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EUROPEAN UNION

## Austria-Czech Republic

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# LOGISTICS AND TRANSPORT

## Transport logistics



UNIVERSITY  
OF APPLIED SCIENCES  
UPPER AUSTRIA



EUROPEAN UNION

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# I. INTRODUCTION TO TRANSPORT LOGISTICS

## I.I. Industrial logistics

**Industrial logistics** (also the Procurement and Production logistics) - research, projecting, realization of the logistics system and managing the material flows, goods and services and related flows of information and cash flows.

Activities are linked and interconnected to **logistics chains**, whose last link is the delivery of goods to the customer. **Transportation function in the logistics chain** = Link between individual articles.

Quality, economy and reliability of transport significantly influence the resulting **effect of the entire logistics chain**, which is **customer satisfaction and cost savings**.

## I.2. Basic terms in transport logistics:

**Manipulation process** is formed by a set of manipulation operations and auxiliary operations required to implement them.

**Traffic** is an intentional movement (ride, cruise, flight) of means of transport on transport ways, or the operation of the transport facilities in which transportation takes place.

**Traffic process** is a summary of time and material-bound actions by means of which transport is implemented and ensured.

**Traffic devices** are facilities that ensure traffic on transport routes.

**The Carrier** is a legal or natural person engaged in transport for hire or reward or own use.

**Transport company** is a legal or natural person primarily engaged in the operation of transport as an independent activity.

**Transport route** is an area designated or defined for transport.

**Freight transport** is a transport which primary mission is the transport of animals and things.

**Corporate transport** is a transport performed by a legal or natural person, authorized to do business primarily for their own needs.

**Public transport** is transport for hire or reward carried out on meeting the general transport needs and accessible to everyone by the announced traffic conditions.

**International transport** is a transport where the route starting point and its destination are located in two different countries.

**National transport** is a transport performed in the area of a certain state.

**The Shipper** is the summary title for the consignor and the consignee (exporter, importer).

**Transportation** (Carriage) is an activity that directly transports people and goods (cargo) by means of transport or transport devices.

**Transportation process** is a summary of time and material-bound actions by means of which the transportation is implemented.

**Transport operation** is the sum of all the activities of the carrier and of the shipper or the persons by whom the transport is carried out.

**Forwarder arranges** transport of goods, or other services related to transportation on behalf of shipper (consignor).

**Operator** is a legal or natural person who organizes the transportation in cooperation with shippers (consignors) and carriers.

**Transportation chain** is a sequence of sub-processes in transport, handling, packaging and storage necessary for the transport of things from the manufacturer to the consumer.

**Transportation system** is the defined way of carrying out the certain kind of transport in a particular area.

**Integrated transport system** is a transport system operated by one or more carriers, one or more modes of transport, according to the specific defined uniform transport, tariff, technical and technological conditions.

**Transport conditions** are the conditions governing the rights and obligations of the persons involved in transportation for hire or reward.

**Consignment** is a thing, a set of things or animals that the carrier has accepted from the sender for transport with the relevant transport document.

**Cargo** are animals, things or goods that are transported by means of transport or transport devices, or they are waiting to be loaded or transhipped.

**Tariff** is a summary of publicly announced tariff terms and rates specified for the transit of persons, animals or things.

**Traffic performance** is an indicator characterizing transport, expressed by the product of a certain number of means of transport or other units (train, number of axles, etc.) and of the distance traveled.

**Transport performance** is an indicator of the transport expressed by product of the number of persons or weights of goods and of the distance to which the persons or goods were transported.

**Logistics** is to ensure the right amount of goods or services, in the right place, with reasonable costs at the right time.

**Logistics technologies** are a sequence of decision processes and procedures that, in a certain economic environment, respect the logistic interactions between the components of the logistics system and with using the optimization, exact, heuristic and decision-making methods lead to optimization of logistics costs.

**Transport logistics** coordinates, synchronizes, optimizes moving of consignments within the transport network, optimizes spatial deployment, capacities and movements of all resources.

**Logistics chain** is a set of activities that always involve identifying the site through the transport process, storage, material handling, modification, and flow of information in the process of managing the integrated system.

**Material flow** is the movement of material from raw material extraction to completion of the final product and the exchange process as well as adjustment processing and processing phases.

## 2. LEGISLATION IN TRANSPORT

The European transport system represents one of the key factors in the proper functioning of the European Union's internal market. The transport system makes a vital contribution to meeting one of the EU's primary objectives, namely the free movement of persons and goods between the member states. The transport sector accounts for about 7 % of the EU's gross domestic product, generating five per cent of all jobs in EU countries and absorbing up to 40 % of public investment in the Union countries. Its operation influences many other sectors as well, and, as in other sectors, the legislation is based on European legislation and legislation in the individual member states:

- **National legislation**
- **The EU legislation**

### 2.1. EU transport policy

Transport policy refers to a common strategy in the field of transport, based mainly on a document called WHITE PAPER – European transport policy for 2010: time to decide:

- to use transport as an implementation instrument of economic, social, regional, integration and environmental policy,
- revitalizing alternative modes of transport to road transport, reducing transport growth, without reducing transport performance,
- about 60 measures in transport policy to be taken at the level of the member states.
- the need to develop and revitalize alternative modes of transport with unused capacities.

#### Main measure in EU White Paper

- Revitalization of railways
- Improving quality in the road transport sector
- Support for maritime transport and inland waterway transport
- Achieving balance between growth in the air transport and environmental protection
- Putting intermodality into practice
- Building the Trans-European Transport Network
- Improving road transport safety
- Adoption of a policy aimed at efficient collection of transport charges (harmonization of fuel taxation for commercial users, particularly in the field of road



alignment of principles of charging for the use of infrastructure, and integration of external costs)

- Respecting the rights and obligations of users
- Developing high-quality urban transport
- Orientation of research and technology to the needs of clean and efficient transport
- Coping with the effects of globalization
- Developing medium and long-term environmental objectives for a sustainable transport system

## 2.2. Selected legislation on road transport

### National Legislation (the Czech Republic)

- Act No. 111/1994 Coll. on Road Transport, as amended
- Implementing Decree No. 478/2000 Coll., on the Road Transport Act

### International Legislation

- EPAR Regulation (EC) No. 1072/2009 on common rules for access to the market of international road freight - see Annex
- EPAR Regulation (EC) No. 1071/2009 establishing common rules concerning the conditions to pursue the occupation of road transport
- Regulation (EC) No. 1072/2009 of the European Parliament and of the Council on common rules for access to the international road haulage market
- Regulation (EC) No. 561/2006 of the European Parliament and of the Council on the harmonization of certain social legislation relating to road transport, amending Council Regulations (EEC) No. 3821/85 and (EC) No. 2135/98 and repealing Council Regulation (EEC) No. 3820/85
- Council Regulation (EEC) no. 3821/85 on recording equipment in road transport

### Selected international agreements on road transport

- Convention on the Contract for the International Carriage of Goods by Road (**CMR**) 11/1975
- European Agreement concerning the Work of Crews of Vehicles engaged in International Road Transport **AETR** - (62/2010)
- Convention on the Contract for the International Carriage of Passengers and Luggage by Road (**CVR**)
- Agreement on the International occasional Carriage of Passengers by Coach and Bus (**Interbus**)
- Agreement on the International Carriage of Perishable Foodstuffs and on the



- Equipment to be Used for such Carriage (**ATP**)
- European Agreement concerning the International Carriage of Dangerous Goods by Road (**ADR**)

## 2.3. Selected legislation and international agreements in rail transport

### National Legislation (the Czech Republic)

- Act No. 266/1994 Coll., On Railways, as amended
- Decree No. 2/2014 Coll., Amending Decree No. 352/2004 Coll., On the operational and technical interconnection of the European railway system, as amended
- Government Regulation No. 133/2005 Coll. on technical requirements for the operational and technical interconnection of the European rail system

### International Agreements

- Convention on International Carriage by Rail (COTIF)

## 2.4. Selected legislation in water transport

### National Legislation (the Czech Republic)

- Act No. 114/1995 Coll., On Inland Navigation
- Act No. 61/2000 Coll., On Maritime Navigation
- Decree No. 222/1995 Coll., on waterways, on navigation in ports, on common accident and on transport of dangerous goods, as amended

### International Agreements

- 163/1999 Coll., The European Agreement on Major Inland Waterways of International Importance (AGN Agreement)
- 102/2011 Coll., European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN Agreement)
- 32/2006 Coll., Budapest Convention on the Contract for the Carriage of Goods by Inland Waterways (CMNI)

## 2.5. Selected legislation in air transport

### National Legislation (the Czech Republic)

- Act No. 49/1997 Coll., On Civil Aviation
- Decree No. 410/2006 on the protection of civil aviation against acts of unlawful interference

### International Agreements

- Council Regulation (EEC) No 2407/92 on licensing of air carriers
- Council Regulation (EEC) No 2409/92 on fares and rates for air services
- EP and Council Regulation (EC) No 847/2004 on the negotiation and implementation of agreements between Member States and third countries on air services

# 3. CHARACTERISTICS OF CARRIERS AND TRANSPORT SERVICES

## 3.1. Transport services market

### An economic area including:

- Activity of transport companies (transport services supply),
- Customer behaviour (transport services demand).
  
- Demand varies depending on its size, time and space,
- Transport performance is constantly being created and consumed in the space between the starting point and destination of the transport,
- The provision of transport services takes place when the supply and demand in transport meet.

### Segmentation of transport services market

- **According to transport subject:**
  - Passenger transport market,
  - Freight transport market,
  
- **According to transport operator area:**
  - Local market or regional market,
  - Domestic market or international market.
  
- According to the level of regulation:
  - Liberal market or regulated market.
  
- According to the conditions in the competitive environment:
  - Perfect competition (a larger number of market players with the same conditions),
  - Imperfect competition (an extreme case of imperfect competition is a monopoly).

## 3.2. Railway transport

- Transport of heavy and bulk substrates,
- Medium and longer transport distances (400-600 km),
- Greater security of the transport system,
- Greater independence from weather conditions,
- Environmental friendliness,
- Lower energy consumption,
- Comparable transport speed to road transport over longer distances.

## 3.3. Road transport

- Lowest transport time (short distances),
- Dense road infrastructure network,
- Flexibility,
- Low shipping fixed costs,
- Timely and fast delivery,
- A diverse fleet of vehicles,
- Low administrative difficulty in transportation,
- High safety of consignments in transport.

## 3.4. Air transport

- For its high speed - especially suitable for long distances,
- Relatively high safety,
- It has a relatively high frequency of connections,
- Differentiation of means of transport according to individual sessions, a certain type of aircraft corresponds to each session,
- Mainly used for international transport,
- Intended primarily for the transport of high-value shipments or those which quickly lose their value (scheduled shipments).

## 3.5. Water transport

- Large capacity of waterways,
- The lowest external costs expressed,
- Long distance transport,
- Low speed of water transport,
- Bulk substrates, containers, heavy loads,
- Low waterway density, necessary use of road or rail network,
- Higher dependence on meteorological and hydrological influences.

## 4. FREIGHT FORWARDING

- A technically highly-funded activity whereby the operator (freight forwarder) provides the transport of goods in return for payment.
- A forwarder position on the transport market - it can be characterized as an intermediary. They provide (arrange) shipping services for the ordering party (shippers) with carriers and other subjects of the transport market.

### 4.I. Main responsibilities of freight forwarders:

- arranging or providing transport and shipping operations, including the organization of unloading and loading,
- arranging or providing hire of carrying and, where appropriate, transport means (most often containers and interchangeable superstructures)
- assistance and cooperation in concluding transport and similar contracts,
- the choice and optimization of the transport route with regard to the funded processing of the methods and conditions of the delivery of the goods (especially with regard to the choice for the ordering party of the optimal delivery parity);
- storage, including ancillary services (e.g. packaging),
- logistic activities - in particular in the field of distribution and logistic systems
- concrete provision of transport and conveyance, eventually also transport by "own forces" operated by transport means,
- ensuring the delivery and collection of goods, the actual implementation of loading, unloading, and reloading,
- operation or co-operation of the collection services, that is consolidation and deconsolidation of consignments, i.e. assembly and dismantling of consignments of collection services, including related transport services (in particular storage, customs, etc.)
- integrated logistic services, individualized complex logistic solution services and other individual forwarding services.

## 4.2. International Federation of Freight Forwarders Associations – FIATA

- founded in 1926 in Vienna as an interest business association in the field of freight forwarding in order to promote and defend its interests on a global scale.
- the regular members of FIATA can become the so-called national unions of forwarders associating specific companies of specific states,
- individual members - forwarding companies,
- headquarters in Zurich,
- representing more than 35,000 forwarding companies,
- FIATA members include over 90 member organizations (national associations) from more than 80 countries and about 2,800 individual members from about 150 countries around the world.

## 4.3. Implementation vs. Arrangement of Transport

**For the contractual negotiation of transport operations, it is necessary to distinguish between two different activities:**

- **Transport arrangement** - this is a **freight forwarding agreement** (but a commitment to carry out the transport may be included as well). By means of a freight forwarding agreement, the freight forwarder obliges to arrange the transport of things in their own name on behalf of the shipper, and the shipper commits to pay them the reward.
- **Transport implementation** - this is a contract on the transport of a thing, a so-called **transport contract**. The following entities are involved in the transport contract: Carrier, consignor (usually the contract owner, i.e. the transport orderer), the consignee.

## 4.4. Transport documentation

- **Consignment note** – a proof of a concluded transport contract, the carrier confirming the receipt of goods for carriage.
- **The bill of lading** - as distinct from the consignment note, it is a valuable, hence negotiable, paper, representing the ownership of the goods being transported. It represents the carrier's right to deliver the shipment.

The essential common features of both these transport documents are that they represent the evidence of the transport contract conclusion, and after their proper completion and confirmation by the contracting parties, they serve as a proof of receipt of the shipment for carriage as well.



# 5.FREIGHT TRANSPORT BY RAIL

## 5.1. Offer carriers

**Carriers in rail transport mainly offer the following services:**

- transport of full loads,
- transport of express parcels,
- creation of unit trains,
- express transport,
- transport of bulk substrates,
- other services - logistics, siding, customs services, car rental etc.

**Under special conditions, following consignments can be transported in railway transport as full loads:**

- dangerous things,
- human remains,
- perishable things
- live animals
- wheeled rolling stock,
- wastes.

Although there are exceptions – things or animals that are excluded from transport (according to valid legislation).

## 5.2. Transport contract

A transport contract is concluded by taking delivery of the full load by the carrier for transportation and by confirming the receipt of the full load for carriage by the carrier in a **consignment note**.

The consignment note is a transport document for the conclusion of a contract on the transport of a thing or live animals as a full load. The consignor is responsible for the correctness of the information given in the **consignment note**. In the case of an express parcel, this document is represented by a **transport note**.

## 5.3. Rail transport process

The quality of the transport process is supported by well-chosen and respected technological processes. Therefore, it is important to create such logistics relationships that greatly accelerate material flows:

- **Transport order** - The carrier must check whether the transport is workable under legal and safety standards.
- **Selection of a vehicle to be loaded** - The choice of the vehicle is shared by carrier's dispatcher and transport warehouse keeper, who choose the car with regards to the mode of transport, the type of goods, (especially dangerous goods), the vehicle technical parameters etc.
- **Shunting the vehicle for loading** at the station or in the combined transport terminal. This process is coordinated by the carrier's employees.
- **Selecting a shipping container, loading and securing of goods** - The consignor is responsible for properly packed goods, loading and unloading, as well as properly secured cargo in the car. The goods must be adequately adjusted for transport and loaded so that they are protected from shocks arising from transport on the railway network and protected against loss and damage (according to the UIC guidelines).
- **Marking and sealing of vehicles** - Marking and sealing of vehicles after loading the cargo is carried out by an employee of the carrier according to the valid legislation.
- **Implementation of legislation** - The following are responsible for proper and timely implementation of legislation:
  - the consignor - before submitting the consignment for shipment,
  - the consignee - at a station of destination or
  - the carrier, when authorized by the consignor or consignee under contract or power of attorney.
- **Conclusion of transport contract** - Receipt of a full load for transport, Completion of the consignment note by both the consignor and carrier, **Confirmation of all parts of the consignment note** (by the consignor's signature).
- **Transport of the consignment from the station of the origin to the destination station** - During the transport, some operations from the transport point of view can arise, which affect the technological processes and, subsequently, delivery times, for example:

- A change of the transport contract,
- Transport obstacles and mistakes from a wrong loading of the consignment,
- Obstacles during delivery
  
- **Termination of transport contract** - It occurs at the moment of the full load delivery to the consignee at the destination station (signature of the consignee when handing over the consignment);
  
- **Unloading** - It is carried out by the consignee, who is obliged to accept the consignment without undue delay. The consignee has to take care of:
  - complete unloading,
  - cleaning the wagon or container,
  - disinfecting the wagon after transporting live animals.

## 6. TRANSPORT WITHIN ROAD HAULAGE

Road freight transport technology provides a rational and efficient organization of transport process, the purpose of which is to transport consignments from the shipper to the recipient by means of road haulage.

**Transported consignments in road haulage include:**

**Full loads** - A customer orders a full capacity of the truck. It is loaded in one place at the consignor and unloaded in another place at the recipient;

**Additional loads** - consignments shipped together with other consignments, or transported within rides which would have to be carried out without cargo;

**Single shipments** - consignments that do not meet the conditions of full loads or additional loads and are transported under special transport conditions.

### 6.1. Transport documents

**Transport contract** - a contract for the carriage of goods can be one-off or long-term, that is, if the transport to a certain place is repeated.

**Transport document** - a document accompanying the consignment during transport. It contains the details of the consignment, the consignor, the consignee, and the carrier. The transport document shall be handed over by the consignor to the carrier. The consignor also guarantees the accuracy of the data contained in the transport document. In road haulage, a transport document means a consignment note, in particular an internationally recognized "**CMR consignment note**".

Other accompanying documents include, for example, "veterinary certificates" for the transport of live animals, etc.

## 6.2. Transport under special conditions

Particularities of carried consignments are reflected in the transport technology and in the preparatory operations that are directed towards ensuring the transport. Therefore, the abovementioned characteristics of individual consignments result into special transport conditions requested for such consignments. Carriage of such shipments is also covered by international agreements. From this point of view, the transport of the following can be considered as special:

- Dangerous things (ADR treaty),
- Perishable goods (ATP treaty),
- Oversized cargo,
- Live animals.

## 6.3. Basic types of rides

Transport of full load is mainly ensured by the following types of rides:

- Shuttle rides
- Radial rides
- Cyclical rides
- Mixed rides

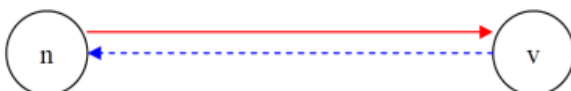
### Shuttle freight transport

Depending on what part of a shuttle ride is performed in a loaded state, it can be divided into:

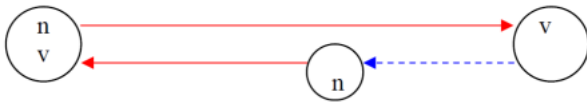
- **Loaded on both ways** – the ride to a destination and back is carried out by a loaded vehicle,



- **Loaded on one way** – a vehicle is empty on the way back,



- **With the vehicle partially loaded on the way back** - the ride back was used to transport a cargo on a part of the section,



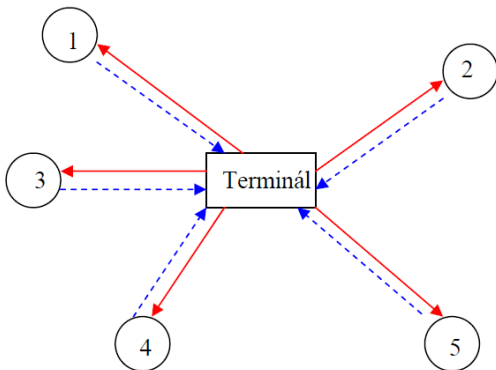
- **With detour** - on the way back the vehicle travels for cargo beyond the original route direction.



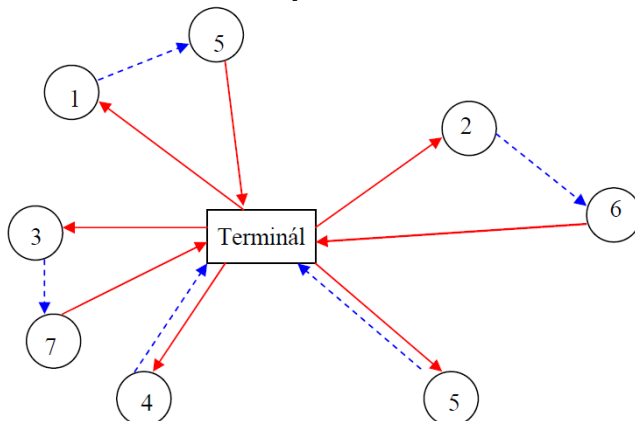
### Radial rides of vehicles

In this mode of transport the goods are delivered and collected by vehicles:

- **From one place to more places**

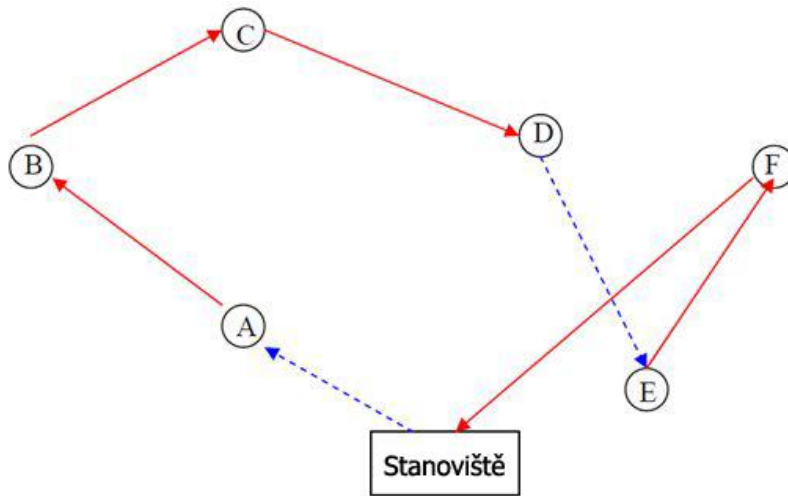


- **From several places in an area to one centre**



## Cyclical rides of vehicles

Individual rides (both loaded and empty) are linked to make a closed circle in which there are both loading and unloading points.



This mode of transport puts high demands on the work of dispatchers of individual carriers - a large number of transport demands must be incorporated into different cyclical rides. Mathematical methods and computing techniques are particularly suitable, reducing the number of empty rides to a minimum, resulting in transport efficiency.

This system is applicable to full loads, but also to the collection and delivery of single shipments, supplies and sales networks.

## Mixed rides of vehicles

In practice, they occur most often. They refer to a combination of shuttle, radial and cyclical rides with the aim of efficient use of vehicles. The number of variants of the individual rides interconnection is so great that the use of mathematical methods and computing techniques is necessary to achieve optimal solution.



# 7. AIR FREIGHT TRANSPORT

## 7.1. Air Cargo – basic forms

- **Additional transport of cargo on scheduled passenger flights**, using the spare volume in the airplane's baggage hold (the "belly") that is not being used for passenger luggage.
- **Scheduled freight transport by cargo aircraft**. This method is operated by large aircrafts dedicated for the job.
- **Charter based cargo transport** - ie. renting all capacity in cargo aircraft. It is often used in the transport of live animals, emergency supplies during natural disasters and the like.

### Forms of freight:

- Separate shipments;
- Unit load device – pallets or containers for air transportation;
- Combination.

## 7.2. Acceptance of goods for air transport

### General conditions and steps:

- The sender (consignor) agrees to the shipping conditions of the airline (for example IATA conditions of carriage for cargo) – type of cargo must comply with the general conditions.
- Goods received for carriage must meet all requirements (for example properly packed consignment, whether documents are required, etc.).
- Shipments of a special nature must also meet all the specific requirements for the transport of each type of commodities.
- Transportation of specific goods is not prohibited by laws or regulations of the countries concerned.
- An air carrier's worker or its agent, after checking the goods, chooses an ap-

tariff and issues the air waybill (AWB) to the customer. The rate is calculated according to the Air Cargo Tariff and Rules (TACT) or a special tariff is selected.

### 7.3. Air Waybill (AWB)

It is the most important document in air freight transport issued by an air carrier or its agent. The basic functions of AWB are as follows:

- Verified by the consignor and the carrier is proof of the conclusion of a transport contract between the consignor and the carrier;
- AWB is a proof of receipt of goods for carriage;
- AWB is also an invoice;
- AWB is proof of payment of premiums;
- AWB is also a customs declaration;
- AWB is a source of information (from when does AWB apply, cargo handling, dispatch and delivery of shipments, etc.).

The air waybill consists of 3 originals and copies. Originals acquire major carrier, sender (consignor) and consignee (at the destination). The remaining copies will be received by the entities involved in the transportation process.

### 7.4. The Air Cargo Tariff and Rules TACT

The tariff for air freight is governed by the TACT document, which sets rates per kilogram of freight or minimum flat rates for given transport routes. The calculation of the shipping cost has its own rules, the type and dimensions of the cargo are taken into account. These are rates for goods:

- **General Cargo Rates (GCR)** – are applied to the carriage of goods not included in another class.
- **Specific Commodity Rates (SCR)** - are used for a certain type of goods, specified by the four-digit code in the TACT.
- **Class Rates (CR)** - These rates are only used for goods listed in the TACT document. These goods are:
  - Live animals, valuables, human remains in coffins and urns, newspapers and Periodicals, unaccompanied baggage sent as cargo, and others.

- **Special tariff concepts:**

- „Home-to-Home“ tariff,
- Express tariff,
- flat rate per piece / unit,
- Contractual rates,
- Tariff for air containers and pallets (ULDs).
- Additional charges, such as a fee for issuing an air waybill, customs clearance, a certificate of origin, etc. may be charged for the shipment transport.

## 7.5. Unit Load Devices (ULDs)

These are unified air containers and pallets approved by IATA. The price for the transport of containers and pallets is valid up to the specified weight limit („Pivot weight“).

- Air freight container is a compact box, which can be made from different materials (molded paper, fiberboard, metal, plastics). The walls of the container are firm. The container forms a single unit for the transport of large quantities of packages (general cargo).
- The pallet is a platform made of compact or non-compact material on which individual shipments are deposited, so that the whole constitutes one load unit. The pallet has handles and the goods are fastened to it by means of mesh.

Container type	Volume	Linear dimensions
		(base width / overall width × depth × height)
LD1	4.90 m <sup>3</sup>	156 / 234 × 153 × 163 cm
LD2	3.40 m <sup>3</sup>	119 / 156 × 153 × 163 cm
LD3	4.50 m <sup>3</sup>	156 / 201 × 153 × 163 cm
LD3-45	3.50 m <sup>3</sup>	143 / 243 × 142 × 109 cm
LD6	8.95 m <sup>3</sup>	318 / 407 × 153 × 163 cm
LD8	6.88 m <sup>3</sup>	244 / 318 × 153 × 163 cm
LD11	7.16 m <sup>3</sup>	318 × 153 × 163 cm
Pallet type	Volume	Linear dimensions
LD8	6.88 m <sup>3</sup>	153 × 244 cm
LD11	7.16 m <sup>3</sup>	153 × 318 cm
LD7	10.8 m <sup>3</sup>	224 × 318 cm
(2 pallet variants)	11.52 m <sup>3</sup>	244 × 318 cm

Tab. 1: Examples of unified ULDs and their characteristics

## Air Freight Forwarders

Freight Forwarders are able to ensure a complex transportation of the shipment from the sender to the recipient without the sender having to enter into further relationships with third parties. Among other things they provide, in particular:

- transportation of a shipment with their own transport vehicles,
- services related to formalities when shipments cross the border,
- clearance of goods at the airport and handling.

**Air freight forwarding** companies benefit from lower tariffs set by the airlines for transportation of large consignments, collect several individual shipments and send them as one large shipment within one bill of lading (consolidation or deconsolidation of shipments). Consolidation requires good technical support, such as sufficient storage space.

### Air Freight Forwarder provide in particular:

#### Own transport:

- transport of general cargo,
- transport of large (volume) shipments,
- express transport,
- „door to door,, transport.

#### Special transport:

- expeditions,
- alternative transport,
- transport of special types of goods.

# 8. CARGO SHIPMENT WITHIN WATER TRANSPORT

## 8.1. Main parts of water transport

- Means of transport – **Watercraft** (Boats, ships, vessels)
- Transport infrastructure
  - **Waterways, artificial and natural lakes, seas and oceans**
  - **Ports and transshipment points**
- Transport units (containers, etc.)
- A carrier within water transport is called a **shipowner**.
- Classification of water transport:
  - **maritime and inland (offshore transport is called cabotage transport)**
  - **passenger and freight**
  - **liner and tramp (charter)**

## 8.2. Inland water ports

- According to specialization: **business, passenger, mixed, protective**
- According to ownership relationship: **public and industrial**

### They usually include:

- Pools, i.e. water areas for putting ships aside, for ships waiting for loading or unloading, etc.
- Loading platforms for loading and unloading.
- Handling equipment for loading and unloading of ships.
- Warehouses and storage areas for storing goods.
- Railroad tracks for placing vehicles to platforms for loading and unloading.
- Roads to transport goods to and from the port, but also for the movement of other vehicles.
- Administrative and operational buildings.

- Equipment for vehicle repairs, vehicle testing etc.
- Separate parts of ports concentrating all passenger services for the needs of passengers.
- Hydrotechnical equipment for water areas and shore protection.

### 8.3. Selected commodities and transport units

- Manipulation with bulk (loose) substrates - cranes with grapples, mobile machinery (conveyors) or special handling equipment are used for loading.
- Unit shipments, interchangeable superstructures, extremely heavy and oversize cargos, prefabricated components (semi-finished products from construction), machines, automobiles. Unit shipments are handled by harbor cranes, and their storage areas are covered in contrast to storage areas for bulk substrates.
- Road semitrailers can be loaded onto the ship via the RO-RO (Roll on-roll off) ramp.
- Containers - transshipment is operated by cranes - SPREJDRU is used - a rectangular perimeter suspension frame that is either:
  - **Sliding** - we can handle both ISO 1 and ISO C containers without changing the frame.
  - **Stable** - Used in small transshipment points, serving only one row.

### 8.4. Subjects of maritime market

**Shipowner** – the owner of a ship, usually operates this activity (shipping), e.g. MSC, Hapag Lloyd, Hanjin Shipping, „K“ Line.

**Ship-manager** – they operate a shipping business with ships which they do not own.

**Ship-broker** - when closing conditions, they represent the shipowner, usually based in the home port of the shipowner.

**Shipowner's agent**- they acquire customers, make deals, represent the shipowner in ports as well as inland. They can be representatives as well as direct companies of shipowners.

**Shipper** – they make agreements with the carrier and are obliged to pay maritime freight, usually have the same function as the consignor.

**Inspection company (Tally)** – inspection of goods loaded on a ship board in accordance with transport documents.

**Stevedor** – they ensure loading and unloading ships and make plan for placing the goods (Stowageplan).

## 8.5. Liner freight transport

- The shipping contract is created by booking of shipping space. It is made for a certain ship and for a certain period of time. By booking, the carrier will ensure embarking of the shipment at the required time at a certain rate. Booking of shipping space is usually checked with a booking letter.
- If the shipper cancels the booking, the carrier is entitled to a cancellation fee. If the shipper does not use the entire shipping space he has ordered, the carrier may request DEAD FREIGHT for unused space.
- Tariffs - in maritime transport, the tariffs are the remuneration for transport from the port of shipment to the port of destination. Tariffs are issued either by conferences, organizations or operators of individual lines. Tariffs are non-public and available to liner agents.
- Normally, the unit usually used in maritime transport is one ton for conventional consignments. For container shipments it is a TEU - a twenty-foot container.

## 8.6. Tramp transport

- In this case, the entire shipping space will be booked. In particular, it is used for bulk substrates, coal, oil, and grain. The CHARTER contract, certified by the CHARTER PARTY, is used to ensure the transport by a tramp vessel. The content of the agreement is not precisely defined, the agreement between the two parties remains.
- in the Czech Republic this contract is regulated by two contracts:
  - Vehicle operation agreement.
  - Vehicle lease agreement.



## 8.7. Bill of lading

The basic document in maritime transport is a **bill of lading** (B/L). It is not directly a transport contract, but rather document on making a contract and, unlike a conventional contract, has many functions. It is used in liner transport.

### ***Bill of Lading functions include:***

- Confirmation of goods take-over on board with the carrier's obligation to deliver cargo to the authorized person in the port of destination .
- It is usually a disposal asset.
- Proof of the transport contract.
- A legitimized recipient is considered by the bill of lading to be the person who legitimates themselves by the presentation of the bill of lading, thus fulfilling a legitimate function.
- It expresses the right to require the delivery of goods that are bound to submit and surrender of a bill
- of lading, fulfils a presentation function.
- It indicates the possibility of disposing of goods, thus fulfilling the dispositional function.
- Unlike CHARTER PARTY it is not a contract, but only one of the documents.

# 9. COMBINED TRANSPORT

## 9.1. What is combined transport?

Combined transport (CD) combines, under certain conditions, system advantages of particular modes of transport, in particular water, rail and road transport.

### Basic concepts in combined transport:

- **Multimodal transport** is generally any transportation by at least two modes of transport.
- **Intermodal transport** is the transport by multiple modes of transport using one and the same transport unit (ITU).
- **Intermodal transport unit** means a container, swap body, road semi-trailer, bimodal semi-trailer, road vehicle, road set, etc.

### Main advantages of the different modes involved in the multimodal transport chain:

- **Rail transport** is more environmentally friendly compared to direct road freight transport, therefore it should be dominant in the intermodal transport chain - to contribute to the transport of large numbers of intermodal transport units over longer distances.
- **Road freight transport** is characterized by greater availability of transport destination points and flexibility in relation to the length of transport. In the intermodal transport chain, it should therefore serve for the collection and distribution of shipments from the rail transport terminal to the customers and vice versa.
- **Water transport**, as the most environmentally friendly mode of transport, allows transport of large volumes at even more favorable prices and energy consumption, as in the case of rail transport. Water transport is one of the safest modes of transport and does not burden land transport infrastructure.

### General advantages of combined transport:

- eliminating the disadvantages of direct road transport (waiting at the borders, independence from traffic and weather, no transport authorization required);
- reduction of heavy road transport on road network, less accident, less impact on the environment from transport;

duction of carrier's operating costs (lower fuel consumption, lower variable costs, etc.);

- More precise timing of shipment with respect to the rail transport schedule, and more.

### The technical basis of combined transport consists of:

- Transport units - in intermodal transport are referred to as **Intermodal Transport Units (ITU)**;
- **Transport vehicles** of various transport modes - road vehicles, railway wagons, container ships, etc.;
- **Infrastructure** consisting of transport routes and combined **transport terminals** - a specially constructed and equipped place in the transport network, where it is possible to transship the ITUs between different transport systems in combined transport using handling equipment. In the case of a combination with water transport, this is an inland port or seaport.

## 9.2. Transport Systems

### The following transportation systems are most commonly used in the combination of road and rail transport:

- **Containers transport** - Carriage of large containers on road special-purpose trailers, rail-mounted platform wagons or specially adapted railway wagons. Loading or trans-loading is done using a crane or a mobile equipment (such as reachstacker) equipped with a special handling equipment "Spreader". This system is the most widespread, as it allows the use of ISO-unified containers.
- **Transportation of swap bodies** - It is the transport of swap bodies on road semi-trailers or on platform wagons or specially adapted railway wagons. Loading is done using a crane or a handling device equipped with a grab arms handling equipment. The disadvantage is that the swap bodies cannot be stacked and therefore require larger storage areas in the combined transport terminals.
- **Transportation of semi-trailers** - Transport system of semi-trailers, which are designed to be manipulated with grab arms of handling equipment. Rail transport is carried out on intermodal so-called „piggyback wagons" with spaces for semi-trailer wheels. Loading is done vertically using a portal crane or mobile front loader.

- **Transportation of road vehicle sets - RO-LA system** (abbreviation from the German "Rollende Landstrasse"). This is the transport of trucks and road freight sets (with trailers or semi-trailers) on flat rail wagons with reduced floor. Loading is done via portable ramp over which the vehicle is entering the wagon.
- **Transportation of bimodal semi-trailers** - It is a bimodal transport system called Road Rail that Europe has taken over from the US. The double-axle semi-trailer has a specially modified (reinforced) structure to allow the coupling of semi-trailers and the creation of a complete train only by rail chassis. The advantage of the system is lesser demand of transport means compared to other modes of transport.

**The following transport systems are used in the combination of water and land transport modes:**

- **The LO-LO system** / Lift on – Lift off / is the classic way of transshipping a ship. It is a vertical transshipment of transport units using port and ship cranes.
- **The RO-RO system** / Roll on - Roll off / is a system of horizontal transshipment of road vehicles where vehicles are driven to the ship on their own axis.  
When using multipurpose ships that carry road vehicles in addition to containers, then a combination of both loading methods is created (RO-LO).

# 10. STATUS OF TRANSPORT IN LOGISTICS

Logistics is a collection of activities that are systematically focused on obtaining materials from primary sources, and all sub-processes prior to delivery to the final consumer, except for manufacturing processes themselves.

- Transport represents one of the components of logistics,
- Transport only acts as a carrier of materials movement (the carrier of material flow within logistic systems)

## 10.1. Transport in logistics chain

- **Transport in the sphere of production** meets the needs induced by production technology, the division of activities and, in particular, cooperation and production specialization between production phases up to the final product.
- **Transport in the sphere of circulation** satisfies the needs of relocation necessary for the realization of the economic circulation (its course in the process of movement of commodity flows serves both ends of the reproduction process, i.e. production and consumption, in terms of time and material).
- **Transport in the sphere of consumption** satisfies the needs of relocation of products which have already entered into consumption if the consumer himself has changed his place of consumption in space and time and relocation of the material goods enables their further consumption.

## 10.2. Transport system factors

**Transport – as the initiating factor of the emergence of new technologies in logistics:**

- Serving areas which incline to a particular centre (“Hub and Spoke” technology),
- Serving large cities where there are a number of constraints for transport system development (“Gateway” technology),
- Self-regulatory principles of transport systems (transport itself is optimized in its costs),
- Warehouse technology.

### teristics of transport in a transport system:

- Ability to create networks,
- Ability to transport any quantity,
- Choice of transport speed,
- Choice of degree of time security,
- Choice of comfort,
- Choice of means of transport,
- Choice of degree of safety,
- Providing additional services.

## 10.3. Functional efficiency of transport

- In monitoring traffic effects, it is clear that the position of transport is based on social infrastructure because:
  - the products of transport is not represented by material possessions but the intangible beneficial effect of relocation,
  - transport does not create new useful properties of material possessions that are the objects of relocation.
- Thus, the condition of transport efficiency is the assumption that, by the implementation of relocation, the useful value will be consumed. Otherwise, there are losses, which have dual nature:
  - losses equal to the costs of producing unexploited utility values,
  - losses equal to the costs of relocating these utility values.

## 10.4. The impact on the quality of transport process

- The ability of transport to create networks, i.e. possibility to provide transport service for any place in a settlement.
- The ability to transport theoretically any large or small amount of goods and material.
- The degree of transport speed ranging from house to house.
- The degree of time security of the transport performance (time determination of reaching the transport destination, and the reliability zone of reaching the de-

terminated value).

- The degree of convenience of reaching and using the means of transport or the transport system.
- The degree of transport safety, including the rate of shocks and other mechanical, chemical, or biological effects arising from the transport technology and the movement of the means of transport along the transport route, which may affect the functional and aesthetic characteristics of the goods transported.
- The level of provision of additional services during the movement of the means of transport along the transport route or at a time during which the transport object spends outside the means of transport (provision of packaging, transport units, feeding of animals, forwarding services, handling of consignments for customers ...).
- The amount of increasing transportation costs.

## 10.5. Affinity of goods

- Summary of properties of the transported object
- **The function of affinity** (depending on the affinity, the elements of the functional efficiency of the transport are selected):
  - An optimal division of transport work,
  - An optimal quality of transport,
  - cost minimization of both the relocation process itself and circulatory processes in general.
- **Is characterized:**
  - By the place of transport origin and termination, or transport route,
  - as the usual quantity of goods transported in one consignment,
  - By demands for speed of transport,
  - By demands for time security of shipment delivery, which can be determined by time (JIT system),
  - By resistance of the consignment to the effects of transport, including the protection of the consignment by the shipping container,
  - By requests for additional services (forwarding, handling...),
  - By limits of transport costs in relation to the circulation processes system, the cost of goods, etc.

# II. LOGISTICS TECHNOLOGIES BASED ON TRANSPORT

## II.1. Factors of transport rationalization

Goods are transported using technology that can be called a logistics technology. Logistics technologies are characterized by the interaction of production, transport and trade.

- In the logistics technologies applicable to non-business transport, the main factors for transport rationalization are transport system and informatics.
- Secondary factors for system choice include material handling, inventory management, but also the choice of transport packaging.

## II.2. The most commonly used logistics technologie

The most commonly used logistics technologies are:

- Just in time (JIT);
- Hub and Spoke (H&S);
- Kanban;
- "House-to-house";
- Quick Response (QR);
- Combined transport (CT);
- Efficient Consumer Response (ECR).

The "**Just in Time**" (JIT) concept means a radical reduction in storage and inventory through a well-functioning transport. The system is based on small deliveries with high frequency, with high time reliability, in a geographically appropriate distribution of production and consumption locations.

### Purpose:

- Production is in accordance with demand,
- consistency in the production and distribution process,
- customer is the dominant part
- eliminating losses and inventories.



**Integrated warehouses and transport terminals** located along transport routes close to the source or destination of the demand (customer). Similarly to the JIT concept, the optimization criterion is to reduce total costs by increasing transport costs at the expense of much more substantial cost savings in maintaining inventory, warehousing and handling systems. Combination with the territory service system (e.g. logistics centres within city logistics).

**Hub and Spoke technology** (Technology of logistics territory service) consists in grouping smaller shipments into larger units that are re-divided into smaller units after transport by large means of transport. "Hub" refers to the logistics centre where consolidation and deconsolidation of shipments occur. Subsequent collection and delivery of shipments for shorter transport distances is carried out by smaller trucks (e.g. vans). Long-distance transport between individual logistics centres (places of consolidation or deconsolidation of shipments) is carried out mainly by means of large-capacity means of transport (trucks, trains, ships).

**Integrated traffic management systems** - Computer networks create great opportunities for managing integration and, above all, for rationalizing logistics activities. Transport becomes an integral part of the transformation process of production. Information systems and logistics coordination at a higher level of management contribute to the optimization of transport chains and lead to saving costs for transport.

**Kanban** is a technology that does not work with inventory (a technology without stock). Most often, this technology is used in mechanical engineering and especially in the automotive industry.

#### How does it work?

- the customer sends an empty means of transport to the supplier,
- delivery of the empty means of transport to the supplier (instruction to commence production),
- the transport means is filled with the given batch,
- the customer is obliged to take over the batch.

**Cross-Docking technology** takes advantage of the integration of the distribution centre into the supply chain as a link between a larger number of suppliers on one side and the retail network on the other. The distribution centre has the function of sorting, assembling and dispatching consignments directly to individual stores. It is important to know that goods are not stored in distribution centres, they only flow through them.

**Quick Response (QR)** - This logistics technology can be characterized as improved inventory management and increasing of efficiency through an accelerated inventory flow. It is true that for the correct application of QR it is necessary throughout the supply chain—which begins with the supplier, continues through the manufacturers and the

and ends with the consumer—to set up working relationships. Partner relationships include sales, ordering, and inventory information that are shared by the individual links of the chain.

### **Combined transport systems**

- Container transport system,
- The system of transport of goods in interchangeable superstructures,
- Goods transport system in road trailers,
- System of transport of goods in road vehicles and carriages, including vehicles crew (accompanied combined transport - RO-LA).

More about combined transport systems in a separate chapter.

# 12. FREIGHT VILLAGES

## 12.1. Basic concepts

**The Logistics Centre (LC) or freight village** is the nodal point in which means of transport of various modes of transport meet. It offers optimal conditions for the creation of combined transport chains.

**The Public Logistics Centre (PLC)** is defined as a confined space, encompassing all logistics activities carried out by different operators in both national and international logistics chains.

The biggest difference is mainly in the way of financing. PLCs are conceived as public and accessible to the general business community. For this reason, the state is involved in their construction and takes care to ensure the same non-discriminatory access to the services and activities offered for everybody.

### Customer requirements for logistics centres:

- local collection and distribution by road to larger nodes within agglomerations,
- carrying out loading and unloading operations, temporary storage of goods,
- customer support in the preparation of transport, provision and planning of means of transport,
- providing and rental of transport units (crates, pallets, containers),
- operation of service stations for vehicles and transport units.

### Organization of LC operation

- Entities of a logistics centre:
  - *operator* - entity operating part of a logistics centre,
  - *user* - entity involved in commodity flows at the logistics centre.
- Distinguishing factors for the organization of a logistics centre:
  - number of operators (one or more operators),
  - relations between operators and users (the operator is a user, the operator is a joint venture of users, the operator is not a user, the operator is a joint venture of non-users, the operator is a combined joint venture),
  - ownership relationships (the operator is the owner, the operator is the lessee).

## Organization models:

- **Minimum association:**
  - one company operates basic functions (transshipment of goods),
  - The following are operated centrally:
  - infrastructure of the centre (transport, energy, water supply, sewerage, repairs, object watching),
  - social background for workers,
  - reloading device.
  
- **Association without external activities:**
  - in addition to the basic functions of model 1, there are the common operation of storage facilities and transport within the centre,
  
- **Association with external activities:**
  - in addition to the basic functions of the previous models, there is a common organization of grouping and distribution of goods in the attraction area,
  - the use of own vehicles for local transport.

## 12.2. The function of logistics centre and the range of services

### Main functions:

- Organization (carried out by the transport intermediary) – activities:
  - Advice, analysis and planning;
  - Choice of mode of transport;
  - Making transport contracts;
  - Issuing transport documents;
  - Load checking
  
- Transport (carried out by a transport company or forwarder)
  - Within a region (collection and distribution)
  - Within national and international long distance transport

### **Additional functions:**

- Transshipment (carried out by a transshipment company, carrier or forwarder)
- Storage (a warehouse company, transshipment company or forwarder)
  - Storage, removing goods from storage, transferring goods;
  - Warehouse management;
  - Assembly and preparation for removal from storage.
- Collecting (a carrier or forwarder) – activities:
  - Creation of handling units;
  - Assembling collection cargo.
- Packaging (packaging companies or forwarder) – activities:
  - Consultation and selection of packages, packaging before shipment.
- Handling (a warehouse company, packaging company, forwarder) – activities:
  - Handling related to dispatching and labelling of the consignment;
  - Treatment of goods and preparation of goods for sale.
- Information (a forwarder or carrier) – activities:
  - Shipment notification notice;
  - Management and control of material flows.

**Special functions provided by external companies in the logistics centre** – the following activities can be included:

- Transport insurance;
- Customs clearance;
- Repair and maintenance, etc..

### **Definition of combined transport terminal:**

- part of the combined transport infrastructure,
- transport node of the transport chain, where the transport units are transhipped from one mode of transport to another,
- other services related to combined transport are provided.



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