems:** Advanced technologies, such as RFID and GPS, enable real-time tracking of containers and goods.

The Importance of Seaports in Combined Transport

Seaports are essential for combined transport, as they provide various connections that enable goods to move from one mode of transport to another. The use of various transport options through ports can:

- **Improve efficiency:** Allows better use of various transport capacities.
- **Reduce operating costs:** Some modes of transportation are cheaper and more efficient for different distances.
- **Reduce environmental impact:** The use of rail and maritime transport can help reduce CO2 emissions compared to air and road transport.

Railway Platforms

Railway platforms are an important part of the railway transport infrastructure and are designed to facilitate the loading and unloading of goods and passengers, as well as the passage of trains. They are spaces organized and equipped with various elements to enable a safe and rapid passage of passengers and goods from trains to other modes of transport or vice versa.

Functions of Railway Platforms

1. Passenger Transport

Railway platforms are primarily used for passenger transport and play an important role in facilitating the transfer of passengers from one train to another or to other modes of transport, such as buses, taxis and personal vehicles.

- **Access and Security:** They are designed to ensure that passengers can enter and exit trains safely. This includes conditions such as adequate lighting, protective barriers, fast and convenient crossings, and signaling for emergency assistance.

2. Transportation of Goods

Railway platforms can also be used for freight transport. In these cases, they are designed to enable the loading and unloading of goods from trains to depots, other railway terminals or to road and sea transport.

- **Freight Terminals:** Platforms are equipped with equipment to load and unload various goods, such as containers, loaded goods, and other industrial goods. This may include the use of cranes and trolleys to move the goods.

3. Interconnection with Combined Transport Systems

Railway platforms serve as interconnection points for combined transport, where trains can connect different modes of transport such as road, air and sea. This enables the movement of goods and passengers across several modes of transport and contributes to the optimization of supply and transport chains.

Characteristics of Railway Platforms

1. Height and Width

Platforms must be suitable for the movement of passengers and goods. In the case of passengers, the height of the platform is important to be in line with the open space of the trains for ease of boarding and alighting. For goods, the platform must have sufficient space and must be flat to enable the transport of large and heavy goods.

2. Signaling and Safety

Security is a very important aspect of railway platforms. As they are points where passengers and goods transfer from one mode of transport to another, it is necessary to have strong security measures in place. This includes:

- **Orientation and warning signals** for approaching trains.
- **Protective barriers and fences** to prevent accidents.
- **Proper lighting** to ensure secure access at any time of the day.

3. Equipment and Technology

Railway platforms can also be equipped with advanced technology to enable fast and safe loading and unloading:

- **Automatic loading systems** and unloading of goods, such as robots and automated mechanisms that enable the management of containers and other industrial goods.
- **Passenger information systems**, which include digital signs, train schedules and passenger instructions.

Types of Railway Platforms

Railway platforms can be classified according to the type of transport they provide:

1. Passenger Platforms

- **Description:** These platforms are designed primarily to serve passengers traveling by train. They are equipped with facilities such as lighting, seating, and passenger assistance facilities.
- **eXAMPLES:** Major railway stations such as those in London, Paris, and Moscow have specialized passenger platforms for quick and safe access.

2. Goods Platforms

- **Description:** Freight platforms are designed to enable the loading and unloading of goods from trains. They are adapted for various types of goods, such as containers, grains, chemicals and heavy goods.
- **eXAMPLES:** The railway ports of Rotterdam and Hamburg are examples of ports that have platforms for loading and unloading goods.

3. Combined Terminal Platforms

- **Description:** These platforms serve as interconnection points for combined transport, where goods and passengers transfer from one mode of transport to another (from train to truck, for example).
- **eXAMPLES:** The Rotterdam and SINGAPORE terminals are combined terminals that use specialized platforms for freight and passengers.

Benefits of Railway Platforms

1. **Transportation Efficiency:** Railway platforms enable the rapid passage of passengers and goods, contributing to the overall efficiency of rail transport.

2. **Safety:** The protection and security of passengers and freight is a priority in the design of railway platforms.
3. **Suitability for Combined Transport:** They allow the integration of freight and passenger transport, ensuring interconnection with other modes of transport.
4. **Capacity Optimization:** Modern platforms and automation of loading/unloading processes can increase transportation capacity and reduce delays.

Road Terminals

Road terminals are key infrastructure points for road transport and serve to manage and connect passenger and freight transport. They enable the transfer of goods and passengers between different modes of transport, such as rail, air and sea, and are important for ensuring the efficiency of the combined transport system.

Functions of Road Terminals

1. Connection to Combined Transport Systems

Road terminals are integrated with other modes of transport, enabling the transfer of goods and passengers from one mode of transport to another (e.g., from trains or ships to trucks and vice versa).

- **For passengers:** Bus terminals, bus stations and taxi stands are equipped to enable the safe and efficient transportation of passengers. They often offer options for international and intercity travel.
- **For goods:** Freight loading and unloading terminals are located at strategic points and are connected to major roads and highways. These terminals serve to transport goods from ships or trains to trucks for onward transportation to other destinations.

2. Loading and Unloading of Goods

An important function of road terminals is the management of the loading and unloading of goods. They provide spaces for loading trucks with various goods, such as:

- **Consolidated and immovable goods:** A range of goods, such as construction materials, food, fuels and chemicals, can be loaded and unloaded at road terminals.

- **Heavy goods terminals:** These terminals are specialized for handling heavy and large-volume goods, which require special equipment for transportation and handling.

3. Security and Customs Control

At road terminals, security and customs controls are essential for the safety of goods and passengers. These terminals are often equipped with:

- **Checks on goods** to ensure that they are legal and do not pose a security risk.
- **Customs checkpoints** which may include detailed controls on goods crossing national borders.

4. Passenger and Truck Services

Road terminals also provide services to passengers and travelers. These may include:

- **For passengers:** Waiting rooms, restaurants, toilets and options for safe and comfortable travel.
- **For trucks:** Services such as gas stations, rest stops, and truck loading points.

Types of Road Terminals

Road terminals can be classified into several categories, depending on the function and typology of transport they support.

1. Bus Terminals

- **function:** Used for the transport of passengers by buses. They are equipped to provide passage between urban and intercity roads.
- **eXAMPLES:** The main bus stations in major cities such as New York, London and Paris, where local and intercity buses pass.

2. Truck Terminals (Logistics and Freight Transport)

- **function:** These terminals are specialized for the transportation of goods by trucks. They are designed for the management of cargo loads and provide facilities for the unloading and delivery of goods.
- **eXAMPLES:** Major truck terminals on well-known expressways and highways such as those in the US and Germany.

3. Combined Transport Terminals

- **function:** They provide opportunities for the transfer of goods and passengers from road transport to rail, sea or air transport, and are connected to other terminals to enable combined transport.

- **eXAMPLES:** Combined transport terminal points at ports, railway stations and airports such as Rotterdam and Hamburg.

4. Customs and Border Crossing Terminals

- **function:** Terminals that serve for the passage of goods and passengers across borders, where customs documentation and insurance of goods are checked.
- **eXAMPLES:** Border crossings between EU countries and outside, as well as US and Canadian border crossings.

Equipment and Technology at Road Terminals

Road terminals use modern technology and equipment to optimize the processes of loading, unloading and transit of goods and passengers. Some of the equipment and technologies include:

- **Automated Terminal Management Systems (TMS):** These systems enable efficient coordination of cargo and management of passenger and freight flows.
- **Loading and unloading equipment:** Like cranes, conveyors and other mechanisms for manipulating heavy and various goods.
- **Passenger assistance systems:** Like digital signs and passenger information systems that display transportation schedules and other important information.
- **Monitoring and security systems:** Video surveillance technologies and electronic customs controls to ensure the safe and smooth passage of goods and passengers.

Benefits of Road Terminals

1. **Transportation Efficiency:** Road terminals enable the rapid and safe transfer of goods and passengers from one mode of transport to another, contributing to the optimization of combined transport networks.
2. **Cost Reduction:** The use of specialized terminals for the transport of goods and passengers helps reduce operating costs and increase the efficiency of the flow of goods and passengers.
3. **Security and Controls:** The terminals are equipped with security and control systems that ensure that the passage of goods and passengers is carried out safely and in accordance with legislation.
4. **Increased Integration:** They enable the integration of different transport options, connecting road transport with rail, sea and air, enabling a successful and sustainable supply chain.

Benefits of Advanced Infrastructure in Combined Transport

- 1. Speed and Efficiency:** Modern infrastructures enable a rapid transfer of goods between different modes of transport.
- 2. Lower Operating Costs:** Automation and good organization reduce loading/unloading costs and delays.
- 3. Security and Sustainability:** Advanced infrastructures increase safety and reduce environmental impact.
- 4. Highest Capacity:** Dedicated spaces and advanced technology allow for the processing of a larger quantity of goods.

Issues related to Infrastructure Facilities Used in Combined Transport at Terminals

Combined transport involves the use of more than one mode of transport (such as train, truck, ship, or plane) to transport goods and passengers from one point to another. The terminals that support this type of transport are integrated with the infrastructure that connects these different modes of transport. However, several problems and challenges often arise related to the infrastructure facilities used at these terminals. Some of these problems are:

1. Lack of Interoperability

One of the most common problems in combined transport is the lack of interoperability between different transport systems and the terminals that serve them.

- **Technological issues and standardization:** The various equipment and systems used to manage cargo and passengers in terminals are often not standardized or cannot communicate with each other. This can lead to slowing down the loading and unloading process, and create delays.
- **At Combined Terminals:** The interaction of different transport systems, such as rail, road, air and sea, requires equipment and platforms that can manage goods and passengers from these different modes, which is often challenging to achieve efficiently.

2. Terminal Capacity and Filling

Capacity and congestion problems are very common in terminals used for combined transport, especially those associated with busy ports or with increasing numbers of passengers and goods.

- **Big load:** When terminals are overloaded, their capacity to handle freight and passengers is reduced. This can lead to delays and increased operating costs for shipping companies.
- **Lack of space:** Increasing freight and passenger numbers can create space problems, especially in terminals that are not designed to handle high levels of traffic.

3. Poor Infrastructure and Lack of Investment

Many intermodal terminals, especially those serving less developed regions, have old and damaged infrastructure. This can affect the efficiency and safety of transport.

- **Old infrastructure:** Terminals that have not been renovated or updated for several years may have problems supporting modern technology, as well as create unsafe conditions for employees and travelers.
- **Lack of investment:** Terminals require continuous investment to maintain and improve their capacity. Often, the lack of funds for renovation and improvement of infrastructure leads to difficulties in managing freight and passenger flows.

4. Problems with Coordination and Flow Management

Managing the flow of goods and passengers in terminals is a major challenge, especially in those terminals that serve combined transport. This involves coordinating the transport and unloading of goods and passengers from one mode of transport to another.

- **Inter-agency coordination:** Combined transport terminals often require cooperation between several agencies, including those of road, rail and maritime transport. When there is no good coordination, this can lead to delays and management errors.
- **Traffic flow management:** While intermodal terminals can serve as loading points, managing the flow of traffic, especially when it is in motion and there are many passengers and goods, can be problematic. Heavy traffic can slow down the loading and unloading processes and cause significant delays.

5. Security and Defense Issues

Terminals that support combined transport are also susceptible to security and safety issues. This can be a major problem, especially when goods and passengers are in motion and are vulnerable to potential hazards.

- **Risks from dangerous goods:** In some cases, goods transported through combined transport terminals may be hazardous chemicals or other substances that require special safety measures.

- **Assault and theft:** Terminals that support the transportation of goods are often the target of theft, intrusion, and potential attacks, especially if security is not sufficient.

6. Lack of Appropriate Services for Passengers

In some cases, the infrastructure of terminals used for combined transport does not provide complete and adequate services for passengers, especially in terminals serving international travel.

- **Inadequate infrastructure:** Terminals that offer interchange between different modes of transport are often not equipped to provide good services to passengers, such as food, accommodation and relaxation opportunities.
- **Safety and travel opportunities:** Some terminals may be congested and do not provide sufficient opportunities for passengers to spend time, secure their travel, or be informed efficiently.

7. Failure of IT Systems and Technology

In many combined transport terminals, the information system and technology used to manage the flow of goods and passengers can fail, leading to delays and loss of efficiency.

- **Software and management systems:** When there is a lack of modernized equipment and software, management processes can slow down and become more unreliable.
- **Incorrect data and interruptions:** Outages in network connections and the transmission of incorrect data can create confusion and slow down the process of passing goods and passengers.