Project funded by the European Union

Handbook Multimodal Transport

This report is funded by the European Union within the framework of the TRACECA project "Strengthening of Transport Training Capacities in NIS countries". The project is implemented by NEA and its partners STC-Group, Wagener & Herbst and TRADEMCO

September 2010

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Introduction

This "Handbook Multimodal Transport" has been elaborated by a consortium led by NEA Transport Research and Training in the Netherlands within the framework of the TRACECA project "Strengthening of Transport Training Capacities in NIS Countries". The handbook is based on many years of professional experiences in projects in many countries in the world. We think that the material is useful for professional staff engaged in transport planning at all levels. The handbook can also be used as training materials for students interested in transport planning, civil engineering and economics.

September 2010

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1 Management

Learning Objectives for Lecture 1:

- The student should understand the definitions of Logistics and Supply Chain Management and the differences between them.
- The student should understand the background and historical development of Logistics and Supply Chain Management.
- The student should understand the characteristics, importance and interrelation of transport chains and supply chains.
- The student should understand the various logistics subsystems and their interrelations in production- and trading companies.
- The student should understand the relation and the main trade-offs between service- and costs elements in logistics.

1.1 Definitions

1.1.1 Definition of Logistics

The original term "Logistics" dates back more than two centuries, originating from the military. There it means the supply of fighting troops with all necessary material (fuel, ammunition, foodstuff, etc.). The term is now used widely in the civil sector to indicate a wide variety of activities, aiming at the supply with the right quantity of needed material, at the right time and at the right place.
Every company that deals with the transport, storage, trading or manufacturing of products and services employs the term Logistics in one way or another. From the various definitions that exist for Logistics we present the definition by CSCMP, the US based Council of Supply Chain Management Professionals (www.cscmp.org):

"Logistics Management is that part of Supply Chain Management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption, in order to meet customers' requirements".

Please note that in this definition:

- Not only goods flows but also services are involved;
- Objective is: to meet *customer's* requirements (which are: good service for acceptable costs.

1.1.2 Definition of Supply Chain Management (SCM)

From the various definitions that exist for SCM we present the definition by CSCMP:

"Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies".

Please note from this definition, that:

- The scope of SCM is wider than of Logistics: SCM also discusses the (worldwide) sourcing and procurement of raw materials, production locations etc.;
- SCM optimises the goods flows not only *inside* companies but also *between* companies;
- SCM promotes the collaboration of (independent) companies and a coordinated, integrated approach of all activities, from product design up to consumption (and even up to the recycling of used products).

1.1.3 Relation with Multi Modal Transport

What is the relation between Logistics, Supply Chain Management and Multi Modal Transport? Multi Modal Transport can be seen as a Logistics activity and also as a Supply Chain Management activity. When dealing with Multi Modal Transport, not only attention should be paid to technical issues such as equipment, infrastructure or institutional aspects, legislation etc.
Multi Modal Transport can only be effective when it is integrated with other logistics activities, in order to meet customer's requirements.

1.2 Development

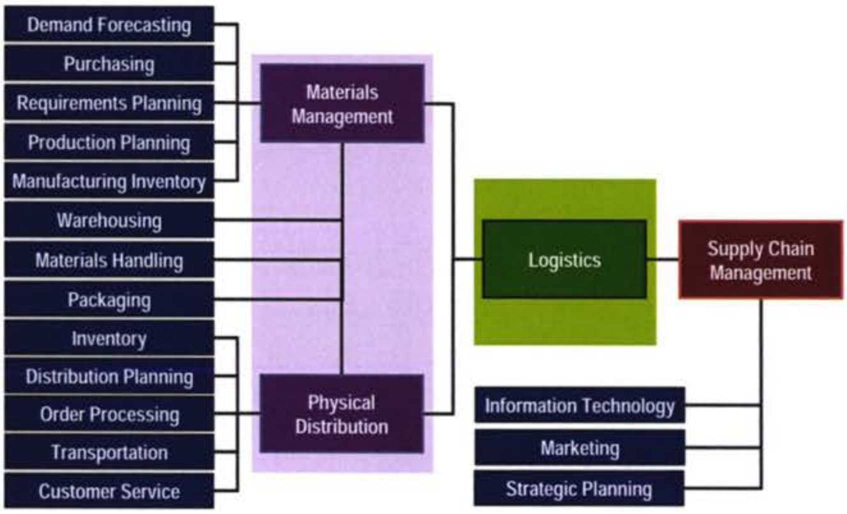
Until 1990, Logistics was dealing with the optimal goods flow inside a company. The focus was on reduction of costs: warehouse optimisation, transport planning etc.
Logistics activities were divided into two categories:

- Materials management, comprising the procurement of raw materials and the organisation of the goods flows through the production process up to the inventory of finished products. These were merely planning- driven activities.
- (Physical) Distribution Management, organising the flow of the finished products to the customers, including the distribution system, warehouse location / allocation, return flows etc. These activities were more directly driven by the customer orders.

Both categories had their own management tools.

Later, marketing and sales people discovered that good logistics is also an important competitive advantage for a company: better availability of goods, higher reliability of distribution etc. mean better customer service, which may increase sales.
The further development, from Logistics into Supply Chain Management, was (and still is) triggered by the ongoing globalisation of trade, the growing importance of worldwide strategic planning, the availability of more powerful and flexible computer systems and internet applications.

Figure 1.1 Development of Logistics and SCM



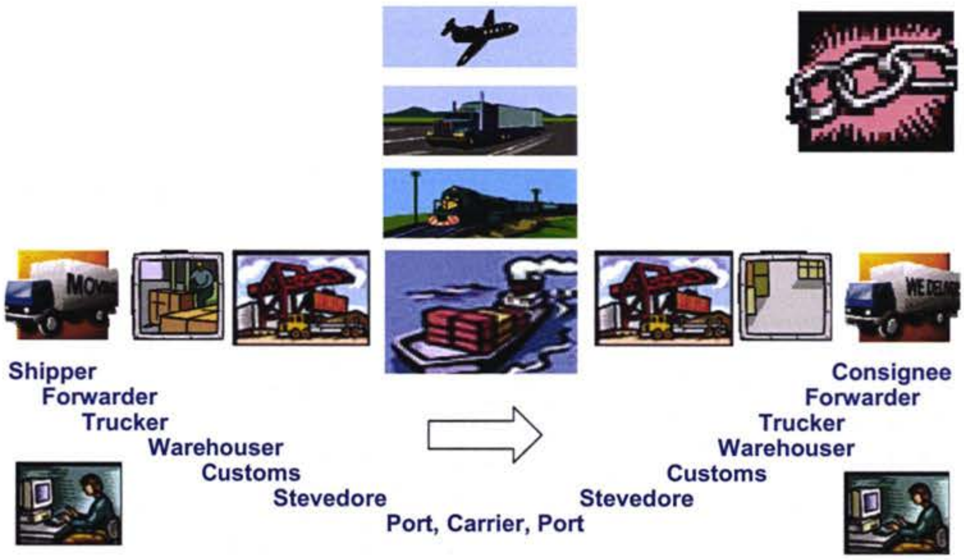
Source: People, hostra, edu

1.3 Chain Awareness

1.3.1 Transport Chains

Transport, Logistics and Supply Chain Management comprise many activities or subsystems, which will be described in more detail in chapter 1.4.
The transport of a shipment from a shipper to a consignee may require a whole chain of consecutive tasks, which may be executed by many different parties. Together, these parties execute the transport of the shipment. This is called a Transport Chain. Re. illustration of example in figure 1.2

Figure 1.2 Transport Chain example



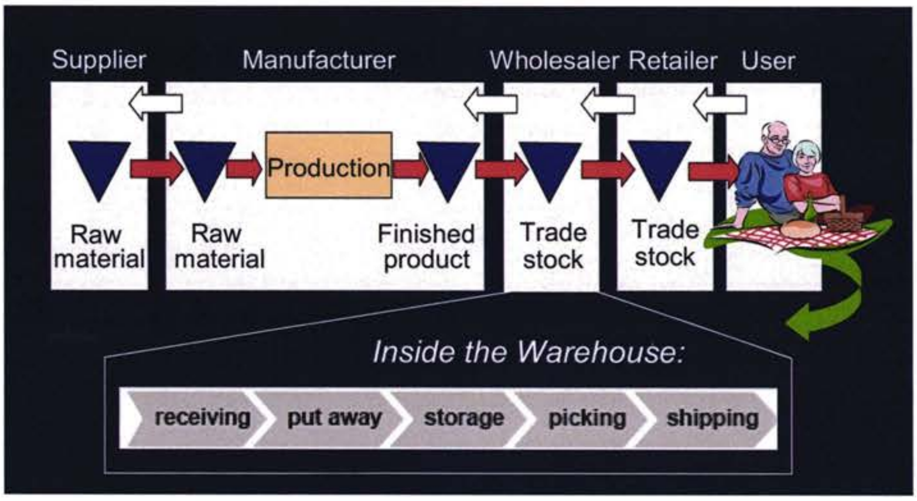
The involved parties may include public institutions such as Customs and Port Authorities, and many independent private companies, such as Freight Forwarders, Shipping lines etc. When one of the parties does not perform its task properly, the whole transport chain can be obstructed or delayed.
Especially the accurate exchange of information (orders, confirmations, transport documents, waybills etc.) by the chain parties is vital for its final effectiveness.

1.3.2 Supply and Demand Chains

The Transport Chain is a representation of all parties and tasks, together *executing* a transport from a shipper to a consignee. The shippers and the consignees can be seen as the clients of the Transport Chain. They do not execute transport but they *generate* transport.
These companies are also operating in a chain, which is called a Logistics Chain or a Supply Chain.

The Supply Chain below comprises 5 of these companies: a supplier of raw materials, a manufacturer, a wholesaler and a retailer. In fact two chains can be seen: a *Demand Chain* and a *Supply Chain*. The left pointing arrows represent the Demand Chain (order information).
The right pointing arrows represent the Supply Chain (the flow of goods); each arrow in itself might comprise a whole (international) Transport Chain. The triangles represent inventories. Re. the example in figure 1.3

Figure 1.3 Supply Chain example

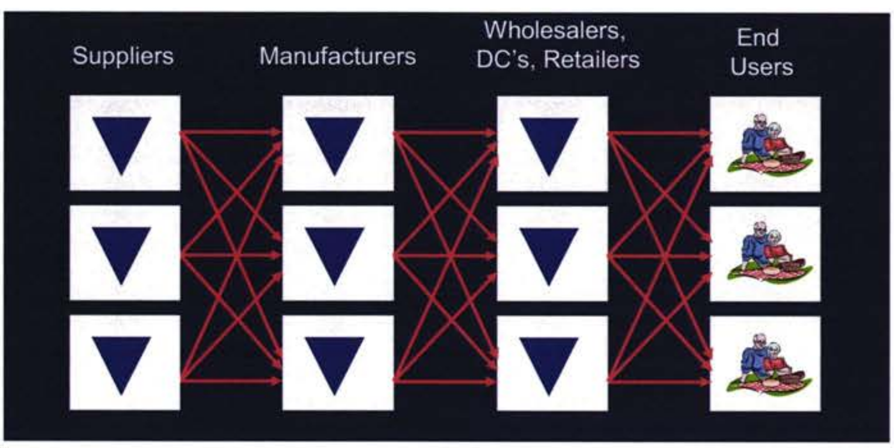


As stated before, Supply Chain Management aims at the integrated management of demand and supply within and across companies, active in a Supply Chain. This should be organised in such a way that chain inventories and costs are minimised and that the chain at the same time responds flexible to the ever changing requirements of the (final) customers.

Same as in the Transport Chain, especially the accurate exchange of *information* throughout the Supply Chain is vital for its effectiveness. All chain parties should have up to date information about (fluctuations in) the demand of the final customers, about the availability of the goods in the chain, inventories, lead times etc.

A manufacturer may procure his raw materials from more than one supplier and he may sell his goods to more than one wholesaler. Therefore in practice the Supply Chain will more look like a Supply Network as illustrated in figure 1.4.

Figure 1.4 Supply Network

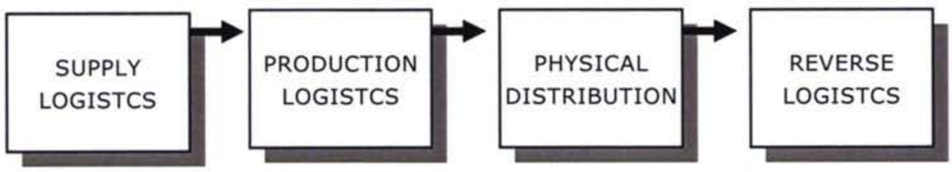


1.4 Subsystems

The following Logistic Subsystems can be distinguished as shown in the figure 1.5:

- *Supply logistics, including Procurement;*
- Production *logistics, including the manufacturing process;*
- *Physical distribution;*
- *Reverse logistics, dealing with return flows.*

Figure 1.5 Logistics Subsystems



These subsystems and the related operational activities in a production company or in a trade company will be discussed below.

1.4.1 Supply Logistics

A Procurement

The supply of materials results from a Procurement activity by the receiver, which includes information processing, planning, ordering, indicating to the supplier that he requires supplies. The materials may include all the raw material, semi-manufactured articles, services and information that a company needs to produce and trade its products.

In many cases, the receiver is not involved in the physical supply itself. Many suppliers will dispatch their products carriage-paid. Then all costs and planning of the supply are the responsibility of the supplier (or his logistics service provider). However, when other conditions of supply have been agreed upon, for instance FOB or Ex Works, the receiver will share the responsibility of planning and paying for the supply.

B Storage of Materials

Storage comprises a range of activities, such as Reception, Put away, Storage, Stock Keeping, Retrieval and Shipping.

Reception: the warehouse performs the inspection (quantitatively and qualitatively) of the inbound goods in close cooperation with Procurement and registers the arrival of the goods.

Put away: the goods are made ready for storage, which may include unpacking, palletising etc. and put on the selected storage location, which is recorded.

Storage: in many cases raw materials and auxiliary materials cannot be processed directly and therefore require a certain storage period. The warehouse will have to guard the raw materials and the auxiliary materials "like a good house master" and should store it in such a manner that it will ensure immediate availability.

Stock keeping: The procurement department mainly determines the amount of stock, influenced by the order volumes and order intervals. Accounting or Management will also have a say in this matter, however. All stock represents quite a large portion of invested capital. And with capital being a scarce commodity, the accountants will see to it that stock levels do not get out of hand. The warehouse administration system will keep track of the stored volumes per item and their exact location.

Retrieval and Shipping: the Production department issues the orders according to their requirements. The warehouse will retrieve these goods from their storage location and if needed prepare them for shipment.

1.4.2 Production Logistics

The transformation of materials and services into end products is a very complex activity, which may comprise alteration, assembly or dismantling, repairing, servicing, installation and adjusting. Logistics is not primarily interested in the physical and technical transformation process itself, but more in the proper organisation of the related flows of goods through the transformation process. This concerns e.g. lay-out and routing, accurate supply of work stations, volumes of work in progress, intermediate stocks etc.
In a trade company, normally no storage of raw materials nor their transformation takes place. Still, many trade companies do have a certain type of "transformation" process going, which can be found at production companies as well, namely: packing and unpacking; even some final assembly. This kind of activities is called Value Added Logistics. It is not surprising to find, therefore, that most trade companies are familiar with production problems as well.

1.4.3 Physical Distribution Logistics

A function that is significant for the logistic service provider in general and for the forwarder specifically is the dispatch and (physical) distribution of the end products.
Physical distribution includes decisions on centralisation or decentralisation of inventories in warehouses and distribution centres, as well as the selection / combination of transport modalities.

A Storage of End Products

In both production and trade companies differences might exist between the moment of end product availability and the moment of delivery to the client, resulting into storage. It is the responsibility of the warehouse management to store the end products and to facilitate their rapid dispatch. In the warehouse of a trade company, the receiving of the end products will be supervised by Procurement; dispatch is part of Sales' responsibilities. Dispatch usually starts with an order that is issued to the Warehouse, indicating the type and amount of end products that are required by the client, as well as the expected time of delivery.
On determination of the stock level of end products, both accounting and the needs of the clients should be considered.

B Distribution and Transport

Most of the time the supplying company will plan the dispatch and distribution process itself, whilst being aware of the fact that all risks involved will be on its own head. In this respect the professional carrier of the goods may contribute

significantly to the quality of the supplier's customer service. Well organised distribution and transport may also add substantially to the value of a product to the receiver, while avoiding delays, damages etc.
The operational management of dispatch and distribution is organised by the distribution department; or the "shipping-department".
Physical distribution includes transport, which includes all the activities involved with the planning and information processing, loading, carrying, discharging, receiving, inspection, required to move any goods to another company.

1.4.4 Reverse Logistics

Reverse logistics organises the return flow of supplied items (or parts thereof) which need to be returned for the following reasons: packing, packaging, superfluous stock, or articles without a money-back guarantee, etc.
Advanced Reverse Logistics already starts at the design stage of the product, determining how the product, after having terminated its life cycle, will be returned, disassembled, recycled etc., in order to reduce waste and to protect the environment.

1.5 Logistics Trade- Offs

1.5.1 Introduction

In chapter 1.1 it was concluded that the main objective of both Logistics and Supply Chain Management is *"to meet customers' requirements"*. Customers require good service and at the same time acceptable costs.

Focusing on service (*"Agile Logistics"*) means: being flexible and adaptive to improve customer satisfaction.

Focusing on costs (*"Lean Logistics"*) means: working at the lowest total costs and minimum tied up capital.

The logistics challenge is to combine both aims, to provide logistics service (value) fast and first time right, at acceptable costs. Good service and acceptable costs are in many cases conflicting interests. As a consequence frequently trade- offs must be made to determine the optimal solution between service and costs. In the following paragraphs some examples are given of service elements, costs elements and trade-offs between them.

1.5.2 Service Elements

In general, logistics service means supplying of the right products, at the right place, at the right time, in the right amount and of the right quality.
Service has become an increasingly important point of attention in logistics.

"Rule 1: The Customer is always right."

"Rule 2: If the Customer is wrong, refer to Rule 1." (Wall Mart)

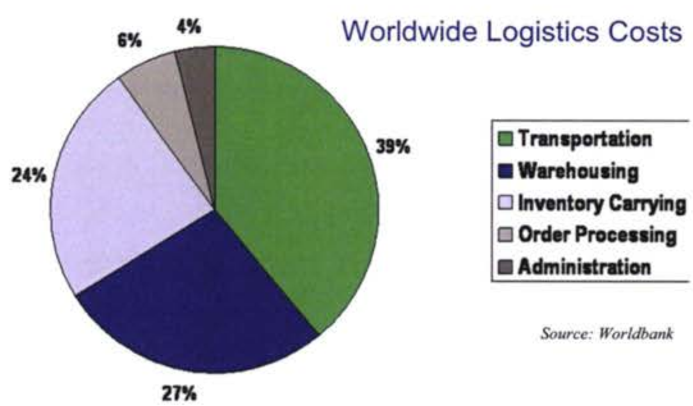
The following service elements related to logistics are important:
- Accessibility: it should be easy for the client to get access to his supplier for ordering and communication;

- Availability: the goods and services needed by the customer should be available to the customer at the moment he requires them;
- Order cycle time: this is the time elapsed between ordering and delivery, which time should be as short as possible;
- Quality: preferably there should be no difference between the agreed versus the delivered product quality;
- Reliability: this is the agreed versus the really supplied performance, in terms of speed and lead times, completeness of shipments without damages etc.
- When a supplier employs a logistics service provider to carry the products to the client, the supplier will have to depend largely on the customer service of the provider to provide the same measure of supplier reliability to its clients.
- On the other hand, when a client requests a short lead time, this usually is an indication that the client has trouble managing his own logistic system. For example, the client may experience problems with the forecasting of product demand, there may be agreement differences between departments, or there may be an unforeseen shortage in materials, auxiliary materials, products or services. There are many reasons why a logistic system doesn't function as it should. From experience we know that a short lead time can be a very important aspect for competition.
- Payment: invoices should match and specify only services which have been provided; payment conditions should be acceptable;
- After service: everybody makes mistakes and man thing can go wrong, but at least the supplier can provide sufficient supply of spare parts, proper warranty and procedures to settle claims.

1.5.3 Costs Elements

The following figure shows that approx. 50% of the worldwide logistics costs are related to inventory and warehousing, and also approx 50% related to transport and administration.

Figure 1.6 Worldwide Logistics Costs



Source: people.hostra.edu

- Transportation costs depend on the selection / combination of transport modalities, distances, transport volumes, the efficiency of transport planning etc. The distribution costs are also influenced by depot location, economies of scale resulting from centralization / decentralization of inventories; transport and handling;

- Warehousing costs are influenced by the applied warehouse systems, equipment and process efficiency. Centralisation of inventories in large distribution centres can lead to economies of scale, as larger warehouses generally operate more efficiently than small warehouses.
- Inventory costs are related to the inventory volumes, the value of the goods and interest rates, determining the related capital costs;
- Order processing costs are the total of administrative order processing, warehouse handling, packing and transport of the ordered goods;
- Administration costs: are influenced by the rate of automation, use of ICT systems, EDI etc.

1.5.4 Examples of Logistics Trade- Offs

Below some examples of logistics trade- offs are given. In many cases the right trade- off can only be determined after an in-depth analysis, involving extensive calculations and after evaluating various scenarios.

A Transport Speed and Transport Costs

Air transport is significantly faster than sea transport. However, air transport costs are relatively higher than sea transport costs, mainly due to fuel consumption. At the same time, the higher speed of air transport reduces the pipeline costs during transport (which are interest costs over the value of the goods during the transportation time).

As a consequence, air transport is selected for smaller, urgent shipments of higher value commodities (electronics, spare parts, flowers etc.), while sea transport is selected for larger, less urgent shipments of lower value goods (raw materials in bulk etc.).

B Availability of Goods and Inventory Costs

This is a major issue in logistics. Everybody wants to have inventory, because it guarantees that the customer orders can be satisfied directly. On the other hand, nobody wants to hold inventory, because of the related storage costs, inventory costs (the interest over tied-up capital) and the risks on lost product quality during storage or dead stocks which nobody wants to buy anymore.

Inventory levels should only be minimised when at the same time the reliability of distribution lead times is increased. Many concepts in logistics and supply chain management try to achieve this: just in time, cross docking, vendor managed inventory, etc. These concepts are discussed in chapter 2.

C Delivery Speed and Warehouse- / Distribution Costs

Imagine a company selling goods throughout Europe. From a service point of view it is attractive for this company to have a large number of decentralised warehouses close to the customers: in that case the delivery distances are short, final delivery can be executed fast, delivery errors can be corrected quickly etc. However, from a costs point of view, one centralised distribution centre is more attractive: economies of scale lead to lower total costs for centralised inventory, warehousing, inbound transport and final distribution.

D The Economic Order Quantity

This is a trade-off between different costs elements. On one hand it is attractive to order frequently in small quantities, since this reduces inventory levels, inventory costs and storage costs. On the other hand it is attractive to order less frequently in larger quantities, since this may reduce the order costs both at the ordering company and the supplier (less administration, maybe warehouse handling of pallets instead of cartons, maybe transport of full containers instead of groupage, etc.). The optimal economic order quantity for a specific item can be calculated using the Camp formula, if certain data on the mentioned costs factors is available (re. figure 1.6). Professional logistics software (ERP) includes such calculations for each item in store.

Figure 1.7 EOQ formula of Camp

$$Q = \sqrt{\frac{2\,D\,S}{C\,I}}$$

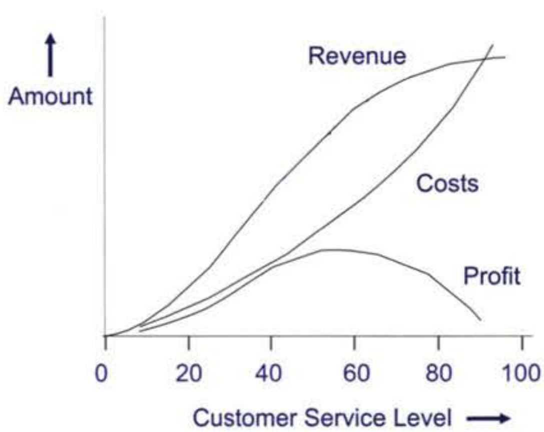
Q = economic order quantity (units / order)
D = annual demand (units / year)
S = supply costs per order ($ / order)
C = purchase value per unit ($ / unit)
I = carrying cost in % of C (% / year)

1.5.5 Service Level, Costs and Profitability

The following graph shows that it does not make sense for a company to increase its service level to a maximum, because of the costs consequences. When the service level is low, already a slight service improvement can lead to relatively large increases in customer satisfaction, sales revenues and profit. However, when the service level is already high and the customers are already satisfied, additional efforts for further service improvements will add up costs but will hardly increase revenues; as a consequence the profit will drop.

Companies should increase the customer level up to the point where profit is maximized ,as is indicated in figure 1.7.

Figure 1.7 Optimal Service Level



1.5.6 Service Level Agreements and Performance Indicators

In order to manage the service level of a logistics services provider in an outsourcing situation, service level agreements are established. These are contracts between the shipper (principal) and his logistics services provider. A service level agreement will describe e.g.:

- A definition of the services (activities) to be provided and a description of the related processes, information etc.
- The agreed service level for each activity (and allowed deviation range from the standard)
- Actions to measure and report the performed service levels
- Actions to maintain the service level, corrections, penalties etc.

To manage the agreed and the real service levels, a continuous cycle is executed of planning, performance, measurement, analysis, adjustment (if needed).
The actual performance is measured, results are compared with predetermined performance standards, and if needed actions are taken to adjust the related processes in order to achieve the agreed standard results (service levels). This requires quantifiable standard performances, which are called performance indicators.
Examples of performance indicators in logistics:

- 97% of all orders delivered complete at the right address within 24 hours.
- 90% of incoming shipments stored at the day of receipt.
- 95% of all complaints settled within 3 days.

The administrative system should be set-up in such a way that all required data could be sampled, analysed and reported with a minimum of manual involvement.

2 Supply Chain Management Concepts

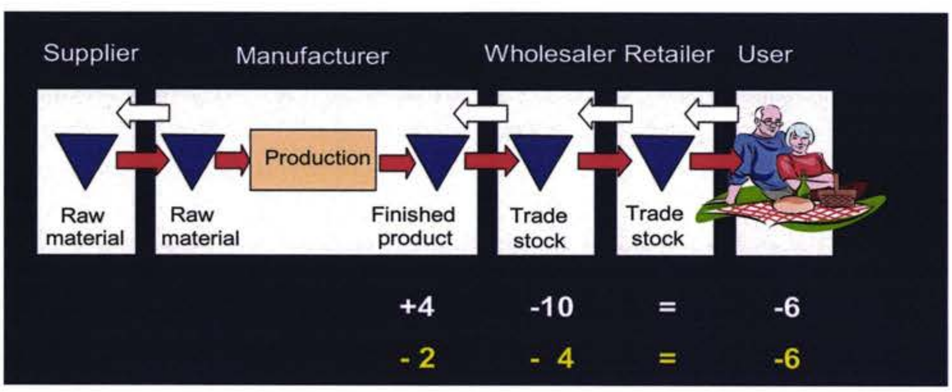
Learning Objectives for Lecture 2:

- The student should understand the characteristics, bottlenecks and the advantages of the main logistics- and supply chain management concepts.
- The student should understand the background, purpose and main characteristics of JIT.
- The student should understand the difference between planning- and order driven chains and the different positions of the Decoupling Point Model.
- The student should understand the process of cross docking and when it is applied.
- The student should understand the meaning of ECR, its advantages and in which business sectors it is applied.
- The student should understand the meaning of VMI, its advantages and in which business sectors it is applied.
- The student should understand the reasons for outsourcing and the arguments pro / contra outsourcing; the student should understand the different categories of logistics services providers, related to the level of outsourcing and to the services offered.
- The student should understand the main examples of value added logistics and the reasons why these activities are postponed by shippers to logistics services providers.

2.1 Introduction

As indicated in Chapter 1, Supply Chain management also includes *the collaboration between channel partners, which can be suppliers, intermediaries, third-party service providers, and customers.* This means voluntary collaboration between independent companies, which in practice is not always easy to realise, because of apparent conflicting interests. Re. figure 2.1 and the following explanation.

Figure 2.1 Example of conflicting interests



Explanation of the example: imagine a wholesaler who intends to implement bar-coding and expects a net reduction of -10 to his operational costs. He can only realise this when his supplier would invest in software, bar-coding printers etc., which increase the suppliers' operational costs with e.g. +4. This action would be advantageous for the chain as a whole because of a total costs saving of -6. However, the manufacturer will be reluctant to cooperate because his costs will increase.
In practice the concerned parties should negotiate to share the costs and benefits, e.g. by giving discounts etc. Sometimes a powerful party dominating the chain can simply force the other chain parties to implement such an innovation.

In the next chapters some major logistics- and supply chain concepts are discussed.

2.2 JIT - Just In Time

JIT as a management technique is much older than its title. It was Henry Ford I who repeatedly attempted to return stock levels to the minimum (especially the work in progress stock), in a number of ways. It was this attitude that empowered him to assemble and supply a motor car only 8 days after having received the order for it.
JIT is a *management philosophy*, first of all. *Management techniques* only take second place.
JIT as management philosophy is based on a number of principles, the most important of which are:

- All activities, investments costs, functions and administration that don't add to the value of a product, are regarded as waste.
- Stock keeping doesn't add to the value of a product, thus stock keeping is also waste.
- In order to prevent from stock keeping, the strive should be towards a production and order series of only *one* piece of material, one product, etc. at a time.
- In order to acquire a production and order series of one piece at a time, without product price increase, an attempt should be made to achieve machine adjustment and preparation times of *zero* seconds.
- By *standardising* production and distribution, as well as the products and materials, the machine adjustment and preparation times will be returned to normal and will not be reflected in the product's cost price.
- The operational employees should be involved in the company's entire policy, as far as possible.
- Improvements to the production and distribution process are made continuously by the operational employees and they have to develop and introduce these on their own (with the possibility of assistance in the future).
- The only measure of *quality* is that which is acknowledged by the client.

The management philosophy of Just In Time devotes its attention to many issues, e.g.:

- Reduced order quantities and production series;
- Minimising stock in the system;
- Initiating and maintaining a training schedule for operational employees;
- Developing team spirit between operation employees;
- Simplifying management to a level where mistakes will become almost non-existent.

The goal of the Just In Time-management, like Ford, is to prevent the manufacturing or the utilisation of material, semi- manufactured articles and end products of coming to a standstill (which would imply storage). A simple, but not less ingenious management method has been discovered to this end, namely *KANBAN*-management. Kanban is a Japanese word that literally means "card". This card can be used to guide the supply, production and distribution processes. This system didn't require any computers.

2.3 Make to Order, Make to Stock

2.3.1 Planning- and Order Driven Chains: the Decoupling Point Model

The decoupling point model was developed by Philips in The Netherlands, at the end of the seventies and the start of the eighties of the previous century. In order to gain more insight in the functioning of the goods flow, Philips was selected as the brand of choice.
In principle, this model starts at the presumption that there are two parts of a goods flow through an organisation, i.e. a goods flow that is managed according to a specific plan, followed by a goods flow driven by orders (customer- or internal orders).
Depending on the nature of the product, the production method, the desired cost price and client or consumer demands, the planning-driven goods flow phase may be shorter or longer, or it may be totally absent, or the whole process in the company may be planning-driven.
The decoupling point is where the planning- driven goods flow changes into the order- driven goods flow. Consequently, five different decoupling point positions are distinguished.

To manage a goods flow, a clear distinction should initially be made between a plan-driven and an order-driven goods flow.

An **order-driven goods** flow occurs when the issue of an order puts the whole process in motion. It may be an order from a client or an internal order. The ordered goods are actually "pulled" through the chain by the entity that submitted the order. An order-driven goods flow has advantages and disadvantages.
The most important advantage is that the requested goods can only be delivered to one location at a time, should this become strictly necessary. No stock needs to be kept at the receiver.
Stock keeping at the receiver will only be required as a direct result of the quantity that was ordered. This quantity depends largely on the way of transport. It may not be practical to request a courier to do daily deliveries to a specific address when weekly shipments with a cargo truck may prove to be less costly.

However, when these considerations are taken, one should keep in mind that stock keeping incurred by weekly deliveries may lead to costs that have the potential to rise above those of daily deliveries.
Another important advantage of the order-driven goods flow is that it enables the company to react directly on a customer's order. Delays, due to the fact that the order was not part of the plan, will not occur as often as it does with plan-driven goods flows.

One disadvantage of the order-driven goods flow that should not be overlooked is the relative unpredictability of the daily inflow of goods. Fluctuations in the flow may crop up. The system should have the necessary capacity to accommodate this situation. This capacity should be such that it will be able to cope with situations where the goods flow might expand to the maximum (required) quantity.
As a result, the warehouse will run out of stock when the goods inflow is smaller, which implies that the capacity will not be utilised to its optimum. Consequently production, storing and transport facilities, as well as all other, related facilities that are required to manage these activities, are never fully utilised.

The most important characteristic of a **plan-driven goods flow** is that the activities do not depend on individual orders, but that they are planned based on a forecast. All the activities are directed and performed according to this plan. The manufacturer will produce and push the goods through the chain, subsequently.

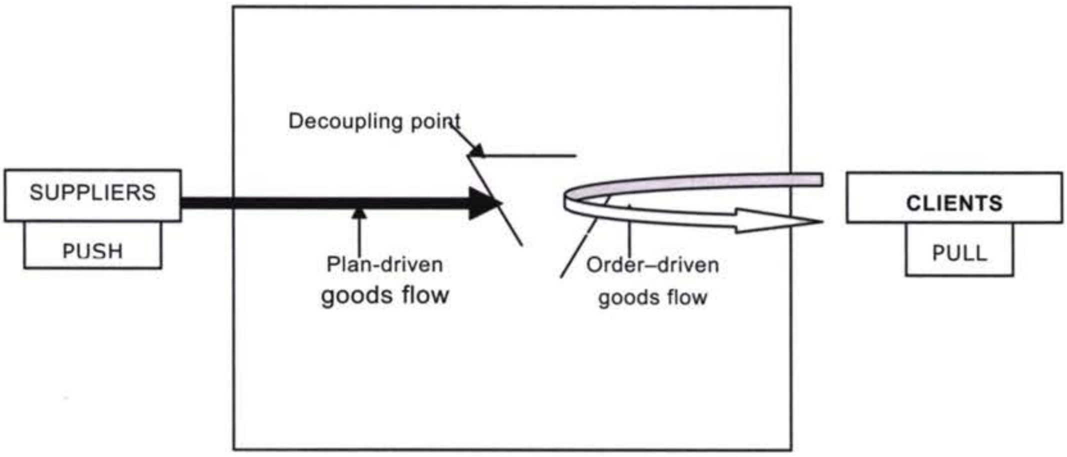
An important advantage of a plan-driven goods flow is that, if a relatively accurate demand forecast can be made, it will allow the growing nature and quantity of the goods flow to be met adequately and efficiently on the short and even medium term and that the system's capacity can be adjusted accordingly.
Through effective management of the goods flow in the medium term, real fluctuations concerning demand may be limited by spreading the consequences that fluctuations have on demand (increasing and decreasing of the average demand) over a longer period of time. Seeing that very few fluctuations will occur in the nature and quantity of the plan-driven goods flow during this type of management, the capacity of the system will still, except for a controllable safety margin, be utilised fully.

One disadvantage of the plan-driven goods flow is that the possibility of sudden increases in the goods flow, except for those already forecasted cannot be taken into consideration. It doesn't have adequate capacity to its disposal, because it wasn't planned. The nature of the goods flow (for example end product type) has also been determined beforehand. It is obvious that there is very little flexibility present in this system.

In practice, both the aforementioned management styles should form part of all supply chains. Presumptions are made that supply logistics is plan-driven. This opinion will ensure that the capacity required for the acquisition of raw and auxiliary materials, as well as the production of end products, be utilised fully.

With distribution logistics the goods flow is mainly order-driven. Quite a lot of effort is exerted to ensure that the flow of end products to the consumer stay dependent on the consumer's needs. From a commercial point of view, it is even essential. There may, however, be other divisions where larger or smaller portions of the goods flow may be plan- or order- driven. These divisions in the plan- or the order-driven goods flow, which occur inside the boundaries of a supply chain, are known as 'decoupling point positions.

Figure 2.2 Order Decoupling Point



Splitting the chain into a plan-driven (PUSH) and an order-driven (PULL) goods flow.

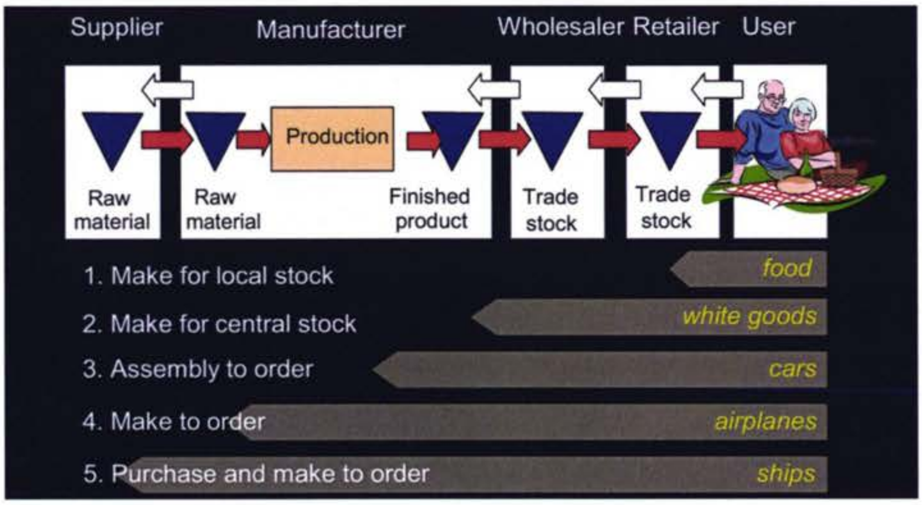
2.3.2 Location of the Decoupling Point

Eventually it will become clear that a direct connection between a plan-driven goods flow and an order-driven goods flow will only be possible once the nature, the quantity and the frequency of both goods flows have been synchronised. If not, differences may lead to shortages in the order-driven goods flow (when the actual demand exceeds the actual capacity of the plan-driven goods flow), or to an accumulation of materials or products (when the actual demand is less than the actual "planned" capacity). In order to contest these effects, a buffer will appear almost spontaneously (in cases where the planned production exceeds the demand), or a buffer will be created intentionally (in cases where the capacity may not comply with the actual demand) between the two goods flows.
Within this buffer, a regular inflow and an irregular outflow of the end product will occur. For the duration of this model's description, this buffer will be called the decoupling point (abbreviated as: D.P.). As a rule, no stock in the company will be found downstream from this the decoupling point model is an important model, mainly for the following reasons:

- the D.P. will indicate the point in the supply chain where the management method is modified (from plan-driven to order-driven);
- the D.P. usually forms part of the final (and mostly the largest) supply point in the supply chain; the area from which clients / customers are serviced;
- the creation of stock in the D.P. allows a certain kind of freedom which lets upstream activities occur independently from the downstream activities;
- the D.P. will indicate the area where an order should be submitted;
- the D.P. divides the supply chain into two subsystems, where decision-making and management styles usually differ largely. While capacity occupation is dominant upstream, customer / client service is dominant downstream;
- the D.P. indicates the point where the client's order or the internal order penetrates the supply chain.

From the abovementioned it is clear that the buffer stock (decoupling point) does not necessarily imply that it consists of end products. The decoupling point can also be implemented in totally different areas. The area totally depends on the nature of the product, the market and the company.
There are five possible positions for a decoupling point:

Figure 2.3 Decoupling Point Positions



Which of the 5 positions will be selected mainly depends on:

- the value of the goods and related costs and risks of keeping inventories;
- the predictability of the customer demand.

For higher value goods with a more unique design and / or a less predictable demand the decoupling point will move upstream (from 1 to 5).

2.4 Cross Docking

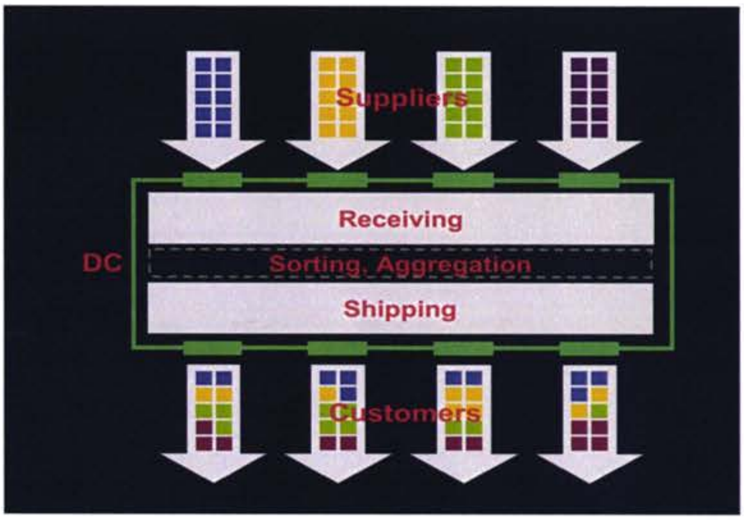
Storage is one of the main activities of warehouses of distribution centres. The main reason for keeping stock is to have the goods available when customer orders are received. However, if this order information already would be available when the goods arrive at the distribution centre, then the inbound goods could be moved directly into the distribution process (almost) without intermediate storage.
The advantage of this would be the reduction of storage costs and -risks.

All other useful functions of the distribution centre could remain unchanged, such as:

- Receiving the goods in large quantities, maybe full truck loads;
- Breakdown of inbound shipments and inbound loading units into smaller units, while sorting the goods over a large number of outbound customers;
- Mixing of various inbound goods into outbound customer shipments;
- Change the transport modality inbound / outbound.

These functions are illustrated in figure 2.4

Figure 2.4 Cross Docking



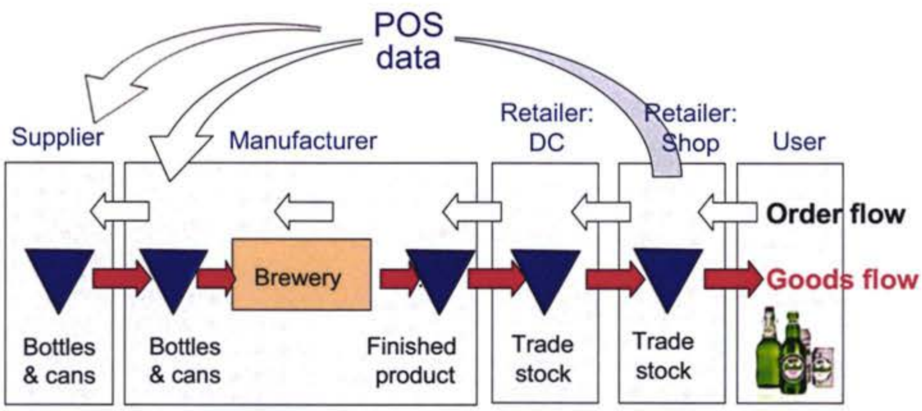
This process where inbound goods are unloaded from an incoming semi-trailer truck or rail wagon, are sorted, consolidated and are loaded into outbound trailers or rail wagons, with little or no storage in between, is called Cross Docking.
Some short storage (some hours) can occur until the outbound shipments are completed and ready to ship.

Cross docking is now widely implemented in retail distribution. The US retail organisation Wal Mart distributes over 80% of its commodities by a cross docking system, reducing its sales costs by 2-3%.
Communication is vital for successful cross docking. The customer demand is transferred to the supplier as soon as possible, in many cases by sending the point of sale (POS) data directly to the vendors.

2.5 ECR - Efficient Consumer Response

Efficient Consumer Response (ECR) is a SCM initiative where various parties in the grocery sector, dealing with fast moving consumer goods, collaborate on the management of demand and supply. Objective is to make this chain more responsive to consumer demand and to reduce costs in this supply chain. Below one example is given concerning ECR- measures on the demand and supply for beer.
This supply chain is shown in figure 2.5:

Figure 2.5 Efficient Consumer Response



Traditionally the demand and supply for e.g. beer is phased, as follows:

- Consumers buy beer at the retailer;
- When the retailers' inventory is exhausted, the retailer will order re-supplies from the Distribution Centre (DC);
- When the DC's inventory is exhausted, the DC will order re-supplies from the brewery;
- When the inventory of finished products ate the brewery is exhausted, new production runs will be requested etc. etc.

This traditional phased approach is rather slow and inflexible, since each supply action has a certain lead time (for order processing, warehouse operations, transport). Distribution can be made faster and more flexible, when supply chain management principles are applied and chain parties make use of modern ICT tools. In this case a number of links in the chain are shortcut, transferring real time POS- data (Point of Sale data, which is the data from the cash register in the supermarket). In this case, POS data is continuously transferred directly from the supermarket to the warehouse of the brewery. The brewery can anticipate on the exhaustion of the retailer's inventory and supply directly to the supermarket, if necessary shortcutting the DC.

More information on ECR initiatives can be found at the website of the ECR Europe organisation: www.ecrnet.org.

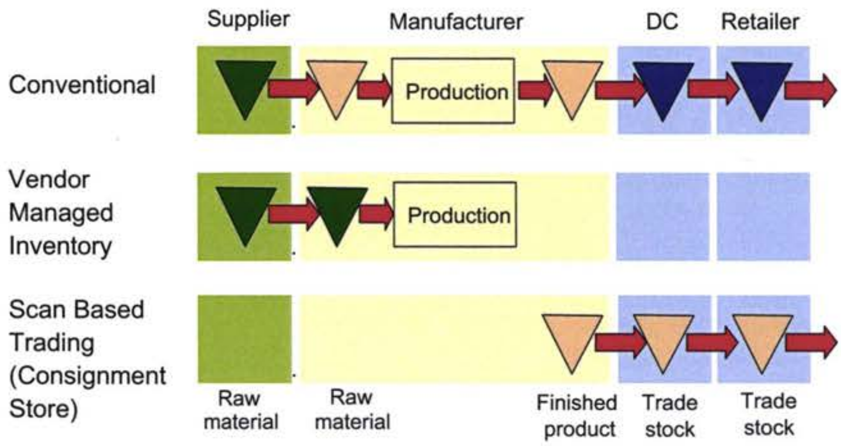
2.6 VMI - Vendor Managed Inventory

In a conventional supply chain, each chain party is responsible for its own inventories and for the re-ordering of new supplies when needed. In the following figure (under Conventional) this is arranged as follows:

- the Supplier manages his inventory of raw materials;
- the Manufacturer manages his inventory of raw materials and re-orders supplies from the Supplier when needed;
- the Manufacturer manages also his inventory of finished products;
- the DC manages its inventory and re-orders supplies from the Manufacturer when needed.

This conventional approach is illustrated in figure 2.5 under "Conventional".

Figure 2.5 Vendor Managed Inventory



Vendor Managed Inventory means, that the Supplier takes over the responsibility for an agreed inventory level and for the timely re-supply of his client (in this case the inventory of raw materials). The Supplier is not waiting for orders from the Manufacturer but uses real time information from the Manufacturer to decide on re-supply when this is most efficient for the Supplier to do so. Sometimes a third party logistics provider is involved to manage this required inventory level and the moments of re-supply.

This approach relaxes supplies not only from the viewpoint of the client, but also from the viewpoint of the supplier ("do not supply when you must but when you can"). The supplier can anticipate better to his client's demand and as a result transports can be planned more efficiently and inventories can be reduced.

Scan Based Trading (SBT, also called Consignment Store) is a variant of VMI, dealing with finished products which are supplied from manufacturers to retail organisations. When using SBT, the supplier takes over the responsibility for an agreed inventory level in a supermarket and for the timely re-supply of these products.
In this case, the products supplied to the retailer are maybe still owned by the supplier until the moment of sales to the consumer. The retailer then provides only housing and staff to sell the products and is compensated by a commission. Wal-Mart is one of the organisations applying this model.

2.7 Outsourcing of Logistics: from 1PL to 4PL

2.7.1 Reasons for Outsourcing

"Outsourcing" originates from "Outsider Resource Using" and describes the transition from using own resources (e.g. own lorries, own warehouses of a production company) towards the contracting of services from outside providers (e.g. forwarders, common carriers, warehouse operators).
The last years have shown that companies have increasingly started to outsource many of their activities. Many companies are starting to focus on their core activities. This means that a few specific logistic duties will be outsourced as well. This is not limited to transport only, but can extend to such a degree that even a portion of the

production activities will be outsourced. However, the decision to outsource is not an easy one to make for the shipper.

During acquisition, the logistic service provider, including the professional freight carrier, should be acutely aware of the shippers' reservations regarding the outsourcing of distribution services. In most cases, tariffs are the most important consideration for shippers. The ability to provide additional services to the shipper might become a valid argument when a professional carrier, who provides these services as a rule, is considered.
When the shipper cannot decide whether to outsource or not, there are a few considerations that might assist him with the decision. These considerations are:

Costs
In many cases, the scale on which the distribution department of a shippers' company is operated is not sufficient to compete with the prices of a professional tender of logistic services. To the shipper these considerations are simply a matter of comparing calculations. The shipper will, of course, have to take all costs in connection with logistic service providing into account. With many shippers this insight is still lacking. On outsourcing, the costs of the shipper become more variable, since he does not have to bear the fixed costs of own assets. On outsourcing, his costs also become more explicit: under own management many costs are indirect and cannot easily be isolated from the administration; but on outsourcing the provider simply sends invoices.

Available Capacity
To implement logistic activities, a considerable amount of investment is sometimes required which ties up capital. The shipper may simply not have enough capital to his disposal, or may be unable to raise enough money to invest in a logistic system. Under these circumstances a shipper will be obliged to outsource some of the logistical activities. Once again, a calculated assumption lies fundamental.

Quality
The quality of logistic activities may present more problems to the shipper than a double-edged sword. Due to the fact that the shipper has no specialised knowledge about logistic activities, he can hardly compete with the level of quality as offered by the professional logistic service provider. On the other hand, the shipper might feel that the logistic service provider doesn't share his ideas about quality. This uncertainty will cause the shipper to be on his guard when it comes to the outsourcing of logistic activities. In this case the consideration has a more emotional than a calculated character.

Available Knowledge
When a shipper has to make a choice, a very important aspect will surely be the amount of available knowledge in the field of distribution. Many companies feel that the distribution of products is not part of their core activities. For this reason, inadequate or no attempts are made to acquire the knowledge needed. In countries with tense labour markets it might even become fairly expensive to attract these knowledge sources.
In this case all activities that the company has decided not to commit to, will be outsourced. The tendency to outsource, due to a lack of knowledge, is increasing.

Manageability
Apart from the influence it has on the nature of the target market and the product, the lack of knowledge has an additional, rather damaging consequence; i.e. the manageability of distribution. Distribution can become so complex that specialised knowledge will be required to manage it. When this happens, shippers tend to outsource distribution as well.

Risk
Greater complexity leads to more risks, which the shipper is not prepared to take. If the shipper wants to avoid the threat of risk, he/she will do so by outsourcing the high-risk activities of distribution.

Available Capacity
In order to perform distribution not only knowledge is needed, but transport capacity as well. There are various companies that have their own freight trucks (combinations) or semi-trailers and/or tractors. Similar companies on the other hand, want to be assured that their vehicles are employed to the best of their abilities. When the amount of products to be distributed varies constantly, this will lead to situations where the transport capacity will be inadequate some of the time and superfluous at other times. Carriers who do their own transport will prefer to keep their own transport capacity down to the minimum and rather rent the additional, but temporary capacity that may be required. The same goes for storage capacity.

Secrecy
A commercially operating company will try to keep its customer database secret from its competition. Once the competition finds out that similar companies are not totally convinced of their customer database's protection, they will want to perform the distribution themselves. A matter that should be of the utmost importance for the logistic service provider is to guarantee total secrecy for shippers.

Identity
The trade or the brand names of companies should be displayed to the public as often as possible. When vehicles are employed to display these trade and/or brand names, people regard them as mobile advertising-pillars. Additionally, existing clients usually experience a vehicle bearing the trade name as a source of positive contact with the supplier. These considerations may motivate the company to acquire its own fleet of vehicles, instead of employing those of professional carriers. If cooperation between professional carriers and the shipper occurs really intensively, an agreement may be reached which will allow the trade name of the shipper to appear on the vehicles.

Service
The ability to offer additional services to the client is the third reason why shippers prefer to control its own distribution activities. These services may vary from tracking and tracing (i.e. following the progress of shipments during distribution), to the employment of co-workers in the warehouse, and a driver at receiving who will deal with complaints some of the time, as well as other, more commercial, activities.
A logistic service provider could provide a similar service. In order to accomplish this however, a good relationship should exist between the shipper and the logistic service provider.

The diagram below summarises the arguments pro and contra outsourcing:

Outsourcing of Logistic Services	**Pro**	**Contra**
Economics	Reduced costs Pay what you use Less tied up capital Increased cash flow	More communication More administration
Management	Focus on core business No staff or assets Costs more explicit	Labour redundancy Confidentiality Less customer contract Loss of know how
Operations	More flexibility Access to innovation	Specific experience Damage risk Less direct control on quality

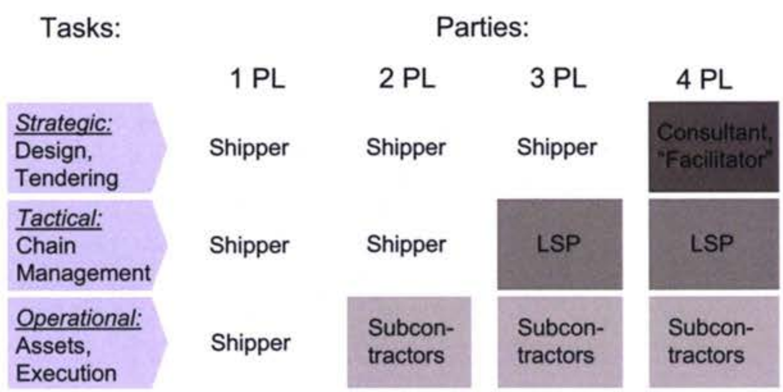
2.7.2 Level of Outsourcing

Concerning logistics services decision levels can be distinguished:

- Strategic: long-term impact; logistics system design, tendering decisions etc.
- Tactical: mid term impact, deciding on ICt systems, warehouse systems etc.
- Operational: day-to-day decisions on transport planning etc., also including the question: who employs the staff and owns the assets?

Depending on who is responsible for each decision level (the shipper or the logistics service provider) four situations can be distinguished: from 1PL to 4PL, as is illustrated in figure 2.6:

Figure 2.6 Outsourcing Options



1PL - First Party Logistics:
There is no outsourcing and therefore only one party responsible for all decisions, who is also employing the staff and owning the assets: the shipper.

2PL - Second Party Logistics:
The shipper (the first party) only out sources some operational tasks to a specialised subcontractor (the second party): maybe customs clearance, transport etc. All strategic and tactical decisions are still the responsibility of the shipper.

3PL - Third Party Logistics:
Logistics service providers (LSP) have become larger and more professional, offering a wide range of logistics services, including warehousing etc. In this case the shipper also out sources the tactical decisions to the provider. The shipper (the first party) only keeps the responsibility for the strategic tasks such as network design and tendering, since these tasks come close to his commercial strategy. The LSP (the second party) may outsource certain operational tasks, such as specialised transport, to a subcontractor (the third party).

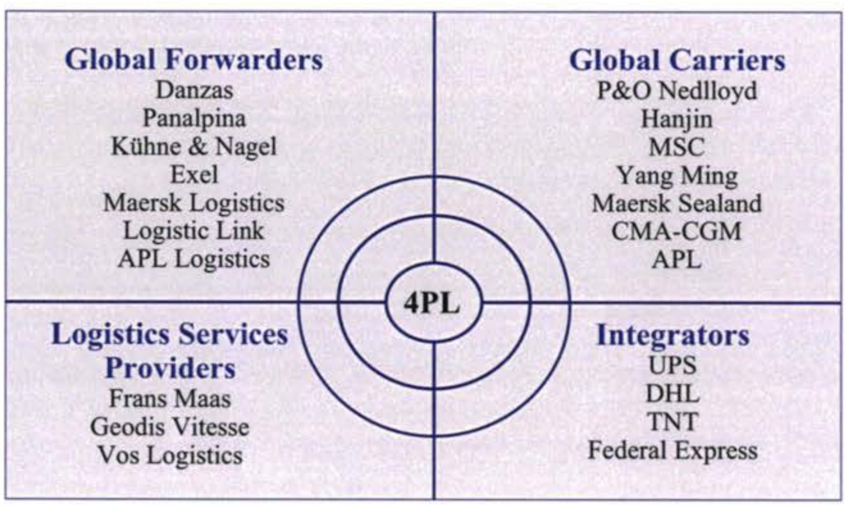
4PL - Fourth Party Logistics:
This is still a rather new concept and subject to many discussions.
All activities are outsourced; a "facilitator" provides strategic solutions to the shipper and contracts one or more 3PL providers.

The facilitator does not necessarily own logistics assets; he could be a consultant, having comprehensive knowledge of the transport market and appropriate computerised analysing tools. He could contract the 3PL parties at his own risk or at the risk of the shipper.
Following considerations to this 4PL option could be made:
- Advantage: he would be an independent party, capable of offering a mix of services which would be most optimal for his client (where 3PL companies are always suspected to offer solutions which merely optimise the utilisation of their own assets).
- Disadvantage: without having assets it would be more difficult for the 4PL® party to manage operations and to control performance and service levels.

2.7.3 Range of Services

Another distinction concerning outsourcing can be made according to the services offered.
Some examples are mentioned in figure 2.7.

Figure 2.7 Outsourcing Parties



- Forwarders: offering world-wide logistics solutions, integrate different means of transport.
- Carriers: road hauliers, rail operators, shipping lines, airlines, warehouse operators.
- Logistics service providers: offering comprehensive logistic solutions, frequently specialized on a certain branch or customer, including transport, warehousing, VAL etc.
- Integrators or system providers: focusing on world wide parcel distribution, applying different transport modalities (air, road etc.), very standardized services.

2.8 VAL = Value Added Logistics, Postponed Manufacturing

Value Added Logistics (VAL) is a relatively new concept for logisticians. Many companies - especially in America - have been introduced to the basic principle behind the concept already some time ago.
VAL can be defined as performing manufacturing operations in the distribution stage based on customer orders, aiming at making products client- or country specific.
The final processing phase in the entire production process is shifted from a production unit to a later stage, i.e. an international distribution centre.
At the same time, the decoupling point of orders in the supply chain is often pushed upstream.

A VAL-unit can transform a product's form, function and location in an effort to supply it according to production, logistical and service-technical specifications.
VAL is basically possible in all production processes that entail compounded products with limited finishing operations. The mass production of soap powder or butter by Unilever will, however, not be considered.

The most important reasons for the existence of VAL are locked up in the demands that are increasing in the field of service providing, as well as the maintenance of excellent relations with the competition, which are all aiming for more rapid supply of client-specific products in the end. To put it another way, VAL is offering opportunities to improve effectiveness/productivity, which can be beneficial to all parties. Low amounts of stock on hand, low distribution costs or economies of scale in production and service providing are a few examples of what can be achieved when productivity/effectiveness is improved.

Three basic forms of VAL can be distinguished roughly:

A Value Added Shipment:
Value Added Shipment is the basic service that companies in the actual distribution branch are offering. To that, other, more advanced services are added. Examples: re- packing and packaging, labelling, re-conditioning, assembling displays or kits with several products, controlling etc.

B Value Added Servicing:
Technical quality control, sampling, testing, activities related to customer service.

C Value Added Transformation:

End- assembly and configuration from separate units, repair of returned goods; examples:

- final assembly of components to motor cycles in order to reduce transport volumes,
- insertion of manuals and electrical cords only after order receipt, in order make the goods customer- / country- specific at the latest moment, in order to reduce inventories.

Apart from the more obvious VAL-services like warehousing (packaging, module building, total distribution, etc.) - that are actually more suited to the area of transport companies and logistic service providers - training, empowering chain management, financing, technical support advice en telecom-services are examples of activities that may add value to a product or a service.

Important factors for successful VAL implementation are:

- In the development of VAL, both the shipper and the service provider should think pro-actively and should focus on improving the entire supply chain. Sub-optimisation should be prevented;
- The advantages of VAL should be proved for the shipper. These advantages will mainly comprise lower stock volumes in the chain, cope with fluctuations, shortened lead times, enhanced customer service, acceleration of information exchange and financial settlement, etc.
- For many tenderers VAL implies an investment in areas like marketing, production processes, logistical processes and also information technology, contracts, cooperation agreements, etc.
- Trust should develop from both sides. From a birds eye view, processes can be implemented step by step; for various specialisms cooperation agreements can be composed to encourage joint investments and to eliminate the lack of knowledge at some tenderers.

Time is needed to organise service providing. It will yield a win-win situation to both shipper and logistical service provider on the medium to long term. The importance of the time issue should be clearly tangible between parties during negotiations and they should be prepared to commit themselves and to risk investment.

3 Water Transport Modalities

Learning Objectives for Lecture 3:

- The student should understand the main features of liner shipping and tramp shipping, and the shipments that are carried by these services.
- The student should be aware of the major sea ports in the world and the main types of loading and unloading, and other facilities at the ports.
- The student should also understand what feeder service means.
- The student should be aware of the general features of conventional vessels, container vessels, Ro-Ro vessel, and understand the types of goods that are usually carried by these ships.
- The student should have knowledge of the European network of navigable
- waterways, inland ports and obstacles such as locks.
- The student should know the main types and classes of barges applied in inland water transport.
- The student should know the characteristics of short-sea and river-sea shipping.

3.1 Deep Sea Transport

3.1.1 Shipping Services

The ocean traffic across the world seas can be split into two types: liner shipping and tramp shipping. In the first mode, ships operate regular services between ports at predetermined intervals. Cargo owners book space on these routes to transport cargo from A to B. In the second mode the ships travel anywhere the cargo wants them to go. The cargo owners hire ('charters') the ships to travel from port A to B.

Figure 3.1 displays the characteristics of the two traffic types.

Figure 3.1 Comparison Liner vs Tramp Shipping

Liner Shipping	**Tramp Shipping (Chartering)**
• Regular service • Fixed routes • Fixed time schedules	• Incidental service • Cargo determines where the ship goes • Charter types: Bareboat, time voyage, slot.
• General cargo, containers	• Special cargo, bulk
• Independent lines, conferences, consortia	• Ship-owners, charterers shipbrokers
• Agents book capacity	

Source: STC-Group

You can compare the difference between liner shipping and tramp shipping with the difference between a tram and a taxi. The tram driver knows well ahead of time when he will be at which stop. He can almost give a minute-by-minute account of where he will be at any given time of the day. He maintains a scheduled service and the tram, the mode of transport, determines the route and time. A taxi driver, on the other hand, has no idea where he will be next. He goes to the passenger (the cargo), wherever the passenger may be. In other words: the passenger/cargo determines the route and time.

Figure 3.2 Liner and Tramp Vessels

Liner Ship

Tramp Ship

3.1.2 Liner Shipping

In liner shipping the ship owner, either carrier or operator, runs a regular service between more or less fixed ports and usually on a fixed time schedule. Only by exception (emergencies) do scheduled ships deviate from this schedule. The liner operator acts as a common carrier, accepting all general cargo shipped between the ports covered by his service.

Liner traffic is a firmly controlled activity where remuneration is geared more to the long term rather than to single voyages. The freight rates in the tariff are by definition not subject to the large variations that characterize the market in tramp shipping. Nevertheless, liner traffic is susceptible to market variations, depending on availability of cargo and load factors on each voyage.

Liner vessels get the larger share of their cargo through contracted liner agents. Forwarding agents and liner agents play an important role in creating the contract of carriage between the ship owner and the cargo owner.

Liner Shipments

General cargo has always been carried in the liner trade. Since the introduction of the container, however, more and more general cargo is shipped in containers. Since the early era of containerization, the market has seen a sharp drop of conventional shipments, and instead, a continuous increase in container shipments.

Consequently the conventional general cargo vessels are more and more frequently replaced by specially equipped container vessels. Despite the fact that containers prevail over liner shipping, the containerization did not completely knock out the conventional liners. Instead, they developed pure container trades parallel to conventional liner traffic.

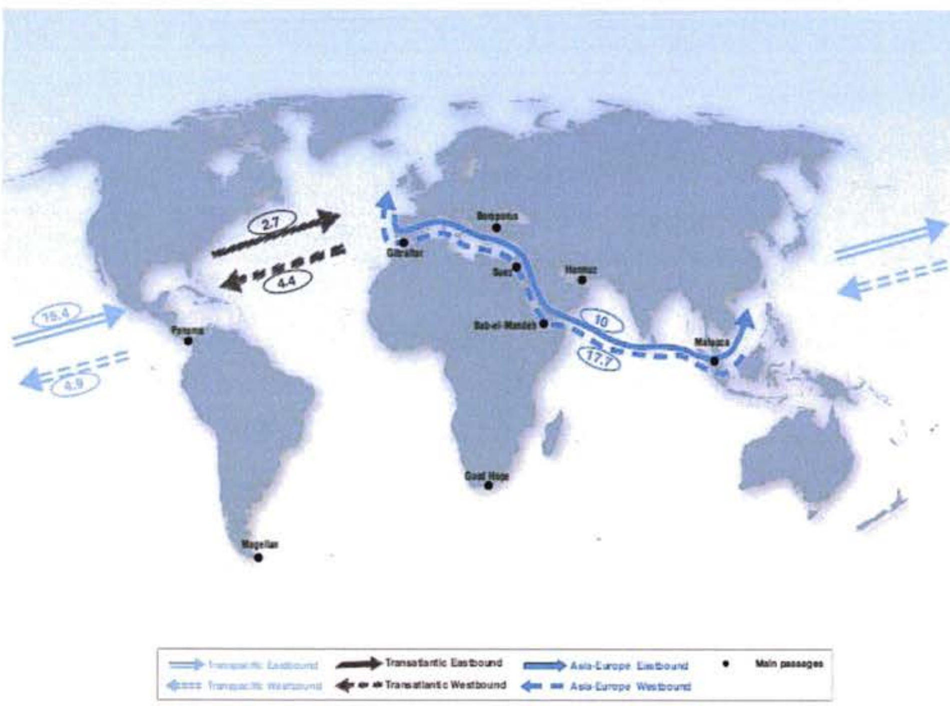
Container traffic requires large investments in specially equipped vessels, port installations and terminal equipment. So it can be said that container line shipping is often operated by international companies, for multi-national purposes, to meet the larger customers' demand.

When it involves less investment in port, equipment, or vessel, and with often less cargo quantity in supply or shorter transport distance, we easily see that conventional shipments still prevail.

Liner Routes

Figure 3.3 displays the largest container trade routes in the world. Between the Far East and Europe 17.7 million laden Teu[1] were transport on the headhaul leg (the primary leg) and 10 million laden Teu on the return leg. Note the imbalance between the volumes between the volumes. As a consequence over 7 million Teu of empty containers need to be transported back from Europe to Asia, this is a huge cost for the shipping lines!

Figure 3.3 Major Maritime Routes - Container Traffic, 2007



Source: UNCTAD, Review of Maritime Transport 2008

Providing regular liner services requires a large number of ships. A roundtrip of one ship between the Far East and Europe may take 56 days. This means that if the shipping lines wants to provide weekly sailings from Shanghai to Rotterdam he requires eight ships. Since these ships are very expensive, liner companies work in a **consortium** to provide sufficient ships on a service. For instance two different shipping lines both add four ships to the service.

[1] Teu = Twenty foot equivalent unit.

Multiple shipping lines can also join in a voluntary organization: a **Liner conference**. The goal of the conference is to maintain a stable market and fair competition among carriers, also to reduce competition between ship owners calling at the same ports. Another important element is to administer operating rules that guarantee the shipper a consistent level of service from participating lines.

Since October 2008 the Liner conferences are considered a monopoly by the European Union. Consequences will be discussed later in this course.

More details on tariffs and regulations will be discussed later in this course.

3.1.3 Tramp Shipping

Charter shipping, also called tramp shipping, carries most of the cargo in terms of quantity or volume in sea transport worldwide. In charter shipping ship owners do not have their ships sailed according to a fixed schedule. Depending on supply and demand they let their ships tramp around the world seas.

Charter shipping mainly deals with bulk cargo. In general, full ship loads of mostly a single type of goods, are carried by tramp shipping. Examples are:

- Grain;
- Coal;
- Ore;
- Mineral oils;
- Chemicals;
- Juices;
- Edible oils.

Figure 3.4 Loading of Bulk Cargo

Source: EMO Dry bulk terminal, Rotterdam NL

Different from liner shipping where ships sail to and from specific ports according to fixed schedules, in tramp shipping the ships go to the cargo, wherever it may be. The cargo determines where the ship goes.

3.1.4 Sea Ports

Seaports, from the simple physical sea/land interface they once used to be, have successively turned into commerce and industrial centres, then into logistics and distribution platforms, and are now becoming intermodal nodes in international supply chains networks, the efficiency of which now drives trade competitiveness.

A port is a sheltered bay or place where ships can anchor or moor safely. When it comes to commercial ports, the description alters as follows:

"an area where land and water joins, that have the facilities and tools to accommodate the loading, discharging and storing of cargo intended for sea-going vessels, as well as the receiving and dispatching of this cargo to and via means of transport on land, and where other sea related activities will take place."

In the definition of the port above, the joining of land and water is mentioned. This means that ports do not necessarily have to be situated right next to the sea. Both Rotterdam and Amsterdam in the Netherlands, for instance, do not border on the sea.

A port offers the safekeeping of vessels. However, to make these ports economically more attractive to vessels, there is still much that needs to be done.

3.1.5 Major Sea Ports in the World

There are more than 2,000 ports around the world, from single berth locations handling a few hundred tons a year, to multipurpose facilities handling more than 300 million tons a year. For developing countries, according to the World Bank statistics, more than 80 percent of the foreign trade in tonnage is carried out by sea.

Containerization of general cargo traffic has progressed steadily over the past two decades. But the container traffic is distributed unevenly between the Far East (45%), Europe (23%), North America (16%), Near and Middle East (6%), Central and South America (4%), and Africa (3%). (World Bank figures)

Worldwide, the port traffic is made up by 45% of liquid bulks (mainly oil, petroleum products, and chemicals), 23% of dry bulks (coal, iron ore, grain, and phosphate), and 32% of general cargo.

Ports can be compared in many different ways - by volume or value of trade, number of calling vessels, revenues, storage capacity, productivity or efficiency, as examples. The most frequently used comparisons are the total cargo tonnage handled, and the total TEUs handled in the port. Because of the generally high value of the containerized cargo and the large investments involved in ports for container traffic, the measurement of container TEUs are often used.

A major sea port can be also known for its specialization in container traffic, bulk cargo, or both. In general, the trade volumes generated from or to the region largely decide the potentiality of the sea port in competing for the top ranking, and the trade patterns i.e. the types of cargo traded determines then whether the port shall be specialized in handling containers, general cargo or bulk cargo.

The following tables display the largest ports in the world.

Table 3.1
Port Ranking in Tonnes in 2007
(1,000 tons)

Table 3.2
Port Ranking in TEU in 2007

RANK	PORT	COUNTRY	TONS *	PORT	COUNTRY	TEUS
1	Shanghai	China	561,450	Singapore	Singapore	27,935,500
2	Singapore	Singapore	483,616	Shanghai	China	26,150,000
3	Rotterdam	Netherlands	401,181	Hong Kong	China	23,999,000
4	Ningbo	China	344,000	Shenzhen	China	21,099,100
5	Guangzhou	China	343,250	Busan	South Korea	13,254,703
6	Tianjin	China	309,460	Rotterdam	Netherlands	10,790,604
7	Qingdao	China	265,020	Dubai	UAE	10,650,000
8	Qinhuangdao	China	248,930	Kaohsiung	Taiwan	10,256,829
9	Hong Kong	Kong	245,433	Hamburg	Germany	9,917,180
10	Busan	South Korea	243,564	Qingdao	China	9,462,000

Source: American Association of Port Authorities

In 2007 Rotterdam was the only non-Asian based in the top ten of ports by throughput in tons. In 2007, seven of the world's top 10 container terminals were Asian based, of which four ports located in China. The top ten of container ports handled a total of traffic of 163.5 million TEU.

CIS
Container volumes handled in the Black Sea ports have risen dramatically over the last few years. Table 3.3 shows the ten-fold increase in volume from 0.3 million Teu in 2000 to over 3 million Teu in 2007. Romanian port Constanza has been the largest port over the years. The port handled 1.4 million Teu in 2007. Constanza was able to accommodate the large container volumes using the newly development container handling facilities.

Table 3.3 **TEU Volumes Black Sea Ports 2000 - 2007**

	2000	2001	2002	2003	2004	2005	2006	2007	CAGR (7 yr)
Bulgaria									
Varna	37	45	59	65	79	84	94	100	15.1%
Bourgas	11	12	14	20	27	30	26	38	18.7%
Georgia									
Poti	35	40	49	63	80	106	127	185	26.7%
Russia									
Novoryssisk	13	20	59	89	135	162	287	342	59.8%
Minor ports				13	19	22	27	39	N/A
Romania									
Constanza	106	119	136	206	386	768	1037	1411	44.8%
Ukraine									
Illychevsk	40	78	103	152	197	291	324	533	44.8%
Odessa	69	76	111	158	201	288	396	523	33.4%
Total	**312**	**389**	**531**	**766**	**1124**	**1752**	**2317**	**3171**	**39.3%**
y-o-y growth %		24.7%	36.5%	44.2%	46.7%	55.9%	32.2%	36.9%	

Source: Drewry Shipping Consultants

3.1.6 Port Accessibility

Transport possibilities to and from the sea ports are largely subject to three conditions:

- Limits of water depth;
- Hinterland connections;
- Strategic location.

The conditions of water depth, hinterland connections and strategic location of the port further determine the port's possibility to function competitively as a node in the intermodal transport.

Water Depth

Water depth is of utmost importance to a sea port, considering in particular the possibility to accommodate the ever larger vessels. All the major sea ports in the world, without exception, either enjoy natural deep water, or undertake the deepening of channels on a regular basis by dredging or by constructing the locks. It is also obvious among the sea ports that water depth is becoming the decisive element in the port competition. For example, the port of Rotterdam is a natural deep sea port. The 15 meters deep water allows it to accommodate the largest container vessels to date.

The port of Shanghai, limited by the water depth in the city area, has invested billions of dollars in constructing a deep sea port that is 33km away from the mainland, which is connected only by a cross-ocean bridge.

Hinterland Connections
Hinterland connection is another important element that determines the competitiveness of a sea port. Hinterland connections mean the possibilities of sea cargoes arriving from the sea-going vessels being further transported to destinations by another mode of transport, i.e. road, rail or inland waterway, or vice versa.

When speed and reliability is a major concern in the competition among sea ports, and between sea transport and other modes of transport, the competitiveness of the port is often, and to a large degree, subject to the availability and efficiency of the hinterland connections.

Strategic Locations of Ports
Port can also benefit from strategic locations, particularly in container traffic. Some major shipping lines have increasingly adopted transhipment strategies to connect different services and increase port serviceability. Even though these ports are not located in a strongly trading hinterland, they benefit from their strategic location.

For instance the port of Salalah (Oman) benefits from the strategic location on the east-west and north-south axis. Dubai, listed in Table 3.2, acts as a single point of entry for all Arabian Gulf destinations. All deep-sea vessels unload their cargoes in Dubai for further shipment to Bahrain, Iran etc by smaller feeder vessel.

In the Black Sea Constanza has a similar role for deep-sea shipments to the Far East, since the other ports are not capable of handling large vessels. An estimate 60% of containers was transhipped from this port to other ports in the Black Sea[2]. Other examples of strategically located ports handling large container volumes are: Panama, Algeciras (Spain), Port Said, Colombo, Singapore / Tanjung Pelepas.

3.1.7 Port Facility

Loading / Unloading facilities
Loading and unloading is the major and main activity that a port performs. In order to improve the port accessibility and enhance the port efficiency, loading and unloading facilities are therefore, often a major concern to the port, as well as the port users.

General Cargo
General cargo was traditionally loaded and unloaded by cranes mounted either on a ship or ashore. Further transport to and in sheds are performed by forklift trucks and other equipment for horizontal transport.

Containers
A significant improvement in this field is the world wide implementation of standardised containers, which introduced the specialised equipment for the fast and efficient container handling in ports. The reach of these cranes has increased significantly throughout the years in order to serve larger and larger container vessels.

[2] Lloyds List, 'Ports suffer as volumes decline', 27-02-2009.

Horizontal Transport facilities
Horizontal transport facilities refer to those equipment and facilities used for the transport and handling of cargo within the port, e.g. at the container yard. The most often used equipment in container handling is:

- Straddle carrier;
- Tug master;
- Reach stacker.

Figure 3.5 Port Handling Equipment

Ship-to-Shore Gantry Crane

Straddle Carrier

Source: Kalmar Industries

Other Facilities in the Port
Apart from the loading/unloading facilities and those for horizontal transport within the terminal, the port is also equipped with other facilities in order to function properly. Such facilities include those for administration purposes, e.g. administration buildings, and communication facilities, warehouses and container yards. In container handling, there is also a control tower in the port where the coordination and communication with regard to the container movement and storage in the terminal is carried out.

3.1.8 Port Developments

The increasing container traffic requires more container handling capacity in the ports. However a container terminal is not easily constructed, at some locations capacity is even scarce.

- The terminal requires deep sheltered water not every location is suitable.
- The terminal requires a lot of civil works, container handling equipment, hinterland infrastructure and skilled personnel. These requirements make the development of a new terminal expensive and time-consuming.
- Especially in Europe and US a lot of objection by local governments and environmental agencies exists against construction of new terminals (due to environment and noise).

The above limitations have resulted in a scarcity of container terminals in certain regions. Therefore shipping lines have started to operate and build container terminals themselves to handle their own vessels. APM Terminals handles the containerships from sister company Maersk Line.

In the Black Sea, there is still a lot of development on going to expand container handling capacity.

3.2 Vessels

The period after the Second World War showed a continuous increase in world trade and in sea trade. This increase in global commerce which lasts even to this day has greatly influenced the development and types of ships.

More and more ships have come since the beginning of global commerce. Subsequently the ships became faster and larger and a lot of small ships were taken out of service. After the 1970's, more and more universal ships were replaced by specialized vessels that can carry only one type of cargo. In addition to the traditional general cargo vessel and bulk carriers, new types of vessels were also developed such as oil and chemical tankers, container ships, heavy-lift ships, Roll-on/Roll-off and so on.

3.2.1 Conventional Ships

Conventional ships are used for transport of general cargo, or a combination of the general cargo and cargoes of other types such as container or bulk cargo. Three concepts are often being used interchangeably; "conventional ships", "general cargo vessels" and "multipurpose vessels". Conventional ships can be distinguished by:

- General cargo vessel: this vessel is employed in the carrying of traditional general cargo and (partly) bulk cargo loads.
- Multi-purpose vessel: one part of this vessel is employed to carry general cargo, whilst another part of the loading capacity has been prepared to carry containers.

General Cargo Vessel

The general cargo vessel has one or more tweendecks, which allows the goods to be stored in lots. In dividing the holds for storage of different cargoes, the following issues are normally taken into account:

- types of goods which might be loaded together or must be separate from each other;
- cargo destinations in order to ensure efficient discharging at the port of destination;
- equal distribution of the cargo on board, in order to achieve equilibrium (stability).

Equipment

General cargo vessels often have air-conditioned holds at their disposal for the carrying of perishable goods, sometimes including tanks that have been provided for the carrying of small portions of liquid cargo.

In order to function independently from the loading and discharging possibilities at the quays, general cargo vessels are often with their own loading and discharging gear at every hold.

In modern vessels this equipment consists of on-board cranes. The amount of cranes aboard a ship depends on the shipping area and on the type of cargo that the vessel has been put in. The same applies to the cranes' capacity. On board modern general cargo vessels, you will also find large hatch covers that can be opened quickly, as well as cranes on deck and a variety of cooling and freezing options to choose from.

Loading/Unloading

Ship management is directly involved with the loading and discharging of a general cargo vessel. The captain is responsible for the stowage of goods, as well as the condition of the separate shipments. He also has to supervise the workforce and materials, as appointed by the stevedore. The loading, discharging and stowage of general cargo (crates, boxes, cases, packages, barrels and drums, etc.) require a large amount of labour. For that reason, these actions are performed explicitly by general cargo stevedores.

Characteristic of the stevedoring companies for general cargoes is the fact that they need many operational people to load, discharge and stow a vessel. On the other hand, the number of administrative people is generally small.

Multi-Purpose Vessel

Multi-purpose vessels are mainly operating in shipping areas where the employment of full container vessels is not yet economically feasible. It also concerns the infrastructure of some countries of origin and destination. Some countries may have limited capabilities in respect to the rapid off and on transport of containers.

Figure 3.6

General Cargo Ship

Container Ship

Source: www.trans-inst.org

3.2.2 Container Ships

General cargo had always been carried in the conventional ships. However, with the introduction of the container, more and more general cargo is now being shipped in containers. The arrival of the containerisation has replaced the conventional general cargo vessels by more and more specially equipped container vessels.

The carrying of cargo in containers has become a very special way to transport goods. Goods can also be shipped in bulk in the appropriate containers. Nowadays container vessels mainly sail in the liner trade.

The cellular container ships have the same outward appearance as the boxes that they carry. These vessels have been designed to be as rectangular as possible with regard to both width and length, in order to carry as many containers as possible, on deck as well as below deck.

Development of Containers

The sharp increase in costs in the industrialised parts of the world during the sixties had a major effect on conventional scheduled voyages. The transhipment of general goods was/is time consuming and very labour intensive. This not only contributed to increasing costs, but also resulted in low returns on the capital invested in ships. Only sailing ships earn money, so the shorter the time in port of the ship, the better it was for the investors.
In an effort to reduce port time larger cargo units were employed.

The first development step towards larger cargo units was from loose general goods to pallets and other forms of transporting goods in units. The real revolutionary breakthrough arrived with the introduction of the container.

The arrival of the container saw the end of the nostalgia and romance associated with the aroma of spices and fresh fruit. There are hardly any ships to be seen any more with multiple derricks and dockworkers loading or offloading packages, wooden chests and boxes carried on their shoulders.

Nowadays there are rows of neatly stacked containers in tidy rows waiting to be loaded. And ships are only for one or sometimes two days at the quay. Crew hardly has any time to go ashore. Everything is about time and time is money.

Containerisation

Containerisation is ultimately a transport system of which the extent and scope are the primary features determined by the trade volumes between countries and/or parts of the world.

Consequences of containerisation:

- Mechanisation of cargo handling and technological advancement in construction and building of ships during the late 1950's led to expanded scale. The spectacular growth in world trade activities further contributed to this.
- "Industrialisation" of transport: this yielded major savings in transhipment costs as well as personnel costs. For example: one container ship replaced approximately five conventional ships.
- The standard unit which the container eventually became, offered intermodal transport possibilities: Goods en route from the factory to the consumer required less handling, and transferring goods from one type of transport method to another was also simplified to a great extent.

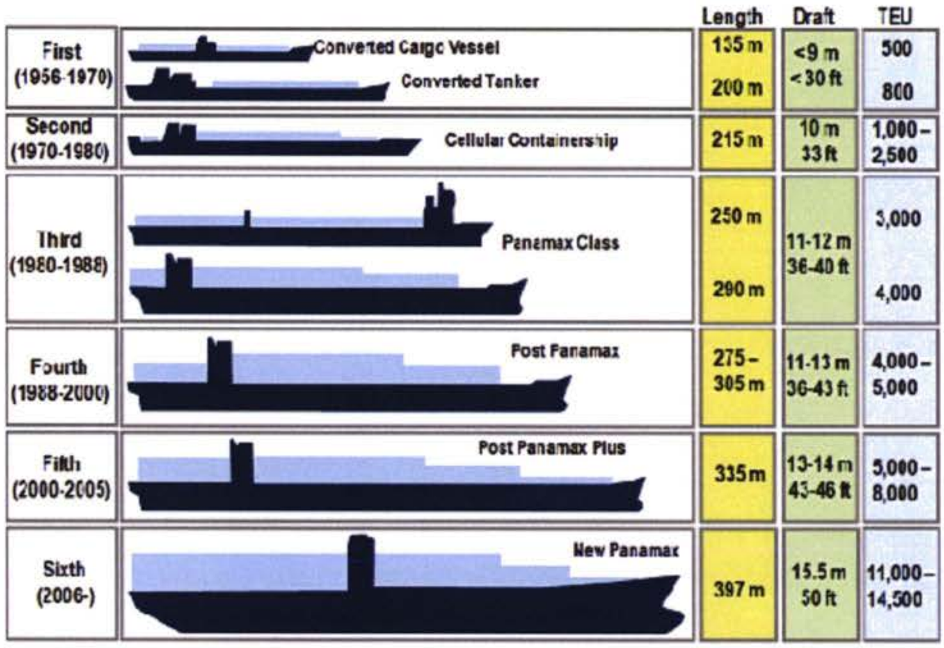
For more information about the history of containerisation, please refer to the reference reading at the end of this section.

Generation of Container Ships

With the development of technology, container ships become larger and larger. As a result, people are starting to refer to the generation of container ships. The size of the container vessel is expressed according to the intended amount of

TEU's (Twenty feet Equivalent Unit) to be carried. TEU is the standard unit of measurement for containers. One 40 ft container is equal to 2 TEU's.

Figure 3.7 Containership Size Development



Source: internet

Constraints
There are other constraints however, that limit the shipping companies from using the largest container vessel. Panama Canal for example, is still a physical limitation for the biggest container ships.

However, a set of new lock will be added to the Panama Canal. From 2015 onwards larger vessels will be allowed to transit the Canal. Surprisingly the largest existing containerships are already too large to transit the new canal.

Loading and Unloading
Container ships are loaded and discharged at container terminals. These terminals are concentrated on the loading and discharging of container ships. That loading and discharging of containers has become largely automated requires large investments in respect of materials like cranes and internal transport at the terminal. The number of operational people directly involved with the task of loading or discharging is however small.

Compared to the general cargo stevedore, the amount of operational people at a container stevedoring company is smaller while the amount of administrative people is larger. In order to conduct the loading or discharging process along the right way, an even greater work force is needed, in proportion to this undertaking.

3.2.3 Ro-Ro Carriers

Ro-Ro vessels are specially equipped for the transport of rolling materials on board, that in most cases can be driven on board by itself. Correspondingly, special arrangements have to be made to accommodate this type of transport at the ports. For example, there has to be a proper connection between the ship and the quay. One possible solution is to use a platform that can be adjusted according to height - the ramp.

Ro/Ro Characteristics
A Ro/Ro vessel has several decks, which facilitates the stowage of vehicles or trailers. Compared with general cargo or container vessels, on Ro/Ro vessels there is a loss of space above and beside the vehicles and trailers. This loss of space (and therefore less revenue) is compensated for by a quick "turnaround". In other words, a Ro/Ro vessel is designed for quick trips, as well as a minimum delay at the ports.

Figure 3.8 Ro - Ro Vessel

Source: www.norfolkfreightline.com

3.3 Inland Waterways Transport

3.3.1 Geography of Inland Waterways

Obviously, the major attribute to inland shipping in Western Europe is the presence of natural waterways and canals. Furthermore, the waterways are continuously being improved. A large number of natural waterways have been improved for inland shipping by human intervention such as deepening and the construction of locks and flood-gates.

Thanks to the opening of the Main-Danube Canal in 1992, Eastern Europe as far as the Black Sea lies open to Western European inland shipping. For the time being this is not yet possible, because of large stretches of shallow water and long periods of low tide.

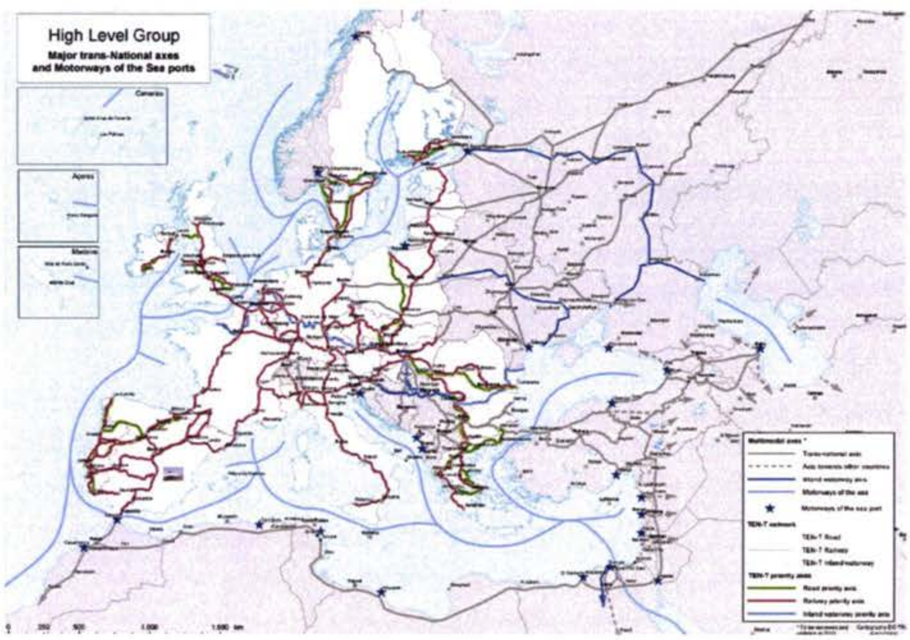
Northwest Europe has a dense grid of waterways, through which most of the country is accessible for inland shipping. There is, however, a concern in inland shipping circles that the smaller waterways are not receiving enough attention as a result of government policy. In practice, this can lead to major catch-up costs. The responsibility is being passed on to the lower authorities. This could lead to the closing of waterways, thereby depriving inland shipping of the opportunity to fulfil its required role, namely offering a solution to the gridlock on the congested roadways.

The Rhine

The Rhine, the main artery of Western Europe, is the most important river for goods transport via inland shipping. The Rhine has its origin in the St. Gotthard, passes the waterfalls at Schaffhausen and becomes a navigable river about 20 km above Basel. The total navigable length of the river is approximately 850 km. Like roadways, rivers are marked with kilometer stones.

In recent years, the infrastructure of the Rhine has been canalized near Strasbourg, while many shallows have been eliminated. This cannot continue infinitely, since doing so may cause too much water to be carried down at once from the Boden Sea - the river's natural reservoir.

Figure 3.9 Major Waterways



Source: DG TREN

The Rhine is divided into specific "stretches", namely:

- Lower Rhine : from the North Sea to Cologne / Bonn;
- Middle Rhine : from Bonn to Bingen;
- Upper Rhine : from Bingen to Basel;
- Hoch Rhein: from Basel to the Boden Sea.

The section between Koblenz and Bingen is known as *the mountains*. Water always runs from high to low ground. In inland shipping, the direction of sail is therefore always expressed in terms of the direction of the river, and not in terms of north, east, south and west as the driver of a car would do.

A skipper sailing from The Netherlands to a destination in Germany on the Rhine, is therefore *sailing up*, *going up* or doing the *up voyage*. In Germany, this is called *Bergfahrt* (in French: *a mont*); captains that are doing the reverse, are *coming down*, *sailing down* or are doing the *down voyage* (in French: *a val*). Basel lies *above Cologne*.

Anyone referring to "boats" instead of "ships" or does not use the terms used in inland shipping to indicate the direction of sail, is immediately recognized as an outsider.

Anyone having a look at the waterway map of Europe will immediately see the enormous possibilities offered by inland shipping. With the Netherlands at the centre, transport routes extend through Belgium deep into the South of France.

By way of the German canals, goods can be transported as far as Poland. Rhine shipping, including the use of the tributaries has long been the most import transport route for inland shipping. There is also a lot of transport to France via the Rhine and the Mosel. The destinations on the canalised Saar have become important industrial centres thanks to inland shipping.

Since the opening of the Main-Danube Canal in 1992, ships can now sail deep into the Eastern European countries. The navigability of the Danube, specifically the upstream section halfway, still leaves much to be desired, but the Black Sea is at least accessible!

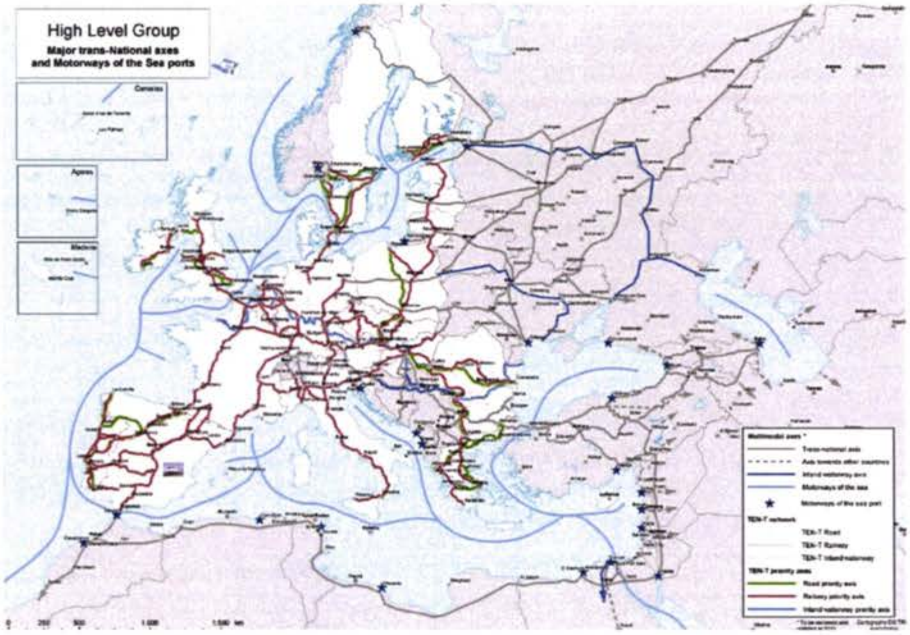
The course of the waterways naturally determines the nature of the transport routes. Coal and ore are transported to the industrial areas, fertilizer to agricultural areas in need thereof, grain from agricultural areas and feed producers to areas with livestock farming. In short, from production area to consumption area, with the sea ports of Western Europe acting as transfer points to transport goods overseas.

The Danube and Don / Volga Rivers
According to estimates by EU specialists in the sphere of international water transport, the volume of transit cargo traffic along the Europe-Asia axis via the Black Sea and the Danube basins is to grow by 35-40% by 2010. This is connected with a number of international (re-) construction projects, such as:

- Gradual restoration of a free navigation on the Danube, which is determined by the EU as the 7th international transport corridor (TEN 7).
- Inland waterway projects on the Don / Volga linking the Caspian Sea - Black Sea and a connection from Volga to the Baltic Sea via St.Petersburg

These projects will create a more international transport system using also inland waterway transport uniting the Black Sea, the Sea of Azov and the Caspian Sea on the one hand, and the Baltic Sea and the North Sea, on the other hand.

Figure 3.10 Displays of the Union of the Major Waterways



Source: EU / Report from the High Level Group chaired by Loyola de Palacio, November 2005

3.3.2 Most Important River Ports

Related to inland waterway transport, the main ports in Europe can be distinguished in two categories:

- Sea ports with an inland waterway connection to (a part of) the European hinterland, such as:
  - Rotterdam, Antwerp (Rhine, Meuse, Scheldt and beyond)
  - Hamburg, Bremen (Weser, Elbe and beyond)
  - Constantza (Danube and beyond)
  - Odessa (Dniepr)
  - St. Petersburg, Astrakhan, Rostov-on-Don (Neva, Don, Volga)
- Inland river ports with a major multimodal transhipment hinterland, such as:
  - Duisburg, Frankfurt;
  - Vienna, Budapest, Belgrade;
  - Volgograd.

Also sea ports such as Baku, Turkmenbashi and Poti may benefit from the developments mentioned in the previous chapter, uniting the Black Sea, the Sea of Azov and the Caspian Sea with the Baltic Sea and the North Sea.

In recent years the number of inland waterway container terminals is rapidly growing, making inland waterway transport an increasingly competitive alternative transport mode for this type of transport. For instance the port of Duisburg handled 370,000 Teu by barge in 2007; this is more than the handlings of port of Novorossiysk in the same year.

3.3.3 Side Rivers and Canals

Classification of the Waterways

European main waterways and side rivers and canals are divided into CEMT classes to standardise the dimensions of the waterways in Europe. This classification was compiled by the *Conférence Européenne des Ministres de Transport* (hence the term CEMT classes).

All waterways are divided into so-called waterway classes. The classification is based on the dimensions of artificial structures such as bridges, locks and flood-gates. These structures, together with the width and depth of a waterway, determine the maximum size of ships that may navigate a particular waterway. When determining the maximum dimensions that ships may have to use a particular waterway, some clearance has been
given to ensure safety. Apart from the classification system indicating the size of ships that may use a waterway, the maximum permissible dimensions of ships and the combinations of pushed barges are specified in the regulations.

Additional rules have been set for ships that exceed the specified dimensions. During the long period of extreme low tide in 2003, Rhine shipping directly experienced the difficulties involved in (large) ships sailing, meeting up and combining under such circumstances. Simultaneous meetings at specific places on the river must therefore be arranged well.

CEMT Classes
Table 3.4 lists the various CEMT classes, providing maximum dimensions of each class. The limits have resulted in the optimization of vessels in cargo capacity, some notable ship types are:

- ***CEMT Class I, Spits*** With its dimensions of 38.5 x 5.05, this is the smallest class designed for the smaller canals.
- **CEMT Class II, Kempenaar** This class covers the traditional Kempenaars (often built before 1980) and the new Neo Kemps, 24 to 36 TEU.
- **CEMT Class III; Dortmund-Ems-Canal barge** Ships in this class have a capacity of 24 to 48 TEU.
- **CEMT Class IV; Rhine-Herne-Canal barge** In this class you will find a large number of ships of approx. 81 to 120 TEU.
- **CEMT Class Va; Big Rhine barge Barges** with a capacity of 120 to 208 TEU. Found mostly in The Netherlands. The length of these barges is approx. 110 metres, with a width of approx. 11.40 metres.
- **CEMT Class VIb, Jowi Class container barges** The capacity of these barges, with dimensions of 135 x 17 metres, is between 300 and 470 TEU. This is a relatively new class of barge.
- **CEMT Classes IV, Va, Vb, VIa, VIb, VIc, VII; Push-towing** These barges can be combined and built up, therefore the capacity of the barges can vary between 50 TEU and approx. 500 TEU (depending on the composition of the pushed convoy).

Table 3.4 Maximum Vessel Dimensions According to CEMT (1992)

Class	Tonnage	Length (m)	Width (m)	Draught (m)	Barges
Motor vessels					
I	300	38.50	5.05	2.20	
II	650	55.00	6.60	2.50	
III	1	80.00	8.20	2.50	
IV	1.5	85.00	9.50	2.50	
Va	2.5	110.00	11.40	2.80	
Vib	6	140.00	15.00	3.90	
Push convoys					
IV	1.5	85.00	9.50	2.80	1
Va	3	110.00	11.40	4.50	1
Vb	6	185.00	11.40	4.50	2
Via	6	110.00	22.80	4.50	2
VIb	12	195.00	22.80	4.50	4
Vic	18	270.00	22.80	4.50	6
VIc	18	195.00	34.20	4.50	6

Source: CEMT Classification System

Other Conditions in using Waterways

The conditions under which a waterway may be used are not only determined by its type and the dimensions of the ships it may carry. The load carried by the ships also plays a role.

All ships used to transport goods have ***load lines***. Ships may only be loaded up to the bottom of this line, also called the ***loaded water line***. A ship may not sail if its draught exceeds its load line. For most types of goods, this does not happen. In sand and shingle transport, however, the cargo is often wet. In such cases, it is often necessary to exceed the load line to carry the maximum tonnes. After the cargo has been loaded, some time needs to pass before the water in the cargo has drained to the bottom and has been pumped out of the ship. The art of loading a ship in this way is to reach the loaded water line. The time required to pump out the water is at odds with the number of voyages that can be made.

Other types of cargo can be too high, thereby limiting the open view of the helmsman. This usually affects the forward view (dead angle). In container shipping, where ships are often equipped with height-adjustable steering cabins, the increase in height can also have an adverse effect on the backward and side views. The stability of the ship can also be affected adversely.

3.3.4 Locks and Other Obstacles in Inland Shipping

Artificial Obstacles: Locks, Bridges

Where artificial structures (bridges, locks, etc) are involved, they determine the inland shipping possibilities. This has resulted in a number of standard dimensions for ships. Ships were, and still are, built to make optimal use of a waterway.

With the increase of container transport, height, in particular, has become an important aspect. On many Western European rivers bridges are built at what is called the Rhine shipping height. At this height, ships fully laden with containers can also pass underneath these bridges without hindrance. However, on many waterways in Western and Eastern Europe, the infrastructure still leaves much to be desired. When improving and expanding the wet infrastructure, the necessary adjustments to bridge heights, specifically, plays an important role. Plans for such improvements are, if possible, submitted to the EU and elaborated with help of the EU.

River information systems and related computer / ICT applications can support barge operators to improve their voyage planning, taking into account the closing times of locks and bridges.

Natural obstacles
Apart from the artificial obstacles in inland shipping, there are also natural obstacles.

Water Level
Because inland shipping depends on water, water levels are crucial to the effective use of these waterways. Low and high water levels (tide differences), as well as ice, are all natural enemies of inland shipping. The water levels of the Rhine and its tributaries are available on a daily basis via telephone or teletext. A large numbers of so-called water level gauges, from which the relative water height can be read, have been placed along the Rhine.
When taking cargo on board, it is very important for a carrier to know whether he can rely on a rise or fall in water levels. Local knowledge and practical experience are indispensable in this regard. The bed of a river is not smooth, but is in fact a creepy landscape in which the peaks and valleys move around and may change height daily. The changes to the river bed are determined, to a great extent, by the strength of the current, which in turn depends on the amount of water being carried down from "above". When specific high water levels are reached on the Rhine, sailing is limited or, in the worst cases, even prohibited. High water is expressed as either Marke I or Marke II. At Marke I or higher, specific safety precautions are in force, while all sailing is suspended at Marke II or higher.

Floating Ice
One of the natural obstacles in inland shipping is ice, specifically in the rivers, canals and lakes in Northern Europe. Rivers freeze less easily these days than before. This is not only the result of pollution, but also because the ships and engines have much more power than before.
There is also a lot more that can be done to combat ice than before. When required, ice-breakers can keep a channel open or create one, enabling ships to move through in convoy. The increased engine capacity of ships also plays an important role. This has enabled them to reach their destinations on their own for longer periods than before. The risk of sailing through ice should, however, not be underestimated.

Long periods of frost cause major ice build-up on artificial structures (such as flood gates) in rivers. To prevent damage to flood gates, which would cause them to be completely unusable, they are sometimes closed when the ice build-up is extreme. Since flood gates serve to regulate the water levels on rivers, this may cause temporary low water levels. Important waterways between mainports such as between Rotterdam and
Antwerp (the Scheldt-Rhine route) is kept open at the expense of the government.

Storms, Fog etc.

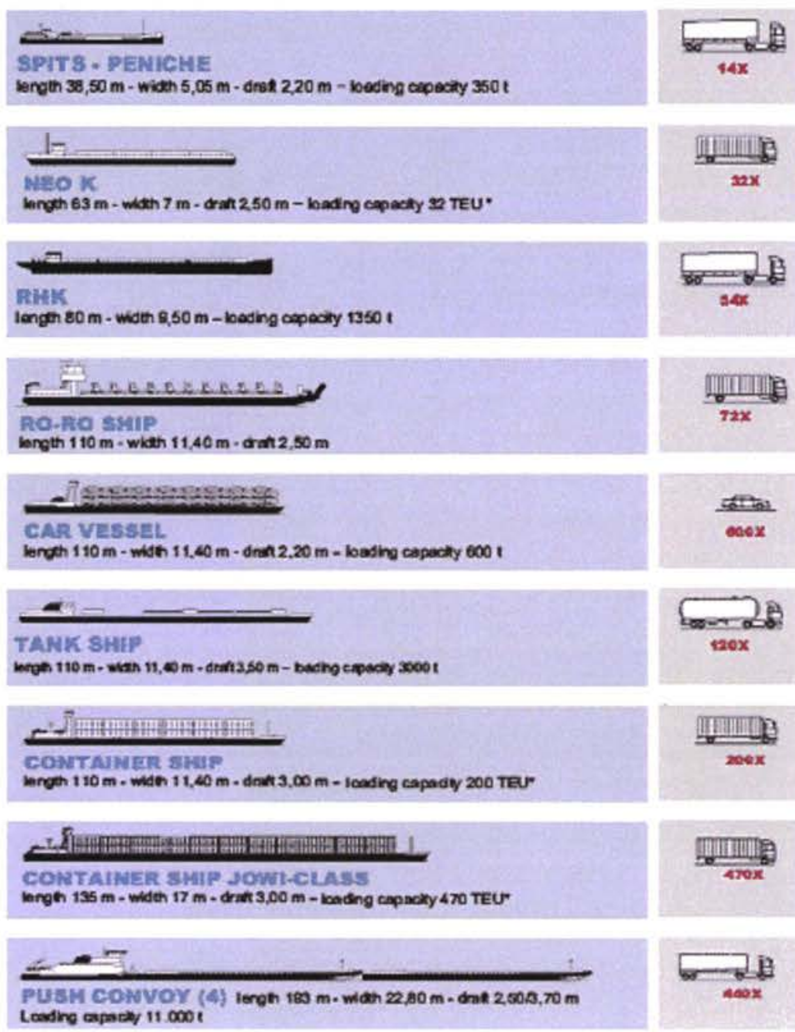
Storms are of course a natural phenomenon which must be kept in mind in practice, but they can hardly be considered an obstacle. The same holds true for fog. For the most part, the fleet is equipped with radar installations that can be used to sail under foggy conditions. To sail with radar, skippers must have a radar permit.

3.3.5 Types of Barges used in Inland Waterway Carriage

Below some examples are illustrated, which indicate that river transport is applied for many different commodities.

Figure 3.11 displays the different types of inland barges.

Figure 3.11 Inland Barge Types



3.4 Short-Sea / River-Sea Shipping

3.4.1 Short-Sea Shipping

Short-sea shipping definition can be defined as follows:

1. The movement of cargo and passengers by sea between ports in Europe, or ports outside Europe having a coastline on the enclosed seas bordering Europe
2. Domestic and international maritime transport, including feeder services, along the coast, to and from the islands, rivers and lakes.
3. Maritime transport between the EU member states, Norway, Iceland, Baltic's and states on the Black Sea and the Mediterranean including northern Africa (see figure 3.12).

Figure 3.12 Short- Sea Shipping

Short-sea shipping is especially suitable for larger volumes of cargo that have to be shipped regularly over longer distances within Europe. On shorter distances within Continental Europe road, rail and inland shipping are more suitable.

Short-sea transport is intra-European, destinations from NL include Russia, Baltic States, Scandinavia, UK, Ireland, France, Iberian Peninsula, North Africa, Mediterranean and Black Sea areas.

An additional advantage for companies is that the ships can be used as floating stock: Just in time deliveries; the stock on land can be limited, warehouse space reduced, costs saved.

Another advantage is the fact that short-sea shipping is not affected by the congestion on European motorways.

Commodities transported by short-sea are:
- Dry / Wet bulk (fertilizers, oil); Neo-bulk;
- General cargo;
- Pallets; Unitised cargo; Containers;
- Forest & Paper products;
- Special cargo; Project cargo;
- Ro-Ro.

Figure 3.13 Short Sea Ship

Source: www.nortrade.com

3.4.2 Sea-River Shipping

The sea-river shipping sector has been a forgotten market sector for a while. However the distinct advantages of the vessels have resulted in an increasing fleet of vessels due to new investments. Sea-river ships are smaller than short-sea ship. The smaller size allows the ships to sail on rivers as well as sea. The characteristics of Sea-River shipping are as follows:
- One vessel can sail both coastal and inland waters;
- Connects hinterland and overseas destinations without transhipment, therefore:
  - lower transport costs
  - reduced damage risks.
- A large number vessels of similar size is available to the market:
  - 400 vessels <3,000 dwt, draught <5 m, bridge clearance <9 m.
- Companies use ships as a floating stock: reducing storage need in the company's silo
- Environmentally friendly.

The main sailing areas are Scandinavia, the German inland ports along the Rhine (even up to Basel), and the UK. With Sea-River navigation cargo can be discharged closer to its final destination, and consequently closer to the customer.

The cargoes transported in these ships are:

- steel products downstream Rhine; timber + paper upstream, both destined for all parts of Europe.
- bulk (grain and ore) as return cargo to Scandinavia
- increasingly containers

Minimum total load approximately 1,000 tons, but separable holds enable smaller part loads

Typical River- Sea Ship Dimensions	
Length	80 m
Height	6.3 m
Draught	3.4 m
Tonnage	1,700 dwt

Figure 3.14 River- Sea Ships Passing in Canal

Source: Arklow Shipping

3.5 Case Study Inland Water Transport

Situation

There are both advantages and disadvantages to individuals or one-man businesses in inland shipping. One strength of individual inland shipping is the low cost price as compared to that of shipping companies. The number of "foreign staff" is relatively low and this translates directly to lower wage costs. In addition, the overheads are much lower, despite the fact that the extensive equipment on board modern inland ships is a major overhead.

Shipping companies no longer use their own ships, but *ships contracted from individuals*. It could also be said that they have become *cargo offices* where the emphasis has shifted to logistical support.

The *container operators* in inland shipping organise line services using contracted ships belonging to individuals. An exception is those shipping companies that specialise in push-towing. Such shipping companies own a large number of push barges and pusher tugs. The old shipping company formats have also continued in tanker services and the chemical sector.

Individual enterprises also have disadvantages. Since there is no land-based operation that explores the market for them to find cargo, they have to do it themselves. This is done especially on the so-called *same-day freight market*. This is easy when there is a lot of cargo to carry, because the carrier can make reasonable freightage and a high turnover rate. When there is little cargo on offer, individuals are at a disadvantage and often have long waiting periods between voyages. The effects of the market mechanism are especially noticeable in the *same-day freight market*. Supply and demand determine the freightage. When a higher supply of cargo coincides with a low water level on the Rhine, the demand for tonnage rises very quickly. Higher demand will lead to higher freightage. This of course applies to normal market conditions when there is a realistic relationship between demand and the supply of ships. When there is a structural oversupply of tonnage, the market mechanism has no effect. At most, waiting times are shortened.

It is almost impossible for individual inland shipping barge owners operating alone
to acquire cargo for longer periods. After discharging their cargo, they approach known cargo brokers for new cargo, obviously as close to the place of discharge as possible. The fluctuations in operating results will therefore be greater than in the case of shipping companies. The fact that they cannot offer clients security of
carriage over longer periods is also a disadvantage.

Assignment
Analyse the characteristics and (dis-) advantages of a One-man Business vs. Inland Shipping Companies.

4 Air and Land Transport Modalities

Learning Objectives for Lecture 4:

- Road Transport: The student should gain general knowledge of road transport, of the pros and cons of road transportation. He should gain an overview of the transport markets by road of the EU. The student should be aware of the existing main road transport routes in the Euro-Asian region, of their main characteristics and of some road market share figures. The student should be aware of the specific technical characteristics (size, weights) of road vehicles.
- Rail Transport: The student should be aware of general advantages and disadvantages of rail transportation. The student should be aware of main transport routes by rail and average transportation times on the main routes. The student should be aware of transit times on main transport routes by rail. The student should be aware of main technologies in rail transport.
- Air Transport: The student should know the major international organizations in air transport. The student should know the types and specifications of most used aircrafts. The student should further have knowledge of the types of air loading devices used the most. The student should have knowledge on the IATA Traffic Conference Areas and city/ airport codes. The student should be aware of the main differences between local airports and international airports. The student should know how air traffic routes should be elaborated.

4.1 Road Transport

4.1.1 Introduction: Advantages and Disadvantages of Road Transportation

Road haulage offers its customers personalised services at competitive prices. It is the only method of transport, which allows the elimination (with the exception of containerisation) of all intermediate handling (door-to-door); what is more, it combines the qualities of flexibility, speed and reliability. Finally, its success is due to its ability to constantly adapt to customer requirements. For the freight forwarder flexibility is a major asset: when the size of a consignment allows the possibility of using a full load, the availability of the means of transport gives the freight forwarder great freedom in the choice of type of vehicle, schedule, itinerary, loading instructions, etc. to make it easier to coordinate the operation. This situation is much more frequent in road haulage than in sea, rail, air or inland waterway transport.

The superabundant supply remains very fragmented. The creation of one's own firm has a certain attraction for a good number of lorry drivers, even if the requirements nowadays are stricter. It is relatively easy to obtain the financing necessary for the purchase of goods vehicles. The larger firms in this sector are restructuring and seek to increase the size of their fleets in order to remain competitive.

Subcontracting is a common practice. As in other sectors of activity, this is brought about by economic necessity: the handling of peak periods, the proposal of a flexible offer. But this can also reflect the lack of independence of the smaller firms. The prices are attractive but the profit margins are low.

The frequently under-capitalised road haulage firms suffer from a lengthening of payment time, the average being 72 days in 1989. At the same time that the industry is becoming aware of the necessity of setting up working conditions which conform to safety and regulatory requirements many firms are reorganising so as to increase their productivity: new analysis of their collection and delivery rounds, using teams of drivers,
managing working times in a more anticipatory manner etc. The lorry being the means of transport that should be optimised. Road Freight forwarding techniques, which are specific to the activities of a freight forwarder, such as chartering and groupage are dealt with in the following paragraphs.
Please find in table 4.1 a summary of some Pros & Cons of road transportation:

Table 4.1. Pro & Cons of Road Transport

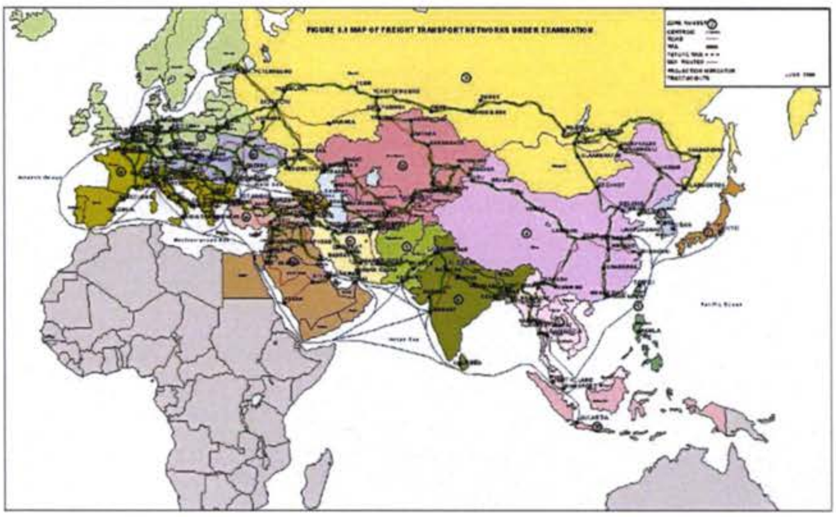
PROS	CONS
• door to door • flexible (compared to rail) • Just-In-Tie supply • flexible prices & price negotiation • lower prices than air, rail • good for small consignments • sometimes is the only available solution (some countries are land locked or there is no continuity in rail networks) • low cost per cargo of not bulky goods	• arrival may vary • freight costs of bulky goods are progressive • using of public roads • lot of borders to cross and need for VISAS for drivers (visa issuing delays), border delays • convoys for security of cargo and driver • not appropriate for big consignments, valuable, perishable, over long distance

4.1.2 Geography in Road Transport

<u>a. The most Important International Traffic Routes</u>

Eurasian Freight Transport Corridors *(source: UIC - Global Rail Freight Corridors Traffic Study - Final Report)*

Figure 4.1 Freight transport routes under examination



There are 3 main global freight corridors for which respective Task Forces have been established by ECMT.

- Corridor Task Force A: Far East - Europe via China & Russia
- Corridor Task Force B: Europe - China via CIS and Middle East
- Corridor Task Force C: South/S.E. Asia - Central Asia/Europe via Middle East

According to ECMT these corridors can be further disaggregated to Trans-Asian Railway (TAR) routes, as follows:

- Trans - Siberian Route (A-1) Moscow - Yekaterinburg - Novosibirsk - Vladivostok/Ulan Baator -Beijing
- Trans-Asian North Route (A-2) Kiev/Moscow - Chelyabinsk - Druzhba - Alashankou - Liangyungang
- Trans-Asia Central Route Kiev - Volgograd - Almaty - Aktogay - Druzhba - Liangyungang
- TRACECA Route Costanza/Varna - Poti - Baku - Tashkent - Almaty - Druzhba -Liangyungang
- Trans - Asia South Route (B, C) Istanbul - Ankara - Tehran - Sarakhs - Tashkent -Almaty - Druzhba - Liangyungang and Tehran - Zahedan - Lahore - Delhi - Dhaka -Kunming

Most routes share common links, as for instance the Druzhba -Liangyungang link traversing China. Beside these routes there are access links to ports or important nodal points which are taken into account. In parallel, rail link extensions to Europe as well as the major rail routes within Europe are taken into account. These are nominated by UIC and EU Trans-European Freight Freeways as well as the relevant Pan-European Rail Corridors as agreed by the E.U. in Crete (1994) and Helsinki (1997) summits.

A number of indicative truck routes, along with the travel times are presented in the table below. These travel times include delays at ports and/or border crossing points, and correspond to the conditions existing in 1999. Unlike the rail case, loading/unloading time to/from a truck is considered insignificant and it is not taken into account.

Table 4.2 Existing operational characteristics at selected road links

Road Link	Distance (km)	Transit Time * (days)
Lianyungang - Tashkent	5,940	12
N Delhi - Calcutta	2,000	4
Lahore - Teheran	3,050	5
Lahore - Tashkent	3,700	9
Teheran - Tbilisi	1,470	4
Tbilisi - Tashkent	2,830	9
Istanbul - Teheran	2,640	4
Berlin - Istanbul	2,390	4
Berlin - Moscow	1,900	3

** Including delays at border crossing points, without loading/unloading time or customs and security control delays at the points of origin/destination*
Source: UIC Study - Global Freight Corridors

The average road speeds have been determined in accordance with existing data and information per link, and may be summarized as follows:

- Russia (Western part): 40 km/hr
- Russia (Central and eastern part): 27 km/hr
- China: 27 km/hr
- India: 27 km/hr
- Iran: 40 - 45 km/hr
- Central Asia: 27 km/hr
- Turkey: 35 km/hr
- Europe: 40 - 50 km/hr

It must be noted that these speeds represent an average daily figure that takes into account an 8-hour driver rest, thus permitting truck travelling for only 2/3 of a day.

b. Ferryboat Connections

Listed below are ferry boat destinations in the TRACECA countries.

Table 4.3 TRACECA ferryboat destinations

Sea	Country	Ferry
Black Sea	Georgia	Poti
	Ukraine	Ilyichevsk'
Caspian Sea	Azerbaijan	Baku
	Turkmenistan	Turkmenbashi
	Kazakhstan	Aktau

Figure 4.2 Ferryboats

4.1.3 Types of Road Vehicles (Technical Standards)

Equipment, road vehicles: The maintenance and management of road vehicles has been the subject of several TRACECA projects that looked to the availability and development of service centres which will also assist in developing entrepreneurial skills. Assistance was provided to create a regulatory environment for freight vehicle operators, corresponding with EU directives. Manuals for owners and managers covering practical, financial, and regulatory issues were prepared and circulated.

a. Length, Width, Height, Loading and Total Weight of the Most Used Trucks

The United Nations Economic Commission for Europe gives the following definitions for vehicles:

Table 4.4 Classification of vehicles of the UNECE

Category	Definition	Remarks
M1	Vehicles used for the carriage of passengers and comprising not more than eight seats in addition to the driver's seat	Passenger cars
M2	Vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding 5 tonnes	Busses
M3	Vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding 5 tonnes	Busses
N1	Vehicles used for the carriage of goods and having a maximum mass not exceeding 3.5 tonnes.	Trucks
N2	Vehicles used for the carriage of goods and having a maximum mass exceeding 3.5 tonnes but not exceeding 12 tonnes	Trucks
N3	Vehicles used for the carriage of goods and having a maximum mass exceeding 12 tonnes	Trucks
O1	Trailers with a maximum mass not exceeding 0.75 tonnes	Trucks with trailer
O2	Trailers with a maximum mass exceeding 0.75 tonnes, but not exceeding 3.5 tonnes	Trucks with trailer
O3	Trailers with a maximum mass exceeding 3.5 tonnes, but not exceeding 10 tonnes	Trucks with trailer
O4	Trailers with a maximum mass exceeding 10 tonnes	Trucks with trailer

Furthermore, trailers of categories O2, O3 and O4 are of one of the three following types:

1. Semi-trailer - a towed vehicle, in which the axle(s) is (are) positioned behind the centre of gravity of the vehicle (when uniformly loaded), and which is equipped with a connecting device permitting horizontal and vertical forces to be transmitted to the towing vehicle.
2. Full trailer - a towed vehicle having at least two axles, and equipped with a towing device which can move vertically (in relation to the trailer) and controls the direction of the front axle(s), but which transmits no significant static load to the towing vehicle.
3. Centre-axle trailer - a towed vehicle, equipped with a towing device which cannot move vertically (in relation to the trailer) and in which the axle(s) is (are) positioned close to the centre of gravity of the vehicle (when uniformly loaded) such that only a small static vertical load, not exceeding 10 per cent of that corresponding to the maximum mass of the trailer or a load of 1,000 daN (whichever is the lesser) is transmitted to the towing vehicle.

b. International standards of dimensions of vehicles

Vehicle dimensions and weights must conform to local regulations. Some dimensions are restricted on particular routes (e.g. tunnels). Most countries impose a height limit on goods vehicles On international journeys the standard dimensions for height and width are:

Height:	4 metres
Width:	2.5 metres (2.6 metres for Refrigerated Trailers)
Length:	12,00 meters for motor vehicle or trailer
	16,5 meters for semi-trailers
	18,75 meters for tractor-trailer

Maximum dimensions for particular countries are listed in Table 4.5.

Figure 4.3 gives examples of truck and trailer combinations.

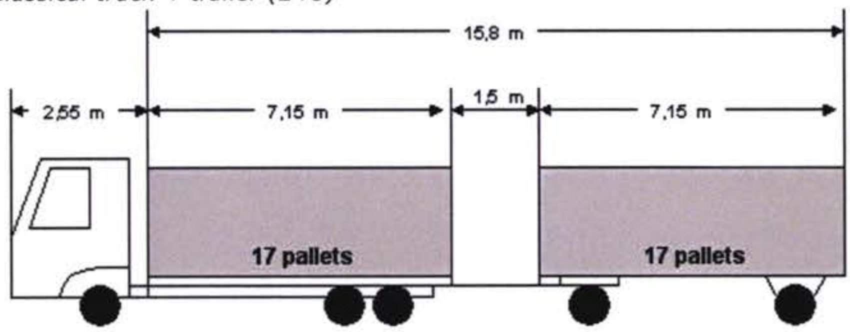
Table 4.5 Maximum vehicle dimensions

Country	Max Vehicle Wt (t)	Max Axle Wt (t)	Max Vehicle Length (m)
Finland	48.0	8.0	25.25
France	40.0	10.0	16.75
Germany	40.0	10.0	18.75
Poland	42.0	8.0	18.75
Russia	36.0	10.0	20.0
Switzerland	28.0	10.0	18.75
United Kingdom	42.0	8.0	18.75

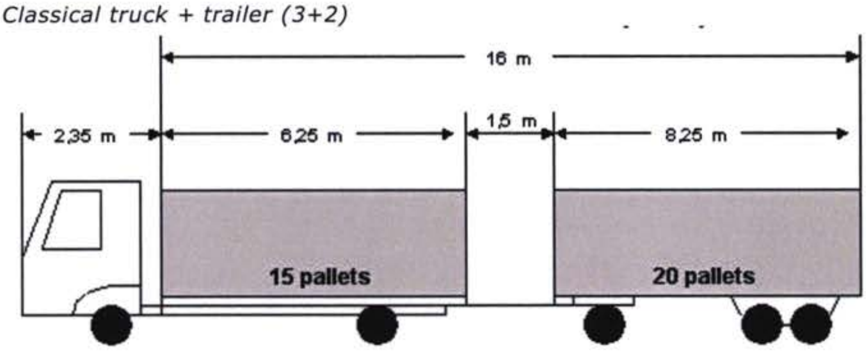
Source: STC-Group

Figure 4.3 Typical truck and trailer combinations

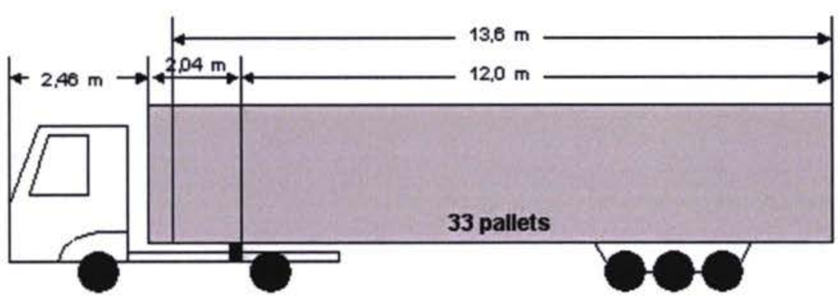
Classical truck + trailer (2+3)



Classical truck + trailer (3+2)



Truck + semi-trailer



4.2 Road Transport Services

a. Transport of Refrigerated Cargo

Food must be handled carefully because of its fragile nature. Food products are susceptible to spoilage, loss of nutrients, contamination, changes in colour, flavour or odour, and even package corrosion and leakage. Environmental control of temperature and humidity is needed to minimize these changes in food quality during transport.

Vehicles must be in a generally good condition. No daylight must be seen inside with doors closed. Door seals should be good and all repairs carried out with the correct materials. No holes may be found in the bodywork. The unit must pull down to Class temperature within 6 hours.

For regulatory requirements see Chapter 18.

b. Chartering
The road charterer carries out for their clients road transport operations that they entrust to third party carriers. They are freight forwarders because they agree to forward goods that have been given to them by their principal using the means and the ways for which the have freedom of choice, and this against payment which has been freely agreed upon. A client will find the service that they expect by dealing with a charterer, rather than directly with a carrier, in the following cases, several of which may be of consideration at the same time which can lead to a reinforcement of the attractiveness of
using chartering:

- Diverse and widespread geographical coverage,
- Irregularity of goods flow: seasonal nature, various sized shipments, emergency shipments, a large number of part shipments which cannot fill a vehicle: LTL = "less than a truck load".

For the carrier, the charterer is also a supplier of additional freight, which can increase the profitability of a less than full vehicle. These two functions are the strong points of the service, which the charterer offers their customers:

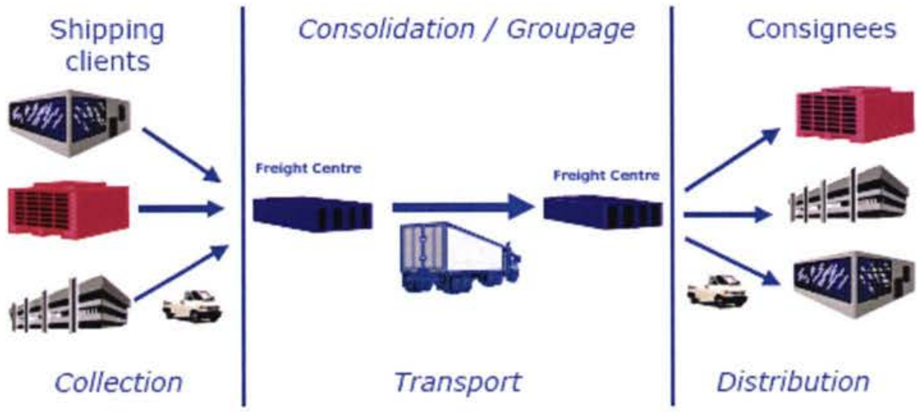
- Economical, reliable and fast forwarding (e.g. delivery from Friday evening to Monday morning) to varied geographical points through the use of carriers who are returning to their home bases and therefore have good knowledge of the destination region.
- Rapid forwarding to all destinations of small quantities of goods without any need for intermediate handling.

The second activity is often the most profit-making for the charterer (being in less of a competitive position compared with carriers), particularly if they are able to group several shipments on the same vehicle. This type of groupage without intermediate handling is given the name of "technical groupage".

c. Groupage
In the chartering section "technical groupage" was defined as the activity of grouping several shipments from several different contractors on a single vehicle, which carries out several collections and deliveries without intermediate handling. In order to deal with a market where:

- The number of clients is high in a given area,
- The goods are of small size,
- There are a large number of goods.

Figure 4.4 Separating of pick-pus, deliveries and main carriage



The time limit must be close to that of forwarding directly using a single vehicle. It is necessary to "be everywhere at the same time": to pick up from a variety of shippers on day A and delivery to a variety of consignees on day B. This is only possible by separating pickups and deliveries from the main carriage, which is used to cover the distance between the pickup and the delivery points.

4.3 Rail Transport

4.3.1 Introduction: Advantages and Disadvantages of Rail Transportation

The table below lists the main advantages and disadvantages of rail transport.

Table 4.6 Advantages and disadvantages of rail transport

Advantages	Disadvantages
• Increased security of cargo (especially in areas such as Central Asia) • Capability to transport large and heavy volumes of cargo over long distances (>200 km) at low unit cost • Efficient operations in a multi-modal environment • Faster (with respect to sea) on some routes • Cheaper (with respect to road) in most cases • Operations usually not affected by weather conditions • Reliability of operations (in most cases) • Effectiveness in regular consignments - block trains / full train loads •	• Interoperability problems (gauges, platforms, signaling systems, voltage, data exchange, operational rules) • Relatively low (in comparison to road) network density and door-to-door capability • Variations in technical / operational characteristics along rail route sections and missing links • Severe delays (in some cases) at border crossings • No single agent for door-to-door transport and intervention of several rail operators / networks in international and transit transports • Tariffs differentiations and complex structures -no single bill of lading • Low commercial speed in most lines • Necessity of two intermediate handling phases in the majority of cases (departure + destination railyards), unless private sidings are used • Expensive in short distances • Limitations to standardized units fitting with load gauge profile restrictions •

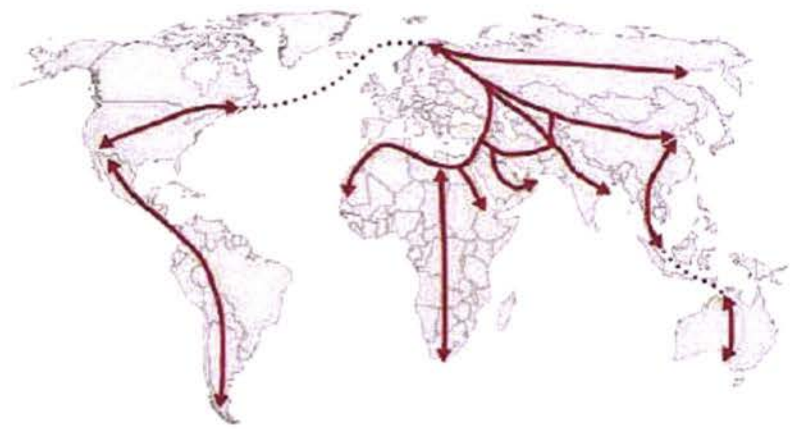
Source: Various

4.3.2 Geography and Rail Transport Operations

a. Global Rail Corridors

ESCAP, as part of the Asian Land Transport Infrastructure Development (ALTID) project which was endorsed by the 48th ESCAP Commission Session in Beijing (April 1992) has studied the three Asia - Europe rail land bridges. The EC also adopted in 1992 resolution 48/11 on road and rail transport in relation to facilitation measures and in 1996 resolution 52/9 on intra - Asia and Asia - Europe land bridges. Three routes of international significance have been identified in the southern corridor of Trans Asian Railways (TAR):

Figure 4.5 Global Rail Corridors



- TAR-S1: Kunming (South China) - Kapikule (Turkish / Bulgarian borders): 11,700 km
- TAR-S2: Bangkok - Kapikule: 11,450 km
- TAR - S3: Sarakhs (Iran/Turkmen borders) - Tehran - Razi (Turkish borders)

In cooperation with ESCAP, the OSJD is working on the organisation and test run of container block trains along the northern corridor in communication East-West. Container trains ran successfully on following routes:

- Nakhodka - Brest (via Moscow)
- Berlin - Moscow
- Budapest - Moscow
- Helsinki - Moscow

The International Union of Railways (UIC) was launched in 1992. It's mission is to promote rail transport at world level and meet the challenges of mobility and sustainable development. UIC has identified major weaknesses that need to be solved in order to make rail corridors more attractive. In summary, such weaknesses include among others:

- Considerable delays in border crossings due to huge documentation, customs procedures, change of trains and other formalities.
- Different gauge widths in various countries which imply that boogies have to be changed or even the whole wagons. Four different types of gauge are existing:
  - 1.435 m (standard) in Turkey, Iran, China and Middle East, as well as in Europe
  - 1.520 m in CIS countries and Russia
  - 1.676 m in India and Pakistan
  - Narrow gauge (mostly 1.000 m) in South / S.E. Asia, Middle East and Europe.
- Differences in tariff structure and liability conditions in various countries.
- Missing links crucial for the rail corridors as well as poor infrastructure.

In order to cope with the above problems and find solutions to a more efficient rail transportation between Asia and Europe 6 international multimodal corridors in world trade were established where the role of railways will be critical and of paramount importance. The corridors addressing freight movements between Asia and Europe are:

1. Europe - China via CIS and Middle East (Task Force chaired by Iran)
2. South/S.E Asia - Central Asia/Europe via Middle East (Task Force chaired by India)
3. Far East - Europe via China & Russia (Task Force chaired by China)

As surface transport links will form the main element in the overall transport chain, UIC is coordinating the various related aspects through Corridor Task Forces' working groups. Recently UIC adopted the N.E.W. Corridor (Northern East West Freight Corridor) linking Far East with Northern America via Scandinavia.

b. N.E.W. Corridor (Northern East West Freight Corridor)

In cooperation with UIC, the technical terms for East - West freight wagons were elaborated as well as the technical requirements for communication between 1,435 km and 1,520 m. gauges.

The growing importance of Asia to Europe's economic future suggests that European rail and other infrastructure investment decisions need increasingly to take account of Euro-Asian perspectives. The importance of the Euro-Asian land bridge will become increasingly obvious as the significance of China to the world economy grows.The EU has already agreed to the further development of the Trans-European Transport Network towards ten Pan-European Crete/Helsinki Corridors on the territory of CEECs. Of particular importance for Europe- Asia routes are the following corridors:

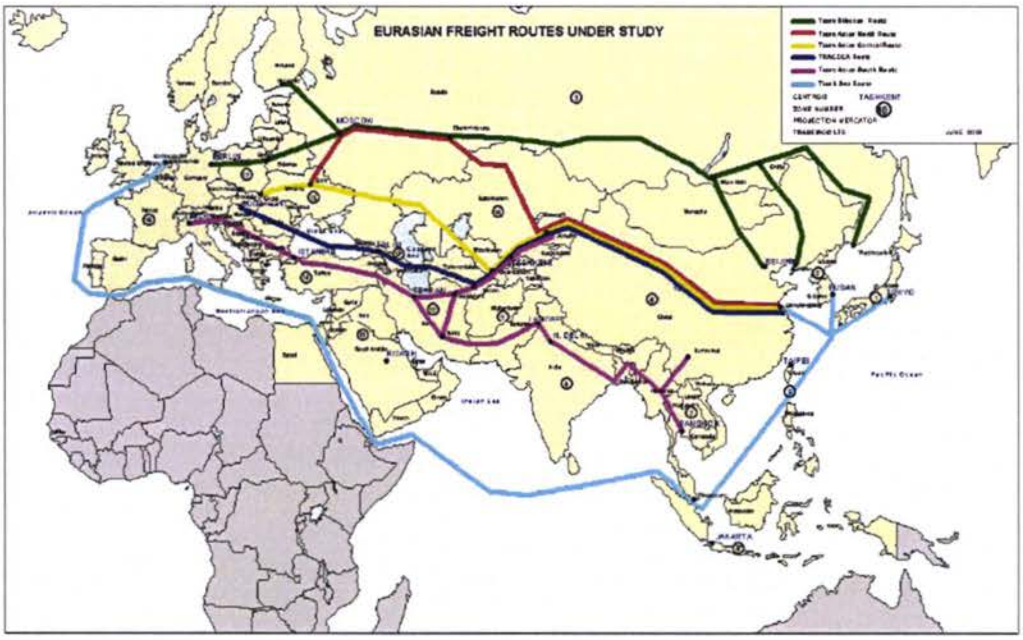
- Corridor No. 2: Berlin - Warsaw - Minsk - Moscow – Nizhny Novgorod
- Corridor No. 3: Berlin/Dresden - Wroclaw - Katowice - Krakow - Lviv - Kiev
- Corridor No. 4: Berlin - Prague - Budapest - Costanza - Sofia - Thessaloniki/ Istanbul
- Corridor No. 5: Venice - Trieste/Koper - Ljubljiana - Budapest - Uzgorod - Lviv - Kiev
- Corridor No. 9: Helsinki - Moscow - Kiev - Chisinau - Bucharest - Alexandroupoli

These corridors link into the following Europe - Asia main routes:

- Trans-Siberian Route: Moscow - Yekaterinburg - Novosibirsk - Vladivostok / Beijing
- Trans - Asian North Route: Kiev/Moscow - Chelyabinsk - Druzhba - Liangyungang
- Trans-Asian Central Route: Kiev - Almaty - Druzhba - Alashankou - Liangyungang.
- TRACECA: Constanza/Varna - Poti - Baku - Tashkent - Almaty - Aktogay - Druzhba - Alashankou - Liangyungang.
- Trans-Asian South Route: Istanbul - Ankara - Tabriz - Teheran - Mashad - Serakhs - Tashkent - Almaty - Aktogay - Druzhba - Alashankou - Liangyungang.

There are track gauge changes at the following borders: Poland – Belarus (Brest), Slovakia/ Hungary - Ukraine (Chop), Russia - China, Mongolia - China, Kazakhstan - China, Iran-Turkmenistan.

Figure 4.6 Eurasian Freight Corridors



c. Transit Times in Euro-Asian Freight Routes

Rail transit times, in general, are lower than sea but higher than road. Indicatively the following comparative figure emerges for transit times by sea or by either rail, or combined sea-rail for movements between Northern Europe and the Persian Gulf with onward connections to South and South - East Asia:

Table 4.7 Transit times from Helsinki

HELSINKI TO:	Sea	Rail	Combined land-sea
Tehran	33 days	11 to 12 days	33 days
Lahore	41 days	17 to 18.5 days	22 to 24 days
New Delhi	32 days	18 to 20 days	25 to 27 days
Bangkok	31 days	Not applicable	33 to 35 days

Source: UN-ESCAP study, 2001

The above estimates show a distinct transit time advantage for rail over shipping, reflecting the actual differences in distances. While there is no doubt that the rail and combined land-sea options are likely to offer attractive transit times in future, much will have to be done to capitalize on this advantage in the fields of tariffs, services and facilitation.

Rail route	**Distance (km)**	**Indicative transit time* (days)**
1. Vladivostok - Moscow - Brest - Berlin (Trans Siberian Rail)	11,830	**16**
2. Lianyungang - Druzhba - Moscow - Brest - Berlin (TAR North)	11,260	23
3. Lianyungang - Druzhba - Kiev - Chop - Budapest (TAR central)	11,870	28
4. Lianyungang - Druzhba - Poti - Costanza - Budapest (TRACECA)	11,310	26
5. Lianyungang - Druzhba - Tehran - Istanbul - Milan (TAR South 1)	13,950	33
6. Calcutta - Delhi - Tehran - Istanbul – Milan (TAR South 2)	10,910	27
7. B. Abbas - Jolfa - Poti - Odessa - Moscow	5,790	19
8. B. Abbas - Tabriz - Istanbul - Budapest	5,400	14

** Includes border crossing delays, as well as loading / unloading time (without customs and security control delays) at the points of origin / destination.*
Source: UIC study, 2000

Existing break-of-gauge points at Drushba / Alashankou (China / Kazakhstan), Sarakhs (Turkmenistan / Islamic Republic of Iran) and Brest (Belarus / Poland) are certainly operational hindrances, but do not cause exceptional delays compared with existing institutional barriers, which represent the main reasons for waiting times and delays at border crossing points.

Different types of railway operations for transport to Central Asia have achieved different transit speeds, with commercially organized block trains achieving speeds in excess of 700 kilometers per day. The potential for realizing low transit times could become a reality, once commercially organized block train operations become more widespread.

Rail transit time between Europe and Almaty / Kazakhstan vary between 25 to 35 days, according to ESCAP.

Minimum and maximum transit times, of 15 days and 23 days respectively, for regular and express rail services from ports in China to Kazakhstan are achieved. Freight forwarders have reported that the transfer time at the border between China and Kazakhstan is 2 -3 days, which includes bread-of-gauge handling and customs documentation and proceedings. Meanwhile, data on the container block trains established for shipments from Daewoo Corporation in Republic of Korea via the Chinese port of Lianyungang, just north of Shanghai, reveal that a transit time of 9 days is possible. This suggests that significant reductions in transit time can be achieved if a high level of priority is given to the transit service.

d. Market Share of Rail Transport

The share of rail transport on total transport (Modal Split) differs widely between the different regions:

- EU (15): 13%
- CEECs: 38%
- USA: 40%
- Central Asia: 70%
- Russia: 80%

In USA rail haulage accounts for 40% of total freight compared with only 13% in EU It is worth noting that in 1970 the rail share in Europe was 21%. In Russia almost 80% of land transports are performed by rail (more than 90% of them bulk cargo). In Central Asia (mainly Kazakhstan, Uzbekistan, Turkmenistan) almost 70% of land transports are performed by rail. In China approximately 35% of domestic freight transports are performed by rail (but only 5% of international transports, as 90% is transported by sea). In Turkey less than 2% of international freight is performed by rail.

e. Container transport on Trans-Siberian Railway

The capacity of the Trans-Siberian Railway is partly used for transport of containers, other commodities transported include for instance, coal and timber. The container transports are required to be accompanied by armed guards for safety purposes. The official transit time between Bejing and Moscow is 8 days. Table 4.8 below gives an indication of the volumes between the Russian Federation, China and South Korea. It should be noted that the total volume is (still) relatively small compared to the volume shipped by sea of 27.7 million laden Teu in 2007.

Table 4.8 Containers on Trans-Siberian railway

Rusian trade with:	2007	2008
China	235,188 Teu	274,384 Teu
South Korea	206,264 Teu	224,085 Teu

Source: RZD-partner.com

4.3.3 Ways and Means of Transportation

Below the main dimensions of rail transport are listed:

The overall length of the wagon	12m, 15m, 18.50m (= three 20' containers, for example); 20m or 25m for a flat wagon
Payload of the wagon	From 20 to max. 50 to 65 t
Speed	depends on lines; 24 to 48 hours in the EU
Trainload	in average 50 wagons, 1000 t payload (differs between 800 to maximum 3,000 tonnes)

Compared to road carriage rail transport is limited by:

- The accessibility (stations, rail lines): additional intermediate handling;
- The rigidity of the schedule;
- The shippable height which varies according to the route;
- The operator's monopoly: even if the customer is able to negotiate prices and conditions more effectively today thanks to the competition, they can still find themselves at the mercy of the carrier in case problems arise during the

carriage: strikes, technical incidents, and concerning rail lines, the closure of the line.

European freight forwarders generally consider rail freight as a viable possibility when it concerns maritime pre- and post-carriage with direct access to the vessel by the "dock siding" and an interesting flexibility concerning waiting times.

Train operating systems in Europe, comprise, among others.

Shuttle trains	directly operating in a loop between two terminals with fixed composition of rail cars
Block trains	directly operating between two terminals, but not with fixed composition
Part trains	composed of sets of rail cars with more than two destinations and not with fixed composition
Liner trains	similar to passenger trains, with frequent stops, where boxes are loaded / unloaded in a sequence of terminals

As gauges in various countries are different and this can not be changed without vast investments, appropriate transhipment equipment and/or rolling stock is necessary to ensure fast procedures, as is the case between Spain and France and between Poland and Belorussia.

Different rail gauges (inner distances between rail tracks)
Due to historical developments we have different rail gauges which must be considered in international transport:

Europe, Turkey, China, Middle East, Iran CIS and Finland (Standard gauge)	1,524 mm
Spain and Portugal	1,674 mm
India, Pakistan, Bangladesh	1,676 mm

Gauge changes thus are existing:
- Between China & Kazakhstan/Russia
- Between Pakistan & Iran in Zahedan
- Between Iran & Turkmenistan in Sarakhs
- Between Turkey/Iran & Caucasus countries
- Between Poland & Belorussia
- Between Hungary/Slovakia and Ukraine

Rail lines should be capable of accommodating axle loads of at least 20 tons, which is not always the case.

Different Loading gauges (maximum width and height of wagon and cargo)
The physical dimensions of a vehicle and its load are governed by a series of height and width profiles, known as loading gauges. These are applied to a given route, to ensure that a vehicle will not collide with a lineside or overline structure, such as station platforms, canopies, overhead power supplies, over bridges or tunnels. Loading gauge profiles vary by route, reflecting the constraints on rail vehicle size caused by lineside and overline structures. For more details see Module 3.2.2

Different Railway Line Classes and Weight Limitations

The different railway lines within a country and internationally are classified in the SMGS and CIM countries, depending on the possible maximum weight per axle and the possible maximum weight per metre. Since the weakest part of an international transport line determines the maximum weight over the whole line it is important to plan the route, the type of the wagon and the maximum payload accordingly.

Figure 4.7 Types of rail wagons

Rail wagons

Open rail wagon
(wagon class E)

Flat cars
(wagon class F, K and S)

Self-Unloading Wagon
(wagon class H)

Closed Wagon
(wagon class G)

Tank Wagon
(wagon class U, Z)

Refrigerated Wagon
(wagon class I)

4.4 Air Transport

4.4.1 Characteristics of Air Transport

The table below displays the typical characteristics of air transport. The high speed of transportation gives this mode a number of distinct advantages, but also brings disadvantages such as high capital cost requirement and limited number of routeing options.

Table 4.9 Characteristics of Air Transport

Routes:
- mainly intercontinental, to utilise speed advantage
- short distances are trucked, under air cargo conditions

Requirements:
- mainport with extensive destinations / connections
- efficient + fast airport handling facilities
- air cargo forwarder with fast declaration possibilities
- fast connecting road collection / distribution services

Cargo:
- urgent shipments
- high value cargo (to save inventory costs, also floating stock)

4.4.2 International Organizations

Due to the international characteristics of air transport airlines have sought to create a global platform for the technical and commercial sector.

below lists the most important international organizations involved in air transport.

Table 4.10 International Organisations in Air Transport

International Air Transport Association (IATA)

www.iata.org

Established 1945 by airlines. IATA's main purpose lies in the technical and commercial sector. Its technical duties were designed from the beginning to achieve safer, more
regular and more economical air traffic. In the commercial sector, IATA's activities were expected to create the best possible conditions for all categories of customers.

- *Active Members:* airlines operating international and / or domestic services
- *Associate Members:* airlines operating domestic services only.

ICAO = International Civil Aviation Organisation (ICAO)

www.icao.org

Established 1947 by member states. The aim of the ICAO is:

- To promote transport by air, international treaties, and to study subsidies, rates, cost prices etc.
- To control air traffic, study airports, flight routes, traffic control, navigational aids, communication systems, the international organisation for the dissemination of weather reports, logbooks, accidents; the requirements to be set for flight personnel and flying equipment, registration etc.

The International Air Cargo Association (TIACA)

www.tiaca.org

Established 1960 by companies active in air cargo industry. Represents the air cargo industry before regulatory bodies worldwide.

4.4.3 Most Used Aircrafts and Air Pallets

Air cargo can be carried in either a passenger aircraft or a dedicated air cargo plane.

a. Passenger aircraft
Air cargo on a passenger aircraft is transported in the belly of the aircraft, which is located below the passenger cabin. The belly is accessible from the outside by means of a loading hatch. Lighting, heating and air conditioning are provided, so live animals can be transported as well. The belly must firstly accommodate the passengers' baggage and airmail. The remaining space is available for the air cargo.
N.B: About 50% of air transportation is done in passenger aircraft.

b. Cargo plane
In cargo planes, the freight is also loaded in the belly, but mainly in the cabin and therefore consists mainly of large and heavy items. To this end, these planes are fitted with a reinforced floor and wide doors. In addition, most cargo planes are equipped with a pallet system. First, the cargo is loaded on pallets in the warehouse and tied down with nets and belting. Then these loaded pallets are lifted to the cabin by a high loader, pushed further into the cabin on rollers, which are fitted in the cabin and stowed in place.
In cargo planes which do not have a pallet system, the cargo is simply loaded into the cabin. In order to prevent shifting during the flight, the cargo must be secured by means of nets, belting and ropes.

c. Combi plane (mixed plane)
A combi is, as the name indicates, a combined passenger and cargo plane (Boeing B747M = Mixed). Unlike in the DC-8M used before, a fixed number of seats has been removed from the rear in the B747M, sufficiently to make room for at most 13 pallets. Naturally, these two sections are separated by a bulkhead.

d. Non-palletised aircraft
Below are some loading capacity and range examples of the non-palletised aircraft. Loading capacity means the maximum amount of cargo the aircraft is destined to carry on board. It is usually defined in the unit of kg/m^3.

Table 4.11 Loading capacity and range of non-palletised aircraft

Type	Cargo capacity	Range (miles)
Fokker Friendship F2	400 kg / 2m^3	1,000
Fokker Fellowship F2	400 kg / 2m^3	1,000
Fokker 100	1,300 kg / 4m^3	1,500
Boeing 727	3,500 kg / 7m^3	2,300
Boeing 707	10,000 kg / 33m^3	4,000
Boeing 737	3,400 kg / 7m^3	2,500

e. Palletised aircraft

Below are some loading capacity and range examples of palletised aircraft (including wide bodies):

Table 4.112 Loading capacity and range of palletised aircraft

Type	Cargo capacity	Range (miles)
Airbus A310 PAX 215	10,500 kg / 50m³	4,000
DC10-30 PAX 248	17,800 kg / 60m³	5,500
B 747 - 200 PAX 387	20,300 kg / 75m³	6,800
B 747 - 300 PAX 428	19,500 kg / 75m³	7,100
B 747 - 300 6P.Main deck PAX 288	35,000 kg / 192m³	7,400
B 747 - 300 6P.Main deck PAX 202	55,000 kg / 300m³	7,400
B 747 - 400 with wing tips PAX 421	60,000 kg / 300m³	7,400

Notes:

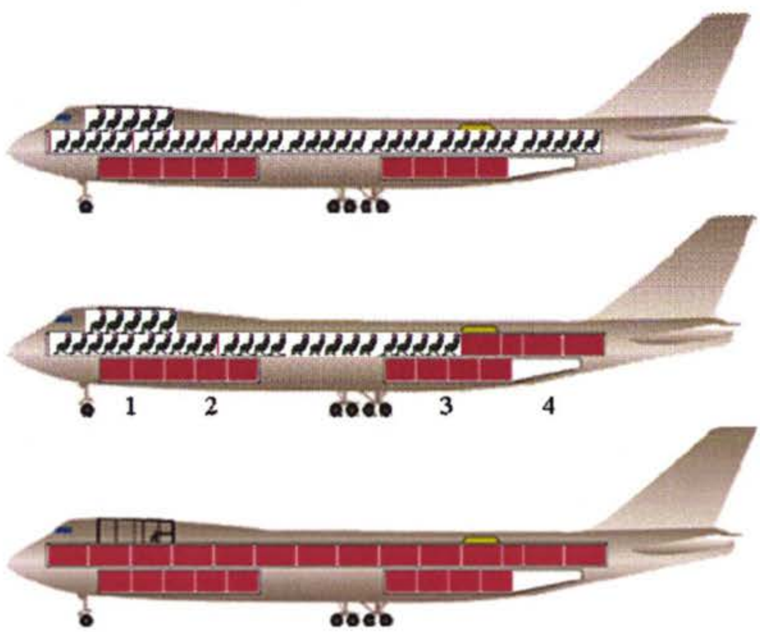
- *Series 300 and 400 with stretched upper deck.*
- *All aircraft appear in various designs pertaining to passenger accommodation and cargo configuration.*
- *Capacity of B 747 - 300 series depends on distance. Example: AMS -BUE direct flight loading capacity is around 900 kg / 75 m3.*
- *Fuel consumption for AMS - NYC flight in normal weather conditions: 80,000 litres.*

Figure 4.8 Aircraft Boeing B747 300 / 400

Passenger aircraft
Cargo capacity approx. 25,000 kg

Combi aircraft
Cargo capacity approx. 50,000 kg

Full Freighter
Cargo capacity approx. 110,000 kg



4.4.4 Loading Devices

In order to speed up the process of air carriage, loading devices, as the easiest manageable packaging units, will be of great use. Easily manageable packaging units can significantly increase the efficiency in handling air cargo, which at the same time will help to change the face of air cargo.
In the sixties and seventies, Unit Load Devices (ULD's) were developed by cargo carriers and container manufacturers in order to facilitate the loading and unloading of cargo, especially for passenger aircraft waiting at the passenger terminal which practically lacked the elaborate on-and-off loading facilities for cargo. As far as the passenger aircraft is concerned, timing is also of great importance. ULD is efficient in use and saves time.

a. Unit Load Device (ULD)
ULD's come in many forms and sizes. Often seen the ULD may consist of:
- Pallet + net
- Pallet + igloo + net
- Container.

There are specialized ULD's as well, which may provide climate control (for vegetables or meats), pressurization (for live animals), or special loading systems (for hanging garments).
ULD's can be easily weighed, physically distributed in the aircraft, and easily handled by ground transportation equipment. Therefore ULD's can be easily integrated in an automated cargo handling and tracking system. Often ULD's can also be used for further carriage by road or water without elaborate re-packing. The disadvantages of ULD's are that they increase weight and fuel burn, and need special handling for packing as well as the harmonization of control and use between carriers. With the increase in size of aircraft and the availability of all-cargo and combi aircraft, the usage of ULD's has been further expanded.

b. Pallet
Pallets are flat sheets of aluminium on which shipment pieces are stacked. It is a platform on which the cargo is built up. Each pallet is usually covered with a net to secure loose pieces. In order to ensure that the built-up pallet fits into the intended aircraft, frames have been designed within which the pallet must be built up. In addition, a maximum permissible mass is set. With regard to flight safety, the cargo must of course not be allowed to shift, so it is firmly tied down on the pallet with a net and straps. To this end, rings are provided around the edges. With this system, loading and unloading can be done in the shortest possible time.

c. Igloo
An igloo is a cap (with net) made from a light but strong material of which the shape matches the profile of the aircraft cabins. The front side is open. The igloo is mounted on a pallet, and the net ensures that the contents cannot move around.

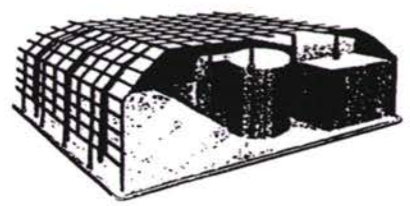
d. Pallet + Igloo + Net
Pallet + igloo + net form an inseparable loading unit. Igloos are made in a range of sizes (large, small, rectangular, half etc.) depending on the type of aircraft in which they are used.

e. Container

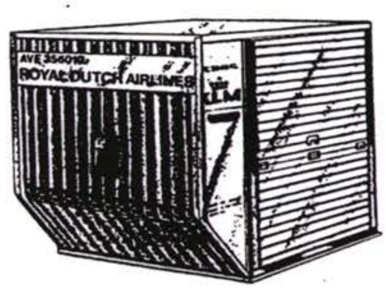
A container is the standardized load unit for transport. The standard size is 20ft, the unit of which is often called TEU. Containers are used for the carriage of most general cargo, baggage and mail. In the Boeing 747 / 747M, DC-10 and A310, containers are often used in addition to pallets and igloos for transporting baggage and / or freight. Containers are loaded into the belly of the aircraft. Detailed descriptions of a set of unit load devices are available on the following page.

Table 4.12 ULD Cargo Units

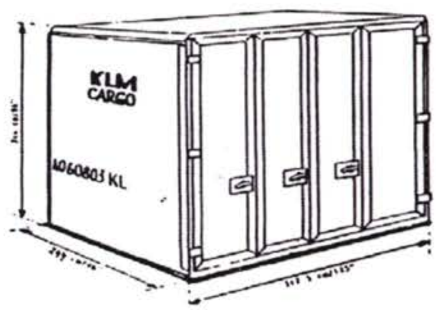
Pallet with net code P



Igloo with net code U



Lower deck container code LD3



Main deck container B747 code MD3

4.4.5 Geography in Air Transport

a. Airports

Local Airports:

A local airport is an airport which handles only domestic flights or flights within the same country. Local airports don't have customs and immigration facilities and are therefore incapable of handling flights to or from a foreign airport. These airports normally have short runways which are sufficient to handle short/medium haul aircraft and regional air traffic.

International airports:

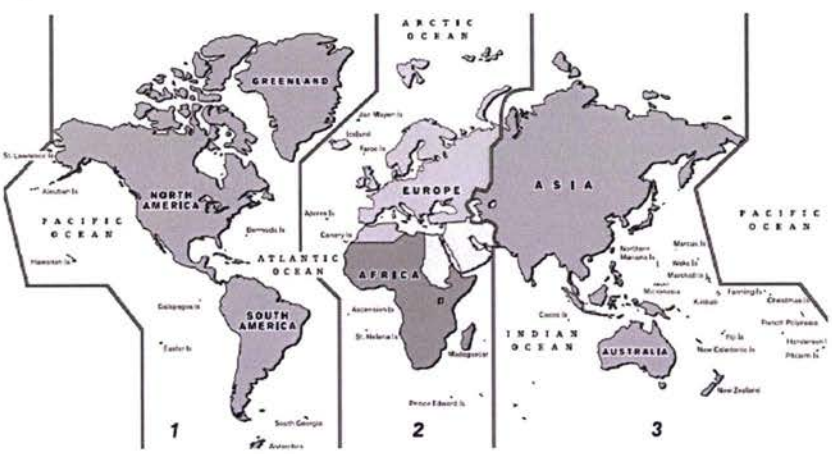
An International airport is an airport where flights from other countries land and/or take off. Such airports are usually larger, and often feature longer runways and facilities to accommodate the large aircraft commonly used for international or intercontinental travel. International airports often host domestic flights in addition to international flights. In many smaller countries most airports are international airports.

Many international airports also serve as "hubs", or places where non-direct flights may land and cargoes may switch planes. International airports often have many airlines represented, and many of these are often foreign.

<u>b. Traffic Conference Areas</u>

Traffic conference areas are divisions of the world used for the purposes of fare construction. The Bermuda Agreement reached between the U.S. and U.K in 1945 established the principle that carriers should make agreements concerning fares and rates, which would then be subject to the approval of the governments concerned. It was also agreed that IATA conferences would be the forum for negotiating agreements on fares and rates. Following that, nine different regional conferences in IATA were established, coordinated by a smaller body of senior industry executives representing the overall view of the industry. It quickly became apparent however that this approach was impractical seeing the difficulty in reaching a universal agreement among the nine regional conferences due to the unilateral action and the frequently incompatible agreements reached among them. The system of Conferences was rearranged and three Conference Areas were established - TC1, TC2, TC3 - which collectively cover the world. This system is still in operation.

Figure 4.9 Traffic Conference Area 1 - 3



Note: TC1 Montreal, TC2 Geneva and TC3 Singapore

To enable the conference system to work in regard to the air tariff construction, airlines have been granted a special exemption by each of the main regulatory authorities in the world to consult prices with each other. However, the organization has been accused of acting as a cartel, and many low cost carriers are not full IATA members. The European Union's competition authorities are currently investigating the body. In the United States, the Civil Aeronautics Board (CAB) accepted the utility of Tariff Coordination in many markets but removed anti-trust immunity from the North Atlantic region.

At Traffic Conferences, transport problems that are not yet amenable to global uniformity are dealt with. These Conferences are autonomous and can therefore, within the framework of their competence, pass resolutions which are valid within their areas.

c. IATA Areas and City/Airport Codes

IATA Areas

IATA divides the world into three traffic conference areas:

1. **Traffic Conference 1** (TC1 - Secretary in Montreal) North, Central and South America and the eastern part of the Pacific
2. **Traffic Conference 2** (TC1 - Secretary in Geneva) Europe, the Near East up to Iran and all of Africa*
3. **Traffic Conference 3** (TC1 - Secretary in Singapore) Asia, Australia, New Zealand and the (western) islands of the Pacific Ocean

The three main IATA areas are further sub-divided into sub-areas. Examples are:

- TC1: the Caribbean sub-area, Mexico sub-area, "Long Haul sub-area, South American sub-area etc.
- TC2: Europe sub-area, Africa sub-area, Middle East sub-area.
- TC3: South Asia Sub-continent, Southeast Asia, Southwest Pacific, Japan and Korea.

d. Airport (City) Codes

Regardless of the size of the airport, all cities in the world that have an airport have assigned a three-letter code that is used in the labelling of luggage and cargo to identify the point of destination. The city code is the same as the airport code. If the city has more than one major airport, codes are then given to identify the airports - the major airport shares the same code as the city - and in such a case, the cargo must be labelled with the airport code instead of the city code.

1. Many codes are made up of the first three letters of the place name:

   ATHENS = ATH DUSSELDORF = DUS
   MEXICO = MEX SINGAPORE = SIN
   RIO DE JANEIRO = RIO TUNIS = TUN

There are cases where several place names start with the same three letters, or that two places in different countries may have the same name:

   MANCHESTER = MAN MANILLA = MNL
   BARCELONA = BCN (Spain) BARCELONA = BLA (Venezuela)

2. Because of the large number of place names encoded (± 5,000), it is also unavoidable that there are codes of which one or more letters do not occur in the place names:

   MONROVIA = MLW LOS ANGELES = LAX
   MALAGA = AGP ABU DHABI = AUH

3. All place names in Canada have three-letter codes starting with Y:

   QUEBEC = YGB MONTREAL = YMX
   WINNIPEG = YWG TORONTO = YYZ

4. Large cities have separate codes for the city and for the city's airport(s):

   LONDON city = LON PARIS city = PAR
   HEATHROW airport = LHR ORLY airport = ORY
   GATWICK airport = LGW LE BOURGET airport = LBG
   NEW YORK city = NYC CH. de GAULLE airport = CDG
   JF KENNEDY airport = JFK
   LA GUARDIA airport = LGA

d. Elaboration of Air Traffic Routes

Figure 4.10 World main air traffic routes (2001)

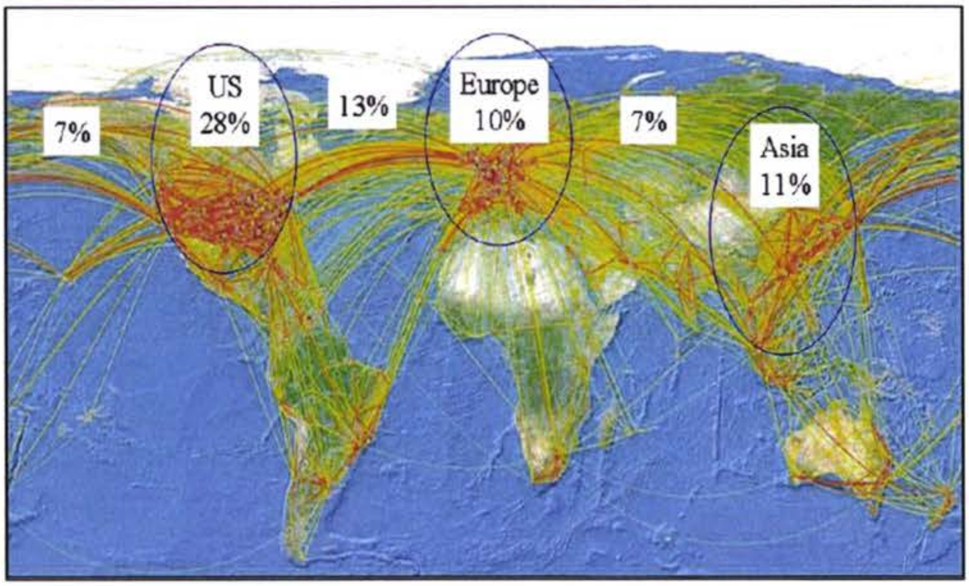


Figure 4.10 shows the world main air traffic routes (2001). Air traffic routes are evolving continuously due to changing world trade patterns, the (re)construction of airports, traffic control and safety issues and political developments, open skies agreements and landing rights etc.

Freight forwarders may also design new air traffic routes as links in multi modal transport chains. For example in the sea-air concept money is saved during the maritime leg while time is saved during the air leg. The total result might be therefore cheaper than full-air transport and faster than fullsea transport.

An example can illustrate the efficiency in designing the new traffic route: the route Singapore – Antwerp, with transhipment in Dubai.

Full sea transport Singapore - Antwerp (containerised) takes approximately 20 days.

The sea - air alternative of Singapore - Dubai by ship (containerised) takes about 10 days, followed by intermediate handling in Dubai (the Dubai airport is located near the port and facilitates rapid sea-air transfer) and by a flight Dubai - Antwerp (palletised), which takes 1 day. The total time saved in this case is approximately 9 days.

Appendix 1, Chapter 4 Acronyms and Terms

AGC : European Agreement on Main International Rail Routes
AGTC : European Agreement on Important International Combined Transport Lines and Related Installations
CEEC : Central and Eastern European Countries
CER : Community of European Railways
CIF : Cost, Insurance and Freight
CIM : Contract for International Carriage of Goods by Rail - International Consignment Note of COTIF
COTIF : Convention concerning International Carriage by Rail
CT : Combined transport
DIUM : Uniform Distance Table for International Freight Traffic
EC : European Commission
ECO : Economic Cooperation Organisation (Islamic states)
ERA : European Railway Agency
EU : European Union
FBL : FIATA bill of lading
FCL : Full container load
FOB : Free on Board
MLA : Basic Multilateral Agreement of TRACECA
MTT/ETT : International Transit Tariff (Russian abbreviation) of OSJD members
NIS : New Independent States (former CIS)
NHM : Harmonised Commodity Code - Harmonised System (HS)
OSJD : Organisation for Railways Cooperation
OTIF : Intergovernmental Organisation for International Carriage by Rail
RID : Regulations concerning the International Carriage of Dangerous Goods by Rail
RIV : Agreement governing the Exchange and Use of Wagons between Railway Undertakings
RIC: same, but for passenger coaches
SMGS : Convention concerning the International Carriage of Goods by Rail - Agreement on International Rail Freight Communications, by OSJD
TEU : Twenty-foot equivalent unit (container)
TRACECA : Transport Corridor Europe - Caucasus - Asia
TAR : Trans - Asian Railway
UIC : International Union of Railways
UIRR : International Union of Combined Road - Rail Transport Companies
UNECE : United Nations Economic Commission for Europe
UNESCAP : United Nations Economic and Social Commission for Asia and the Pacific

Appendix 2 Chapter 4 Rail Transport Further Reading

Web Sites

CER (Community of European Railway and Infrastructure Companies) **Link**: www.c
CIT (International Railway Transport Committee) **Link**: www.cit-ra
CLECAT (European Association for Forwarding) **Link:** www.cleca
ECMT (European Conference of Ministers of Transport) **Link:** www1.oecd.org
EIA (European Intermodal Association) **Link:** www.eia-ngo
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Freight Forwarders Training Courses
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EIM (European Rail Infrastructure Managers) **Link:** www.eimra
ERA (European Railway Agency) **Link:** www.era.
ERFA (European Rail Freight Association) **Link:** www.er
ERFCP (European Rail Freight Customers' Platform) **Link:** www.erfc
European Commission Link: europa.
European Railway Review Link: www.russellpublishing.com/railway/index
ICF (Intercontainer - Interfrigo) **Link:** www.icfonline
OSJD (Organisation of Railways Cooperation) **Link:** www.rail-net.org
OTIF Link: www.ot
(Intergovernmental Organisation for International Carriage by Rail)
RFG (Rail Freight Group) **Link:** www.rfg.o
UIC (International Union of Railways) **Link:** www.uic.a
UIP (International Union of Private Wagons) **Link:** www.uipra
UIRR (Int'l Union of Combined Road - Rail Transport Companies) **Link:** www.uirr
UNECE (United Nations Economic Commission for Europe) **Link:** www.unec
UNESCAP Link: www.unesca
(UN Economic & Social Commission for Asia & Pacific)
UNIFE (Union of the European Railway Industries) **Link:** www.unif

Legal Documents

- Convention concerning International Carriage by Rail of 9/5/1980, version applicable as from 1/11/1996 (COTIF).
- Uniform Rules concerning the Contract for International Carriage of Goods by Rail (CIM) - Appendix B of COTIF.
- Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) - Annex I of CIM.
- Regulations concerning the International Haulage of Private Owners' Wagons by Rail (RIP) - Annex II of CIM.
- Regulations concerning the International Carriage of Containers by Rail (RICo) - Annex III of CIM.
- Regulations concerning the International Carriage of Express Parcels by Rail (RIEx) - Annex IV of CIM.
- Amendment Protocol (Vilnius Protocol - 3/6/1999) for revised COTIF 1999.
- UNECE International Convention to facilitate the crossing of frontiers for goods carried by Rail (1952).
- UNECE International Convention on the Harmonization of Frontier Controls of Goods (1982).
- UNECE European Agreement on Main International Railway Lines / AGC (1985).

- UNECE European Agreement on Important International Combined Transport Lines and related Installations / AGTC (1999).
- E.C. Infrastructure Directives (91/440, 95/18, 95/19, 2001/12, 2001/13, 2001/14).
- E.C. Interoperability Directives (96/48, 2001/16).

Selected Studies and Reports

- E.C. / TACIS Technical Assistance projects (TRACECA region)
- TRACECA Trade Facilitation, 1998.
- Joint Venture for Trans - Caucasian Railways, 1998.
- Railways Tariffs and Timetable, 1998.
- Intermodal Services Implementation and Training, 2000.
- Harmonisation of Border Crossing Procedures, 2003.
- Unified Policy on Transit Fees and Tariffs, 2003.
- Common Legal Basis for Transit Transportation, 2004.
- UN-ESCAP Studies and Reports
- Development of Asia - Europe Rail Container Transport through Block Trains,
- Northern Corridor of TAR, 1999.
- Development of Trans-Asian Railway (TAR), Southern Corridor, 1999.
- Development of Trans-Asian Railway (TAR), North - South Corridor, 2001.
- Transit Transport Issues in Landlocked and Transit Developing Countries, 2003.
- UIC: Global Rail Freight Corridors (Europe - Asia) Traffic Study, 2000.
- E.C. With Paper: European Transport Policy for 2010, 2001.

Appendix 3 Chapter 4 The Warsaw Convention

The Warsaw Convention provides, among others:

- the transportation document (air waybill);
- the right of disposal of the sender and the receiver;
- the carrier's liability and
- the right to claim.

Sender's right of disposal
The sender may dispose over the shipment up to the arrival of the goods at the destination. He can exercise this right only upon presentation of his original copy of the waybill. (He can have the goods held up pending closer instructions, change the destination and/or address, request return to his address etc.).

Receiver's right of disposal
The sender may dispose over the shipment after arrival of the goods at the destination (he may be notified of its arrival by telephone and/or in writing; sometimes receivers give specific instructions on how to deal with all shipments arriving for them by means of transfers to shippers.)

Carrier's liability
The carrier is liable for all damages arising from damage, delay and loss due to negligence of the carrier. If the provisions of the Convention apply, then it is up to the carrier to prove that the damage was not caused by negligence on his part, but by force majeure, for instance. The carrier's liability is limited to U.S. $ 20.00 per kg.
However, the carrier may be held liable without limitation if:

- gross negligence or wilfulness on the part of the carrier is proven;
- if no waybill is present when the shipment is stored;
- if the waybill was not completed in full.

Value for transport
By stating a "value for transport" for shipments with a value exceeding U.S. $ 20.00 per kg gross, the sender can raise the carrier's liability to this stated amount. In this case a value surcharge of 0.5% is payable. Some exceptions are possible. Little use is made of this option, as the sender can cover his risks better and often even at a lower premium by insuring the shipment on the waybill. This facility is offered by many airlines.

5 Logistics Terminals in Central Asia

Learning Objectives for Lecture 5:

- To learn about current situation in Logistics Centers in Central Asia.

5.1 Trends in Logistics and Multimodal Transport

Inter- modality is in its infancy in the Central Asia region countries. To fully develop the transit potential of the area, and to cope with changing demands, it is needed to close missing links and introduce modern logistic concepts and technology, including the increased use of IT.

Over the past decade, ESCAP member countries have benefited substantially from the process of globalization. While the examples of China and India (where growth rates have persistently exceeded 8 per cent and 5 per cent respectively) are often cited, the Republic of Korea, Singapore, Thailand, and more recently the Russian Federation and the Republic of **Kazakhstan,** have also performed strongly.

Closer examination of this regional success, however, reveals that, in general, it is the coastal areas of the region that have benefited most, with development levels often declining in areas further away from the coastline. Many factors have influenced this process, including the higher costs of accessing international markets, as well as doing business without adequate connections, which often make inland locations less competitive.

Historically, economic growth and trade in countries has been centred around seaports. As this trade has grown, it has attracted to the area both factors of production and a supply of associated services, which in turn have attracted further growth and investment.

With the coming into force of the Intergovernmental Agreement on the Asian Highway Network, and the adoption of the Intergovernmental Agreement on the Trans-Asian Railway Network, Asia has made substantial progress in creating new opportunities to expand the benefits of globalization to inland locations and to a wider population.

According to ESCAP establishing dry ports would allow shippers to undertake consolidation and distribution activities as well as export/import procedures at inland locations that are at relatively short distances from factories and farms. Completing necessary documentation and procedures at these facilities could help reduce congestion and delays at border crossings and ports, thereby reducing transaction costs for exporters and importers. This is particularly important for landlocked countries, and is consistent with the objectives of the Almaty Programme of Action.
The development of a network of dry ports as load centres also has the potential to promote traffic on railways rather than roads, which could have significant environmental benefits.

The extensive coverage of the Trans-Asian Railway and the Asian Highway networks across the ESCAP region indicate they may provide a useful "starting point" for considering dry port locations. For example, the Intergovernmental Agreement on the Trans-Asian Railway Network, adopted by ESCAP at its sixty-second session, in April 2006, identified stations with container terminals to handle International Standards Organisation (ISO) containers of at least 20-foot dimension in length.

5.2 Current Situation about Logistic Centres in Central Asia

The globalization of economy and the growth in Asia (basically in China), has created a strong potential for rising transit freight flows through C. Asia on the Eurasian corridors. The disintegration of Soviet Union, earlier, has also redirected the flows or changed the type of raw materials or final products transported.

Although Kazakhstan is advancing very fast in liberalizing transport sector, Uzbekistan has still enough government control in transport sector and not enough deregulation, advancing at very slow speed.Kazakhstan and Uzbekistan have recently conducted National Transport strategies, while Kyrgyzstan and Tajikistan are conducting such plans with support from ABD.

The changing methods of transport and the further development of multimodal transport have and are imposing new needs for infrastructure, especially multimodal terminals which internationally are developing to Logistic Centers incorporating all related functions of international transport and logistics.

LC's is no more an unknown development in Central Asia. In **Kazakhstan** there is already an LC in full operation ("**ASTANA CONTRACT**" in the north suburbs of Almaty), while another one is under construction nearly to finish and partly operating too ("DAMU Almaty") also located north of the Almaty city centre.

Kazakhstan is advanced compared to the other CAR's in the development of its network of LC's. But there is no clear strategy yet and no clear legislation for FF and Logistics, neither clear rules of how and where, who may develop LC's.

However DAMU, a private fund is developing a second LC at Astana. They move very fast irrespective of the bureaucracy and the big number of permits they have to get. They are also about to start development of a third big LC of 250 HA at Aktobe, while planning another at Dostyk. "ASTANA CONTRACT" also plans to develop one at Astana and recently bought the land.However in Kazakhstan according to ANEK (KIFFA) the terms Logistics and Logistics Centres are not well understood yet. There is lack of trained human resources, thus capacity building is needed with appropriate courses, from the ANEK training centre or from the universities .In addition the LC's referred above do not operate as full LC's offering the full spectrum of services but rather as warehouses and container yards.

Uzbekistan is also in the final stage of developing a LC in Tashkent near Sergely rail station. The planning is done by **UZVNESHTRANS** a state company, however private capital is welcome for the development and operation, but the rules of participation are not set yet.

Moreover operates in Uzbekistan the very well organised **Bukhara Cotton Terminal** which gathers a lot of the functions of a LC, but is dedicated to one product.

Tajikistan and **Kyrgyzstan** are way behind in developments, but the need is widely recognised, strategic ideas are discussed, finance is missing and therefore a lot of steps are to be done. In the two countries the retail is done through bazaars where they bring directly containers (e.g. with shoes imports from China or Turkey) and sell directly from the inside of the container.

In general in the countries of the region one can identify different levels of deregulation and of liberalization of economy, different level of recognition by the respective governments, of the benefits of LC's and lack of clear policies and legislation in FF and Logistics.

There is need for training of International freight operations, freight forwarding, multimodal transport, logistics organization. In addition there is need for cooperation between the countries of CA in order to develop a regional network and not isolated LC's, which will cater for transit, imports and exports and regional distribution. The new project for feasibility of LC's in CAR assigned by EC, will define the priorities.

The international trend is to develop LC's with the cooperation of private sector under PPP schemes, always involving big players in the international logistics market (with appropriate know-how, already operating big LC's.

The institutional and legal framework should be adapted to allow for such PPP schemes in all the countries of C. Asia.

For any planning and feasibility studies are necessary proper Origin / Destination Data which are not available in CAR's. Thus there is a need to establish an **observatory for transport sector in C. Asia**, in order to collect information on flows, fleets, networks, O/D surveys, monitor implementation of policies, accidents, projects / works, schedules and to establish databases and GIS, maintain these by common funds in regular basis.

5.2.1 Kazakhstan

Almaty new Industrial & Logistic Centre LC, DAMU

Photo 5.1. DAMU

It is located in Kazakhstan, Almaty Oblast 10 km far from Almaty centre to the north, on the Almaty - Kapchagai road. It is also 2 km away from "Otegen Batyr"settlement and 1.5 km from "Zhetysu" Railway station. The Total area is 130 Hectares. Of it the Industrial zone is 90 Hectares, the Warehouse facilities occupy 20 Hectares, the Infrastructure & Logistic area takes 10 Hectares and the Infrastructure zone, 10 Hectares.

The Infrastructure includes: Electricity - heating - water supply system, Sewage system, Digital telecom, Locomotive depot, Office premises, hotel, catering and Road and railway network. The schedule for sale or leasing to Clients is for the Industrial area sale: 2006, for Industrial buildings sale: 2007, for Administrative building for rent: 2007.

The Development Plan foresees the following:

- Warehouse facilities 100.000 pallets
- Industrial zone: 90 Hectares
- Auto & railway network
- Railway depot (own locomotives)
- Wagon washing facility
- Switch yard
- Railway loading park
- Weight platform (for wagon & auto)
- Administration unit (hotel, office premises, sport facility, parking, car wash, catering)

- Sewage purifying facility
- Fire fighting facilities
- Heating system
- Sewage system
- Water supply system
- Electricity supply
- Container area
- Parking for long vehicle
- Infrastructure for multimodal transportation
- Video monitoring

The total Area will reach 220 Ha. It is still under construction but there are warehouses already in operation.

A Special decree exists to install Logistics centres outside city centres.

Rail siding exists to the site and a main highway in front (highway Almaty - Ust Kamenagersk to Russia). It will have its own locomotive depot and own locomotives. There are 2 warehouses of 17.000 m^2 3 of 25.000 m^2 with a height of 10,5 m. AGIPLAN (Germany) has CONDUCTED the master plan.

The facility can accept 80 - 120 wagons (capacity) per day plus 15-20 containers / day. The same joint venture has also under construction one LC in Astana and is planning start shortly construction in Aktobe and in Dostyk. The company has signed a memorandum with KAZTRANSSERVICE for joint container operation to they Almaty 1 rail terminal. DAMU is totally providing the investment, having bought the land and financed the development and operation.

A big manufacturing plant of Philip Morris exits nearby and does not have enough warehouses. Thus PM wants to use a warehouses DAMU. In addition Prokter Gable is their client for imported goods (from Europe). Already some warehouses operate for storage (since years). These are heated warehouses.

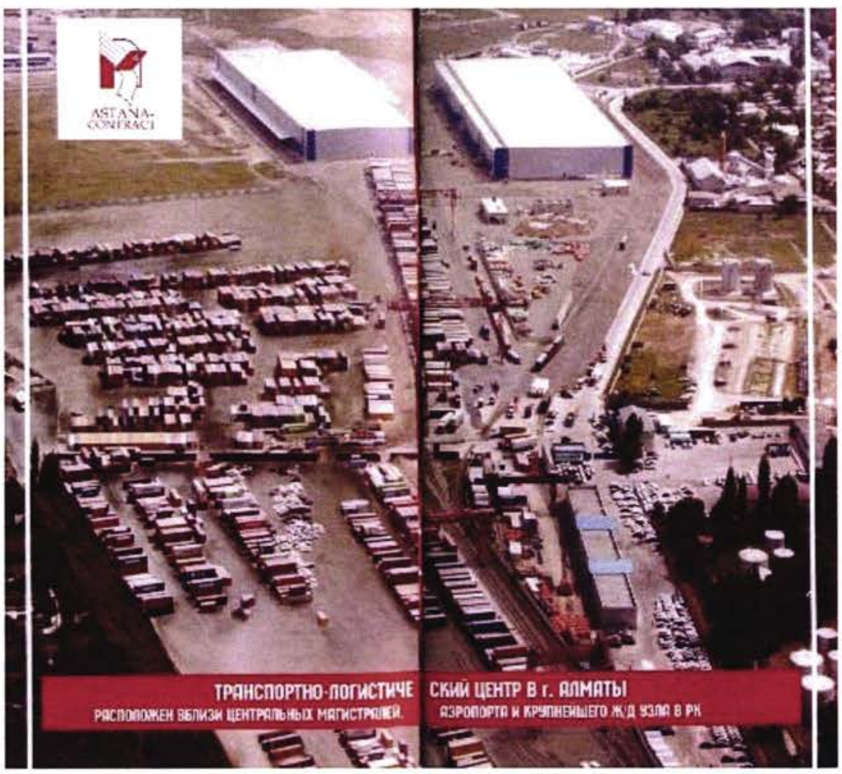
"ASTANA CONTRACT" Transport-Logistics Centre (LC) in Almaty
It is located near the international highways, airport and the biggest railway junction in Kazakhstan at the North suburb of Almaty (3 kms far from airport).
It offers: Railway container terminal; Commodity cash desk of Railway station Almaty 1; Customs station; Modern A+ class warehouse made from lightweight metal constructions; Offices; Twenty-four-hour parking for trucks

The CONTAINER TERMINAL SERVICES include:
- Specialized container terminal with access railroad lines to perform all operations with large-tonnage containers (60000 TEUs per year);
- Storage of containers;
- Receipt and dispatch of cargoes (including oversized cargoes and motor vehicles) in freight cars and platform;
- Commodity cash desk services of Railway Station Almaty-1;
- Customs Clearing services;
- Professional management system;
- Fiber-optic telecommunications;
- Services of commercial access centre to information systems & data bases of transport department.

The WAREHOUSE LOGISTICS SERVICES include:

- Safe storage of products;
- Information about stock, status and movement of products in real time regime;
- Customs clearing;
- Address delivery of products;
- Pallet-forming, orders-forming;
- Co-packing, marking;
- Handling of products, registration of movement and storage of products in warehouse;
- Products insurance from all types of risks.

Photo 5.2. Astana Contract



The construction of this transport-logistic center, was done to international standards, with application of modern information systems and technologies, and has permitted during the year 2006 to operate more than 25.000 containers, that is 40 % more than in 2005.

The plans of the "ASTANA-CONTRACT" (joint-stock company) for the next 5 years include building of Transport-Logistical centers in the cities of Astana, Karaganda, Shymkent, Aktobe (Kandygash) on the Dostyk railway station, on the Horgos road border crossing and the port or Aktau city. This first Transport Logistic Center of Kazakhstan, was inaugurated in Almaty on the 20th September 2007. This Project was started two years ago, and took 14 months to complete.

The cargo is stored, in an area of 50.000 square meters. There are permanent storage areas, and one compartment of 5000 square meter for temporary storages. The sites will be leased for 5-7 years. Simultaneously, 70.000 pallet –

places will be stored, or 500 to 600 railcars. The Terminal area is 25 hectares, the 5 hectares of which is a grant of Almaty Akimat. The Project cost was $ 50.000.000.This TLC can operate 60.000 containers today and later 80.000 per year.

(PARAGON Development is one of developers of "Astana Contract" which has 2 admin. Structures one joint stack (owners a done limited liability for operations). The land belongs partly to Paragon Dev. and the rest to Astana Contract which is owned by the same shareholders. Paragon is a financing company. The Astana contract Ltd leases the land from Paragon and Astana Contract J. Stock company. Two (2) warehouses Class A (European standards), total 50.000 sq.m covered area height is 12 m. They established also a company (CALM) to do the warehouse management. They visited 3 years ago 14 warehouses in NL to learn. It is divided in warehouse zone, container yard and zone for imported cars. It has 9 rail sidings. "Astana Contract" is mainly container terminal.

The equipment includes 5 gantry cranes Russian or Ukrainian fro 40' and 20' and 1 reach stacker and 5 mobile cranes. Almaty is major rail junction towards China and Russia and South Kazakhstan, (Karaganda is also big freight junction) near Almaty 1 rail terminal (2 km chose to Taldy Kurgan city region (to the North). Very strategic location. The area in Sq. m for container park is 5 HA for full, plus 12 HA for empty containers. Big problem are the empty containers, they transfer them to China or Pusan port, South Korea and to Russia via Vladivostok. They only import full containers to Kazakhstan, then most are sold to the market empty or returned back via the ports (China, Korea).

Containers per year handled: (already the container yard operates 10 years) 1.200 - 2.000 per month full, 1.000 - 15.00 empty per month X 1,7 = TEU's. 4 of the 5 cranes are new and can carry up to 50 tones (one is older and is only for 20 feet containers) is not PPP, purely private they constructed 6 kms of the approaching rail line. Thus 117 wagons can be processed by proprietary shunting locomotive.

There are plans to expand the area by 20 HA (to buy the land) and build new warehouses. But still they don't work in full capacity (medicals from Germany, Bulgaria, Hungary) for parts Nissan use the warehouses. There are also 8.000 sq.m. bonded heated warehouses for pharmaceuticals . There are also custom control, custom brokers, X-ray control.

The owners of "Astana Contract" have bought 46 HA in Astana and will develop there a new LC too.

Astana new Industrial & Logistic Centre, DAMU

It is located in Kazakhstan, in Akmola region, 7 km far from Astana centre to the north, on the Astana - Pavlodar and Astana - Kustanai roads. It is also 20 m away from the Railway station No 39. The Total area is 53 Hectares. Of it the Industrial zone is 29 Hectares, the Warehouse facilities occupy 12 Hectares, the Infrastructure area takes 3 Hectares and the WDC zone 3 HA and the container platform 3 Hectares. The Structure includes Industrial zone, Heating system , Wholesale distribution centre, Utilities (power station, water-well, etc), Expocentre.

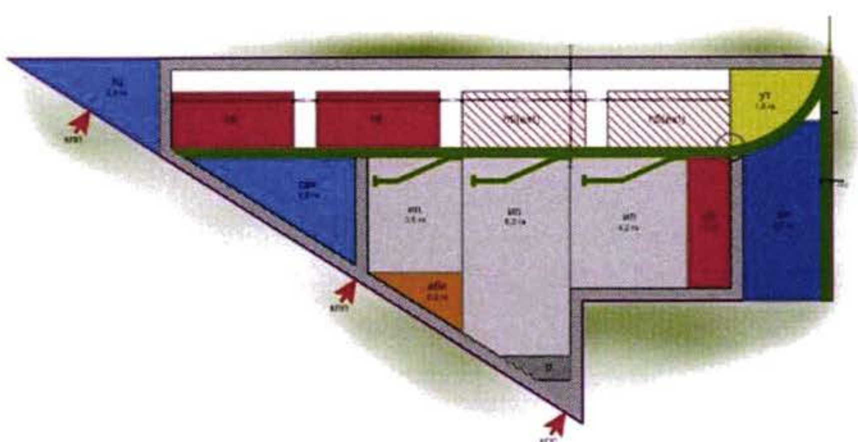
The Infrastructure includes: Electricity - heating - water supply system, Sewage system, Digital telecom, Locomotive depot, Office premises, hotel, catering and Road and railway network. The schedule for sale or leasing to Clients is for Industrial area sale: 3 quarter 2007, for Warehouse facilities for rent: 3 quarter 2007, for Expocentre for rent: 3 quarter 2007, for Industrial buildings sale: 2008 and for Administrative building for rent: 2008.

The start of operations is scheduled for end of 2008.

The Development Plan foresees the following:

- Warehouse facilities 88.000 m^2, first phase - 44.000 m^2
- Industrial zone: 53 Hectares
- Auto & railway network
- Railway loading park
- Weight platform (for wagon & auto)
- Wagon's carriage
- Administration unit (hotel, office premises, sport facility, parking, car wash, catering)
- Sewage purifying facility
- Fire fighting facilities
- Heating system
- Sewage system
- Water supply system
- Electricity supply
- Container area
- Parking for long vehicle
- Infrastructure for multimodal transportation
- Video monitoring

Photo 5.3. DAMU Astana



The Forecasted Freight Turnover for Loading/unloading operations will be 1.350 wagons per month or about 16.200 wagons per year.

The Types of freight to be handled will include:

1. Containers;
2. Construction materials;
3. Construction machinery and facilities;
4. Cars;
5. Agro-machinery / equipment;

6. Household chemicals, cellulose;
7. Other cargos (non-dangerous)

Tashkent Tovarnyi ("Goods") Rail Terminal

The available area is about 16,5 HA, but there is no other area for expansion, the infrastructure is old fashioned. Main activities are focused on cargo storage in accordance with cargo classifications. For this purpose there are over 20 warehouses available in the terminal, each of them has its own railway track enables cargo loading / unloading inside of the warehouse. The path-routing is divided into 4 railway tracks. The terminal is planned for handling of the cargoes with final destination in Uzbekistan. Loading / unloading activities of transit cargoes are not possible there. All warehouses need renovation or better need to be built from the beginning to be taller (12 m high instead of 5m). At the moment 3 warehouses with the total square area of 2250 sq.meters (750 sq.m each) are under large-scale rehabilitation financed through the budget of the company. The reconstruction is being undertaken in accordance with the European standards, main aim of which is ability to maintain certain temperature regime. However reconstruction has stopped due to lack of funds from international donors or private investors (PPP or private financing). The cranes for 3-5 containers should be removed. The areas for stowing 3-5' containers should be freed as these containers are not used anymore. The location is appropriate for city logistics (it is located near the city centre).

The Owner and Operator is UZTEMIRYULKONTEYNER, a Jointstock company of the State and of the Railways, which has branches in Bukchara (not priority for upgrading), Termez, Andijan, Tashkent, Fergana (Kokhand city), Nukus and Karshi city, but not in Navoi city (in Tinchlik station where the government is planning to develop a LC as a first priority).

Containers of 3-5-20-40 feet can be processed there. Joint Uzbek-Russian Entity is located in the terminal (Uztemircontainer from the Uzbek side - and DVTG company from the Russian side). There are 5 loading trucks of Japanese origin (Mitsubishi) operated in the terminal.

Chukursay Railway Terminal

Photo 5.4. Railway Terminal Chukursay

Suitable for 20-foot and 40-foot containers handling		
Total square area of the freight yard	-	18,9 ha
Platform for handling of large-, medium-tonnage and bulky containers / freights	-	5
Total area of the platform	-	43100
sq.m.		
Turnover capacity for large tonnage containers (2 levels)	-	1200
Daily handling output for large tonnage containers	-	300
Simultaneous wagon placing capacity	-	141
Quantity of approaching ways	-	13
Total length	-	7 km
Availability of electric gantry cranes (8):		
of 5 tn load capacity	-	2
of 10 tn load capacity	-	1
of 20 tn capacity	-	3
of 30 tn capacity	-	1
of 32 tn capacity	-	1
Availability of wheeled-facilities track for unloading	-	1
Availability of reach stackers	-	1

The terminal is owned by the Open Joint-Stock Company Uztemircontainer. The company is a transport-forwarding container fleet operator of "Uzbek Railways" (Uzbektemiryullary), involved into international and domestic cargo transport. At the time being 90% of the company's assets are put out to tender. The total square area takes 18,9 hectares. There are 2 cranes for 20-feet containers of Russian origin and one for 40-feet containers of German origin. Also there is a crane suitable for handling of 3-5 tn containers, which is practically is not under operation at the present moment. All the available facilities are being operated for over 30 years mainly for transit freights handling and are in obsolete condition causing often failures. Accessing railway branch line has 12 path-routing tracks, on one of which all the operated cranes have been assembled. Usually 23 container platforms are handled during 1,5 hours. There are opportunities to upgrade the terminal productivity in double through spare area and available 3-shift technical personnel provided that an additional 40"-container crane is installed. Alternative and considerable advantage will provided through purchase of one shunting diesel locomotive (in terms of independent platforms delivering) for independent operation by technical engineering services of the terminal enable inner self planning of loading / unloading activities and awaiting time reduction. There are a number of companies leasing the terminal area aimed at container cargo handling and presenting repair and maintenance services of railway wagons and facilities, obtaining their own equipment. They are - "Shoshtrans" company and private car-repair operator and other small ones.

Photo 5.5. Chukursay

The Chukursay Rail terminal is mainly operated by Shoshtrans. Shoshtrans has here a warehouse, own fleet and a new reach stacker. According to Shoshtrans Chukursay is the best location for serving Tashkent and the area. Shoshtrans is JV of Russian and Swiss investment with the State, which in essence means that this is a good example of a PPP. Shoshtrans JV has started in 1994. 5 years ago there was a very limited volume, now it's growing bigger, due to a boom of textile industry, exports are expected to grow ("Daewoo Textile"). Import has grown too from China. They own a part of Chukursay terminal (15.000m^2) and their capacity reaches 600 containers per month. A 32% share belongs to the UZBEK partners, while "Transsibirsk express" is the Russian partner. The partner from Swiss is "Transrail", while UZBEK railways is also a partner. They are profitable but need more financing to enlarge. Their truck fleet age is over 12 years, thus they want to renew it. If they can enlarge the truck fleet by 30 trucks, they can provide full operation to Fergana avoiding passing through Tajikistan.

Only Shoshtrans, has in Chukursay, a throughput of 600 containers of 20' and 40' per month, only for Asaka (Daewoo) factory. They use the route through Kamchik pass to go to Fergana - Andijan where is the Daewoo Asaka factory (origin Korea, China).

Bukhara Cotton Terminal
Bukhara is a cereal and cotton producing area, irrigated from Aral lake and rivers, however salivation of waters is a problem. Bukhara Cotton Terminal is dedicated only to cotton storage and loading to trains for long distance, or trucks (minor share) for short distance. There is some container handling too, for small quantities and for cotton only. The area of the terminal is 19 HA. Warehouses exist for cotton storage, the covered area is 35.000m^2. There is no area for expansion.

Nine (9) factories produce cotton in the greater area of Bukhara, at a range of 70 kms (125.000 tons yearly), cotton comes to the Bukhara terminal for consolidation and reloading for long distance transport (on trains). Trucks are mainly used for incoming cotton except from Karakol district that are transported with rail. Wagons are loaded from the side with 18 forklifts and reach stackers. The cotton terminal is equipped with two big cranes (Kalmar) for loading containers (which they fill here with cotton).

This is a very well organized and equipped cotton terminal where it is possible to have storage of cotton bought from clients. The land outside the terminal is not available (is privately owned), while there is also a refinery of oil from the other side. Traceca is donor for equipment (reach stacker) to the Bukhara cotton terminal. The poor condition of access road due to heavy winter should be pointed out.

The LC planned by UZVNESHTRANS in Sergely (Tashkent)

UZVNESHTRANS is a Transport F.F. company established 1991 as a joint stock company, having branches in all regions of UZBEKISTAN. They offer also the functions of customs brokers and of freight insurance for freight coordination of cotton consolidation in Buchara terminal (it's their terminal). Main cargo is cotton fiber export. They are the basic player in fiber export from Uzbekistan, while 30% of their activity goes to metal, fertilizers, grain transport

In 1998 they have established a JV "UZ Georgia Trans" with Georgian partners, within MLA agreement they have had 5 ~50% discounts on rail way tariffs. On Trans Caucasus corridor which is part of TRACECA, within 4 years, with the above JV, they have managed to transport 270.000 tons of cotton. Then discounts were cancelled and it became a non viable operation. They are mostly interested again to operate on this corridor and more. Specifically from Turkmebashi (by ferry) to Baku then by rail to Poti in 15 days or from Aktau port by ferry to Baku, then by rail to Poti (a trip duration of 15 days is expected in both cases). Now they obligations go to Bandar Abas by rail or to Ilytsevsk by rail through Kazakhstan and Russia in 25 days.

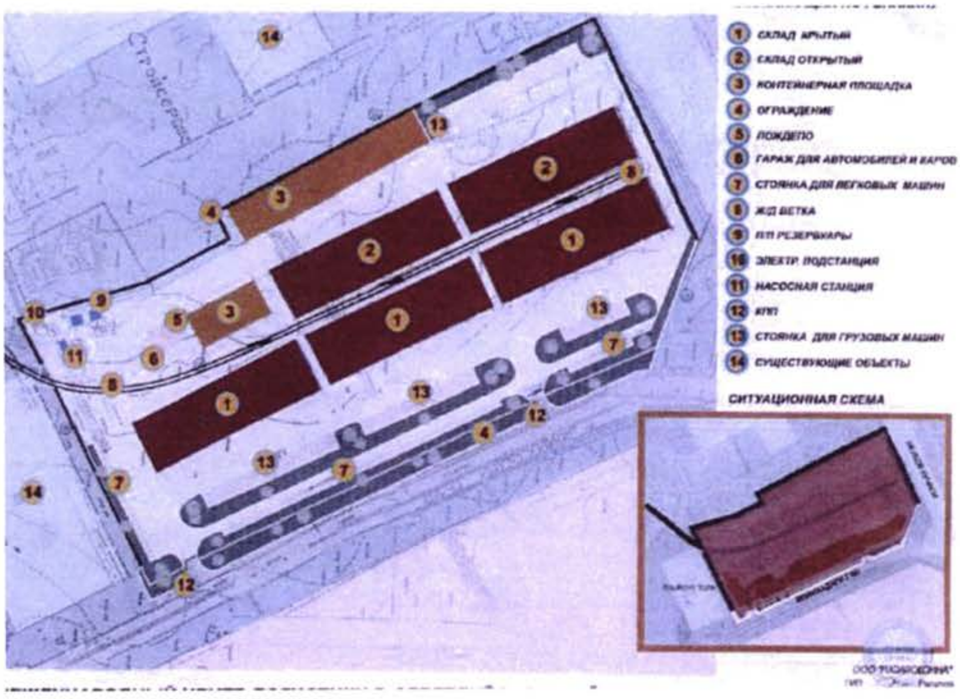
Two (2) years ago the President of Uzbekistan has signed a resolution for establishing LC's. The idea existed as of 1998. Dornier has consulted them, they already have a master plan for a LC in Sergely, they will start construction in a plot of 19 HA, for 50.000 sq m. of covered warehouses (10m high), with special custom zone and hotel. For refrigerated storage warehouses of 10.000 sq m are foreseen for commodities warehouses 20.000 sq m (electronics, white appliances), 10.000 m^2 for cotton products (fibre), 10.000 m^2 for metal, timber and 2 container yards, independent to speed the process. It will be financed by UZVNESHTRANS but also welcome private investors because it is a huge project of 15 mio €.

The Uztsasprom national design company, having experience from Kazakhstan of such LC's design, has conducted the Sergely LC master plan and detailed design, (they have branch in Almaty). It is not a part of the existing rail terminal and they will construct a rail siding 800 m long, to connect it. It will be for international transportation, will be the first LC in Uzbekistan, will serve all regions up to Bukhara.

They plan to establish a second one in Termez, which is a junction for borders of Afghanistan, Turkmenistan, and Tajikistan. It will be nearby the river port. They operate vessels to Turkmenistan, Tajikistan, Afghanistan (limited volumes 200.000 tonnes / year for humanitarian aid, charcoal, construction materials). The capacity of the port is 2-3 mio tones. They do not have their own fleet of trucks but are planning to buy within the new Sergely LC project budget. They use rail wagons or containers (of which there are many available in Uzbekistan).

Photo 5.6. New IC planned at Sergely Site by Uszvneshtrans

Photo 5.7. Master Plan of New IC planned at Sergely Site by Uszvnehtrans



5.2.2 Prospects about Logistic centres in C. Asia

The LC concept is considered to be appropriate for the C.ASIA region .It is expected that the development of freight villages would show similar benefits as in Europe. It is reasonable that the municipal and regional administrations coordinate the spatial planning. The state should be responsible for infrastructure development (roads, rail, waterways, ports, terminal concept). The LC concept is appropriate in general, but C. ASIAN countries specifics must be considered. The private sector could / should play a bigger role in development and financing (development funds, development enterprises). Openness of the freight villages should be ensured, monopolies should be avoided. Railways involvement is necessary (intermodal terminals). Pilot projects to learn from should be encouraged. Locally different solutions are possible. An umbrella organization and master planning would be helpful

Multimodal logistics network cannot exist without proper rail terminals. Railway is very important ingredient in a logistics network. Railways were very strong in old Soviet Union and there is a lot of infrastructure especially in Uzbekistan and Kazakhstan left from its heritage, that should be maintained for not being neglected with its role in comparison to the road transport. The Rail Terminals need renovation in general and better road connections. Some rail terminals need parking and manoeuvre areas for truck and warehouses. Some are congested as Chukursay and Almaty, but most other underutilized such as Bishkek, Tovarniny.

Kazakhstan can be seen as a model in the area in terms of developments in Logistics for setting up the legislation and preparing the proper environment for allowing PPP or totally private investments, but training, capacity building is needed in all 4 countries.

The possible government and private sector roles, as it is shown from international experience in seaport ownership and operation, are that the state usually has the ownership and is responsible for the regulation, while operation and management is given with concession agreements to private sector. Government also cares about improving transport infrastructure links to ports and ensuring competition in the sector.

5.3 The Criteria for Developing Logistics Centres

The LC's should be located on major transport corridors, on intersections of such corridors, near ports, airports or rail terminals, in the periphery of big cities, near major border crossings near FEZ. The availability of cheap land, ample space for possible expansion is very important. An initial space of 10 to 30 hectares with the availability of additional land to expand is a prerequisite.

The location should have all required permits by the government for such land use, should have EIA and environmental terms and should not negatively affect other dedicated land uses such as housing-residential.

The LC's are very important for improving transport operations and for contributing to the economic development of the region.

Potential benefits of logistic centres include: reduced transport costs and resulting improvements in export competitiveness; increased supply and use of logistics and associated services in business; potential employment creation as services are attracted to supply the dry ports; and environmental benefits, if a modal shift towards rail is encouraged;

LC's would allow shippers to undertake consolidation and distribution activities as well as export / import procedures at inland locations that are at relatively short distances from factories and farms.

These facilities could help reduce congestion and delays at border crossings and ports, thereby reducing transaction costs for exporters and importers. This is particularly important for landlocked countries.

LC's can be developed with PPP. Depending on the legislation of each country and the site ownership various combinations of public private partnerships will be examined such as concessions -DBFMO, DBFT, etc with possible involvement of IFI's too.

In summary the required conditions for preliminary assessment of needs and selection of location for the development of Logistics Centers are:

- Existence of O/D data by commodity, sub region for national, intl and transit movements of freight
- Availability of land
- Traffic, environmental impact studies for the site
- Availability of funds
- Consensus on location between government, local authorities, transport unions, forwarders, railways, transport operators, etc
- Existence of large scale consumption (big city) or production (manufacturing, mining, agriculture etc) near the site
- Major transit corridor and / or major border crossing nearby
- Major railway node, multimodal node, motorways junction nearby
- In case of LC's near borders, consensus with neighbouring countries
- Preliminary Financial feasibility studies

5.4 Is the LC Concept Appropriate for the Central Asia?

- The development of freight villages would show similar benefits as in Europe.
- It is reasonable that the municipal and regional administrations coordinate the spatial planning. The state is responsible for infrastructure development (roads, rail, waterways, ports, terminal concept).
- So the LC concept is appropriate in general, but C.ASIAN countries specifics must be considered.
- The private sector could / should play a bigger role in development and financing (development funds, development enterprises).
- Openness of the freight villages should be ensured, monopolies should be avoided. Railways involvement is necessary (intermodal terminals).
- Pilot projects to learn from should be encouraged. Locally different solutions are possible. An umbrella organization and master planning would be helpful

5.5 Possible government and private sector roles

From international experience in seaport ownership and operation it is shown that the state usually has the ownership and is responsible for the regulation, while operation and management is given with concession agreements to private sector. Government also cares about improving transport infrastructure links to ports and ensuring competition in the sector.

5.6 What a LC should incorporate?

5.6.1 Functions

The objective of a Logistic center is the consolidation and distribution of goods. The functions are similar to those of a seaport, and should include customs clearance services.
Functions that could be expected to be typically present at a LC include:

1. container (and possibly bulk) handling facilities;
2. consolidation of cargo;
3. distribution of goods;
4. intermodal infrastructure connections;
5. a geographical grouping of independent companies and bodies dealing with freight transport
6. (including, for example, freight forwarders, shippers and transport operators);
7. customs inspections,
8. tax payment, customs clearance
9. storage,
10. maintenance and repair,
11. banking and information communication technology connections.

5.6.2 Buildings

A Logistic centre may include various buildings such as:

- Depots for dried products as well as for cargos of various types
- Depots for frozen products
- Cargo distribution centre
- Regulation terminal of cargo transported in containers
- Multimodal terminal
- Buildings of common usage

5.6.3 Expansion of functions

The Potential expansion of functions at an inland intermodal facility may be the following:

- Container Yard
- Container Freight Station
- Inland Container Depot
- Import Processing Zone
- Industrial Park
- Export Processing Zone
- Special Economic Zone
- Logistics and other Value Added Services

6 Best Practices for Logistics Terminals

Learning Objectives for Lecture 6:

- To know about international best practices for Logistic terminals.
- To know which are the basic steps in conducting a feasibility study for a Logistic Terminal.
-

6.1 International Best Practices

6.1.1 Experience from Landlocked Countries in Europe

Austria and Hungary have similarities with Central Asian countries, as they are landlocked too and positioned in the center of freight flows for Europe, as Central Asian countries are for Asia.

Austria
Austria is an example of what a landlocked country can do to act as a hub for international logistics. Austria is a Distribution Centre (logistic hub) for multinational companies (HP, Peugeot, Volvo, Danfoss) due to location, efficiency, transport infrastructure, modern terminals, communications (internet and mobile), high productivity, knowhow and regular transport services. Transit time to other Central European countries including Customs formalities is only one day. "Rail Cargo Austria", a subsidiary of OBB (Austrian Rail), has established 7 logistics centers in Austria and 6 Multifunctional Logistics Centers.

Hungary
Hungary, (a landlocked country in the center of freight flows across Europe), is also modernizing its Logistics Infrastructure the last 15 years including:

- transport and communication systems and other infrastructure
- building modern logistics centers
- eliminating missing links (by building river bridges, etc)

6.1.2 France

France has a privileged geographical position and long experience in logistics.

"Logistics", employs more than 887,000 people in France. Although modern logistics has military origins, at the end of the 20th century it had become a full, and most often strategic, function of business management. Its importance can be judged from the fact that French companies devote 8% to 12% of sales revenue (€ 120 billion) to logistics.

France's central position at the heart of a market of 380 million inhabitants and GNP of $916 billion in 2000 (greater than that of the USA and double that of Japan), is an undeniable advantage.

The French workforce is well qualified, with an hourly cost that is 15% to 40% lower than in the countries of Northern Europe. France is a first-class multi-modal point of entry to the European Union. Placed firmly at the centre of logistics organisation plans, the **logistics platform** is no longer seen as a mere warehouse. Its location is as crucial a choice as its design in determining an enterprise's performance.

Operated directly or via an external service provider (a 3PL provider), warehouses are today much more than simply space to store goods. Last-minute customisation of goods (known as "late differentiation"), packaging, and handling of administrative or customs procedures have been added to the traditional order preparing activities.

Rail in France carried more than 55 bio ton-kms in year 2001 (of it 20% combined road - rail). Rail has an important role in multimodal transport.

The Nord Pas-de-Calais is France's second region for logistics and boasts dozens of platforms, including the 260 hectare multi-modal centre at Dourges built by "Logistis" and "Prologis".

The local government and economic decision-makers in the Lyon region have an ambitiously aggressive policy on logistics. Under the "Lyon Logistics" label they are pursuing a policy of joint international promotion, putting the advantages of their region to the fore. This strategy has met with great success and a very large number of enterprises of international stature have arrived in the region.

The Japanese logistics service provider, "New Wave Logistics" (a subsidiary of the NYK shipping line), runs a 20,000 m^2 warehouse for Yamaha Motors at Lyon - l ' Isle d ' Abeau.
Koyo Steering Europe, the world leader in automotive steering systems, has decided to build its new HQ and European R&D centre on the southern outskirts of Lyon.

DaimlerChrysler has built a distribution centre at Etoile-sur-Rhône, in the Drôme département. In 2001, the economic impact of logistics activities on the Lyon region has been estimated at more than FRF 9 billion; 46 sites of more than 10,000 m^2 have been created in five years, corresponding to 4,000 jobs.

Ile de France, the most highly developed centre in France with 955 million square metres of warehousing and 12 million consumers, is the favoured location for new sites. The port areas of Marseille-Fos, Le Havre-Rouen, Dunkerque, and the airport zones of Roissy-CDG, Marseille Marignane, Lyon Saint-Exupéry, Vatry, and Châteauroux-Déols (linked to Paris airport operator ADP), are confirming their role as logistics centres.

Some companies choose to locate their operations on the edge of the socalled Blue Banana belt (which extends from London to Milan, passing through Frankfurt), near to rail, motorway or waterway centres in the Nord / Picardie, South East, Lorraine and Champagne regions.
The Lorraine region has a large number of exceptional logistics centres chosen by world-class businesses, for example the multi-modal platforms at Nancy, Eurotransit at Ennery, and the Pôle Européen de Développement at Metz.

- Ikea has opened a logistics platform with a 165,000 m^3 storage facility at La Maxe; this is operated by logistics service provider Norbert Dentressangle Logistics.
- Cat Logistics, a subsidiary of Caterpillar Inc, chose Lorraine in 1993 as a base to manage supply flows of its customers Chrysler, Land Rover, H i a b, Electrolux etc. in a 32,000 m^2 logistics warehouse.
- GE Lighting operates from the Eurotransit platform at Ennery.
- Tenneco Automotive, a manufacturer of automotive exhaust and suspension systems, is located at Fameck (Moselle).
- Smart (SCC) has set up its worldwide logistics centre at Hatten (Bas-Rhin).

Port zones: The Marseille port authority, PAM (Port Autonome de Marseille) has set up a 160 hectare logistics zone at Fos named "Distriport", where such firms are present as Danone, Kawasaki (which has a distribution centre managed by Lorafret and P&O-Nedlloyd), Dole Foods, and logistics specialist T N T. Since 1999, the "Clésud" 260 hectare multi-modal platform, chosen by Rexel, Nortène and by logistics service providers La Flèche and Giraud Logistics, has provided further capacity.

The US company <u>Prologis</u> the world leader in logistics, has bought Garonor (450.000m^2) in Paris.

Prologis has also built a 125,000 m logistics platform on the Le Hode site at Le Havre.

At Rouen, the Antwerp-based giant "Westermund", the world's largest forestry products distributor, has set up a 13,500 m terminal to serve its customers UPM, Kymene and M-Real and to export its pulp and kraft paper to as far as China.

Dunkerque has a 20 hectare multi-modal platform where such world-class firms as Coca-Cola, Dupont de Nemours, Cynamid, Ajinomoto, Nutrasweet, Péchiney, Maersk Logistic, Lego and Falcon have operations.

Investors can rely on the expertise of the major construction companies to design and build turnkey platforms.

Even though the world leader in logistics warehouses, the US company Prologis, has been very present in France since the purchase of Garonor (450,000 m^2), French companies are also well established in this market. Bouygues and its specialised subsidiary Parcolog have plans to build ten major logistics parks between now and 2005, for a total area of 550,000 m^2. GSE manages properties totaling 8,000,000 m^2 in 12 countries. Logistis, a subsidiary of Caisse des Dépôts, manages ware house capacity of 600,000 m^2. Sogaris, which was the initiator of such platforms in France at Rungis, has a total capacity of 350,000 m^2 in Lyon, Rouen, and Bayonne, and is involved in a 200,000 m^2 p roject in the Pont de Normandie logistics park at Le Havre. Coming from the building and public works sector, these companies have been able to follow the evolution of the logistics sector and have become real specialists in platform engineering.
<u>How much does a 20,000 m^2 logistics centre cost?</u>
Land costs of € 2 million + construction costs of € 5m = € 7m, or there is an annual rent of € 0.82m (€ 41.16 per m^2).

These high construction costs are due to the ancillary aspects of warehouse construction, covering quality landscaping, with trees, lawns and flower beds, as well as:

- anti-theft and fire-prevention systems;
- ergonomic design of the work environment;
- lighting of 150 lux in storage areas, 200 lux in order preparation areas, 250 lux in offices; more pleasant central lighting through the roof to provide 6% of the total lighting;
- heating, ensuring a minimum temperature of +7°C in warehouses.

In the future, the needs of e-commerce for storage and distribution facilities could lead to the appearance of smaller sites closer to large urban centres, resulting in even higher property costs.

A sign of things to come was the inauguration, in April 2001, of a 16,000 m^2 telehousing platform at Garonor (Paris), which brings together all the communication equipment for internet-based trading required by the e-merchants present on the site.

Platform operators 3PL, 4PL, LLP

The trend towards enterprises focussing on their core activities has also affected logistics. By abandoning this function, enterprises have allowed a true market for service provision to emerge in the sector, in particular in the field of platform management.

DAHER, a company formed in about 1880, now derives more than 1/5 of its sales from logistics (€ 157.17m out of a total of € 760m in 2001) and employs 2,205 people of whom 550 are engaged in logistics. It manages 675,000 m^2 of warehousing on five sites.

Daher transports airframe sections for AIRBUS and ATR.

In the chemical industry sector, DAHER runs 21,000 m^2 of special category storage.

For the automobile industry, DAHER stores, prepares, and delivers goods.

BILS DEROO, which made sales of € 833m in 2001 and employs 1,800 people on 40 platforms with a total area of 450,000 m^2, is a good illustration of this participation by a 3PL provider in the optimisation of upstream logistics. The company provides services for Renault or for PSA such as:

- assembly and distribution of spare wheels;
- distribution of parts
- holding of safety stocks

The logistics revolution is coming from the new capabilities provided by Information Technology for database storage and management (DBMS) and for their processing by various software solutions. These tools either allow various sections of an enterprise to communicate with each other, or handle logistics activities in particular. Some also enable action to be taken on flows during production processes.

Specialised Logistics services

1. Upper stream and "last-mile" logistics
2. Returned goods logistics
3. E-Logistics

6.1.3 Germany

Logistics costs in Germany are 180 bio euros (2006) or 8% of GDP! The Logistics Net Berlin Brandenburg is a PPP "Public Private Partnership" to promote the German Capital region as a region for logistics. It was founded in January 2006 on the initiative of the German Federal States of Berlin and Brandenburg. It has 27 members: Agiplan, BEHALA, Gazeley, Investor Center Ostbrandenburg, ReiCo Spedition, Rieck Logistic, Ulrich Transport, Verband Verkehr und Logistik, Wagener & Herbst, ZAB Zukunfts-Agentur Brandenburg, Flughafen Berlin Schoenfeld and other.

The history of the development of freight villages (LC's)

1965	The first sea container was landed in the port of Bremen.
1970's	First visions of scientists and transport managers to shift Forwarders from narrow, expensive town centres to outside estates and to shift transport from road to rail.
1972	establishment of a terminal for combined transport road / rail (piggyback, swapbody, container) Bremen.
1974-84	Bremen regional administration investigated and planned the development of a freight village in the former agricultural area Niedervieland (Bremen).
1985/86	Bremen administration developed industrial estate with public financing (40 mio Euro). Establishment of the first German freight village Bremen. Foundation of the GVZe managing company by the first 6 enterprises settled in the freight village and by the Bremen industrial promotion agency.
2005	After 20 years the freight village in Bremen consists of 360 ha (165 ha free), since 1985 260 mio Euro public investment, 200 mio Euro private investment, 150 enterprises with 5.000 employee.

LC's (Freight villages) in Germany (2008)

- 32 freight villages in operation
- 4 freight villages in planning
- 1.300 enterprises in freight villages
- with 45.000 employees
- average total area 150 ha
- average utilization 50%
- average land costs 50 € / sq.m (between 10 € and 200 € / sq.m)
- German FV Society with 22 FV

Seven (7) locations are selected for LC's (Freight Villages)in Berlin region:

1. City FV BEHALA
2. FV Berlin West Wustermark
3. FV Berlin South Grobbeeren
4. FV Berlin East Freienbrink
5. Logistics Park Berlin - Schonefelder Kreuz
6. FV ETTC Frankfurt / Oder
7. Magnapark Berlin Werder

For example in the Freight Village "Berlin South (Grobbeeren)", the services offered include car wash, restaurants, gasoline station, private rail access, leasing trailers center, maintenance of refrigerated units and container service.
It is located 5 km far from Berlin, 15 km from Postdam near motorways B101, near KV rail terminal (700 m lines, 2 portal cranes) near Berlin Schonefeld aiport and access to S-bahn.
Buildings available sizes range from 3000 to 60000 m^2. The investors are GFODIS, REWE LIDL, RHENUS AG.The LC's in Berlin region are gateways to Eastern Europe. For example the Container Train Eastwind, is running 3 times a week Berlin - Moscow / Kazakhstan, operated by Intercontainer - Interfrigo.Thus there are approximately 20 connections from Western Europa through the Eastwind and 2.000 connections to Eastern Europe regions

Advantages and disadvantages of LC's (Freight Villages)

Advantages	Disadvantages
For administration	**For Administration**
• Less congestion, better city logistics • Better access of the region through intermodal connections • Focus of infrastructure investments • Spatial planning • Higher corporate and income taxes • Environmental protection	• Initial efforts and investments needed • Risk of long planning • Risk of utilization •
For enterprises	**For enterprises**
• Faster and easier realization of logistic location (buy or rent) • Access to rail and intermodal terminal • Auxiliary services • State support	• Cost per sq.m may be higher • Must wait until FV is ready • Sometimes fear of competition •

For successful development of LC's a joint effort of state and industry is needed. An organisation responsible for development and management, should be established. There should be openness and initial financing, maybe State subsidies too.

6.1.4 ProLogis

PROLOGIS is a multi national company, one of the biggest of the distribution and logistics market in the world. The company operates in 118 markets across North America, Asia and Europe, with more than 46,000,000 m² owned, managed or under development. Its customer base includes manufacturers, retailers, distributors, transportation companies, third-party logistics providers and other companies with large-scale distribution needs. ProLogis has entered the European market in 1997. ProLogis was established in 1993.

Table 6.13 Prologis Logistics Parks in Europe

	No of Log. Parks	Leasable m^2 (000)	Rail served	Rail m^2 (000)
Belgium	2	43,5	1	21
Czech	8	136	-	-
France	106	2026,1	17	746,4
Hungary	14	179,5	1	23
Germany	19	275,1	-	-
Italy	17	475	8	248,1
Netherlands	23	500,7	-	-
Poland	19	353,4	7	81
Spain	10	235,1	-	-
Sweden	4	111,6	1	45,9
U.K.	41	679	5	88,9
Total	**263**	**5015,2**	**40**	**1254,4**
	100%	**100%**	**15%**	**25%**

Since entering Europe in 1997, ProLogis has expanded its presence in strategic distribution markets in European countries. The rapid growth is directly linked to customer demand throughout the region, enabling it to create a distribution network that serves some of Europe's largest manufacturers, retailers and third-party logistics providers (3PLs).

ProLogis currently owns and operates more than 9,4 million square meters of distribution facilities in 37 markets throughout Europe. ProLogis' European Customer Services Headquarters is based at Schiphol Airport, Amsterdam. ProLogis has more than 263 Logistics Parks in Europe. The 15% of them are rail served These figures show the important which is given by Prologis to the multimodality. ProLogis received the "European Deal of the Year" award for its successful acquisition of Parkridge in February of 2007, and the "Green" award for its sustainable development of ProLogis Park Pineham in the Midlands, United Kingdom.

The park is being constructed using a variety of advanced environmental features and technologies designed to significantly reduce energy consumption and carbon emissions at the site.

<u>ProLogis Leasing Activity in Inland CHINA</u>
ProLogis, announced April 21, 2008 strong leasing activity at major new distribution parks under construction in inland CHINA. At ProLogis Park Jiangning in Nanjing, the capital of China's Jiangsu Province, ProLogis has leased 100 percent of a 234,000-square-foot distribution center to Anji-TNT Logistics, a leading provider of logistics services for automotive parts. Anji-TNT will operate the space on behalf of Fiat, the Italian automobile maker, serving customers throughout China. ProLogis Park Jiangning, which is located in a government-sponsored economic development zone adjacent to the Nanjing Lukou International Airport, will comprise six facilities totaling more than 140,000 square meters at full build-out.

ProLogis initiated operations in five of China's major inland markets -- Changsha, Chengdu, Chongqing, Nanjing and Wuhan -- during 2007 and since then has experienced a significant increase in demand from the region's manufacturers, retailers and third-party logistics providers.

ProLogis IN FRANCE

France has exceptional road, air, train and river networks. These assets attract industrial companies and logistics operators who count on the growth and quality of their exchanges.

As part of its global strategy, ProLogis continues its development policy focussing on the most important economic French poles located on the north-south axis of European exchanges, and providing its customers with distribution facilities in strategic markets.

ProLogis IN HUNGARY

The Hungarian economy in 2007 developed at a considerably more moderate pace than that observed for the past few years. The growth of the Hungarian economy arises mainly from the increasing gross value added of industry, which contributed significantly to the increase in export. Over the past years, Hungary has stabilized itself as a strategic location for distribution and logistics in the EU. The country's central location is still the main drive behind the success of the Hungarian logistics market. By the end of December 2007, in accordance with the Schengen treaty there will be no border control between Hungary and other Schengen countries, which will speed up the logistics processes even more.

The majority of the fast developing logistic facilities in Hungary are located around Budapest, the central location of the Hungarian logistics market.

ProLogis Environmentally Friendly Facilities

Sustainability has long been central to the way of doing business at ProLogis. Implementing leading-edge, environmentally friendly features in distribution facilities is a basic aim.

They have launched numerous pilot projects around the world that have given world-class expertise in sustainable warehouse design. For example, they are implementing an interior lighting retrofit program in the United States that can reduce electricity usage by up to 75%. In the United Kingdom, they have begun development at a new distribution park that will evaluate a number of cutting-edge, environmentally friendly building materials and construction methods.

And in Japan, they recently completed an industrial facility in Osaka that utilizes a new pavement technology for neutralizing vehicle carbon emissions.

ProLogis is active in brownfield redevelopment, a complex process that involves cleaning up and developing contaminated land as well as redeveloping land that has been unproductively developed and/or is considered to have a low landscape value. They are also involved in urban redevelopment, the creation of master-planned, mixed-use developments at the site of former airports and military bases. In recent years, several of their sustainability-related efforts have been publicly recognized, certified or rewarded: ProLogis Park Chanteloup in France was recognized with a 2005 Logistics Innovation Award. The park's state-of-the-art design features one of the largest solar panel installations in France.

ProLogis was a 2006 recipient of the "Leader in the Light" award for sustained energy use practices. ProLogis is exploring several sustainable warehouse design features:

Recycled and locally sourced construction materials that reduce environmental impact.
Skylights and clerestory windows that increase natural light, thereby lowering electricity usage and improving work environments for warehouse personnel.
T5 and T8 energy-efficient fluorescent lights that offer significantly improved energy performance over traditional metal halide systems.
High-reflectance, white thermoplastic polyolefin (TPO) roofing that offers the same performance as traditional black EPDM rubber roofing at essentially the same cost but with less load on the building's cooling system.
Air-tight building construction that reduces air leakage, thereby permanently lowering costs for heating and air conditioning.
Solar and wind power that provide alternative energy systems, especially photovoltaic solar cells and wind turbines.
Low-usage water systems that utilize treated "gray" water and recycled rainwater, resulting in lower water consumption at facilities.
Special landscaping that can help to minimize water consumption and reduce net carbon emissions.

Their developments are increasingly combining multiple sustainability-related features. For example, ProLogis announced in February 2007 that it will develop a 530,000 square-foot industrial facility in the Midlands area of the United Kingdom for leading supermarket chain Sainsbury's. The facility will utilize a variety of technologies and environmental features designed to significantly reduce on-site energy consumption and carbon emissions such as:

- Solar walls that generate heat from sunlight
- Wall-mounted photovoltaic panels that generate electricity
- An on-site power plant that reuses the heat produced by air conditioning
- An on-site recycling facility
- Energy-efficient lighting systems
- Air-tight exterior building construction

6.1.5 Thriassion Logistics Terminal in Greece with Concession

A new Logistics Centre, the first of its kind in Greece, is to be developed at Thriassion (Athens, Greece). The concession period will be 30 years with possible 10 years extension. It is located besides the freight terminal of Greek Railways.,46 km from Athens International Airport, 17 km from port of Piraeus (connected by new rail line), 20 km from Athens centre, just on the "Attiki Odos" peripheral motorway of Athens, on the Suburban railway and on new High speed rail line connecting Athens to Patras Port and to Thessaloniki / Balkans - Turkey. The total area is 588.000 sq.m, while the permitted building area is 40% or 235.000 sq.m. The permitted building height is 13,5 m. The planned buildings include according to the Master Plan 200.000 sq.m. of warehouses, 14.115 sq.m. of offices, 1.110 sq.m of restaurants / coffee shops, 2.800 sq.m of hotel, 1.200 sq.m. of shopping, services and 1.875 sq.m. of other facilities. In addition are foreseen parking areas for cars, trucks, container terminal, customs, fire station, security kiosks. The LC will offer cross-docking warehouses for courier, forwarding and parcels, warehouses for bulk loads served by rail. For stowing containers an area of 20.000 sq.m will be available with 190 spaces for containers (2-3 containers stowed at each space).

GAIAOSESA is a public service company, subsidiary of Hellenic Railways Organisation (OSE), founded to manage and develop its high value real-estate property in order to increase the revenues and the net worth of its shareholder, OSE.

OSE is one of the largest property owners in Greece.

The market value of the Railways Real Estate Property is estimate at €4,6billions.

	Number	Area
Land	3600	90.000.000 m²
Buildings	4600	500.000 m²

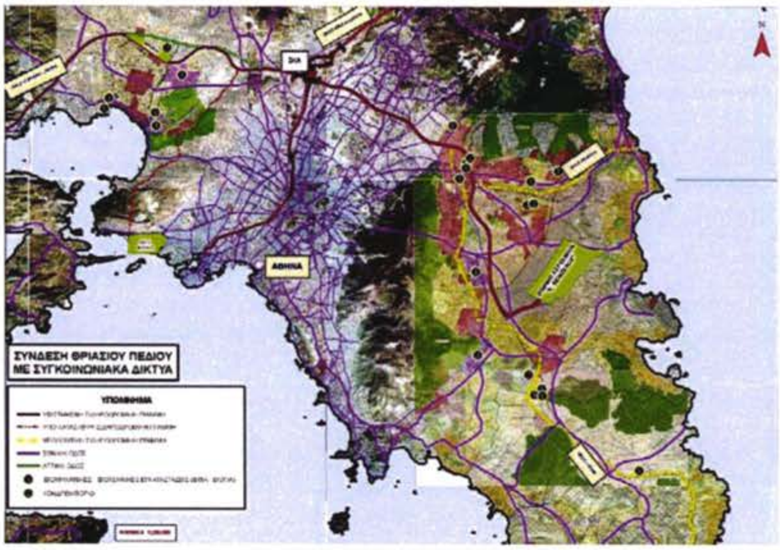
Thriasio Freight Terminal Location

Strategically Located within Athens Greater Area

- Direct Access to the entire Railway Network (including the new Athens - Korinthos high speed line, the northern Greece and the line to Athens Int. Airport)
- Excellent Access to the New Athens Ring Road (to Athens Int.Airport & Athens -Thessaloniki Highway), Athens -Korinthos /Patras Highway
- Direct Railway Connection to the Commercial Port (Neo Ikonio)

Photo 6.1. Location of Thriassion

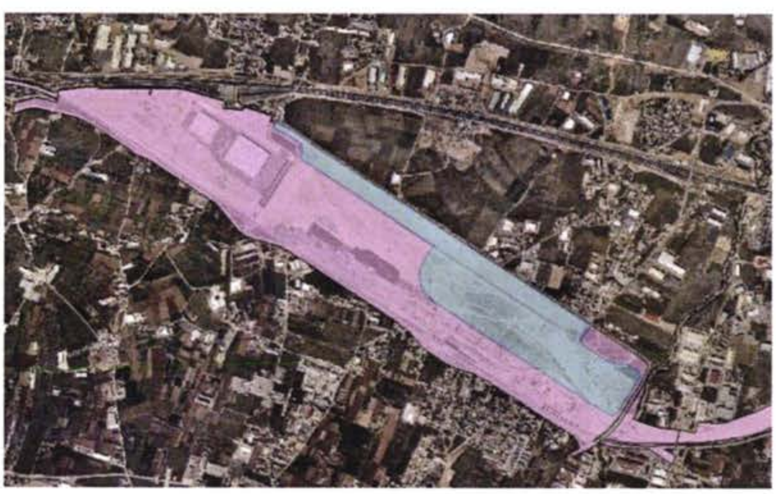
Photo 6.2. Attica region



Project Details

- Land Area: 590.000 m²
- Total Buildings Area: 240.000 m²
- Construction Budget: €150 million
- Project to be implemented through PPP (Long Term Concession Scheme)

Photo 6.3. Plot of Triassion



Part of the site infrastructure has been constructed by ERGOSE (by state and EU finance) including:

- A road access to Athens Ring Road (Attiki Odos)
- Preliminary site earthworks
- Site internal road network
- Utilities and main site drainage infrastructure

Photo 6.4. Air photo

PHOTO 6.5. Infrastructure built

Tender Procedure

- Two Stage International Tender Procedure
- The Concessioner will establish an S.P.V. which will: design, build, finance, maintain and manage the Freight Terminal for 30 years
- Construction will be estimated in two phases:
- 1.Phase A: 60.000 m²
- 2.Phase B: 180.000 m²

Thriassio international bid.
- 6 offers submitted
- 5 preselected
- 2 financial bids for a concession of 30 + 10 years

During the 2[nd] semester 2007 the tender procedure has started.
- European money have already been put for site clearance, rail infrastructure and bridges construction (20 mio €)
- 150 mio € will be put by concession
- Land is owned by GAIAOSE
- 15% of capital will be transferred to GAIAOSE
- The concessionaire will pay minimum lease per annum and 2,5% of turnover, and part of the turnover (profits)
- The use will be for containers, land lines, for storage etc
- Shunting activities will be here for forming block trains
- The bidders estimate 10 - 15 block trains per day up to 70 - 100 containers 40' 20 wagons = 40 containers
- 13m high warehouses (most of them)
- 5 € / m^2 / month the rent cost for warehouses in Thriassio
- CoSco has not shown interest to Thriassion
- Final bidders are:
  - Prologis, J&P
  - ELLAKTOR, Hellenic Logistics technical bids grades are similar financial bids not open yet
- 30% of capital own concessionaire funds and ~70% from banks

6.1.6 Benchmarking

From the international experience the Logistic centres may be grouped in terms of: size (total area, covered area / warehouses), costs of usage, quality, transit and processing time, reliability, TEU's throughput and distance from generators.

The LC's usually at least 30 HA and up to 100 HA of total area may be characterized as small size, from 100 to 200 HA medium size and above 200 HA of big size.

Benchmarks for site selection and quantity of Dry Ports
The paper "Cross cutting issue for managing globalization related to trade and transport: promoting Dry Ports as means of sharing the benefits of globalization with inland locations" (Ref. 1), identifies the need for the creation of a network of dry ports in Eurasia, connected to sea ports by multimodal transport and especially to the Trans Asian Railway and to the Asian Highway networks. A map is included also showing proposed locations of dry ports in C. Asia. It also includes benchmarks of dry ports from Europe / USA (200 dry ports in Europe 2005, 370 major in USA and 200 smaller, 100 facilities in ESCAP region.

Seaport container throughput is a good predictor of the no. of dry ports in many Asian countries (more effective than output measures such as GDP). ESCAP secretariat estimates one dry port per million TEU of containers handled at a country's seaport (not reflecting land locked countries in C. Asia, where existing facilities are under used or need modernization). In addition India has one dry port per 140.000 TEC of containers handled at port. The predictor is not valid for Europe, USA (one dry port for each city with an output exceeding $ 2,5 billion.

Where GDP and population density in USA are very high, dry ports tend to be lager and generally located 10.000 km^2 apart.

In Europe one dry port may serve more than one countries. ESCAP estimates the need for an additional 200 dry ports for the region by 2015 to reach a total of about 312 (of these 130 in China, 61 in India, 10 in Kazakhstan and 1 each in Tajikistan, Kyrgystan, Uzbekistan).

In Europe dry ports size: throughout: 40.000 to 1.9 mio TEUs / year
land: 30 - 200 hectares
no. of firms: 25 - 100
overall employment: 7000 to 37.000
there are more dry ports of smaller size in highly urbanized countries.

In Nepal a dry port at Birgunj (38 hectares capacity of 200.000 TEU per year) offers rail / road transhipment, storage and custom facilities for containerized, break-bulk and bulk cargo moving by rail.

Successful dry ports requirements according to ESCAP:

Cooperation of government with private sector, PPP, appropriate policy environment (reduced transport costs, environmental benefits, modal shift to rail, transport networks, communications, regional and SME policies, trade and investment attraction policies, prices of labour, capital and land).

In the European Union, there is considerable variation in the average size of dry ports (typically 40,000 to 1.9 million TEU throughput per year), land area (**typically 30-200 hectares**), number of firms (typically 25-100) and overall employment (approximately 7,000 to around 37,000 people).

6.1.7 Conclusions from International Best Practices

There are a lot of international developers who finance, develop and operate LC's in developed or developing countries. The governments of CAR's should aim to attract such developers, in order to transfer the risk of spending for developing and operating LC's, to them (or share this risk with them), as the costs are high.

From the development of LC's a lot of benefits result for the economy of the countries. The high employment in the LC's is a strong asset. Multimodal transport and the railways play a crucial role in LC's operation.

Even land locked countries in Europe, such as Austria and Hungary, act as hubs for internationally logistics, in order to serve transit traffic. Prerequisites are modern and well maintained transport infrastructure, modern LC's, good communications, high productivity, know how and regularity in transport services.

The trend in LC's development is to develop environmentally friendly ("green") facilities using energy self efficiency and energy saving techniques (solarwalls) and recycling on site. A lot of LC's are developed around big cities in Europe, which means that if it is proven feasible and viable (which is examined properly in advance by the developers), it can be the case to develop more than one LC in the periphery of big cities in C.A. (the case if Almaty where already 2 LC's are developed, proves this, under the prerequisite of course that these LC's will operate at capacity and that the feasibility studies were properly conducted in advance, before developing them). LC's are promoted in Europe to decongest cities and protect environment.

6.2 Outline of a Feasibility Study for Freight Centres

6.2.1 Methodology

The methodology which can be implemented in order to access the feasibility and the preconditions for developing the freight logistics centers included the following steps:

- Evaluation of the overall freight traffic within the range influenced by the freight logistics center, and especially the cargo, that can be engaged by the freight logistics center in a number of time horizons, through research, questionnaires, forecasts of similar studies and other data.
- The conversion of freight traffic to the necessary space of land in order to be accommodated, but also taking into account international experience and the appropriate transportation coefficients.
- Survey of the locations which satisfy the demand in terms of available land for the operation of the freight logistics center.
- Analysis of the strengths, weaknesses opportunities and threats (SWOT Analysis) for the alternative locations.
- Final selection of the appropriate locations for the allocation of the Freight Logistics Center.
- Financial Plan proposals, economic and financial evaluation of the investment for all the scenarios of freight movement (basic, optimistic and pessimistic).

6.2.2 Freight Traffic Forecasting for the Freight Logistics Center

Medium and long term predictions for the years 2010, 2015 and 2020.

For the evaluation of the cargo's latent demand which the Freight Logistics Center can serve, similar experience from the establishment of such Centers can be used and the type of the freight movement (for example if the movement is internal, export, import or transit), but also the origin or the destination. Based on international experience, the latent demand of cargo at a Freight Logistics Center is differentiated between 1,5 and 25% depending on the time horizon and the scenario which may be basic, optimistic and pessimistic.

$\text{Freight Traffic}_{\text{attracted}}\ I, j = \text{Scenario}_{x}\ \text{coefficient} * \text{Freight Traffic}_{i,j}$

Where:

Scenario_{x}	=	scenario (basic, optimistic or pessimistic)
$\text{Freight Traffic}_{i,j}$	=	Freight Traffic for each time horizon and category
j	=	category (transit, import, export, local)
I	=	time horizon (2010, 2015, 2020)

6.2.3 Assessment of the Spaces Required for the Freight Logistics Center

For the final selection of the appropriate scenario for the development of the Freight Logistics Center it is necessary to specify the type of facilities which will be constructed and specify their dimensions. For this reason, development and transportation flow scenarios are used, also taking into account their disaggregating in flows which have origin - destination to the Freight Logistic Center, imports- exports, local distribution and transit. The transit flows concern international transit cargo. Depending on the distinction of the flows, different facilities are required in order to handle the cargo.

In order to calculate the necessary spaces required for the facilities (including the secondary buildings, the car park area and car manoeuvre's area) conversion indicators are used for the transportation cargo to spaces needed in accordance to studies and practice in Europe (EUROPLATFORMS, 1996) which are shown in table 6.2.

Table 6.2 Freight Cargo per Category, Scenario and Time Horizon

Freight Village Services	Conversion Indicators	Comments
General Storage	45 sq.m / per tonne per day	Building Facilities
International Transit	6 sq.m./ per tonne per day	Temporary area for unaccompanied cargo
Local Distribution	84 sq.m./ per tonne per day	Logistics and Storage Services
Parking and Manoeuvre's Area	60% of the total Building Facilities	150 sq.m./ per lorry
Other, Support Services	10% of the total Building Facilities	Other services (bank, offices, motel, etc.)

Based on the above and taking into consideration the cargo we conclude the required surfaces for each time horizon (2010, 2015, 2020), but also for each scenario of growth (pessimistic, basic, optimistic) as it is shown in table 6.3.

Table 6.3 Freight cargo per category, scenario and time horizon

Function	2010			2015			2020		
	Pessimistic	Basic	Optimistic	Pessimistic	Basic	Optimistic	Pessimistic	Basic	Optimistic
Local Distribution									
General Storage (Imports-Exports)									
Areas for unaccompanied cargo and transit									
Sub Total									
Parking and Maneuver's Area									
Assisting Services									
Total									

6.2.4 Investment and Financial Plan for the Freight Logistics **Center**

The cost of the investment for the construction of the Freight Logistics Center arises from the evaluation of the need for open air areas, infrastructure, storage and other building facilities and equipment. On the other hand the dimensioning of the infrastructure in order to service the later mentioned needs is based on qualitative and quantitative analysis of the freight cargo traffic that is estimated to be serviced by the Freight Logistic Center. The analysis of the need for grounds, transportation and infrastructure, storage buildings and equipment can be estimated by taking into account the basic scenarios' for each target time horizon (2010, 2015, 2020)

Construction Cost - Unit Prices, Greece

Cost of earthworks	7,5 €/cubic metre
Construction Cost of Storage Areas	500 €/sq.m.
Construction Cost of Facilities Support	1000 €/ sq.m.
Cost of Parking and Maneuver's Area	100 €/ sq.m.
Cost of utilities	500 € / sq.m.

Investment Cost (example from OLIG freight centre, Greece)

Category of Investment Cost	Cost in 2010	Cost in 2015	Cost in 2020
Cost of Land*	270.000	330.000	870.000
Paving - Parking Areas	1.900.000	2.300.000	6.100.000
Road Networks**	900.000	1.200.000	3.000.000
Storage Buildings	15.800.000	19.200.000	52.000.000
Support Services	3.150.000	3.850.000	10.200.000
Mechanical Equipment***	1.000.000	4.500.000	
TOTAL	**24.020.000**	**31.080.000**	**72.170.000**

(*) It has been calculated that the cost is around 30000 € / acre.

(**) It is assumed that 10 klm of internal road network and network which will connect with motorways will be constructed.

(***) It includes 2 gantry cranes and 10 straddle carriers.

Income, Revenues

The calculation of the Freight Logistics Center's income on an annual basis includes the income from the movements of freight cargo units, logistic services, customs clearance services, rent of storage facilities and buildings for a number of different services.

In order to calculate economically and financially the financing of the investment, 3 investment plans can be proposed for the 3 different scenarios (basic, optimistic, pessimistic) which are:

Plan 1: 25% own capital, 55% financed by National and IFO funds and 20% 20 year duration loans with 6% interest rate.

Plan 2: 45% own capital and 55% financed by IFO funds.

Plan 3: 25% own capital, 40% financed by National and IFO funds and 25% 25 year duration loans with 6% interest rate.

The economic indicators which were calculated for all possible combinations of freight cargo traffic and financial investment plans are demonstrated in the table below:

Table 6.4 Economic indicatiors (Olig example)

Investment Plan	Financial Schemes	NPV	IRR*
Basic Scenario			
Plan 1	25% Own Capital - 20% Loan- 55% Financing	1,142 M €	7,9 %
Plan 2	45% Own Capital - 55% Financing	-8,662 M €	Out of the Limit
Plan 3	25% Own Capital - 35% Loan - 40% Financing	-2,876 M €	1,0 %
Optimistic Scenario			
Plan 1	25% Own Capital - 20% Loan - 55% Financing	5,903 M €	13,3 %
Plan 2	45% Own Capital - 55% Financing	-5,905 M €	-0,5 %
Plan 3	25% Own Capital - 35% Loan- 40% Financing	1,336 M €	7,7 %
Pessimistic Scenario			
Plan 1	25% Own Capital - 20% Loan - 55% Financing	1,867M €	10,2 %
Plan 2	45% Own Capital - 55% Financing	-6,720 M €	Out of the Limit
Plan 3	25% Own Capital - 35% Loan - 40% Financing	-1,018 M €	3,6 %

* IRR equals'Net Profit - own capital"

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Acronyms and Abbreviations

ADB Asian Development Bank
AIFU International Forwarders Association
BOMCA The European Union's Border Management Programme in Central Asia
BSEC Organisation of the Black Sea Economic Cooperation
CA Central Asia
CAR Central Asia Republics
CAREC Central Asia Regional Economic Cooperation (under ADB)
CIS Commonwealth of Independent States
EBRD European Bank for Reconstruction and Development
ESCAP Economic Commission for Asia and the Pacific
EC European Commission
EU European Union
EURASEC Eurasian Economic Community
EWG Expert Working Group
FIATA Fıdıration Internationale des Associations de Transitaires et Assimilıs (International
Federation of Freight Forwarders Associations)
GDP Gross Domestic Product
HLG High Level Working Group
IATA International Air Transport Organisation
ICT Information and Communication Technologies
IFI International Financing Institution
IGC Inter-Governmental Commission
IMO International Maritime Organisation
IRF International Road Federation
IRU International Road Transport Union
LC Logistic Centres
LLDC Landlocked Developing Countries
M&E Monitoring and Evaluation
MLA Multilateral agreement
MoTC Ministry of Transport and Communications
MoU Memorandum of Understanding
NGO Non-governmental Organisation
OSCE Organisation for Security and Co-operation in Europe
OSZhD Warsaw-based Committee for the Organisation for Cooperation between Railways
OTIF Bern-based Intergovernmental Organisation for International Carriage by Rail
PETrA Pan-European Corridors and the Black Sea Pan-European Transport Area
PPP Public-Private Partnership
PRC People's Republic of China
SCO Shanghai Cooperation Organisation
SME Small and Medium Enterprises
SMGS Agreement on the International Carriage of Goods

SCO Shanghai Cooperation Organisation
SME Small and Medium Enterprises
SMGS Agreement on the International Carriage of Goods
SMPS Agreement on International Carriage of Passengers
SPECA Nations Special Programme for the Economies of Central Asia
TACIS Technical Aid to the Commonwealth of Independent States
TEN-T Trans-European Transport Network
TIR Transports Internationaux Routiers
TLC Transport Logistics Centre
ToR Terms of Reference
TRACECA Transport Corridor Europe-Caucasus-Asia
UIC Paris-based International Union of Railways
UN United Nations
UNECE United Nations Economic Commission for Europe
UNESCAP UN Economic Commission for Asia and the Pacific
USAID United States Agency for International Development
WTO World Trade Organisation

Glossary and Terms

Dry port: A dry port is a yard used to place containers or conventional bulk cargo, and which is usually connected to a seaport by rail or road and has services like, storage, consolidation, and maintenance of containers and customs clearance. They may be used for shipping, receiving and distribution centers designed to relieve the congestion in increasingly busy seaports, like an inland port.

Industrial park: An industrial estate is an area of land set aside for industrial development. Industrial parks are usually located close to transport facilities, especially where more than one transport modalities coincide: highways, railroads, airports, and navigable rivers.

Special Economic Zone: A Special Economic Zone (SEZ) is a geographical region that has economic laws that are more liberal than a country's typical economic laws. The category 'SEZ' covers a broad range of more specific zone types, including **Free Trade Zones (FTZ),** Export Processing Zones (EPZ), **Free Zones (FZ),** Industrial Estates (IE), Free Ports, Urban Enterprise Zones and others. Usually the goal of an SEZ structure is to increase foreign investment. One of the earliest and the most famous Special Economic Zones were founded by the government of the People's Republic of China under Deng Xiaoping in the early 1980s. The most successful Special Economic Zone in China, Shenzhen, has developed from a small village into a city with a population over 10 million within 20 years. Following the Chinese examples, Special Economic Zones have been established in several countries, including Brazil, India, Iran, Jordan, Kazakhstan(Astana and Aktau port), Pakistan, the Philippines, Poland, Russia, and Ukraine.

Container terminal: A container terminal is a facility where cargo containers are transhipped between different transport vehicles, for onward transportation. The transhipment may be between ships and land vehicles, for example trains or trucks, in which case the terminal is described as a maritime container terminal. Alternatively the transhipment may be between land vehicles, typically between train and truck, in which case the terminal is described as an inland container terminal.

Maritime container terminals tend to be part of a larger port, and the biggest maritime container terminals can be found situated around major harbours. Inland container terminals tend to be located in or near major cities, with good rail connections to maritime container terminals.

Both maritime and inland container terminals usually also provide storage facilities for both loaded and empty containers. Loaded containers are stored for relatively short periods, whilst waiting for onward transportation, whilst unloaded containers may be stored for longer periods awaiting their next use. Containers are normally stacked for storage, and the resulting stores are known as container stacks.

Inland Container Depot (ICD) and Container Freight Station (CFS): An Inland Container Depot / Container Freight Station may be defined as: -A common user facility with public authority status equipped with fixed installations and offering services for handling and temporary storage of import/export laden and empty containers carried under customs control and with Customs and other agencies competent to clear goods for home use, warehousing, temporary admissions, re-export, temporary storage for onward transit and outright export. Transhipment of cargo can also take place from such stations.

Functionally there is no distinction between an ICD/CFS as both are transit facilities, which offer services for containerization of break bulk cargo and vice-versa. These could be served by rail and/ or road transport. An ICD is generally located in the interiors (outside the port towns) of the country away from the servicing ports. CFS, on the other hand, is an off dock facility located near the servicing ports which helps in decongesting the port by shifting cargo and Customs related activities outside the port area. CFSs are largely expected to deal with break-bulk cargo originating / terminating in the immediate hinterland of a port any may also deal with rail borne traffic to and from inland locations.

The primary functions of ICD/CFS are:
- Receipt and dispatch/delivery of cargo.
- Stuffing and stripping of containers.
- Transit operations by rail/road to and from serving ports.
- Customs clearance.
- Consolidation and desegregation of LCL (less than container load)cargo.
- Temporary storage of cargo and containers.
- Reworking of containers.
- Maintenance and repair of container units.

The main benefits from ICDs/CFSs

i) Concentration points for long distance cargoes and its unitisation.
ii) Service as a transit facility.
iii) Customs clearance facility available near the centres of production and consumption
iv) Reduced level of demurrage and pilferage.
v) No Customs required at gateway ports.
vi) Issuance of through bill of lading by shipping lines, hereby resuming full liability of shipments.
vii) Reduced overall level of empty container movement.
xi) Competitive transport cost.
ix) Reduced inventory cost and Increased trade flows

Rail Siding: The place where container trains are received, dispatched and handled in a terminal. Similarly, the containers are loaded on and unloaded from rail wagons at the siding through overhead cranes and / or other lifting equipments.

Container Yard: Container yard occupies the largest area in the ICD, CFS. It is stacking area were the export containers are aggregated prior to dispatch to port, import containers are stored till Customs clearance and where empties await onward movement. Likewise, some stacking areas are earmarked for keeping special containers such as refrigerated, hazardous, overweight/over-length, etc.

Warehouse: A covered space/shed where export cargo is received and import cargo stored/delivered; containers are stuffed/stripped or reworked; LCL exports are consolidated and import LCLs are unpacked; and cargo is physically examined by Customs. Export and import consignments are generally handled either at separate areas in a warehouse or in different nominated warehouses / sheds.

Gate Complex: The gate complex regulates the entry and exist of road vehicles carrying cargo and containers through the terminal. It is place where documentation, security and container inspection procedures are undertaken.

Free trade zone: A free trade zone (FTZ) or export processing zone (EPZ) is one or more special areas of a country where some normal trade barriers such as tariffs and quotas are eliminated and bureaucratic requirements are lowered in hopes of attracting new business and foreign investments. Free trade zones can be defined as labor intensive manufacturing centers that involve the import of raw materials or components and the export of factory products.

Most FTZs are located in developing countries. Bureaucracy is typically minimized by outsourcing it to the FTZ operator and corporations setting up in the zone may be given tax breaks as an additional incentive. Usually, these zones are set up in underdeveloped parts of the host country, the rationale being that the zones will attract employers and thus reduce poverty and unemployment and stimulate the area's economy. These zones are often used by multinational corporations to set up factories to produce goods (such as clothing or shoes).

Containerization: is a system of intermodal freight transport cargo transport using standard *ISO containers* (known as Shipping Containers or Isotainers) that can be loaded and sealed intact onto container ships, railroad cars, planes, and trucks.

Transhipment: is the shipment of goods to an intermediate destination, and then from there to yet another destination. One possible reason is to change the means of transport during the journey (for example from ship transport to road transport), known as intermodal freight overhead travelling cranes and gantry cranes are types of crane which lift objects by a hoist which is fitted in a trolley and can move horizontally on a rail or pair of rails fitted under a beam.

"**TEU**": stands for "Twenty-foot Equivalent Unit," i.e. a 20 foot shipping container. Thus a 40 foot container is 2 TEU, etc.

CFS (Container Freight Station): The term CFS at loading port means the location designated by carriers for the receiving of cargo to be loaded into containers by the carrier. At discharge or destination ports, the term CFS means the bonded location designated by carriers for devanning of containerized cargo.

CFS/CFS (Pier to Pier): The term CFS/CFS refers to cargo delivered at origin in less-than-container load quantities to a container freight station (CFS) to be loaded into containers and to be unloaded from the container at destination CFS.

CFS Charge (Container Freight Station Charge): The charge assessed for services performed at the origin or destination for loading or unloading of cargo into/from containers at a CFS.

Consignee: The individual or company to whom a seller or shipper sends merchandise and who, upon presentation of necessary documents, is recognized as the merchandise owner for the purpose of declaring and paying customs duties.

Consignor: A term used to describe any person who consigns goods to himself or to another party in a bill of lading or equivalent document. A consignor might be the owner of the goods, or a freight forwarder who consigns goods on behalf of his principal.

Consolidated Shipment: A method of shipping whereby an agent (freight forwarder or consolidator) combines individual consignments from various shippers into one shipment made to a destination agent, for the benefit of preferential rates. (Also called "groupage") The consolidation is then de-consolidated by the destination agent into its original component consignments and made available to consignees. Consolidation provides shippers access to better rates than would be otherwise attainable.

Consolidator: An agent who brings together a number of shipments for one destination to qualify for preferential rates.

The difference between Free Trade Zones and Special Economic Zones (which were pioneered in China) is that Free Trade Zones tend to limit their concessionary terms and conditions to exports, while Special Economic Zones also cater for goods produced for the local market. In most ways, however, they are very similar.

Its terms and conditions are similar to those offered in other countries, including Jebel Ali. In particular, there are:

- No import duties, although this concession applies only to a selected list of goods,
- No corporation tax,
- No property tax,
- No VAT or customs duties on goods imported for personal needs.

3PL = Third Party Logistics: sub-contractors that play a traditional execution role, managing and performing a specific logistic function using their own assets and resources for the account of another party.

4PL = Fourth Party Logistics: sub-contractors that undertake scheduling and planning work that do not have their own resources but that steer, combine, optimize and sub-contract the entire physical and data flows of their customers.

Co-manufacturing: repackaging on demand, assembly of several products at the storage
site to meet customers' orders.

Co-packing: grouping products by batch for promotional operations.

Cross-docking: transforming a group age / break-bulk warehouse (without storage) into a profit centre, adding value to primary tasks.

EDI = Electronic Data Interchange.

ERP = Enterprise Resource Planning: software packages that organise data flows and enable them to be connected within an enterprise in order to create a single database covering accounting, commercial and production management functions.

JIT = Just in Time: a production method under which all the manufacturing processes are launched on the basis of firm orders an not forecasts, as was the case under MRP2.

SCM = Supply Chain Management: software package that allows flows of good and information to be managed, in a chai running from the supplier's suppliers to the customers' customer, in four major processes scheduling, material supply, manufacture delivery.

TEU = Twenty-Foot Equivalent: the ISO un of measurement in containerization (= 6.06m In maritime supply chains, one 40-foo container counts as two TEUs.

The EU has recently put into force the new concept of **CO-MODALITY:** The efficient use of different modes both individually and in combination, that will result in an optimal and sustainable utilization of resources.

DRUZBA (Russian) = Friendship = DOSTYK (Kazakhstan) = DOSLYK (Uzbekistan)

7 Trade - Offs Between Transport Modalities

Learning Objectives for Lecture 7:

- The student should be aware of the components of the intermodal transport chain.
- The student should understand the factors influencing the choice of the transport method.
- The student should understand the main characteristics of each transport modality in the intermodal chain, their strong and weak points.
- The student should understand the main differences and trade-offs between the various transport modalities.

7.1 Components of the Intermodal Transport Chain

The following main components of the intermodal transport chain can be distinguished:

7.1.1 Modes of transport

Within the inter-modal system, shipments may move on one or any number of different means of transport: Rail, Air, Road, River etc. The shipper does not necessarily wish to know or to understand the technicalities of the various means of transport: the shippers' concern is that the goods reach their destination on time, in undamaged condition and at a competitive cost.
In chapter 6.2 we will discuss the characteristics, strong & weak points of the following transport modalities: Rail, Road, Air, (Short-)Sea, and River transport.

7.1.2 Interfaces

Each change of transportation mode requires an interface between one or more modes. An interface is a point where the cargo or the loading unit is handled and information is transferred. Specialised equipment is required for each mode. Consequently, the more flexible the interchange is, the greater the capital investment is in plant and equipment.
Some examples and remarks:

- Air cargo interchanges require large numbers of small, very specialised units, often designed to only handle one specific class of aircraft.
- Deep-sea container terminals require huge gantry cranes to reach over increasing ship beams. Vessels with container securing guides above deck level demand increasing the lifting height to load the container clear of obstructions. Generally, two main interfaces cannot be combined - air and sea. However, it is possible to combine air, road and rail, or sea, road and rail. It is unusual to have a rail and air connection other than for passenger services.

- There are two separate transport industries, air and ocean, with few links to reduce cost for the shipper. The air industry has been more successful in minimising delay time for cargo waiting to be shipped. Except on very long haul routes, cargo shipped by sea spends 22% of its transit time waiting to be transported. Preparation of shipping documentation, customs clearance and general transportation delays need to be streamlined in order to reduce delays. Greater emphasis should be placed on paperless systems.
- International trade is growing on average 10% annually and requires new investments in interface terminals. This will necessitate more substantial land use causing environmental objections to be resolved. Also, automation enabling the 24 hour working shifts often results in objections by local residents.

7.1.3 Equipment

Commodity, route and destination determine the type of loading unit required by shippers. Local door-to-door requirements are different to long haul deep-sea shipments.
The availability of a rail connection for long overland transport is essential to reducing costs.
The type of commodity defines specialist transport modules: reefer, insulated, tank etc.
One-way traffic requires leased equipment.
Closed circuit internal company movements may benefit from purchased equipment.

7.2 Factors Influencing the Choice of the Transport Method

The choice of the type of transport service provider is no longer limited to the simple choice of the means of transport. The shipper, or the freight forwarder, or the logistics service provider on behalf of the shipper, must decide upon a transport system among others, of which some are already a combination of several different means.
It is a question for the freight forwarder to discourage their customers from contacting carriers directly, or in certain cases from carrying their products themselves (own-account). The factors influencing this choice are:

Reliability: being reliable is being present in the place and at the moment that a need exists, not too late, not too early. With the development of logistics (zero stock; Just in Time) this factor has taken on a greater importance.

Flexibility: this factor has grown in importance due to the developments in logistics. This characteristic can be defined as the agility of adaptation of the transport system when faced with daily collection schedule changes and amounts to be delivered. This adaptability can be defined by the skill of the service provider to react rapidly to changing situations and their ability to efficiently handle high traffic periods.

Time limits: without being decisive, the factor of transit-time is an important criterion of choice. For certain types of goods, such as fresh or frozen foodstuffs, flowers, etc. the rapidity of transit-time can be essential for their preservation. In general, high value goods and those necessitating a high capital investment tend to use the faster methods of transport.

Security: this concerns the various misfortunes that can happen to the goods in the course of a transport operation during the loading, transhipment, or unloading phases, while the goods stay at intermediate handling points (ports, airports, bonded warehouses, etc). These misadventures can include theft, breakage, shortages and other miscellaneous damage. The best insurance in the world cannot reimburse the freight forwarder for the loss of confidence and brand image that they will be subjected to in case of problems.
Costs: even if there is a difference of analysis between the value of the goods transported and the qualitative requirements of the service asked for, the costs of transport services is the primary criterion in the choice of what means of transport. In general, the price includes the following costs:

- Forwarding (relating to speed, distance, weight),
- Packing (relating to the intrinsic characteristics of the goods),
- Insurance (relating to the value of the goods and the probability of their being subjected to risks),
- Handling and warehousing (at intermediate handling points),
- Associated services (forwarding, Customs operations, etc).

Other criteria:
Let us mention, in no particular order: the absence of intermediate handling, the ease of handling, a well thought out range of materials (containers, swap-bodies, etc), the ease of tracking the goods and the rapidity of information transfer.

7.3 Characteristics of Transport Modes

In this chapter some major characteristics and strong / weak points of the main transport modalities are listed.

7.3.1 Air Transport

Strong / weak points:
The main strong point of air transport is its speed;
the main weak point is its high costs, mainly due to fuel consumption.

Cargo:
As a consequence of high speed and high costs, air cargo is most suitable to urgent shipments with a relatively high value, to save inventory costs, also floating stock.

Routes:
Air cargo routes are mainly intercontinental, in order to utilise the speed advantage.
Short distances are trucked, under air cargo conditions.

Requirements:
Air cargo needs main ports with extensive destinations / connections. The main ports need efficient and fast airport handling facilities, air cargo forwarders with fast declaration possibilities, and fast connecting road collection- / distribution services.

7.3.2 Road Transport

Strong points:

- Door to door service possible, almost everywhere;
- Sometimes road transport is the only available solution (some countries are land locked or there is no continuity in rail networks);
- Flexible to cargo and routing, also good for small consignments.

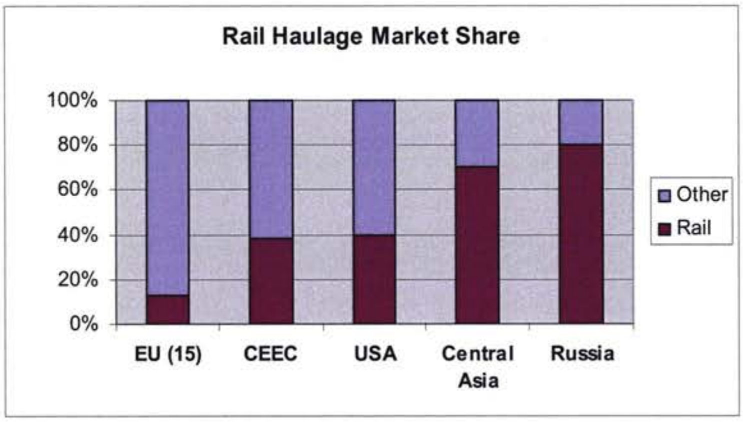
Weak points:

- On international transport: many borders to cross and need for visas for drivers (visa issuing delays, border delays);
- Sometimes convoys needed for security of cargo and driver;
- Not appropriate for large consignments, valuables, perishables, over long distance.
- Traffic congestions;
- Air pollution, noise, accidents.

7.3.3 Rail Transport

Rail Favourable characteristics:
As illustrated in the next figure, rail transport is especially applicable in regions with long distances (>100 km.). Other favourable characteristics are: full wagon loads; bulk cargo; general cargo (if *combined transport*).

Figure 7.1 Rail Market Share



Rail weak points:
According to the EU White Paper, many trains don't run properly, frequently information is missing, and the average speed of international rail haulage is only 18 km / h., which is slower than an icebreaker! Generally long distance rail transport is quicker than maritime, but slower than road transport. Some Indicative Rail Transit Times:

- Vladivostok - Berlin / TranSiberian (11,830 km) : 16 days;
- Lianyungang - Berlin / TAR North (11,260 km) : 26 days;
- Lianyungang - Budapest / TRACECA (11,310 km) : 26 days;
- Lianyungang - Budapest / TAR Central (11,870 km): 28 days;
- Lianyungang - Milan / TAR South (13,950 km) : 33 days;
- Western Europe - Almaty (KZ) : 25 - 35 days (ESCAP study).

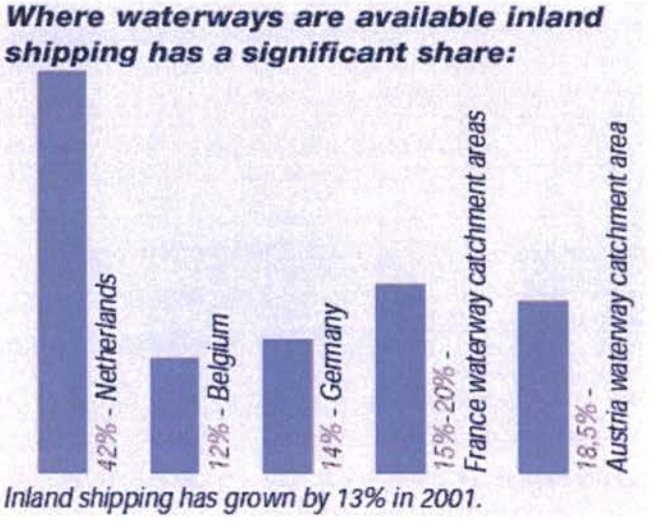
Other rail weaknesses are:

- Delays at border crossings (documentation, customs, formalities);
- Different gauge widths and other technical / operational characteristics;
- Differences in tariff structure and liability conditions;
- Missing links and poor infrastructure / low commercial speeds;
- Absence of a direct consignment note between OTIF and OSJD spheres of influence.

7.3.4 Inland Waterway Transport

The applicability of inland waterway transport is highly related to the availability of waterways:

Figure 7.2 IWT Market Share



Being confined to inland waterways, such as rivers and canals, some characteristic bottlenecks of this transport modality are:

- Bridges: traffic height (high cubes); curfew;
- Locks: size, operating times
- Maintenance (dredging etc.)
- Draught restrictions through tides and dry seasons.

Figure 7.3 IWT Bottlenecks

Traditional cargoes are dry and wet bulk commodities; however the above figures show that inland shipping increasingly also deals with container transport.

7.3.5 Shortsea Shipping

Shortsea shipping is especially suitable for larger volumes that have to be shipped regularly, over longer distances within Europe. On shorter distances within Continental Europe road, rail and inland shipping are more suitable. Other characteristics of Shortsea Shipping are:

- Intermodal: Vessel + truck; vessel + rail; vessel + barge;
- Intra-European: Destinations from NL include Russia, Baltic States, Scandinavia, UK, Ireland, France, Iberian Peninsula, North Africa, Mediterranean and Black Sea areas.
- Door-to-door basis: Fast, modern ships & intermodal transport for collection and delivery; the whole operation can be arranged by the shipping line itself and/or the agent.
- Alternative to road transport: The answer to congestion on European haulage motorways.
- Slower than road transport, but also cheaper.

Strong points:

- Reliability by fixed sailings between 200 European ports;
- Large, flexible capacity;
- Door to door, one provider;
- Environmental friendly. Environmentally friendly ands reducing road traffic jams.

Weak points:

- Relatively slow;
- Few control over delivery conditions;
- Procedures within ports.

A special case of Shortsea Shipping is Sea - River Shipping.
Some specific strong points of Sea - River Shipping are:

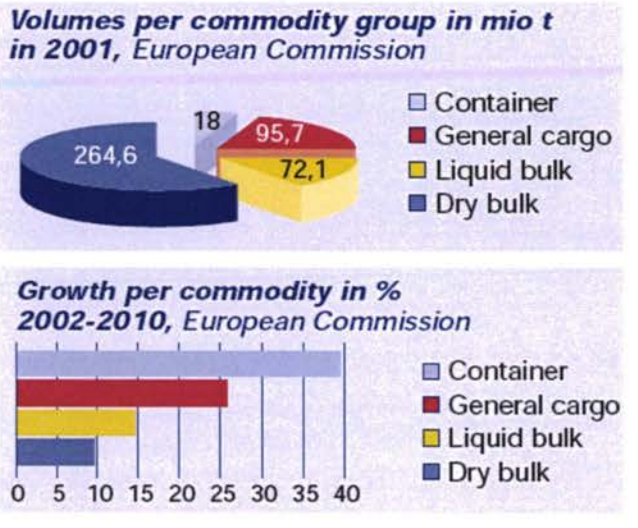
- One vessel, sailing both coastal and inland waters;
- Connects hinterland and overseas destinations without transhipment, realising lower transport costs and lower damage risks;
- Availability of 400 vessels (capacity less than 3,000 dwt, draught less than 5 m, bridge clearance less than 9 m.).

7.4 Comparison and Trade-Offs between Transport Modalities

7.4.1 Cargo Developments

The following figure shows the expected cargo developments up to 2010. This illustrates that transport systems should increasingly be able to transport and handle containerised cargoes.

Figure 7.4 Cargo Development

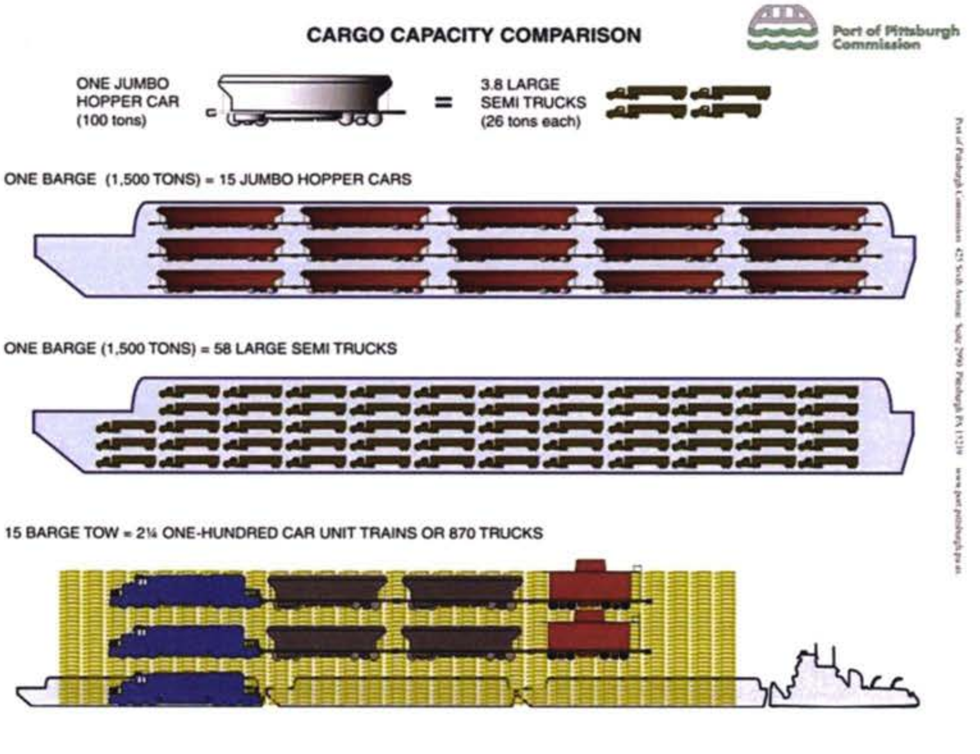


Source:
INE
www.inlandnavigation.org/

7.4.2 Capacity Differences

The following figure illustrates the huge transport capacity of one inland waterway barge or push- barge combination, compared to road transport or rail transport.

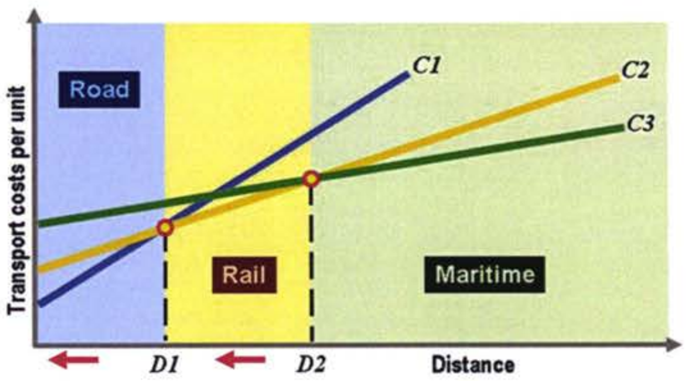
Figure 7.5 Cargo Capacity Comparison



7.4.3 Costs Differences

The next figure compares road-, rail- and maritime transport in terms of costs. The fixed costs (capital costs etc.) of road transport are relatively low; however its variable costs (especially fuel consumption) are relatively high. As a consequence, two break even points occur with the other two modalities (D1 and D2). At shorter distance road then this break even point, road transport is cheaper, at higher distance the other modality is cheaper.

Figure 7.6 Break Even Points

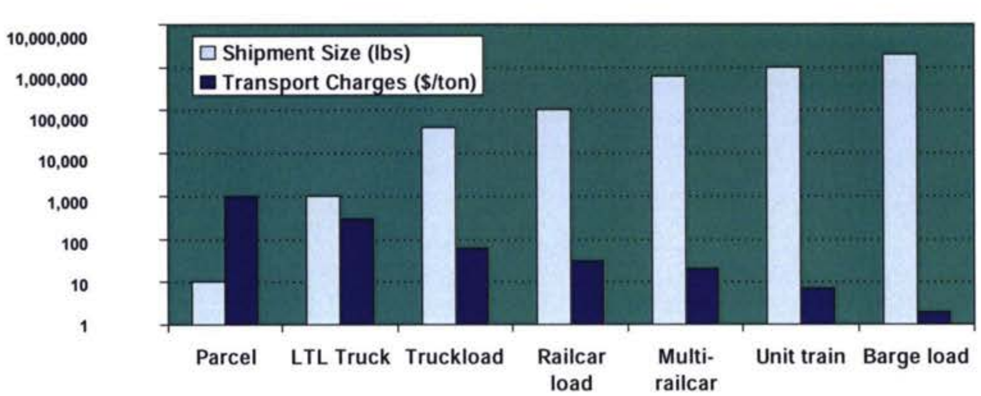


Source: people.hofstra.edu

These break even points are moving. Today, inland vessels reach more destinations at shorter distances; due to more efficient port handling facilities inland waterway transport becomes competitive at shorter distances.
As an example, in Belgium, France and The Netherlands more than 30% of the inland waterway traffic is carried over a distance of less than 50 km.

As a consequence of existing costs differences, the various transport modalities are most suitable to different types of cargo and shipment sizes, as has been illustrated below:

Figure 7.7 Transport Charges and Shipment Sizes



Source: people.hofstra.edu

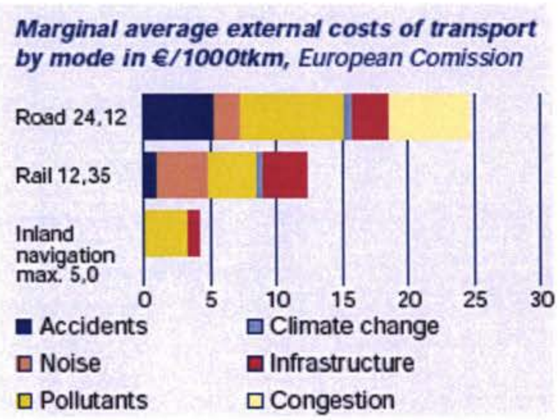
External costs:

The above mentioned costs can be directly related to the means of transport: capital investment, labour, maintenance, fuel consumption etc.

According to the European Commission, also other costs should be taken into consideration when comparing different transport modalities.
These are the so- called external costs, comprising the costs of the required infrastructure, as well as the damage caused by accidents, noise, pollutants, climate change, and traffic congestion.

The following figure shows the differences in external costs of some transport modalities:

Figure 7.8 External Costs

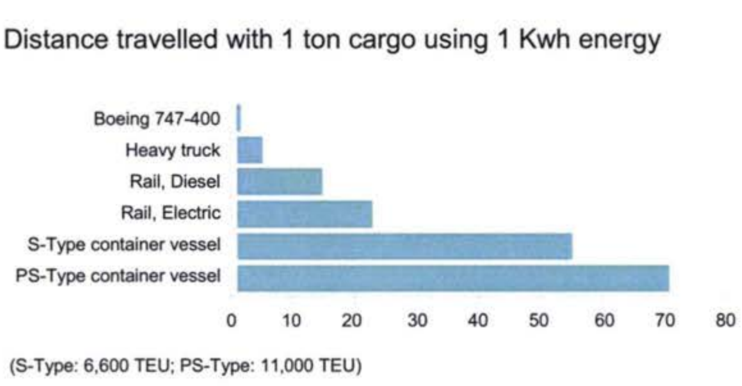


Source:
INE
www.inlandnavigation.org/

7.4.4 Environmental Differences: the Carbon Footprint

There are large differences in fuel consumption between various transport modalities:

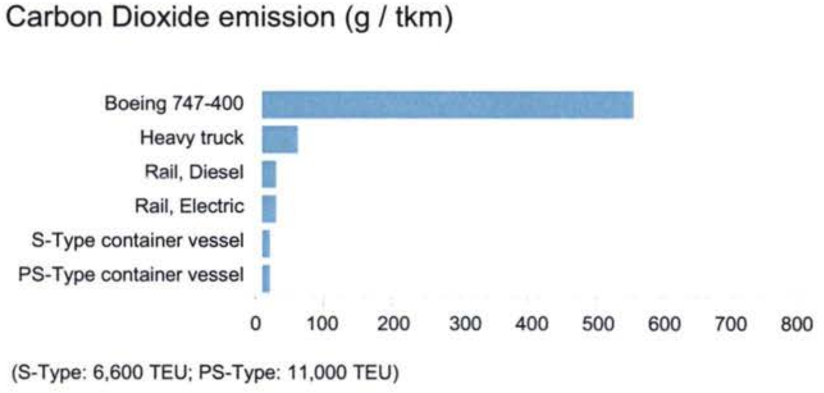
Figure 7.9 Carbon Footprint



Source: www.maerskline.com

As a consequence, the environmental burden (the "Carbon Footprint") of these transport modalities, which is mainly caused by fuel consumption, is also highly varying between different modalities:

Figure 7.10 Carbon Footprint



Source: www.maerskline.com

This carbon footprint is a growing concern and an increasingly important aspect in environmentally responsible transport (Green Logistics).

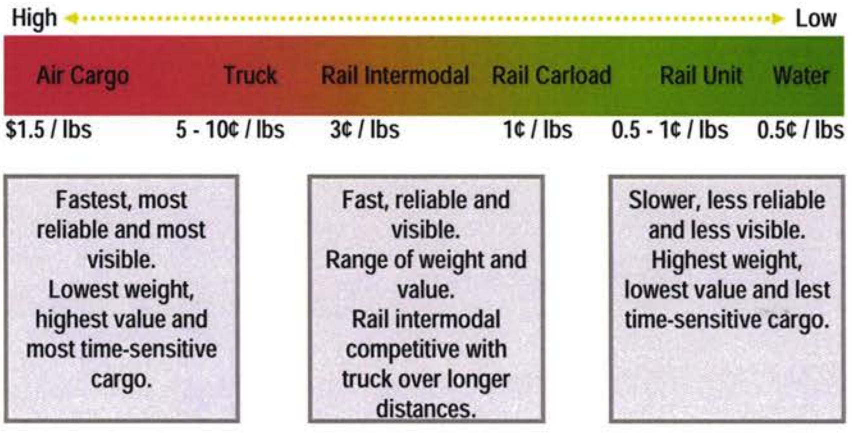
7.4.5 Trade-Offs between Costs and Service

The following figures compare different transport modalities in terms of costs, environmental aspects, capacity, speed and flexibility.

Figure 7.11 Trade-offs between Modalities

Modality	Costs (cents/ ton-mile)	Energy (BTUs/ ton-mile)	Air Pollution	Unit capacity (tons)	Linehaul speed (miles/hr)	Flexibility
Water	0.3 - 3.0	990	Low	1,000 - 60,000	3 - 10	range of direct service is limited to areas adjacent to a waterway
Rail	1.0 - 8.0	1,720	Medium	50 - 12,000	20 - 40	permit "door-to-door" service between many inland ports
Truck	4.0 - 15.0	3,420	High	10 to 25	10 - 60	can provide "door-to-door" service to almost any inland point

Figure 7.12 Trade-offs between Modalities

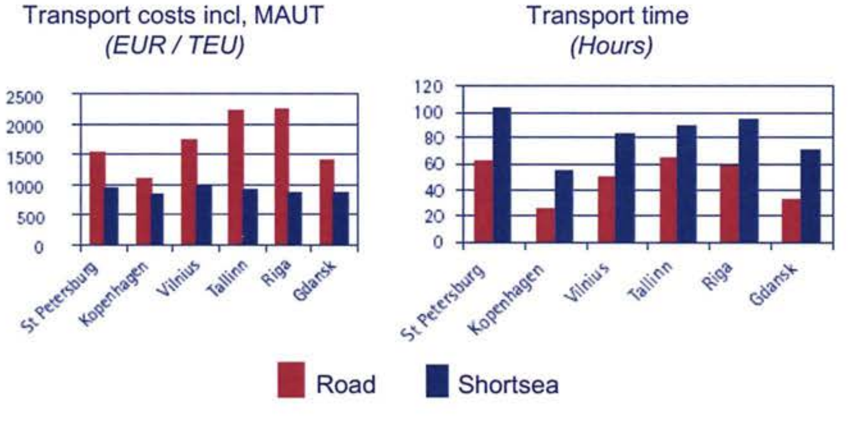


Source: people.hofstra.edu

In many cases a higher level of service (speed, flexibility etc.) is related to a higher level of costs.

This is also applicable in the following case, where a comparison is made between road transport and short sea transport from Rotterdam to ports in the north-east of Europe:

Figure 7.13 Comparison Road- an Short Sea Transport



These figures illustrate that in practical cases a thorough assessment of all service- and costs aspects is needed to determine the most appropriate transport modality.

Case Study: "Dancing Clogs"

A company in Limerick in the Republic of Ireland received an order to supply 4,000 pairs of traditional Irish dancing clogs to be delivered to the St Patrick's society in Odawara, near Tokyo in Japan. The weight of the consignment is 3,200kg and the cube is 22.0 cu. There is a requirement to speed the consignment through to the destination so the airfreight option was investigated, but as the receivers were an amateur dance team the cost was of great importance.

Option 1 – Airfreight Method (route A):
Day 1 Transport from factory on shrink-wrapped euro-pallets to Dublin Airport by road truck.
Day 2 Pallets broken down at Air cargo Terminal and loaded into standard air freight containers (potential loss through pilferage, damage through mishandling, adverse weather as operation carried out on airport apron, minor damage not affecting contents but visual appearance of packaging).
Day 3 Air freight containers transported to London Air Cargo Centre for transfer to long haul cargo aircraft.
Day 4 Long haul transport by cargo aircraft
Day 5 Containers unloaded at Tokyo Cargo Centre and placed in warehouse. Containers unloaded and made available for collection (potential loss through pilferage, damage through mishandling, minor damage not affecting contents but appearance of packaging).
Day 6 Consignment collected in loose condition and delivered to consignees by road truck (potential loss through pilferage, damage through mishandling, adverse weather, minor damage not affecting contents, but appearance of packaging).
Quotation from Airfreight Agent US $ 7225.

Option 2 – Airfreight Method (route B)
Day 1 Transport from factory on shrink-wrapped euro-pallets to Dublin Seaport by road truck. Truck loaded on to overnight RoRo ferry to Liverpool port in England.
Day 2 Truck departs Liverpool early morning and arrives London Air Cargo Centre early afternoon. Consignment unloaded and placed in warehouse. Goods remain shrink wrapped on pallets. Little likelihood of significant damage.
Day 3 Pallets loaded on to long haul aircraft and transport commenced.
Day 4 consignment arrives Tokyo Air Cargo Centre and unloaded in to warehouse.
Day 5 Consignment collected and delivered to consignees by road truck. Goods remain shrink wrapped on pallets. Minor damage to some packaging and 14 pairs of clogs missing. Insurance claim made against carrier.
Quotation from Airfreight Agent US $ 6955.

Option 3 – Sea freight Method (Route 1)
Day 1 Shipping line 20 ft general purpose container delivered to factory for loading by shipper's employees. Damage risk – minimal. Road vehicle departs for Dublin and container shipped on overnight RoRo ferry to Liverpool.
Day 2 Container discharged from ferry and loaded to Rail freight train for shipment to Southampton Container Terminal. Unloaded overnight and placed in export shipment stack
Days 3 – 5 Container remains on quay awaiting arrival of next vessel for Tokyo.

Days 6 - 42 Vessel in transit via Rotterdam, Hamburg, Le Havre, Jeddah, Singapore, Manila, Hong Kong, and Kaohsiung.
Days 43 - 46 Container remains on quay awaiting customs clearance and collection.
Day 47 Container collected by road truck and delivered to consignees. Unloaded by volunteers from the St Patrick's Association. No damage to contents.
Quotation from Sea freight Agent US $ 1851.

Option 4 - Sea freight Method (Route 2)
Day 1 Shipping line 20 ft general purpose container delivered to factory for loading by shipper's employees. Damage risk - minimal. Road vehicle departs for Dublin.
Days 2 - 7 Container unloaded at seaport container terminal to await next feeder vessel for Southampton.
Days 7 - 9 in transit to Southampton via Liverpool.
Days 9 - 12 Container remains on quay awaiting arrival of next vessel for Tokyo.
Days 12 - 48 Vessel in transit via Rotterdam, Hamburg, Le Havre, Jeddah, Singapore, Manila, Hong Kong, and Kaohsiung.
Days 43 - 46 Container remains on quay awaiting customs clearance and collection.
Day 47 Container collected by road truck and delivered to consignees.
Unloaded by volunteers from the St Patrick's Association. No damage to contents.
Quotation from Sea freight Agent US $ 1470.

Source: Alan Duncan, Tacis Project: MBA in Intermodal Transport, Moscow 2000

Assignment:
Read the case study and discuss pros and cons of the different transport options. What would be your criterions to decide and which option would you have chosen?

8 Containers

Learning Objectives for Lecture 8:

- The student should know the main types of containers and for which cargo they are designed for. He/she should have an understanding of the main parameters of a container and about its handling requirements.
- The student should know different container types, their loading capacities and their purpose.
- The student should understand the contents and the objective of the identification code of a container.
- The student should understand basic requirements for a safe loading of consignments
- into a container. He/she should be aware of possible damage arising from non-proper
- packing.

8.1 Types and Specification for the Most Used Container

8.1.1 Container Types, Dimensions and Payloads

ISO, the International Standardisation Organization, has implemented following standards for containers:

- Length: 10, 20, 30, 40, 45 ft;
- Width: 8.5 ft;
- Height: 4, 8, 8.5, 9.5 ft;
- Gross Weight: variable up to 35 tonnes.

Below some ISO Standard containers are specified:

Standard Box		BOX 20´ : dimensions inside 590 x 234 x 239 cm ; payload ca. 22 ton. BOX 40´ : Dimensions inside 1203 x 234 x 239 cm payload ca. 26,5 ton. High Cube (40´) dimensions inside 1203 x 234 x 271 cm payload ca. 26,6 ton For all kind of general cargo.
Open Top		Open Top Container 20´ dimensions inside: 590 x 233 x 236 cm; payload ca. 18,2 ton; Open Top Container 40´ dimensions inside: 1202 x 232 x 233 cm; payload 26,3 ton. Especially for over-height cargo.
Refrigerated Container		20´and 40´ also High Cube Electrically operated heating/cooling aggregate. Needs board or landside electric connection or "clip-on" diesel aggregate during land transport. For all temperature controlled cargo.

Platform		20' or 40' For heavy lift or oversized cargo (not for land transport).
Flat Rack		Special open platform container, which is not closed on the top or eventually at the sides.
Open Side Container		Special container which is open at the sides Useful for cargo which should be loaded/unloaded from the side, e.g. paper rolls.
Tank Container		20' For the transport of liquid foodstuff cargo, e.g. • alcohol; • fruit juice; • sweet oil.

8.1.2 Dimensions of ISO containers

Containers are always marked with their Tare and Gross weights on the doors.
A 40-foot container will have an approximate weight of 3.5 tonnes and a maximum gross weight of approximately 28 tonnes.
Road Haulage Vehicles carry 20-foot containers of up to 20 tonnes gross weight.
In rail transport the maximum payload is increased to 90 tonnes.

The **most common sizes** in ft. are:

- in length: 20' (6,05 m) - 30' (9,12 m) - 40' (12,19 m) - 45' (13,71 m);
- in height: 8' (2,44 m) - 8' 6" (2,60 m) - 9' 6" (2,90 m), but the 8' type tends to make way for the other types, with all of them being 8' (2,44 m) in width.

These dimensions are bound to change: the 30' type accounts for only 1 % of the fleet, whereas the 45' type continues to develop.

Length	***Width***	***Height***		***Type***
20′	8′	8′ – 8′ 6″		Standard
40′	8′	8′ 6″ - 9′ 6″	Height of 9′6″	High Cube
45′	8′	8′ 6″ - 9′ 6″	Height of 9′6″	Super High Cube

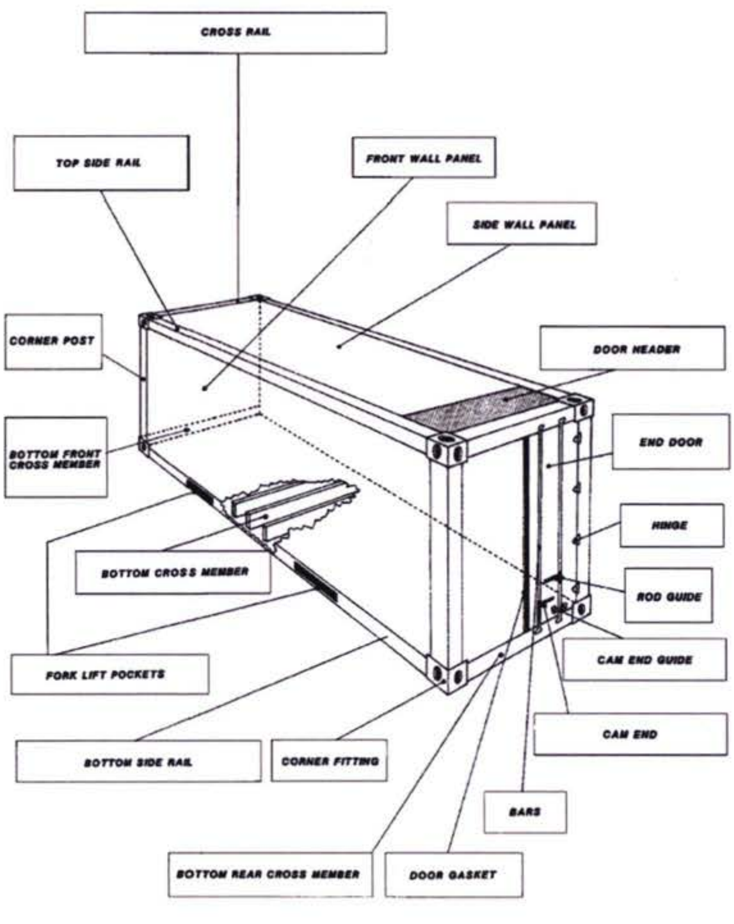
There are indications that in the USA, the number of 45 and 53-foot containers is increasing but there are difficulties with these units operating within European standards.

8.1.3 Twenty Foot Equivalent Unit TEU

This is a measurement unit in container trade which is based on a 20′ ISO standard container.
One 20′ ISO Container is equivalent to 1 TEU.
One 40′ ISO Container is equivalent to 2 TEU.

Some cellular container vessels can carry several thousands Twenty Foot Equivalent Units (TEU). 4,000 TEU represents approximately 56,000 tonnes of deadweight capacity. A train can carry 30 - 60 TEU, while container ships carry 1500 - 4000/6600 TEU.
A container truck can carry 2 TEU, that is: 2x20′ containers or 1x40′ container.

8.2 Container Dissection



8.3 Identification Codes of Containers

8.3.1 ISO Numbering System

ISO standards require each container to have a series of identification marks and safety certification details.

The **CSC Plate** carries information showing amongst others, date of construction, load rating, and any repair information. In general, any container used for international transport must have a valid safety approval plate or "CSC plate". CSC is the abbreviation for Container Safety Convention.
For further details on Container safety see www.tis-gdv.de

The **Identification Marks** are fixed to the top and to each side of the container. These marks are:

a The owners code letters - a four letter code of which the last letter is "U" indicating that the marks comply with the ISO numbering code.
b The individual container identification number - a six-digit number followed by a check digit (sometimes outlined). This is a computer generated
c number not sequential, which can be validated by a simple mathematical process. This ensures that the number has been correctly transcribed from document to document. (c) A country code - a three letter code identifying the country of origin
d (d) A size code - a two digit code indicating size (combination of length + height)
e (e) A type code - a two-digit code indicating the special characteristics of the unit.
f (f) These latter two codes are *Examples.*

(a) and (b) are the so called **BIC-Code**, the international identification codes of container owners.

8.3.2 Example

OCLU 024263 0GBX 2000

OCLU:	OCL	owners code for Overseas Container Line;
	U	indicates ISO code in use.
GBX:	GB	country of origin Great Britain (X is added to make up the three digit code).
2000	20	indicates a 20 foot long, 8 foot high container;
	00	indicates a standard dry van container with opening(s) at one or both ends.

Other examples of the size type code are:

4332
40 foot long, 8.5 foot high, thermal container that can be heated or refrigerated;

3277
30 foot long, 8.25-foot high, tank container for dangerous gasses maximum tested pressure 22 bar.

Additionally there are tare and maximum permissible gross weights for the individual unit marked on the door. There are many and varied internal dimensions depending on operator, with a wide range of special constructions for project cargo, bulk liquids, open top, open side, collapsible, refrigerated, insulated, and base flats.

More information can be found on www.bic-code.org

8.4 Loading Procedures in Container Traffic

8.4.1 Loading Plan for Containers

Shippers are very often unaware of the risk their goods or products can face in a container or swap-body when they are in transit between origin and destination.
A manufacturing company that has little or no knowledge of the international shipping trade may believe that once their goods have been placed inside a container that they will be safe from damage. Unfortunately this is not the case, as containers (or swap-bodies) can experience considerable violent acceleration and deceleration forces throughout their journey. Not only are containers and their contents subjected to the normal motions experienced in normal road transport, but when used as a link in the inter-modal chain, they will experience rapid velocity changes in all three planes (sometimes simultaneously). The forces imposed on freight units during rail transport during shunting or switching operations can be violent and intense, but generally in only two planes, whereas those forces imposed by sea transport are generally less violent but of greater degree and in all three planes. It is essential that goods packed inside containers are fully secured against movement, to avoid damage to the contents, and also to protect personnel when the unit is opened for discharge. Each different type of commodity (cartons, cases, loose items, heavy or hazardous goods) will require special stowage considerations and securing methods.

Container leasing companies may advise shippers how to stow their goods safely and securely in their containers, and some of the larger companies have a special department for this function, but the majority are amenable to lease containers or swap-bodies to a shipper without any information or stowage advice whatsoever. With the wide range of specialist containers in circulation, designed for different conditions and types of freight, it is essential that the container is packed properly.
More advice can be found on www.imo.org

8.4.2 Case Studies: Stowage + Packaging of Goods in Containers

Incidents of Poorly Stowed Cargo in Containers

a) A twenty-foot (6m) container with top loading hatches in addition to the rear doors had been filled with loose grain. With such a commodity a retaining fence and plastic membrane should have been positioned inside the doors to enable the doors to be opened safely without the contents moving. Unfortunately this had not been done as recommended and when a Customs Officer loosened the first door to check the contents, the weight of the cargo on the door forced it open and the majority of the contents was deposited on the ground, completely overwhelming the Customs Officer. Fortunately the truck driver was able to dig the Officer out before he drowned under the pile of grain.

(b) Before the general trend of constructing containers out of lightweight corrugated steel, the method of construction was that the corner posts were the main strength members of the unit, and the top, end and side panels were constructed from materials such as GRP, plywood or aluminium.

One such container with aluminium end panels had been loaded with a large 1.8m diameter reel of electrical cable weighing 16 tons. The company that had loaded the cable reel had simply rolled it into the container, closed, locked and sealed the doors. The unfortunate truck driver (who had not been present when the container was loaded) soon became aware that there was something not quite right about his load. However, before he could take any action to stop and inspect the contents of the container, he was obliged to stop abruptly to avoid an accident. The result was that the cable reel burst through the front panel of the container almost crushing the cab of the truck.

(c) A Mercedes Benz "S" Class motorcar had been loaded into a 40-foot (12m) container, but instead of having the petrol tank drained for safety, the loading company had left the tank half full. Additionally the vehicle was only secured with short lengths of thin rope, instead of having the wheels chocked and also secured with ropes of the correct thickness and properly tensioned. In an incident in the container terminal when a straddle carrier was in collision with the container, the impact caused the car to break free of the securing lashings, and then as a result of the petrol leaking from the damaged tank, burst into flames.

The Mercedes was damaged beyond repair.

(d) Containers are always marked with their Tare and Gross weights on the doors. A 40-foot container will have an approximate weight of 3.5 tonnes and a maximum gross weight of approximately 28 tonnes. (Although there are a limited number of containers with a gross weight of 35 tonnes in circulation with a Far East Company) A regular open top container had been loaded with small pieces of scrap metal in the USA for discharge in Europe.

The shipper had not understood that the commodity was a dense material and had therefore loaded the container until it was full to the top and could not hold any more scrap. The container was loaded safely in the USA but when the shore gantry had lifted the container clear of the ship's side the bottom fell out and all of the contents were dropped approximately 15 metres on to the wharf.
Fortunately the port operated a strict safety policy and the access of all pedestrians - including dockworkers - on to the wharf when cargo was being

worked was strictly forbidden. When all of the scrap was eventually cleared up it was weighed and the result was that the container with a payload of 24.5 tonnes had actually been loaded with 47.5 tonnes.

Two points for discussion

a Did the shipper realise the danger of his actions and the possibility of injury or death by his actions, but did he not worry in his attempt to ship the maximum freight for the minimum cost?

b The container leasing company should have advised the shipper of the maximum payload permissible for that particular container and when they were advised that the cargo was to be scrapping metal they should have taken steps to have it weighed as soon as possible after loading to ensure that the safe load was not exceeded.

8.4.3 Weight Limits (container and on transport modes)

When packing containers the weight limits of the container and the vehicles must be respected. Overloading can cause serious damage and accidents (e.g. falling out of the bottom when lifted).

Road Haulage Vehicles

Introduction of 20-foot containers of up to 20 tons gross weight put pressure on the haulage industry to develop trucks to carry such weights. Permissible axle loads have been increased to 8 tons per axle and gross vehicle weights have been increased to 40-44 tonnes. Different countries have varying regulations on truck construction requirements, but Europe is slowly harmonising. New designs of engines and transmissions for improving fuel consumption from 47 litre/100 km to 25 litre/100 km over 10 years are being developed.

Country	Max. Vehicle Weight (ton)	Max. Axle Weight (ton)	Max. Vehicle Length (m)
Finland	48.0	8.0	25.25
France	40.0	10.0	16.75
Germany	40.0	10.0	18.75
Poland	42.0	8.0	18.75
Russia	36.0	10.0	20.0
Switzerland	28.0	10.0	18.75
UK	42.0	8.0	18.75

Rail Transport

Introduction of ISO containers produced the demand for flat railcars to transport units from ports to inland terminals. Original railcars offered 20 foot capacity only, but soon developed 60 foot flat bed units capable of carrying 20 foot, 30 foot, 40 foot and 45 foot containers or swap-bodies. Max. payload increased to 90 tonnes. Some "well" or "pocket" units are in service to permit carrying of over height containers. Spine wagons have been developed for carrying piggyback trailers. A range of specialist units is being developed for these trailers designed to swing open, permitting the trailers to be driven onto wagons.

9 Elements and History of MMT

Learning Objectives for Lecture 9:

- The student should understand the difference between Multi Modal, Intermodal and Combined transport.
- The student should understand the elements of the Multi Modal costs function.
- The student should now the historical development of Multi Modal Transport

9.1 Definitions

9.1.1 Multi Modal Transport

Multi Modal Transport can be defined as:
the movement of goods in two or more different modes of transport, using transhipment, organized by one carrier (MTO - Multi modal Transport Operator), applying one contract, one document, one liability, one price.
Please note that is this definition the *goods* are moved (handled and transported).

9.1.2 Intermodal Transport

Intermodal Transport can be defined as follows:
"the movement of goods in one and the same loading unit or vehicle, which uses successively several modes of transport, without handling of the goods themselves in changing modes".
Please note that in this definition not the goods are moved, but a loading unit which is containing the goods.

Intermodal transport can also be organized by one carrier (MTO - Multi modal Transport Operator), applying one contract, one document, one liability, one price.
The difference with Multi Modal transport is the movement of the loading unit instead of the cargo itself. This loading unit can be different types of air / road / sea containers swap bodies, semi- trailers etc.

Figure 9.1 Multi Modal or Intermodal Transport?

9.1.3 Combined transport

According to the ECMT (European Committee of Ministers of Transport), Combined Transport has been defined as follows:
Combined transport is intermodal transport, principally carried out by rail, inland waterways, or by sea, with the trips beginning and ending by road.

Combined transport encompasses the following techniques:
- Piggyback systems (a mix of road- and rail transport);
- Roll-on Roll-off systems (a mix of road- and water transport).

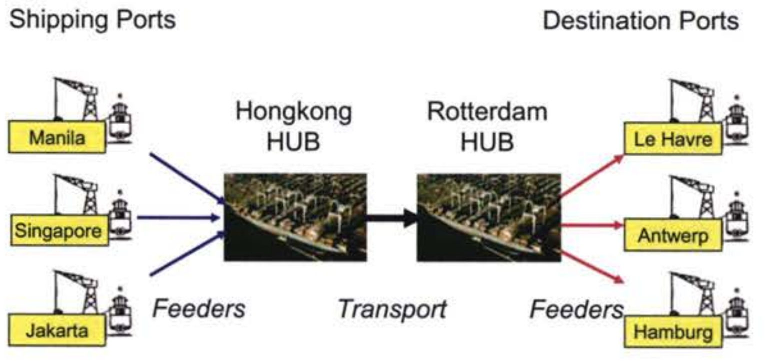
9.2 The Intermodal Transport Chain and Costs Functions

9.2.1 Hub and Spoke Networks

A widely implemented structure for transport and distribution is the Hub and Spoke network.
In this structure, cargo is collected from the shippers' premises to a Hub, which is a transhipment / distribution centre. At the Hub the cargo is transferred (transhipped) to another transport modality, which transports it to a second Hub. At the second Hub, the cargo is transferred again and distributed to the destinies. The collection and distribution links are called the spokes of the network.

The next figure shows a Hub and Spoke network in maritime shipping. Feeder vessels perform the collection from regional shipping ports to the mainport Hub of departure, and feeder vessels perform the distribution from the mainport Hub of arrival to the regional destination ports. Large scale container vessels are sailing only between the mainport Hubs.

Figure 9.2 Maritime Hub and Spoke Network



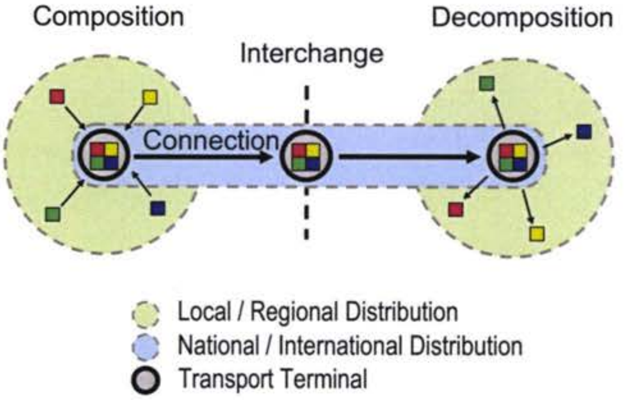
The same structure is also widely implemented in:

- Road transport (where smaller vans perform collection and distribution in routes to and from the Hubs, and large truck- / semi trailer combinations perform the long distance haul between the Hubs);
- Air transport, with regional flights connecting to intercontinental flights between the Hub airports.

9.2.2 Costs Elements of the Intermodal Transport Chain

Figure 9.3 shows an example of an intermodal transport chain, which is also a hub and spoke structure.

Figure 9.3 Costs Elements



Source: people.hofstra.edu

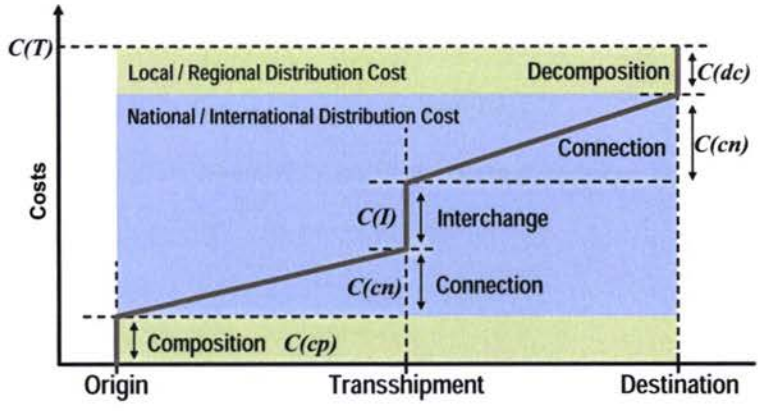
Composition is the collection of the cargo from the shipper and stuffing it into a loading unit, e.g. a container, at the hub.
Connection is the long haul container transport between the hubs; in this case executed in two stages by different transport modalities, with therefore an additional interchange in between.
Decomposition is the stripping of the arriving container and the distribution of the cargo to the final destinies.

In this example four different transport modalities are applied: for collection, for the connection part 1, for the connection part 2 and for distribution. As a consequence 3 interchanges occur: at both hubs and halfway the long haul transport.

9.2.3 The Intermodal Costs Function

The graph below shows the costs function of the intermodal transport chain which was discussed in paragraph b. In this example the total costs are built up from composition, connection (first part), interchange, connection (second part) and decomposition.

Figure 9.4 Intermodal Costs Function



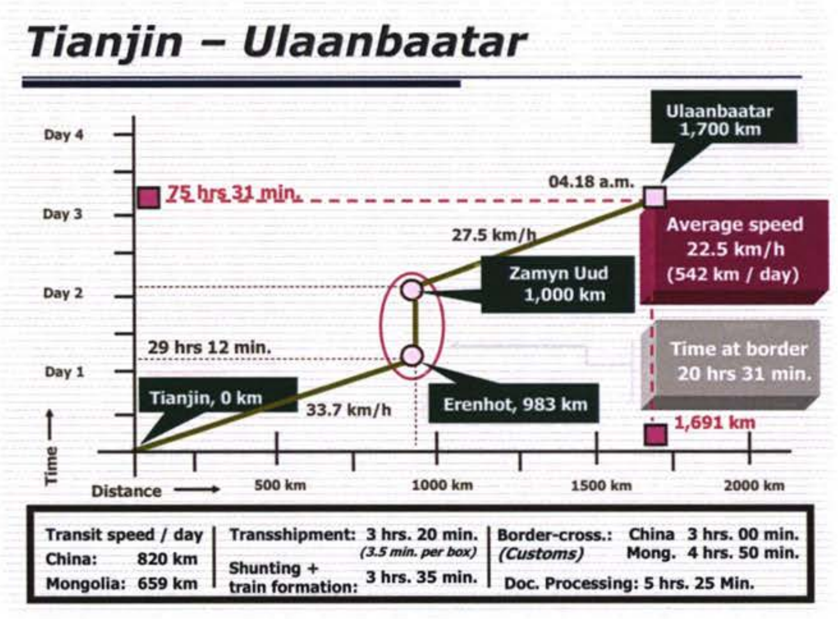
Source: people.hofstra.edu

Composition, interchange and decomposition increase the total costs of this transport.
In order to be competitive, these costs must be compensated by (higher) costs savings, resulting from better capacity utilisation during the long haul transport connecting the hubs.
In practice this many times proves to be a bottleneck. Inefficiencies occur especially when crossing borders, due to:

- Lack of simplified, standardized and harmonized documentation and procedures;
- Lack transparency in application of procedures;
- Denial of access to foreign vehicles;
- Incompatibility of vehicle weights and dimensions, insurance and drive licensing qualification;
- Operational difficulties from differences in the capacity of vehicles used in cross-border traffic;
- Inadequacy of transport and cargo handling and storage facilities both at, and in the vicinity of, borders;
- Lack of multimodal transport and logistics services.

As an example, figure 9.5 shows how the average speed of a total transport was reduced (and thus the costs were increased) by the time needed for transhipment.

Figure 9.5 Shipment Time



9.2.4 Requirements for Intermodal Transport

Intermodal transport becomes an option when the costs are lower than the costs of uni- modal transport. Combined transport is more capital intensive than road transport and has a higher transport capacity per voyage. Therefore it requires higher transport volumes and a high utilisation degree.
Intermodal transport occurs also at shorter distances (<100 km), if there are large transport volumes and a balance in flows.

A high frequency in number of slots or departures per day is important for carriers in order to keep the lead time of the transport short.
Carriers who apply intermodal transport must be able to rely on the various modalities (reliability) and these modalities must connect well (connectivity).
Intermodal transport must also be flexible since circumstances related to the transport can change op to the last moment.

9.2.5 Cargoes

Intermodal transport moves merely 'general cargo', than bulk- or conditioned cargoes; also tank-bulk containers, dangerous goods and exceptional cargoes frequently are moved by intermodal transport.
Also small shipments can be efficiently consolidated into intermodal LCL containers.

9.2.6 Loading Units and Other Equipment

Container
The most important loading unit in inter modal transport is the container. Containers are boxes with standardised dimensions which can be stacked and can be handled efficiently.

A disadvantage of sea containers is that they are not suitable to an optimal utilisation of EUR- pallets and that they are rather heavy in road transport applications.

Swap Bodies

Also swap bodies are used, mainly for intermodal overland transport. This is a loading platform, which is independent of a lorry or a semi-trailer. It can be a box trailer, an isolated trailer, or a tilt. Advantage is the lighter Construction compared to the container. On the other hand swap bodies can not be stacked.

Semi- trailers

The combined transport of semi-trailers requires that the semi-trailer possesses lift pockets for lifting by tongs. The gantry crane can in this way lift both the bed and the chassis of the vehicle and then place it on a low loader wagon.

Tank Containers

The tank container forms a niche market with much smaller volumes than the regular container. The tank container is more expensive and applicable for transport of liquid bulk products.

Ro - Ro Transport

Roll-on, Roll-off transport. In this system road vehicles or train wagons are carried by ships, which are provided with special ramps for the movement of this rolling stock.

Pallet

Raised platform on which loads can be stacked and constructed for easy movement by a forklift or sling. Standard form in the EU is 800mm x 1200mm.

Barge-carrier

a ship borne system in which the barges are loaded inland, linked together and pushed down an inland waterway to a point that can be reached by a ship, where the barges are lifted onto the mother ship with the use of gantry cranes or by lowering the mother ship. Two types of barges exist (lash-lighter-abroad-ship for use of up to 370 tonnes/Lykes and Seabee for use of up to 850 tonnes).

Piggyback

Or trailer on flat car TOFC system, where semi-trailers are loaded on flat cars (usually by crane) and transported as a unit. At the terminal of destination the semi-trailer is picked up by a tractor for final delivery.

Kangaroo-system

Where both trucks and trailers are transported by rail; this system is also referred to as the "rolling road". The trucks roll-on and roll-off horizontally onto / from the railcar.

Road-railer

Bimodal service, where the bogies from the chassis for road transport are exchanged in the rail terminal by rail bogies, the road railers form a train and are transported like wagons to the rail terminal of destination from where they continue travelling as normal road trucks exchanging the bogies.

Courier and parcel systems

Courier and parcel transport systems are part of the fast freight market. Fast freight includes the scheduled carriage of goods from door-to-door within a minimum of time. The fast freight market can be divided into four service segments with different products, structures and rules.

The different operators on the market are:

- Courier service ;
- Express service ;
- Parcel service ;
- Integrators.

Heavy lift transport:

heavy lift transport requires a solid preparation of the whole transport chain in advance. Specific projects for each individual transport problem have to be worked out. From the technological aspects every heavy lift transport has to be planned and carried out as a door-to-door transport. In this sense the commercial terms of multimodal transport should obviously also be applied. In fact heavy lift operators tend to use more multimodal transport especially in the framework of industrial project deliveries. They also offer carrier conditions for the main leg and "as agent"- conditions for the pre- and on- carriage.

River-sea shipping:

river-sea shipping is a through shipping starting or ending at an inland port via inland waterways and ocean going traffic. River-sea ships are licensed for inland waterways and ocean going traffic. Main advantage is that there is no necessity for ocean port transhipment. River-sea ships have up to 4 metres draft and are able to load up to 5.000 tdw. At the moment about 2/3 of the European river-sea cargo is handled by 2.000 units and about 6-7 Mio. tdw by units under Russian or CIS flag.

9.3 History of Intermodal Transport

In this chapter some historical moments in the development of intermodal transport are highlighted.

9.3.1 Containerisation

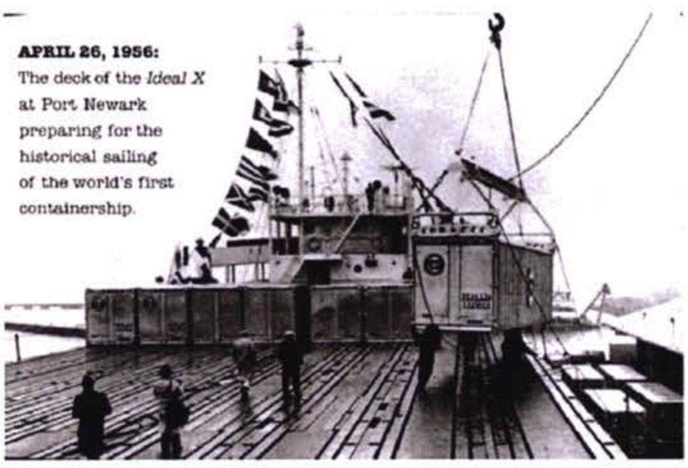
On April 26th 1956, the Ideal-X left the Port of Newark, New Jersey to the Port Houston, Texas, which it called 5 days later. It carried 58 35-feet containers, along with a regular load of liquid cargo. This ship was converted under the initiative of Malcom McLean (1914-2001), a trucking magnate who saw the tremendous potential of containerization, particularly in terms of loading and unloading costs.

Figure 9.6 First Containership, Ideal-X, 1956

Source: Maersk

McLean calculated that in 1956 loading a medium-sized ship the conventional way cost $5.83 a ton. Comparatively, loading the Ideal-X cost less than $0.16 a ton. The economic advantages of such a mode of transportation thus became clear to the shipping industry. In 1960, McLean founded SeaLand, a major container shipping line, which was purchased in 1999 by Maersk, the world's largest container shipping company. The Ideal X carried containers until 1965, when it was scrapped.

Figure 9.7 Container Handling, 1956



Vessels have rapidly developed since then and also container terminals have adapted quickly in order to facilitate larger vessels at reduced turnaround times.

Figure 9.8 Post Panamax Container Vessel at the Port of Le Havre, France

9.3.2 Combined Transport

The UIRR (International Union of Combined Road- Rail Companies) was founded 1970 in Munich. The first member companies were ASG (S), Hucketrans (A), Hupac (CH), Kombiverkehr (D), Novatrans (F), Trailstar (NL) and TRW (B). The members organised rail transport using swap bodies and semi-trailers: at that time national traffic represented around 230,000 shipments, and there were only 17,000 international shipments.

In 1972 the first international rolling road link was established. This Combined Transport technique, involving the transportation of complete trucks by rail, is introduced between the cities of Cologne and Verona.

Figure 9.9 Combined Transport, 1970

In 1975 the Directive 75/130 of the European Commission on the promotion of combined road-rail transport was issued.
In 1981 the first rolling road wagons were introduced by Hupac and Kombiverkehr, 240 wagons with a length of 19 m for the rolling road (payload of 38 t and later of 40 t). That same year, traffic reaches no less than 500,000 shipments.
In 1984 the first General Terms and Conditions, setting out uniform regulations on the responsibilities in international Combined Transport between the CT operators of the UIRR and their clients, were adopted.

9.4 Relevant Websites on Multi Modal Transport

Newsletters and Magazines (English):
- OECD International Transport Forum: itf.subscriptions@oecd.org
- International Reference Centre for Intermodal Freight Transport: www.eurift.net
- Holland International Distribution Council: www.hidc.nl
- Russia and Eastern Europe: www.eastview.com/
- UNCTAD Transport Newsletter: trade.logistics@unctad.org
- Transport & Logistics News (Australia): www.tandlnews.com.au
- Lithuanian International Business Magazine: http://www.jura.lt
- Middle East: www.arabiansupplychain.com

Transport and Logistics Web sites:
- Info site on Logistics Management: www.logisticsmgmt.com/
- Worldbank Transport website: www.worldbank.org/transport/ports_ss.htm
- Wikipedia: www.en.wikipedia.org/wiki/Logistics
- Supply Chain Management News and Resources: www.logisticshub.net
- Transport Research, Berger World: www.louisberger.com/berger/world/
- SCM System: www.log-net.com/news.htm
- 3PL Provider: www.penskelogistics.com/
- Containerisation International Info Service: www.ci-online.co.uk/
- SCM Business Software: www.infor.com/solutions/scm/
- International Projects Database: www.ist.org/
- Legal Info on Freight Forwarding and Logistics: www.forwarderlaw.com
- Italian Forum on Shipping and Logistics: www.informare.it/
- Production Logistics: www.manufacturing.net/
- Directory of Logistics Resources: www.logisticsworld.com/
- Web portal for Transport, Logistics and SCM: www.loglink.net/
- Singapore Economic Development Board: www.sedb.com
- Info site Supply Chain Management Review: www.supplychainlink.com/
- Web portal for transport: www.transportweb.com
- Dutch webportal on rail, shortsea and inland shipping: www.hollandintermodal.com

Intermodal / Multimodal Transport:
- UIRR www.uirr.com
- EIA www.eia-ngo.com
- ICF-Intercontainer www.icfonline.com
- DGTREN europa.eu.int/comm./dgs/energy transport/index en.html
- ENO Transportation Foundation www.enotrans.com
- University of Texas, College of Business Administration (many intermodal page links) www.coba.unt.edu/mktg/logsa/logmania/1.htm
- The Intermodal Container FAQ (excellent on-line text book of intermodal transport) www.roblw1/transport/intermod.htm
- Intermodal Association of North America (homepage) intermodal.org/news.html
- Motorways of the Sea: www.ec.europa.eu/transport/intermodality/motorways sea/
- International Multimodal Transport Association: www.immta.org/
- UNCTAD / ICC Rules for MMT Documents: http://r0.unctad.org/en/subsites/multimod/mt3duic1.htm

Maritime Press:
- Containerization International: http://www.ci-online.co.uk/
- Fairplay : http://www.fairplay.co.uk/
- Lloyd's List: http://www.lloydslist.com/ll/home/index.htm
- TradeWinds: http://www.tradewinds.no/
- Drewry Shipping Consultants, Container Market Quarterly: www.drewry.co.uk

Warehousing & Distribution Centres:
- Inventory Management and warehouse Operations: www.inventoryops.com
- Development of Distribution Facilities: www.prologis.com
- Decision Support System for Warehouse Design: www.warehousedesign.org
- Supply & Demand in Real Estate: www.warehousematch.com
- Order Picking Strategies: www.fbk.eur.nl/OZ/LOGISTICA
- Web Portal for Materials Handling: www.materialhandlinginfo.com
- Routing Methods in Warehouses: www.roodbergen.com / interactive warehouse

ICT in Logistics:
- ICT provider: www.capgemini.com
- Barcoding, RFID and traceability standards: www.gs1.org
- Barcoding: www.ibcaweb.org/guidelines/
- Wikipedia: en.wikipedia.org/wiki/Information technology
- Information Technology Association of America: www.itaa.org/business/it/
- IT Systems for Shipping and Transport:
- www.klnet.co.kr/english/business 4 2.htm
- RFID Technology:
- www.rfida.com/weblog/2005/03/rfid-supply-support-logistics.htm
- IT Systems for Distribution: www.ceilogistics.com/publications/default.htm
- Voice Recognition: www.vocollect.com

Supply Chain Management:

- Council of SCM Professionals : www.cscmp.org
- Green Logistics: www.ntm.a.se/ntmcalc/Default.asp
- Maersk: www.maerskline.com
- General Search Platform: www.logistics.about.com/
- Consultancy: www.manh.com/
- Government Support: www.usaid.gov/
- Korea: www.asiagander.typepad.com/asia_gander/korea_logistics/index.html
- Collaborative Planning, Forecasting, Replenishment:
- www.vics.org/committees/cpfr/
- Efficient Consumer Response: www.ecrnet.org
- Transport Buying System: www.shipitsmarter.com
- Fulfillment: www.eclasia.com
- Supply Chain Strategies: www.glscs.com
- SCM Info Portal: www.sdcexec.com
-
- Training institutes:
- Cornell University: www.orie.cornell.edu/~jackson/distgame.html
- Hofstra University: http://people.hofstra.edu/geotrans
- Intermodal Transportation Institute (Denver):
- http://www.du.edu/transportation/

Air Transport :

- Manufacturing: www.boeing.com/
- Airport: www.aeroportsdeparis.fr
- International Organisation of Airlines: www.iata.org
- International Civil Aviation Organization: www.icao.org
- International Air Cargo Association: www.tiaca.org
- Association of European Airlines: www.aea.be

Freight Forwarding:

- International Federation of Freight Forwarders Associations: www.fiata.org
- Organisation of Freight Forwarders and Customs agents: www.clecat.org

Road Transport:

- Supplier of Semi-trailers: www.tracontrailers.eu
- Australian Trucking & Road-Trains: http://outbacktowing.tripod.com
- German Road Trains: http://www.roadtrain.de
- International Road Transport Union: www.iru.org

Various International Organisations:

- EU Traceca: www.traceca.org
- European Conference Ministers of Transport: www.cemt.org
- EU Interactive Transfer Point: www.eutp.org
- European Shippers Council: www.europeanshippers.com
- FFE Freight Forward Europe: www.freightforwardinternational.net
- Fonasba Federation of Shipbrokers & Agents: www.fonasba.com
- Freight Transport Association: www.fta.co.uk
- ICHCA International Cargo Handling Association: www.ichcainternational.co.uk
- ICC International Chamber of Commerce: www.iccwbo.org
- IFCBA – International Federation of Customs Brokers Association: www.ifcba.org

- ILO International Labour Organisation: www.ilo.org
- ISO International Organisation for Standardisation: www.iso.org
- OECD: www.internationaltransportforum.org/jtrc/DiscussionPapers/DP200810.pdf
- UNCTAD: www.unctad.org
- UNECE: www.unece.org
- UN-ESCAP Asia & Pacific: www.unescap.org
- WCO World Customs Organisation: www.wcoomd.org
- Worldbank: www.worldbank.org
- Romanian Intermodal Association: www.ria.org.ro

Maritime Organizations:
- BIMCO : http://www.bimco.org/
- ECSA European Community of Shipowners Associations: www.ecsa.be
- IMO : http://www.imo.org/

Rail Transport:
- Organisation of Railway Companies: www.uic.asso.fr
- Rail- Road Transport: www.uirr.com
- European Rail Organisation: www.otif.org
- Railway Company: www.bnsf.com/aboutbnsf
- EU – CREAM project: www.cream-project.eu/home/index.php
- EU - CORDIS project: www.cordis.europa.eu
- EU - TREND project: www.trend-project.com
- EU - BRAVO project: www.bravo-project.com

Inland Waterway Transport:
- INE - Inland Navigation Europe: www.inlandnavigation.org
- Barge Transport Provider: www.bargecargo.nl
- Container Transport in Port of Hamburg: www.containertaxi.de
- International Commission for Protection of the Danube: www.icpdr.org
- Austrian Waterway Company: www.via-donau.org
- INES - Inland Navigation E-Learning System: www.ewit.info
- Central Commission for Navigation on the Rhine: www.ccr-zkr.org
- Infrastructure: www.seine-nord-europe.com/

Shortsea Transport:
- European Shortsea Network: www.shortsea.info
- Shortsea Promotion Centre Holland: www.shortsea.nl

River Sea Transport:
- European River-Sea-Transport Union: www.erstu.com

City Distribution:
- Underground Urban Transportation: www.cargocap.com
- Cargo Tram Dresden: www.dvbag.de/untnehm/gbahn.htm
- City Cargo Amsterdam: www.citycargo.nl

Seaports & Terminals:
- IAPH : www.iaphworldports.org
- Busan Port : http://bpa2007.busanpa.com/service?id=eng_index
- Gwangyang Port : www.portgy.com/02eng/
- Hong Kong Port : www.pdc.gov.hk/eng/home/index.htm

- Port of Rotterdam : www.portofrotterdam.com/en/home
- HHLA - Hamburger Hafen & Logistik Gesellschaft: www.hhla.de
- PSA : www.internationalpsa.com/home/default.html
- Port Strategy; Insight for Port Executives: www.portstrategy.com

Inland Terminals:
- European Federation of Inland Ports (EFIP): www.inlandports.be
- Federation of European Private Port Operators: www.feport.be
- Waterland Terminal Amsterdam (NL): www.waterlandterminal.nl
- Birs Terminal Basel (CH): www.birsterminal.ch
- Intermodal Terminals Duisburg (D): www.duisport.de
- BILK Combiterminal Budapest (H): www.bilkkombi.hu
- Infrastructure: www.noellcranesystems.com/ncs/en/index.htm

Shipping Market:
- Clarksons : http://www.clarksons.com
- The Baltic Exchange : http://www.balticexchange.com

Marine Insurance:
- Lloyd's of London homepage : http://www.lloyds.com
- P&I Clubs : http://www.american-club.com
- UK P&I club:
  www.ukpandi.com/ukpandi/infopool.nsf/HTML/index?OpenDocument

Marine Classification:
- ABS : http://www.eagle.org
- DNV : http://www.dnv.com
- IACS : http://www.iacs.com
- Korea Register of Shipping : http://www.krs.co.kr
- Lloyd's Register : http://www.lr.org

Transport Research & Statistics:
- EU: www.transport-research.info
- EU: www.transport-research.info/web/publications/policy.cfm
- EIA - European Intermodal Association: www.intermodaltransport.org
- EU - DG TREN: http://ec.europa.eu/transport/index_en.html
- Eurostat: www.eustatistics.gov.uk/themes/transport/index.asp
- European Commission: www.ec.europa.eu/transport/index_en.html
- TEN-T Trans European Network: www.ec.europa.eu/ten/index_en.html
- EUTP: www.eutp.org

Annex to Chapter 9

Case Study: Stowage & Packaging of Goods in Containers

Shippers very often are unaware of the risks their goods and products can face in a container or swap-body while in transit between origin and destination. A manufacturing company that has little or no knowledge of the international shipping trade may believe that once their goods have been placed inside a container that they will be safely protected from damage. Unfortunately, this may not the case, as containers and swap-bodies can experience considerable, at times violent acceleration and deceleration forces throughout their journey.

Containers and their contents are subject to regular motions experienced in normal road transportation. When used as a link in the inter-modal chain, they will also experience rapid velocity changes in all three planes and this often simultaneously. The forces imposed on freight units in rail transportation during shunting or switching operations can be violent and intense, generally in two planes only. Forces imposed during sea transportation are less violent but of a greater degree and in all three planes.

It is essential that goods packed inside a containers are fully secured against any movement, to avoid damage to the contents, and also to protect personnel when the unit is opened for discharge. Each different type of commodity (cartons, cases, loose items, heavy or hazardous cargo) will require special stowage considerations and securing methods.

Forwarders, shipping and container leasing companies may advise shippers how to stow containers safely and securely. Some of the larger companies have specialised departments for this function. A majority however, will release containers or swap-bodies to shippers without any information or stowage advice whatsoever. With a wide range of special design containers in use and built for different requirements and types of freight, it is essential that the proper unit be utilised for the commodity to be shipped. These units range from flat-bed units with or without end frames for heavy lifts, half height units for commodities with a high weight/cube ratio, temperature controlled boxes or tanks, open top/side units to general-purpose units with or without ventilators.

Incidents of Poorly Stowed Cargo in Containers

a A twenty foot (6m) container with top loading hatches in addition to rear doors had been filled with loose grain. With such a commodity a retaining fence and plastic membrane should have been positioned inside the doors to enable the doors to be opened safely without the contents moving. Unfortunately, at the time of loading this had not been done as recommended. When the Customs Officer at destination loosened the first door to check the contents, the weight of the cargo on the door forced it open and the bulk of the contents was spilled on the ground, completely drowning the Customs Officer. Fortunately the truck driver was able to dig the Officer out before he suffocated under the mass of grain.

b Before the general trend of constructing containers out of lightweight corrugated steel, the method of construction was that the corner posts were the main strength members of the unit, and the top, end and side panels were constructed from materials such as GRP plywood or aluminium. One such container with aluminium end panels had been loaded with a large 1.8m diameter reel of cable weighing 16 tons.
The company that had loaded the cable reel had simply rolled it into the container, closed, locked and sealed the doors.
The unfortunate truck driver (who had not been present when the container was loaded) soon became aware that there was something not quite right about his load. However, before he could take any action to stop and inspect the contents of the container, he was obliged to stop abruptly to avoid an accident. The result was that the cable reel burst through the front panel of the container almost crushing the cab of the truck.

c A Mercedes Benz limousine had been loaded into a 40 foot (12m) container, but instead of having the petrol tank drained for safety, the loading company had left the tank half full. Additionally the vehicle was only secured with short lengths of thin rope, instead of having the wheels chocked and also secured with ropes. In an incident in the container terminal when a straddle carrier was in collision with the container, the impact caused the car to break free of the securing lashings, and then as a result of the petrol leaking from the damaged tank, burst into flames. The Mercedes was damaged beyond repair.

10 Multi Modal Systems & Equipment: Rail and Road Oriented

Learning Objectives for Lecture 10:

- The student should understand the difference between (un-) accompanied combined transport.
- The student should understand the difficulties related to loading gauges.
- The student should understand the reasons behind specific applications of multi modal transport.
-

10.1 Combined Transport

According to the ECMT (European Committee of Ministers of Transport), Combined Transport has been defined as follows:

Combined transport is intermodal transport, principally carried out by rail, inland waterways, or by sea, with the trips beginning and ending by road.

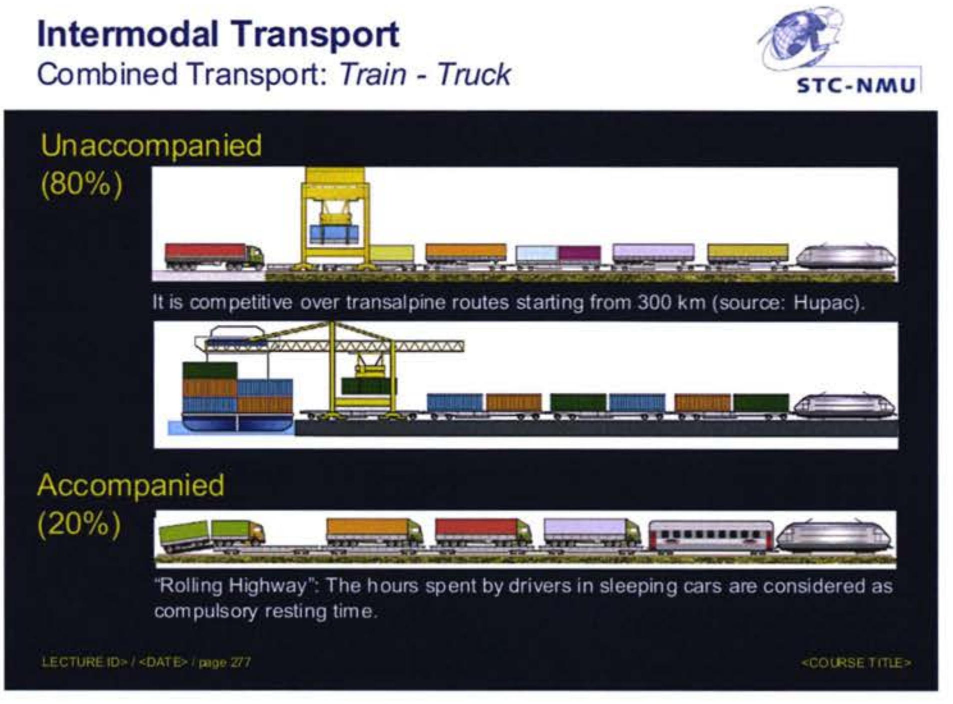
Combined transport encompasses the following techniques:
- Piggyback systems (a mix of road- and rail transport);
- Roll-on Roll-off systems (a mix of road- and water transport).

10.2 Piggyback Systems

10.3 Unaccompanied and Accompanied Transport

Piggyback systems are also called Huckepack systems.
This type of Combined Transport which is a mix of road transport and rail transport can be executed in two ways: unaccompanied and accompanied.

Figure 10.1 (Un-) Accompanied Combined Transport



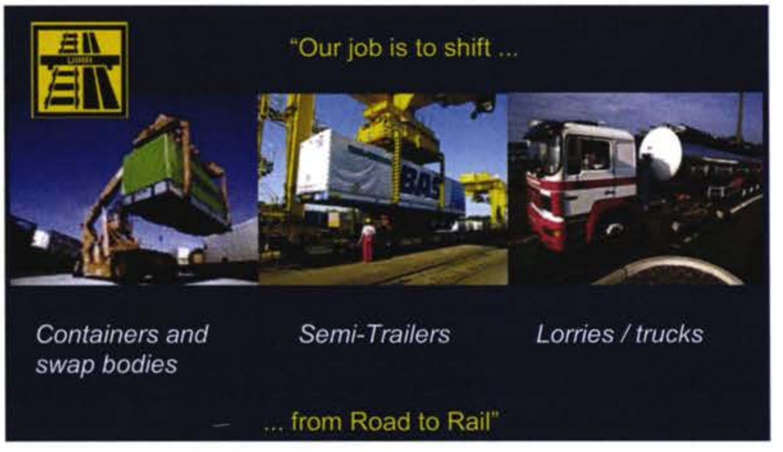
- Unaccompanied (the first truck driver stays behind, at the end of the rail track another truck driver takes over);
- Accompanied (the truck driver travels with the same train as the cargo and continues road transport to the destination). This is called the Rolling Highway concept.

An important application of Combined Transport is the north - south cargo traffic in Western Europe, where trains are running across Switzerland and Austria, thus reducing the air pollution, congestions and accidents on the main roads in these countries.
There are two Service options for Combined Transport:
Type 1: terminal to terminal;
Type 2: door-to-door.

Benefits of Combined Transport are:
- Reliability;
- Safety and less damage to cargo;
- More effective use of equipment (trucks at both sides of the track);
- Speed / efficiency;
- Environmental compatibility;
- Increased transport capacity;
- Low personnel costs;
- Flexibility;
- Integrated logistics.

More detailed information on Combined transport can be found at the website of the UIRR - International Union of Combined Road - Rail Transport Companies: **www.uirr.com**

Figure 10.2 Combined Transport Activities



Source: UIRR

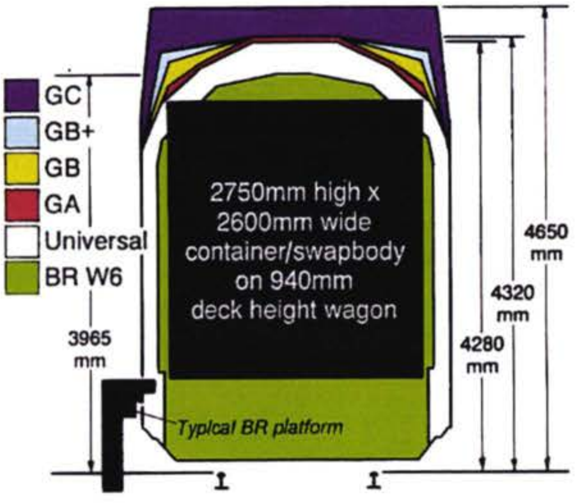
10.3.1 Loading Gauges

A special problem concerning the rail transport section of combined transport is related to loading gauges.
Loading gauges are *standardised height and width profiles on given rail routes.* Standardisation is done in order to ensure that a vehicle will not collide with a lineside or over line structure, such as station platforms, canopies, overhead power supplies, over bridges or tunnels varying by route (historically by railway company), reflecting the constraints on rail vehicle size caused by line side and overline structures.

Examples:
- GC: for tractor-and-trailer piggyback;
- GB: for unaccompanied piggyback;
- Universal: W. European standard for vehicles.
- BR W6: British Rail;
- SB1 (black box): for Channel Tunnel containers and swap-bodies.

Bottlenecks:
- BR platforms obtrude into Universal;
- BR height insufficient for GC and GB.

Figure 10.3 Loading Gauges



10.3.2 Case 1: Beijing-Hamburg Container Express

At 9 January 2009, after a 15 days journey time, a container freight train from Beijing reached the port of Hamburg. The Beijing-Hamburg Container Express left Dahongmen Station in the Chinese capital for the journey of over 10,000 kilometres through China, the Mongolian Republic, Russia, Belarus, Poland and Germany.

The cargo on the Beijing-Hamburg Container Express consisted of electronic equipment, clothing and shoes, among other items. Hamburg was chosen as the destination because the city's port also makes the city a key rail-cargo junction. The participants in the Eurasian Land Bridge project are the railroads of the six countries along the route. The goal is to strengthen rail's competitive position in relation to ocean transport. Purpose of this journey was to test the feasibility of new agreements to ensure that the Eurasian Continental Bridge between China and Europe could function in a timely way - and this was proven when the train arrived five days ahead of the expected 20-day schedule. This is well less than half the time it would take to transport goods by sea, and this is the time frame for transport that Deutsche Bahn officials considered would make the rail service "viable."

This record rate of transit was ensured by cooperation between all the countries along the route to ensure that customs, gauge change, and other factors did not delay the container train. Strictly speaking, the engine and wagons that arrived in Hamburg were not the same rolling stock that left Dahongmen station in Beijing. The containers were transferred twice to new trains because of changes in track gauges. Russia and Belarus have a different width of track from China and Western Europe. According to Deutsche Bahn, the test train was a success. "We have demonstrated that we can transport goods by rail between China and Germany safely, reliably and yet twice as fast as compared with ships; at the same time, we are considerably cheaper than air freight for many types of cargo. By the end of the decade we can aim at launching regular freight transport services along this axis." Deutsche Bahn said that goods produced in the Chinese interior could be transported more cheaply on the Beijing-Hamburg route than by way of China's east coast ports. DB believes the service could fill a gap in the market between fast and expensive airfreight and slow but cheap seafreight, and argues that it has a lower carbon footprint than either. Planes take 10 hours, but ships take 30 days to travel to Hamburg from Chinese ports.

10.3.3 Case 2: Combined Transport from East China to Europe

Question was: can overland rail compete with an 11,000 TEU ocean service?
In 2007 the following proposal for a container train was made: China - Kazakhstan - Russia - Ukraine to Western Europe. Russia and Ukraine approved the tariff agreement for the transportation by container train using 40 foot containers. The rates were as follows:

Kazakhstan	$ 847
Russia	$ 1,104
Ukraine	$ 274
Total	$ 2,225 plus added costs to reach the German markets.

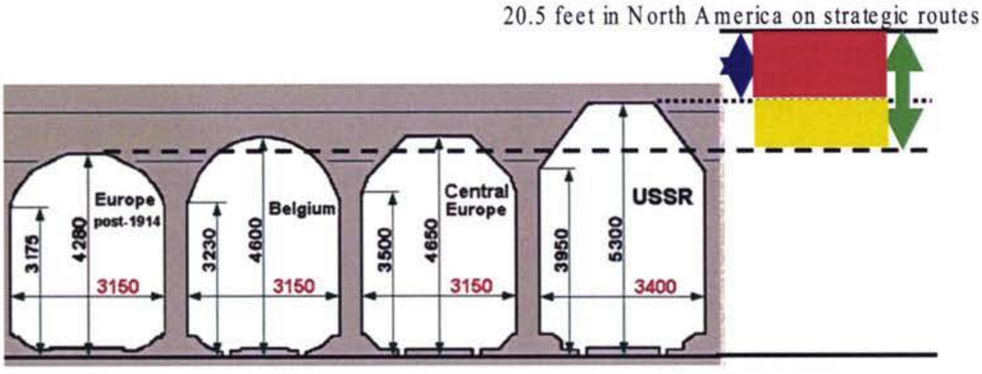
It was concluded, that both time and price charged per box will matter. The rail option may be faster than the Suez sea route to Rotterdam, but the few days saved is worth maybe $200 per box in on-time inventory. The sea option would be charging $1,200 per box plus added costs to reach the German markets. As a consequence, the rail option would increase prices.

A technique which considerably contributed to reduce rail prices in the USA was double stacking of containers:

Figure 10.4 Double Stacked Container Train

However, this efficiency improvement of modern container trains is not possible on most of the world's railways, because of overhead clearance restrictions:

Figure 10.5 Railway Clearances



Source: UIC

10.3.4 Case 3: LHV Development

LHV's are Long and Heavy (road) Vehicles.
Tests with LHV's in the Netherlands were executed from August 2004 to November 2006, where 2 LHV combinations (max. 25,25 m.; 60 ton) carried the cargo of 3 conventional combinations (max. 18,75 m., 50 ton). Some test results:

- Fuel consumption -/- 33%;
- CO2 emission -/- 3-5%;
- Congestion -/- 1%;
- Cost price per tonkm -/- up to 25%;
- Less accident casualties.

Figure 10.6 LHV Road Transport Combination

LHV Threat to Combined Transport?

(Source of following article: UIRR)

The campaign which is currently being conducted for the introduction of Long and Heavy (road) Vehicles (LHV) with an authorised length of 25.50 m and a total weight of up to 60 t, also named the "gigaliners" or "ecocombis", is meeting with a growing response, especially in Germany. The argument advanced is that these vehicles would make it possible to have an identical transport volume with a lesser number of trucks. The European Commission in 2007 launched a call for tenders relating to a study which should examine the various aspects relating to a general authorisation of megatrucks. For this purpose, the analysis should focus in particular on the impact on transport safety, road infrastructure and intermodal competition.

A study commissioned by UIRR and its German member company Kombiverkehr from the consulting firm TIM Consult revealed that, following the introduction of trucks with a length of 25 m, 55% of Combined Transport (CT) traffic would return to the road and would involve a 24% increase in journeys by trucks, which would represent a very substantial change in the competitive positions of transport modes. Existing rolling stock would have to be adapted and all investments agreed to by the companies concerned in wagons, locomotives and crane able loading units on the one hand as well as the infrastructure financed by the public authorities on the other would be greatly devalued.

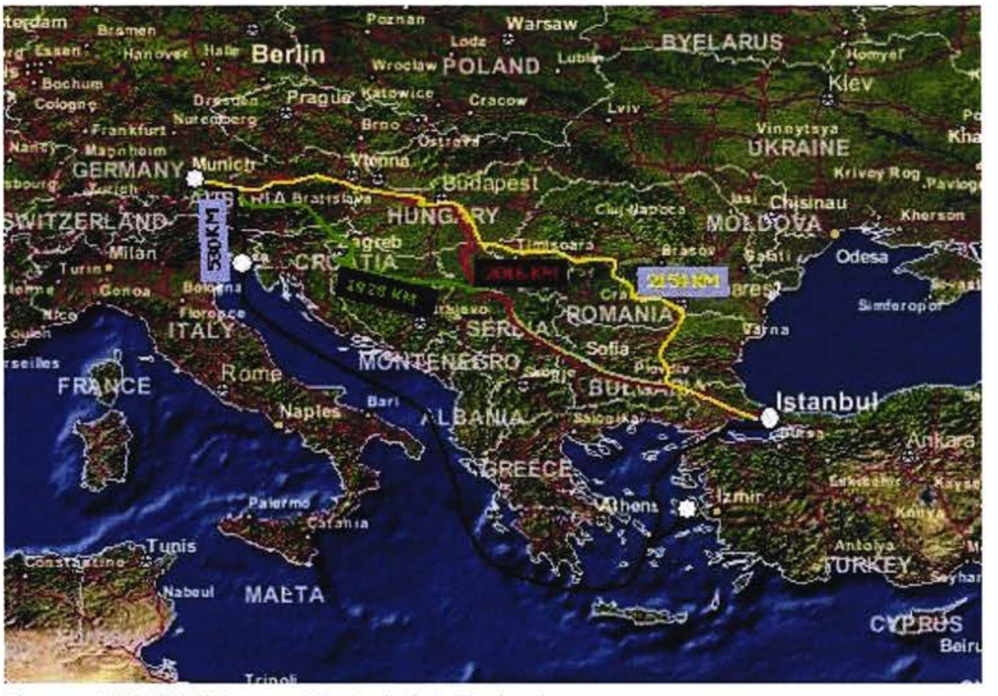
In addition, the roads are not designed to withstand the stress of increased weights, and mountain roads involving bridges and tunnels would particularly give rise to problems. The same consideration obviously applies to the servicing of cities which often takes place on narrow and winding streets. The possible establishment, on the outskirts of cities, of specific relay points for the transfer of the loading units from traditional trucks to gigaliners and vice versa would also entail enormous investments. Increased weights and dimensions therefore do not, as far as UIRR is concerned, in any way constitute a solution to the problems of road transport. UIRR therefore appeals to the Authorities to keep Directive 96/53 in force as it guarantees to the various modes of transport relatively fair access to the market. It is much more important to take measures to enhance the efficiency and productivity of the RUs which would also be beneficial for CT.

10.3.5 Case: RODER

RODER is a NGO - Non Governmental Organisation, founded in Turkey in 2001, committed for the purpose of development of the Combined Transport sector nationally and internationally.

In the year 2004, through its Ro-Ro companies, RODER have succeeded the carriage of almost 92,000 vehicles from Turkey to mainly EU countries over the port of Trieste in Italy (from 12,500 vehicles in 1993) with the 12 Ro-Ro vessels it owns.

Photo 10.1. Main Road Transport Routes from Turkey to Europe



Source : EUROMED Transport Project, Main Contract

Only in the year of 2004, 4 billion ton-km of goods were managed to be shifted from Road to Sea through RODER's Short Sea Shipping services.

A major shift from Road to Sea was achieved, well in harmony with the Marco Polo concept (Modal Shift Action).

Unaccompanied Transport:
A unique application in the sense that since May 1993 drivers utilize air way to Ljubljana, then travel to Trieste port by road following the embarking of their vehicles in Ro-Ro and be at Trieste the same time with the vessel. Thus the driver is able to rest for 2 days after the vehicle is embarked on the ship, enabling an efficient means of transport. In 2004, our 40.000 drivers were transported this way.

Photo 10.2. Shift from road to Short Sea and Rail

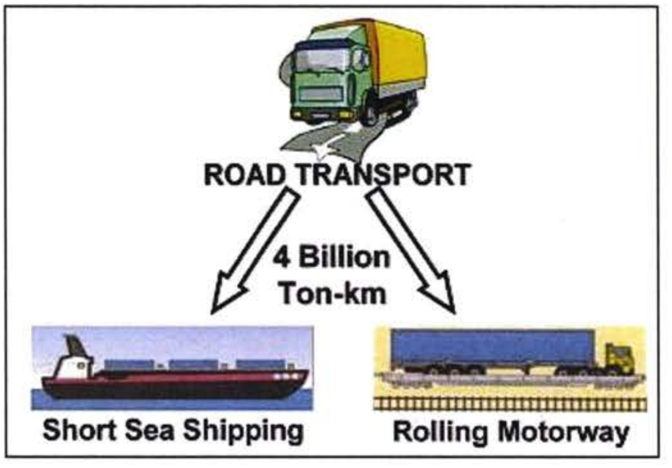


Photo 10.3. Intermodal Transport Chain Incorporating Road / Rail / Sea / Air Transport

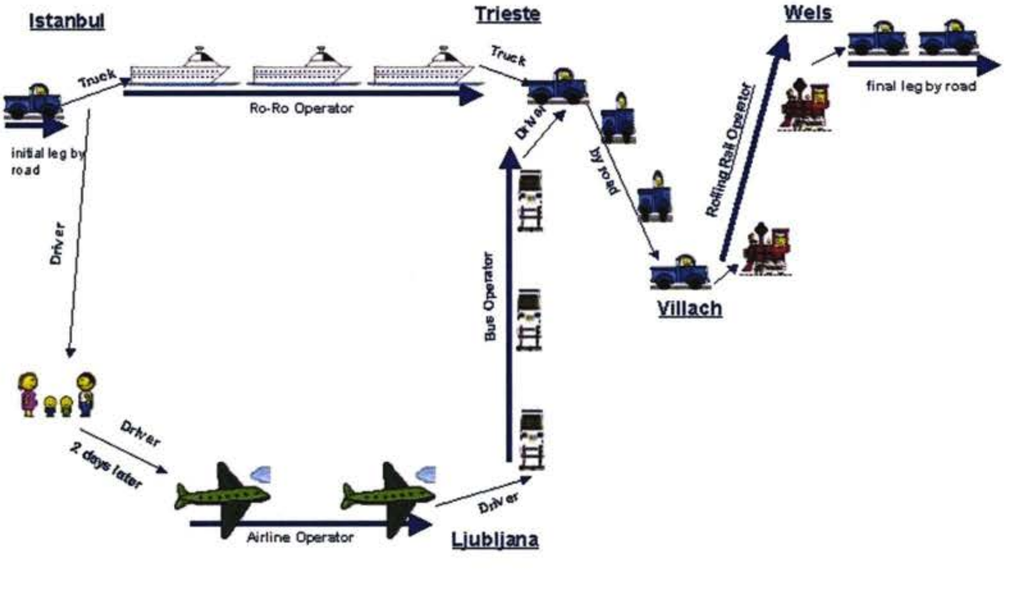
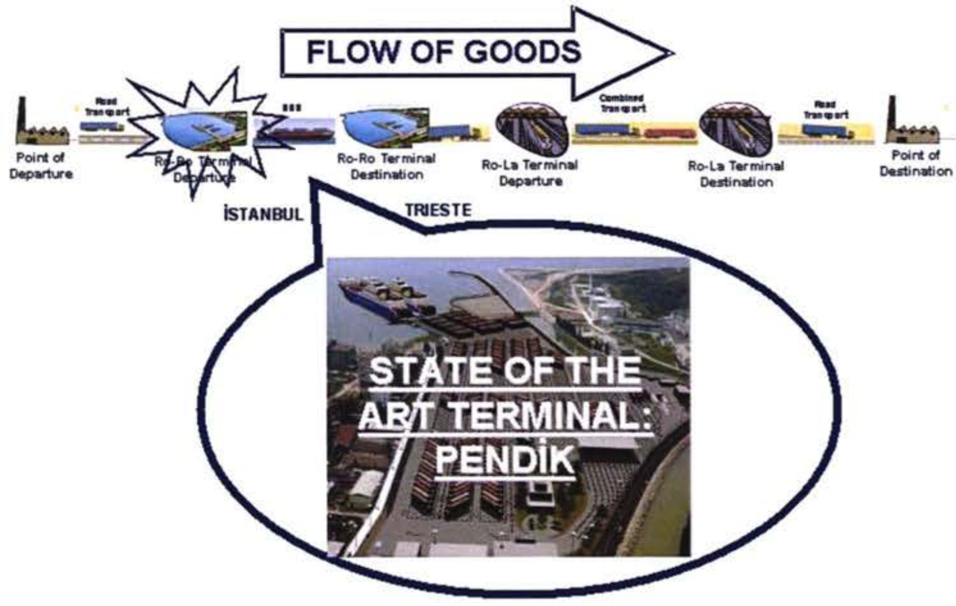


Photo 10.4. Flow of Goods



10.4 Ro - Ro Transport

Ro - Ro is the abbreviation of Roll-on, Roll-off transport. In this system road vehicles, train wagons or other rolling stock are carried by ships.

Figure 10.7 Ro - Ro Rail Transport

The figure 10.7 shows the Black Sea ferry "UKRFERRY", sailing from the Port of Ilychevsk, Ukraine. This vessel carries train wagons on two decks, interconnected with a lift. Other Ro - Ro applications are discussed in Chapter 11.

10.5 Specialised Rail - Road Systems

10.5.1 ACTS - Abroll Container Transport System

This system was developed in Switzerland; it concerns multi modal transport without cranes or terminals, using a roll - on roll - off container system. The system transports bulk cargo (e.g. waste, building materials, agricultural products) and consumer goods. The main aims of the system are to reduce transport costs and to reduce vehicle mileage.

Figure 10.8 ACTS System

A similar system was implemented in The Netherlands by VAM, a large company dealing with waste disposal. The figures show how containers with waste are transferred between train and truck.

Figure 10.9 VAM System

The ACTS system as the following advantages / disadvantages:

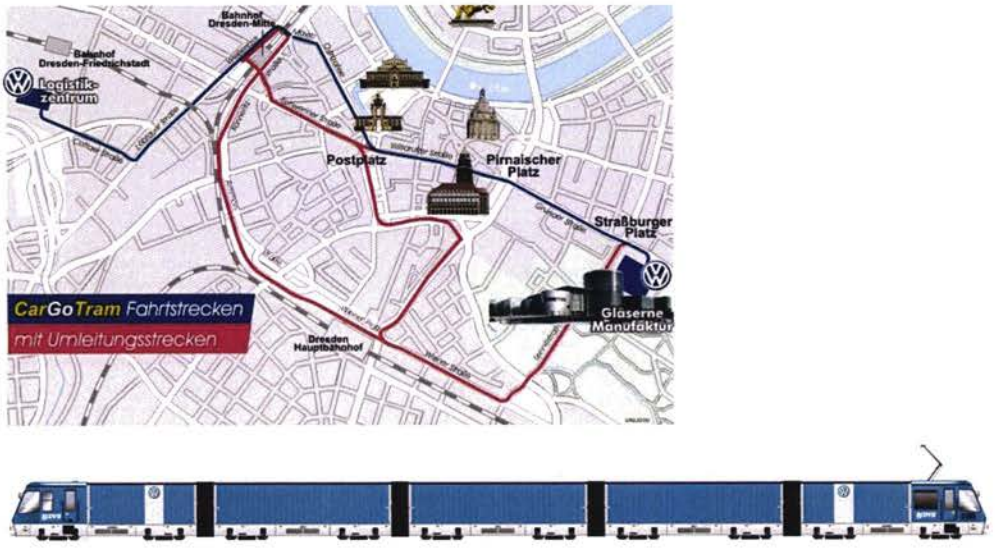
Advantages:
- No fixed equipment needed in the terminals for transhipment of loading units;
- Loading units are suitable for rail and road transport;
- Short transhipment time;
- Easy to control: operated by one man only.

Disadvantages:
- Special equipment (e.g. hydraulic jib) mounted on all lorries;
- High investment in loading unit and equipment;
- High total weight of lorry with the ACTS loading unit;
- Large area required for transhipment operations.

10.5.2 Cargo Tram

This system was implemented in Dresden, Germany in order to utilise the tramway system for the transport of cargo between two Volkswagen plants.

Figure 10.10 Proposed Cargo Tram System, Amsterdam NL



10.5.3 City Cargo

This is an intended multi modal transport system for city distribution in Amsterdam, the Netherlands. It is envisaged that 53 trams and 600 E-Cars will replace 2,500 distribution trucks. Aim is to reduce traffic congestion and air pollution in the city centre. Incoming cargo will be transhipped to cargo trams at four distribution centres at the edge of the city. At a number of transhipment points in the inner city, small electric vans will take over the cargo for final distribution to the destinies.

Figure 10.11 Proposed Cargo Tram System, Amsterdam NL

11 Multi Modal Systems & Equipment: Water Oriented

Learning Objectives for Lecture 11:

- The student should understand the application of Ro - Ro transport, its cargo and equipment.
- The student should understand the application and advantages of sea - air transport.
- The student should understand the importance and facilities of modern inland terminals.
- The student should understand the application of some specific water oriented multi modal developments.

11.1 Maritime Ro - Ro Transport

11.1.1 Characteristics

The characteristic of maritime Ro - Ro (Roll on - Roll off) transport is that the cargo is not loaded onto vessels or discharged from vessels using cranes, but is rolling itself on or off the vessel.

This chapter shows some examples of maritime Ro - Ro transport, combining road transport and water transport. The water section of this transport can involve sea-going transport or inland waterway transport.

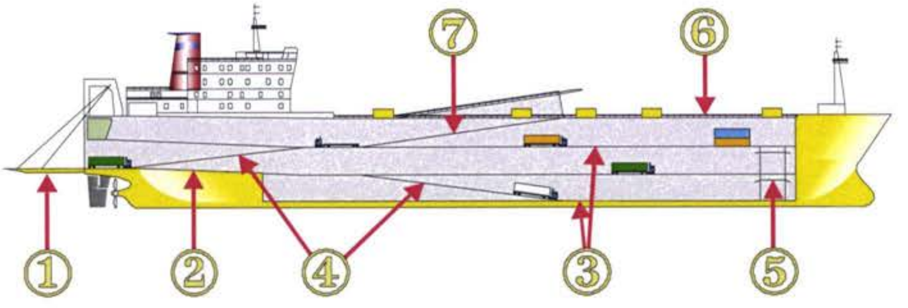
Figure 11.1 Examples of Ro - Ro Transport

Sea Transport

River Transport

Ferries are Ro - Ro vessels; but Ro - Ro vessels also comprise vessels specifically designed for this type of transport. The following figure shows the typical construction of a Ro-Ro vessel:

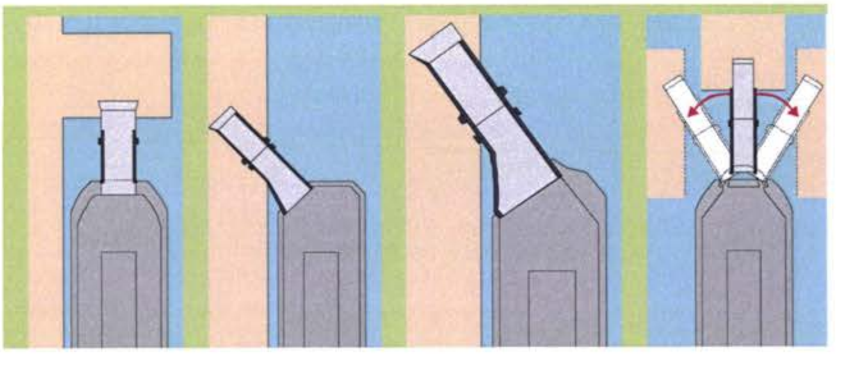
Figure 11.2 Ro - Ro Vessel Construction



1.	External ramp	2.	RoRo deck
3.	RoRo decks	4.	Internal ramps
5.	Cargo lift	6.	Weather deck
7.	Ramp to weather deck		

The following figure shows some specific ramp lay-outs.
The first and the last option also require special adaptation of the landside berth.

Figure 11.3 Ro - Ro Ramps

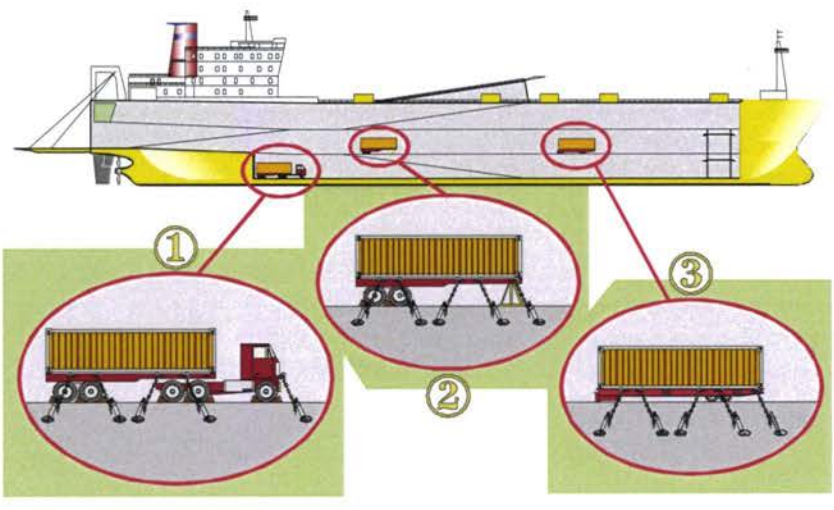


The following figure 11.4 shows an external ramp of a Ro-Ro vessel. This figure also illustrates that Ro-Ro vessels are not only carrying cars, trucks and other rolling stock, but also cargo which is not rolling itself, such as containers, crates etc. That cargo is moved by specialised equipment: tug masters and so-called Mafi- trailers (re. figure 11.4).

Figure 11.4 Mafi Trailer on External Ramp of Ro - Ro Vessel

Figure 11.5 illustrates how the various types of Ro - Ro cargo are secured onto the vessel.

Figure 11.5 Ro - Ro Cargo Securing



1. Road truck plus chassis;
2. Road chassis only;
3. Roll (Mafi) trailer.

11.1.2 Case: Ro-Ro transport from River to Sea

Figure 11.6 Ro – Ro Transport with River – Sea Connection

- *Shipping Company:* NMHG (American manufacturer of Hyster and Yale forklifts).
- *Product:* heavy duty forklifts (8 – 48 tons lift capacity).
- *River transport*: per barge from the manufacturing plant at Nijmegen (The
- Netherlands) to Port of Zeebrugge (Belgium).
- *Sea transport*: Ro/Ro vessel to USA.
- *Advantages*: costs savings + environment protection (20 forklifts per barge, was 1 forklift per truck).
- *Future Development:* flat rack, to enable use of standard sea-going containers.

11.2 Sea – Air Transport

Sea – Air transport is a combination of sea transport and air transport, with the following characteristics:

- Costs saved during the maritime leg;
- Time saved during the air leg;
  Cheaper than full-air transport; faster than full-sea transport.

As an illustration the following example: container transport from Singapore to Antwerp, with transhipment in Dubai:

- Full sea transport:
  Singapore - Antwerp by ship (containerised): approx. 20 days

- Sea - air alternative:
  Singapore - Dubai by ship (containerised) approx. 10 days
  Intermediate handling in Dubai; Dubai airport is located near the port and facilitates rapid sea-air transfer
  Dubai - Antwerp by plane (palletised) 1 day

- Time saving approx. 9 days

According to the following (summarised) article, sea- air transport is not only an interesting option for the link between Asia and Europe, but can also serve as a solution for land locked countries in general.

"Until recently, the main traffic lane for sea-air cargo moving through the United Arab Emirates (UAE) was from the Far East to Europe, contributing to Dubai's expanding role as a transhipment hub. More recently, Africa has developed into a growth market, particularly for land-locked countries on the continent, which is

11.6 million square miles in size, making it bigger than China, the United States and Europe combined. Dubai as transit hub has a strategic geographic location that can serve the Far East, Indian subcontinent, CIS countries and parts of Europe and North America. Approximately 20 airlines are currently plying the UAE-Africa route, which encompasses most areas of the continent. The UAE has an open sky policy and efficient customs facilitation. Essential to the success of a sea-air logistics solution into Africa from the Far East via the UAE is the collaboration of expertise amongst freight forwarders, shipping lines and airlines. The collaboration of Swift Freight, Ethiopian Airlines and Maersk Shipping Lines is a perfect example. Working under the product title SAM (Sea Air Model into Africa), the service combines sea-air transport from the Far East to Africa, using Dubai as a stopover. It utilises ocean freight from the Far East to Dubai and offers prompt transfer executed by Swift Freight via air cargo from Dubai to African destinations. SAM defies the transit time of sea freight, plus the constraints and high cost of airfreight."

Source: ArabianBusiness.com, May 2008

11.3 Multi Modal Inland Terminals

Terminals are a critical success factor for water- oriented multi modal transport. Inland waterway transport has succeeded in attracting a substantial market share of containerised and other non- bulk cargo, due to a rapidly increasing number of inland terminals with excellent multi modal handling facilities. Below two examples of multi modal inland terminals are given.

11.3.1 Duisburg, Germany

The figures below show the inland port of Duisburg, Germany. This port is a transhipment hub with river-, rail- and road connections, all-weather terminals, as well as storage facilities for containers and for (liquid) bulk cargoes.

Figure 11.7 Port of Duisburg, GE

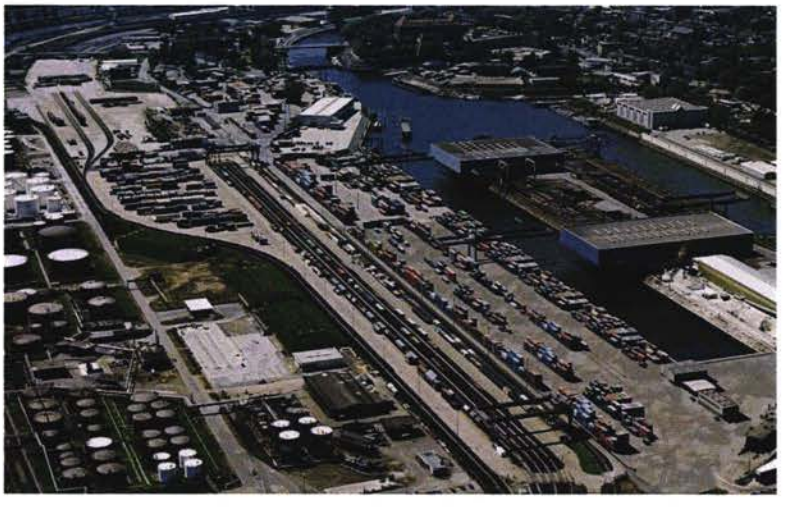


Figure 11.8 Trimodal Transhipment Terminal, Port of Duisburg: Haeger & Schmidt

11.3.2 Amsterdam, The Netherlands

The multi modal Waterland Terminal in the port of Amsterdam comprises a Ro-Ro Terminal, a Shortsea and Barge Terminal, as well as an Open terminal / Open Quay facilities.

It offers total 420 meters quay length with 10 meters draft, which is sufficient for sea-going (shortsea) vessels. The terminal has a direct highway access, a direct connection to the European railway network and to the European waterways. Amsterdam Schiphol Airport is 15 minutes away by car or train. The storage capacity is 20,000 m2 warehouses (incl. 4,000 m2 humidity controlled) and 40,000 m2 open storage, including storage area for dangerous goods.

Figure 11.9 Overview Waterland Terminal, Amsterdam, NL

Ro-Ro Terminal:
- for Deepsea and Shortsea vessels;
- handling of motorcars, trucks etc.;
- parking area 30.000 m2.

Shortsea and Barge Terminal:
- all weather (un-)loading;
- vessels up to 50,000 tons;
- cranes up to 40 tons;
- cargo: steel, zinc, aluminium, forest products, big bags, pallets;
- in-house railway transfer.

Open terminal / Open Quay:
- crane capacity up to 40 tons;
- cargo: timber, projects, pipes and steel sections, containers;
- storage area within crane reach.

Figure 11.10 Waterland Terminal Amsterdam, railway connection inside the Barge Terminal

11.4 Specialised Water Oriented Applications

11.4.1 Distribution by Boats, Venice, Italy

This application has following characteristics:
- General cargo distribution by boats using canals;
- Provision of loading / unloading points;
- Also applied to waste collection.

Figure 11.11 Water Distribution, Venice, IT

11.4.2 Barge Cargo, The Netherlands

Barge Cargo is a combination of 3 companies in the Netherlands, applying inland waterway transport for cargoes such as bulk, pallets and liquids, which are traditionally transported by semi -trailers from The Netherlands to South Germany.

Solution:

- 3 Dutch transport companies move cargo via Inland Waterway Transport across the river Rhine, using containers which would otherwise be moved empty to South Germany.

Motivations:

- There is a shortage for containers in South Germany, therefore a re-positioning of empty containers from the port of Rotterdam to South Germany is needed ("every hour a container ship passes the border to Germany");
- The introduction of the German MAUT road tax (12.4 ct / truck / km).

Effects:

- Costs saving up to 25 % on road haulage costs;
- Longer lead time, but the cargo can be regarded as "floating stock";
- Requires intermodal expertise and a strong (computerised) control function, in order to combine both flows (cargoes and empty containers).

More detailed information: www.bargecargo.com

11.4.3 Container Collection and Distribution in Ports

The collection and distribution of containers to and from sea- going terminals requires a large number of road transport trips, contributing to the congestion in main ports. Secondly, in the port of Rotterdam 500,000 containers must be exchanged annually between sea-going and inland waterway vessels, leading to on average 10 terminal calls per barge in 36 hours.
To organise all this transfer transport more efficiently and more environment-friendly, the ports of Rotterdam and Hamburg have introduced similar concepts:

Figure 11.12 Container Collection in Ports

These barge services offer fixed daily schedules between terminals for the transfer of containers, thus reducing turnaround times for sea-going vessels and barges, and reducing the congestions in these ports (and on their roads).

A number of companies in port areas are located on the waterside but are not equipped with a berth and a crane. As a consequence containers from / to these companies must be transported by road. In the ports of Antwerp and Amsterdam special barges were implemented with an on-board crane (capacity 1,350 tons) for the collection and distribution of containers at these companies (re. figure below).

Figure 11.13 Container Barge with Crane

11.4.4 River Shuttle, Germany

The aim of this concept is to increase the market share of inland waterway transport in the transport of palletised goods, at the cost of road transport.

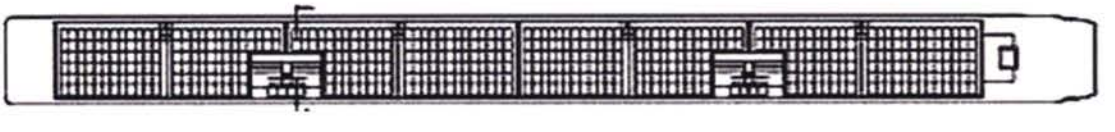
Concept:

- service 4x per week between 2 Rhine river terminals;
- 1 push vessel + 3 barges x 800 pallets;
- 3 storage levels;
- barcode managed handling system (capacity 300 pallets / hour).

Handling system:

- the pallets are loaded in cages;
- a barcode control station checks identity, size and weight;
- buffer systems secure continuous handling.

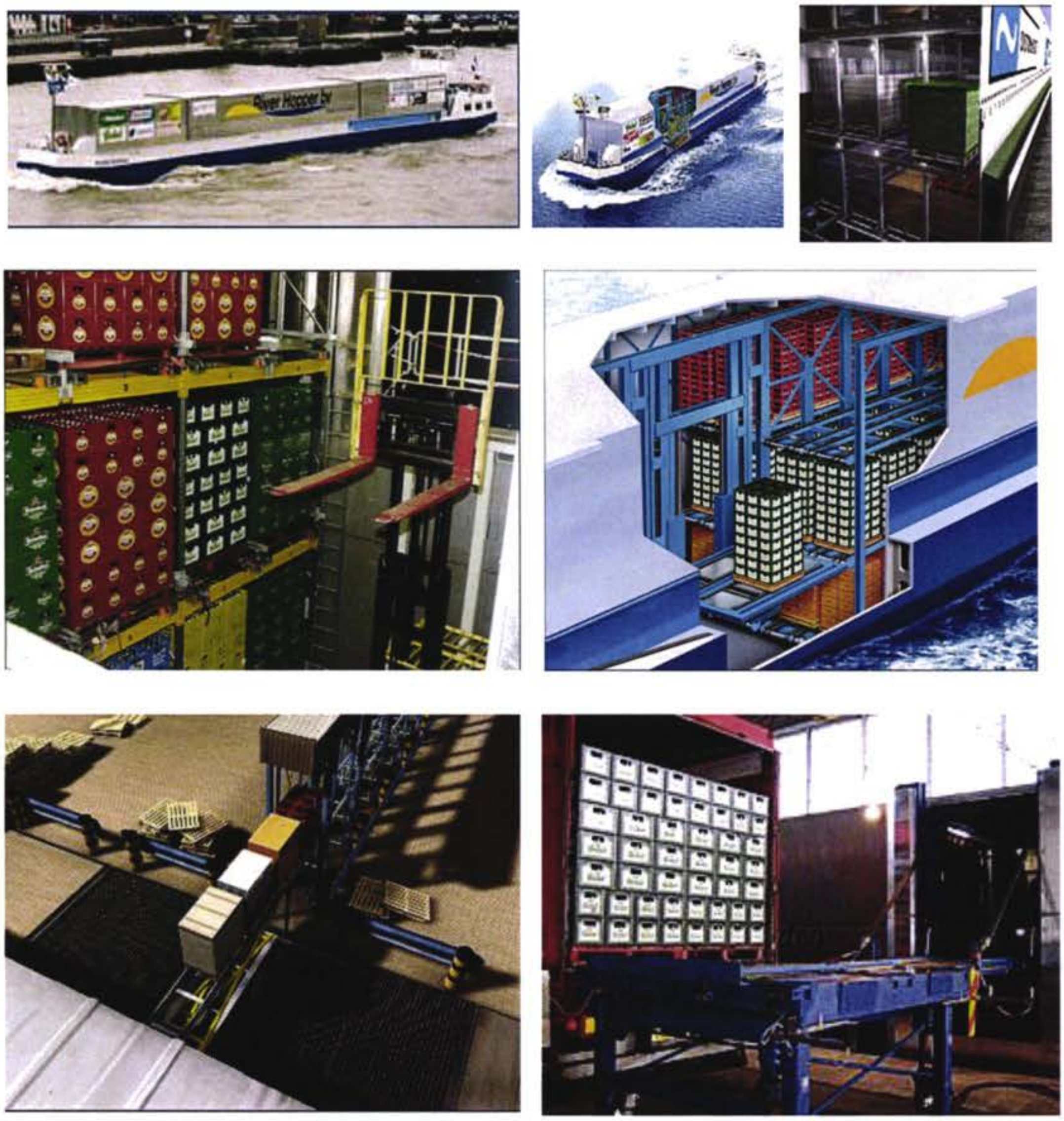
Figure 11.14 River Shuttle, GE



11.4.5 Distrivaart, The Netherlands

Distrivaart is a joint initiative of companies distributing large volume consumer goods, such as beer, diapers, toilet paper etc. Distrivaart is an experimental distribution system, combining inland waterway transport and road transport. The idea is to replace trucks by barges for the longer- distance transport of bulk volumes from factories to regional distribution centres, complemented by final road transport to the destinies.

Figure 11.15 Impressions of Distrivaart Barge Equipment



The main challenge in this experiment is to mechanise the loading and discharging of the barge in a flexible and cost- effective way.

11.5 Case Study: How to Solve a Complex Multi Modal Transport Case

Situation

Considerable volumes of Scotch whisky are exported from warehouses in Scotland to the rest of the world. It is carried in containers and, as a dead weight cargo: the containers can be loaded to their maximum gross capacity by weight.

In the UK the maximum gross weight permitted on the road of this case was 38 tonnes, which gave a vehicle payload of approx. 25 tonnes of cargo carrying capacity. With the weight of a 20 ft. (6m.) container of approx. 2 tonnes, this resulted in a net payload of 23 tonnes.

At the same time the max. weight permitted on British Railways was the same as the individual container max. permitted gross weight and this was approx. 28 tonnes. Each manufacturer's containers are of different construction and as such each has a slightly different gross weight thus affecting the capacity.
It can be seen that a container moved by the rail system therefore can be loaded to a heavier weight than a container moved by a road vehicle.

One significant market for Scotch whisky is the Far East and this route is serviced by a number of major shipping lines. One of these lines wished to break into this lucrative traffic but did not have any ships calling directly at any of the UK ports. Other shipping lines involved in the Europe - Far East trade guard this very profitable trade jealously ad to minimise transport costs utilise rail services to either Felixstowe or Southampton for the deep sea connection.

The new line investigated the potential also of utilising the rail system to carry the heavier containers, but to tranship them across the North Sea by ferry or feeder vessel, and to deliver them to their ocean ship in the port of Rotterdam.
The preferred route would be by rail from the warehouse in Scotland to the North Sea ferry terminal in the north of England, where it would be loaded directly on to the ferry for the transfer to Rotterdam. On arrival at Rotterdam it would be moved within the port limits on a transfer trailer and loaded on the deep sea ship for the Far East.

Although the overland distance in UK was less than normal for economic rail transport it was felt that with the increased payload, the operations could be financially effective.

When the company approached the British Railways container handling company "Freightliner", it was advised that due to the restrictions in the rail network operating system, the Freightliner trains that carry the container traffic in the UK could not travel directly from Scotland to the specified port in England.
Freightliner was willing to accept the additional freight, but would not be in a position to guarantee the delivery of the containers by the next day, as the routing was outside the accepted normal Freightliner paths.

It would be necessary first to transport the containers from Scotland to London (650 km) and then after being transferred to another train, would be moved onward to the port for shipment (another 390 km). Therefore the containers would travel a distance in excess of 1,000 km. in order to cover a distance of 270 km. The shipping company was advised that the time taken to transport the containers would be at least two days (not guaranteed) and that the charges would be based on distance plus the additional handling charge for train transfer at the London terminal.

The road haulage option guaranteed delivery within 6 hours and at a rate based on the 270 km. distance. The haulage operating companies also indicated that additional discounts would be available for large volumes of container movements.

Results

Environmentally the preferred transport route was by rail, but from all practical operational and financial aspects the only sensible option was to move the containers by road transport. However as the containers could not be stowed to their full potential gross weight, the overall economic viability was lost and the potential traffic never materialised.

The resultant was a potential carrier was unable to submit a proposal to a client due to the inflexibility of the state- owned (at that time) British Railways. Since that time the rail operating companies have been privatised and there is a more flexible and entrepreneurial approach towards prospective customers.

12 Markets and Players, Contracts and Liabilities

Learning Objectives for Lecture 12:

- The student should understand the main players in the various transport markets and how these markets are governed by international conventions and regulations.
- The student should understand the possible types of freight forwarders and Multi modal Transport Operators (MTO) and their contract relations with shippers.
- The student should understand that in Europe combined rail-road transport operators are privately organized companies. He/she should be able to name some of the reasons and measures for promotion of combined transport.
- The student should know different documents for multimodal transport.
- He/she should understand the principles of the MTO liability.

12.1 Markets, Players

12.1.1 Air Transport

The air transport system comprises the following parties:
- Carriers: private or state- owned airlines, cooperating in alliances such as Sky Team, Star Alliance etc.;
- Ground handling companies, at the airports;
- Governments: arranging landing rights, providing and enforcing rules, such as traffic control;
- Integrators (UPS, Fedex, DHL etc.), offering total door-to-door service including road transport collection / distribution, warehousing etc.

Same as in sea transport, also air transport comprises scheduled liner services and incidental charter services.

Air transport is subject to world-wide regulations, enforced by international agreements and institutions, such as:
- IATA (International Air Transport Association, established 1945 by airline companies), providing tools for co-operation between airlines (settling accounts, dangerous goods transport, documents, liabilities, etc.);
- ICAO (International Civil Aviation Organisation, established 1947 by member states), regulating international treaties on airports, flight routes, landing rights, traffic control, navigational aids, communication, weather reports, logbooks, accidents; staff & equipment requirements, registration etc.

12.1.2 Sea Transport

Generally speaking the sea transport market is divided into (charter) vessels mostly for bulk goods and (liner) vessels mostly for containers.

Two groups of parties dominate these markets: the main ship owners and their alliances (Maersk, MSC, Evergreen etc.) versus the main terminal operators (HPH - Hutchison Port Holdings, APM - Maersk, DPW - Dubai Ports World, PSA - Singapore).
Increasingly also the large world-wide logistics service providers (Panalpina, Schenker etc.) become more powerful in especially the container market.

Same as in air transport, sea transport is governed by world wide conventions and regulations on safety, security, dangerous goods, environment protection etc. For sea- transport these regulations are controlled by the IMO - International Maritime Organisation.

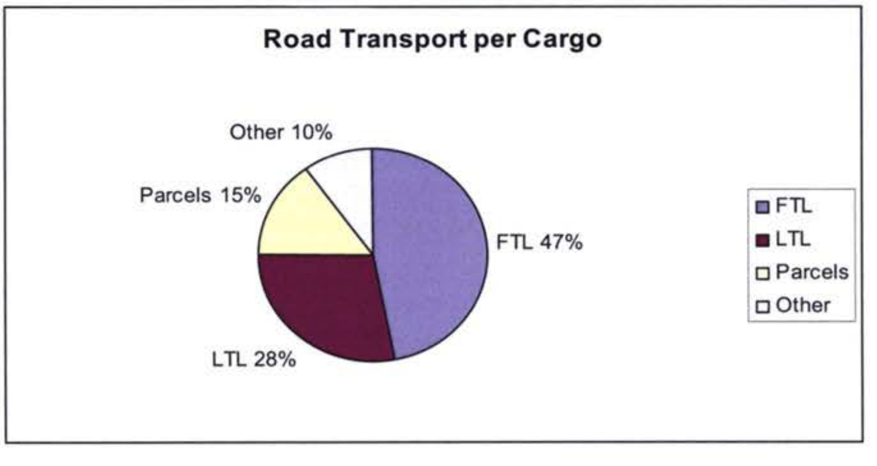
12.1.3 River Transport

River transport traditionally is performed by single skippers, owning one barge. In order to guarantee continuous cargo, these skippers united in cooperatives. Also larger barge operators exist, offering scheduled (container) barge services between sea- and inland terminals.
Another category is the so-called own operators. One example is a large steel industry in Germany with their own bulk terminal in the Port of Rotterdam and using their own barges for the transport of ore and coal across the Rhine river to Germany.
There are no world-wide conventions and regulations governing river transport. Only regional conventions exist such as the Mannheim Convention (for the Rhine), the Belgrade Convention (for the Danube), etc.
The European Union strives to harmonise the various conventions to achieve a Europe wide standard, such as the ADNR regulation for dangerous goods transport.
Other parts of the world have their own regulations, such as the Yangtze area in China, the Mississippi area in the US and the Mekong river system in South East Asia.

12.1.4 Road Transport

The following figure shows the division of the various cargoes in the European road transport market: FTL (Full Truck Loads), LTL (Less than Truck Loads), Parcels and Other.

Figure 12.1 Road Transport Market: Cargo Division



Road transport in Europe is executed by a large number of relatively small, mostly private, companies. Following table indicates that the 10 largest companies together comprise only 7.7 % of the European road transport market!

Figure 12.2 Market Share of Main Road Transport Companies in Europe

Company	mio. €	%
Schenker	5.165	1,6
DHL Freight	3.646	1,2
DVS A/S	3.430	1,1
Geodis	2.343	0,7
Dachser	2.240	0,7
Gefco	1.795	0,6
Kuehne & Nagel	1.791	0,6
Norbert Dentressangle	1.693	0,5
Willi Betz	1.200	0,4
LKW Walter	1.030	0,3
Others	290.777	92,3
Total	315.110	100

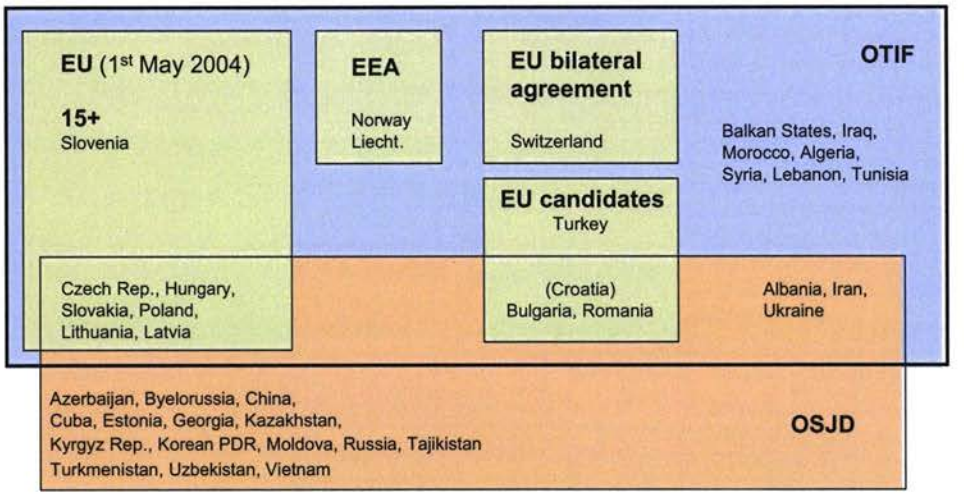
There are no world-wide conventions and regulations governing road transport; regulations are only regional, e.g. applicable in European and some North African countries, such as following conventions:

- ADR on dangerous goods transport;
- TIR on cross-border transport;
- CMR on documents, liabilities etc.

12.1.5 Rail Transport

Rail transport traditionally is executed by national state- owned railway companies. Increasingly these companies are (partly) privatised, where infrastructure, maintenance and traffic management remain public interest, while private railway operators execute the transport with own staff and equipment.
Same as in road transport, railway transport is governed by regional conventions, such as OTIF (West / Central Europe), OSJD (Central Europe / Asia) etc. The following scheme indicates the spheres of influence of both conventions.

Figure 12.3 OTIF and OSJD Regions of Influence



12.2 Forwarders and Carriers

12.2.1 Freight Forwarders

The traditional Freight Forwarder acts only as an Intermediate. This means that he only advises the Shipper about the most efficient transport solution. The contract between the Shipper and the Freight Forwarder only concerns this advice. The Shipper himself will close contracts with one or more Carriers who will execute the transport.

12.2.2 Carriers

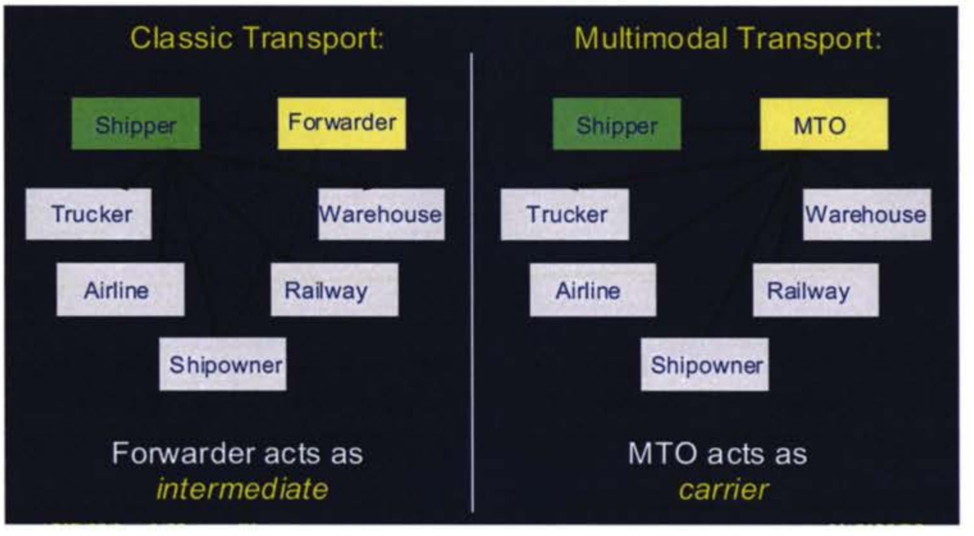
The Freight Forwarder can also act as a Carrier. In this case the Forwarder not only advises the shipper but he also closes the contracts with one or more Carriers, on behalf of the Shipper. In that case the contract between the Shipper and the Forwarder not only concerns the advice, but also the responsibility for the whole transport. The contract between the Forwarder and each Carrier concerns the responsibility for each specific transport.

NB. The Freight Forwarder can also act as a Carrier (take the responsibility for the transport) when he does <u>not</u> own or operate any transport equipment.

This distinction between Freight Forwarders acting as an Intermediate (advising only) or acting as a Carrier (being responsible for the transport) is important because of liabilities in case of damage etc. Therefore the Freight Forwarder should explicitly state in his contract with the Shipper that he only acts as an Intermediate; if no such statement is made he will be legally regarded as a Carrier (re. also Chapter 11.3).

The different contract relations for Intermediates and Carriers (also called Multi Modal Transport Operator - MTO) are shown in the following scheme.

Figure 12.4 Contract Relations of Forwarders and Carriers



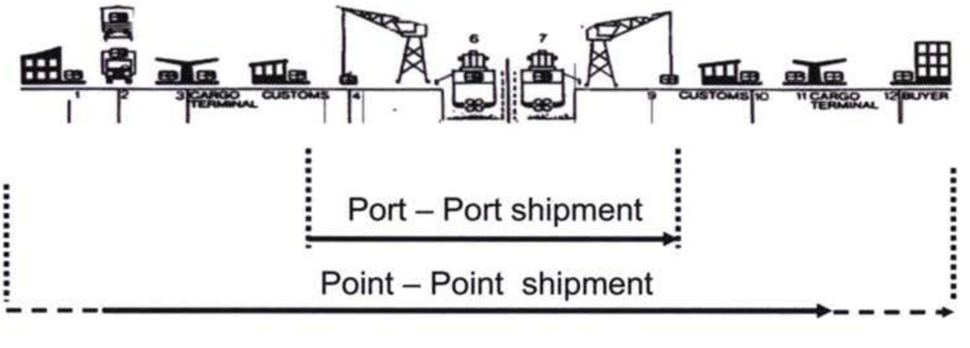
12.2.3 Multimodal Transport Operators

Carriers (or Forwarders acting as Carriers), who perform multi modal transport are also called Multimodal Transport Operators (MTO). This MTO acts as a full responsible carrier and not as an intermediate. In his relation to the customer he offers one single contract, with one document, one liability (network or uniform liability system) and one price for the whole multimodal chain. In his internal business relations he subcontracts different transportation, handling and ancillary services.

Multi Modal Transport Operators perform following tasks:

- Issue Bills of Lading as Contract of Carriage;
- Take the responsibility to carry goods from point A to B (this can be : Port-Port or Point-Point, also Multi Modal):

Figure 12.5 Scope of Responsibility



We distinguish between Carrier-MTO with vehicles of their own and Non- Carrier-MTO which do not possess their own vehicles. Carrier-MTO can be shipping lines (Vessel-Owning-MTO, abbreviated VO-MTO) or Forwarders and Non- Vessel-Owning-MTO (in USA according to US-Shipping Act 1984, NVOCC = Non Vessel Operating Common Carrier):

Figure 12.6 Various Types of Carriers

Possession of equipment	Possession of ships	Market share	Main activities	Example companies
Non Carrier MTO (NC-MTO): without own equipment	Non Vessel Owning MTO (NVO-MTO) or Non Vessel Operating Common Carrier (NVOCC): without own ships	40 %	Forwarder Ship's Agent Trucker Integrator Railway Terminal Operator	Kühne & Nagel PAN Agencies ...... Federal Express CSX Port of Seattle
Carrier MTO (C-MTO): has own equipment	Vessel Owning MTO (VO-MTO): has own ships	60 %	Conference Carrier Non Conf. Carrier Inland Water Carrier	Hapag Lloyd Evergreen Lines ......

The commercial interests of an MTO differ according to its investment in infrastructure and vehicles. The functions of an MTO include, but are not limited to:

- To identify and to provide the proper means of carriage for the through transportation of shippers' goods;
- To schedule timetables to suit both the shipper and the receiver;
- To provide transportation traction for the entire journey;
- To provide a standardised documentation set to ensure a minimum delay in transit through national borders;
- To provide for a simple billing structure to minimise the number of invoices;
- To provide tracking and tracing facilities;
- To provide as much detail on each transit move as shippers require;
- To provide cargo-handling advice for stowage of goods in containers and swap bodies.

12.2.4 Combined Transport Operators and Services

(Source: CNT Transport / Europe: Bulletin of the Observatory on Transport Policies and Strategies in Europe: Intermodal Transport in Europe, Double issue Nos.13-14, April 2005)

Operators

Throughout Western Europe privately organised companies are acting on national and international levels offering services in combined transport road-rail. In Germany the company is called KOMBIVERKEHR. These companies are organised on an international level in the "Union Internationale des Sociétés de Transport Combiné (UIRR)". See www.uirr.com.

Following please find an overview of members.

Adria Kombi	Slovenia	Kombiverkehr	Germany
Bohemiakombi	Czech Rep.	Novotrans	France
Cermat	Italy	Ökombi	Austria
Combiberia	Spain	Polkombi	Poland
Crokombi	Croatia	Portif	Portugal
C.S. Eurotrans	Slovakia	SWE-Kombi	Sweden
CTL	Great Britain	T.R.W.	Belgium
Hungarokombi	Hungary	Trailstar	Netherlands
Hupac	Switzerland	Associated member	CNC Compagnie
Kombi Dan	Denmark	Nouvelle de Conteneurs (France)	

The entry onto the market of new operators has not had the dynamic effect for which many had hoped. Traditional operators (Kombiverkehr, Hupac, Cemat, Ökombi) are still playing the main role, while the volume shipped by the international cooperative organisation ICF is in decline.

The trends in international intermodal traffic are diverging between French operators (a drop of 22% in 4 years) and the other operators as a whole (an increase of 27%; CEMAT alone + 66%).

Difficulties and trends

The international traffic of the UIRR operators

TEU	1999	2000	2001	2002	2003
CNC, Vincennes	156 794	146 584	131 491	117 429	103 436
Cemat, Milano	304 187	343 607	366 743	405 927	504 566
Combiberia, Madrid	25 207	30 227	26 839	29 391	31 542
Hupac, Chiasso	424 099	531 438	514 089	497 794	562 219
Hupac, Rotterdam	56 448	60 663	73 048	78 465	84 930
Kombi Dan, Padborg	8 938	12 475	14 288	14 902	12 749
Kombiverkehr, Frankfurt	818 770	862 121	857 424	869 682	947 591
Novatrans, Paris	174 426	177 730	167 360	171 716	154 207
Okombi, Wien	307 295	342 169	381 779	416 562	389 839
Polkombi, Varsovie	26 034	26 098	10 512	854	0
Rocombi, Bukaresti		725	501	232	9
Swe-Kombi, Helsingborg	16 555	17 234	18 547	8 646	0
TRW Brussels	126 660	132 818	139 794	148 582	144 234
TOTAL TEU	**2 445 412**	**2 683 888**	**2 702 415**	**2 760 181**	**2 935 321**

Source: UIRR

Intermodal transport faces some real problems. Operators are generally undercapitalised or in deficit, therefore unable to invest in and develop an activity of low profitability. The cost structure is often poorly understood; the division of business receipts and public subsidies between the various elements of the total costs, i.e. between infrastructure, traction, provision of wagons and traction units, multimodal railheads, handling, purchase of materials, etc, is not clear. The justification for intermodal transport is more often made in socio-economic terms (referring to external costs) than in financial terms (the profitability of the operators); the 'rail motorway' for example cannot survive without a considerable level of subsidy. The regulations on using the rail network, whether concerning the tariff structure or the allocation of track paths between the different types of traffic and operators, pose an additional problem. The succession of European directives since 1991 shows the difficulty there is in reforming the system and making it work better. Finally, shippers complain that the punctuality of both rail and rail-road transport is poor. In commercial terms, it is evident that customers who have been disappointed with the failings in the system will not return willingly. However, the success of intermodal solutions in certain countries and on certain rail lines shows that the right conditions for it can exist in Europe.

Measures to Promote Combined Transport

In combined transport, the rail companies' main customers are the operators, who currently handle some 90% of such transport. The operators constitute the link between the forwarder and the rail companies. They organise transport and transhipment capacities for the road-rail transport chain between the forwarding and reception terminals, or in door-to-door transport. Comparable to wholesalers, they buy from the rail companies complete trains or the means of traction for their own wagons, and sell the various transport capacities / wagons to their own customers. They thus fulfil the basic conditions of combined transport, accumulating different individual road transport dispatches into transport volumes that can economically justify rail transport.

Over the years, they have perfected the technical and organisational aspects of combined transport in collaboration with the rail companies, and have caused significant transport
volumes to pass from road to rail. This has enabled the rail companies to handle dispatches in a much more economical fashion, with full trains. The UIRR member companies alone hold a market share of about 65%, routing loading units equivalent to about 5 million standard units (TEUs), or to the daily transhipment onto the railway network of 9,000 long-distance road transports.
In this connection, a series of targeted promotional measures have been put into application, to good effect. These have enabled transport policy to support the development of combined transport at the national and European levels, while broadly complying with the rule of cost neutrality. Support for CT is based mainly on Directives 92/106 and 96/53 and includes derogations for road vehicles used for the positioning legs before and after rail transport.
The following is a brief survey of the principal promotional measures:

1st .Exemption from road tax: In accordance with the European Directive, road vehicles primarily engaged in the first and last legs of combined transport operations must be completely or partially exempt from road tax. This solution prevents the over-burdening of transport with infrastructure taxes, since a rail infrastructure utilisation fee already has to be paid in connection with combined transport. Additionally, these vehicles generally only cover very short distances.

2nd Exemption from traffic prohibitions: Transport by rail may also be carried out without restriction at weekends and on public holidays, whereas road vehicles are subject to traffic prohibitions during these periods. To make the most of this advantage of rail transport, road
vehicles used in the relatively short positioning legs are exempt from traffic prohibitions at weekends and on public holidays.

3rd Increase in maximum gross weights: This measure aims to compensate for an inherent disadvantage of combined transport. Because of the use of intermodal swap-bodies, road vehicles involved in combined transport are generally heavier than fixed-structure trucks. The logistics companies whose job it is to route heavy goods will only opt for combined transport
if they can have the same payload available as they do with pure road transport.

As regards to the demands made on transport to the hinterland of seaports, it is already possible today to transport 40-foot containers with a vehicle gross weight of 44 tonnes by road upstream and
downstream by rail transport, even in countries where the maximum authorised weight is generally 40 tonnes. An extension of this weight compensation measure to all loading units used in unaccompanied combined transport (20-foot containers, swap-bodies and cranable semitrailers would be logical, and would contribute to the development of combined transport.
Unaccompanied combined transport: the transport of containers, swap-bodies and Semitrailers transhipped in a terminal between a road vehicle and a wagon. By way of comparison, in accompanied combined transport - known as the "rolling road or motorway" -, the entire vehicle is loaded onto the wagon and accompanied by the driver.

4th Extension of promotional measures: The European Commission has drawn up proposals to modify the above-mentioned Directives, under which it wishes to extend and unify certain promotional measures which have already proved highly useful in some States. These modifications would be warmly welcomed by the combined transport sector. Unfortunately, a proposal to modify Directive 92/106, which would stipulate a maximum road transport segment of 20% of the total distance for combined transport operations to be eligible for support, is far too rigid. It would have the effect of excluding certain combined transport
chains from the promotional measures. This is because the decision to opt for combined transport does not depend exclusively on the geographical proximity of a transhipment terminal, but also on the possibility of opting for the terminal via which rail transport services may best meet with the overall logistical requirements. The current rule, which requires use of the "closest suitable terminal" for transhipment onto the railways is clearly closer to reality, and should therefore be retained. Turning to subsidies for operational improvements or investments, currently governed by Directive 1107/70, care should be taken to ensure that these are not granted in their entirety to the rail companies, but, in the spirit of liberalisation, directly to users or operators. This would also enable a closer check to be kept on results. The subsidisation of investments in transport units such as swap-bodies and cranable semi-trailers would also help haulage and logistics companies to acquire the appropriate equipment for intermodal transport.

5th The Switzerland-EU Transit Agreement: One of the most effective measures in support of international combined transport has proved to be the 28-tonne limit imposed on HGV's in Switzerland. The significant difference from the permissible gross vehicle weight in the neighbouring countries to the north and south has had the effect over the last few decades of encouraging the use of combined transport to route a large proportion of all freight crossing the Alps. Environmental considerations led the Swiss to maintain this limit for a long time. Nonetheless, under pressure from the European Union, Switzerland has had to accept a gradual rising of the limit up to 40 tonnes. But unless this liberalisation of transalpine road transport is accompanied by a similar liberalisation of rail transport and an allocation of external costs to each transport mode, even with the current level of transit costs, there are fears of a serious decline in transalpine rail transport, which represents the largest flow of combined transport in Europe, with all the accompanying consequences for the environment.

This example shows that the goal of liberalising road transport and of managing it using uniform conditions throughout Europe is a good one. The liberalisation of rail should be regarded as equally important and environmental protection is vital. If these goals are pursued according to differing degrees of priority, undesirable consequences may be expected.

6th State subsidization of investments into the infrastructure of combined transport: There are subsidizations into new buildings and reconstructions of combined road-rail terminals and into equipment (reach stacker etc.) within some EU countries (e.g. Germany). So the state
wants to lower the entry barriers for new combined traffic.

12.3 Multimodal Contracts and Liability

12.3.1 Multi Modal Transport Documents

The MTO may be a freight forwarder who acts as a carrier and as a principal for subcontractors, and who sets up a single multimodal transport document on behalf of the shipper which covers the entire transport operation from door - to - door.

The MTO may issue following Multi Modal Standard Contracts:

Type	Negotiable / Non-Negotiable	More information (See Annex 2)
FBL FIATA Bill of Lading	Negotiable	FBL_Standard_Conditions.Doc FBL_Cover_Page.PDF
FCT Forwarders Certificate of Transport	Non.Negotiable	FCT_Cover_Page.PDF
FWB FIATA Multimodal Transport Waybill	Non-Negotiable	FWB_Cover_Page.pdf FWB-Second_Page.pdf
MULTIDOC 95	Negotiable	See also www.bimco.dk
MULTIWAYBILL 95	Non-Negotiable	Multiwaybill95.pdf See also www.bimco.dk
Company own Bill of Lading for Multimodal Transport	Negotiable	

Bill of Lading

The Bill of Lading (B/L, also the FBL) is issued in a negotiable form unless it is marked as "non-negotiable". Negotiability means that it constitutes a title to the goods and the holder, by endorsement of the B/L, is entitled to receive or to transfer the goods mentioned. At the place of receipt (port of loading) the consignor1 (usually the forwarder) has the right - against delivery of the goods - to receive the Bill of Lading from the carrier respectively from the carriers agent. At the point of delivery (port of unloading) the goods are then delivered by the carrier (resp. his agent) against the Bill of Lading.

The Bill of Lading serves three functions:

(1) Proof of receipt:

The B/L is a receipt issued by the carrier (usually filled in by the forwarder and signed by the carrier's agent or by the master of the ship) which contains information on condition, volume and kind of the goods shipped.

(2) Proof of Ownership (Document of Title):

The person who is endorsed and holds the B/L is entitled to the goods and has the right to receive the goods from the carrier against B/L. The B/L represents the goods. The goods can be traded by trading the B/L.

(3) Document for the transport contract:

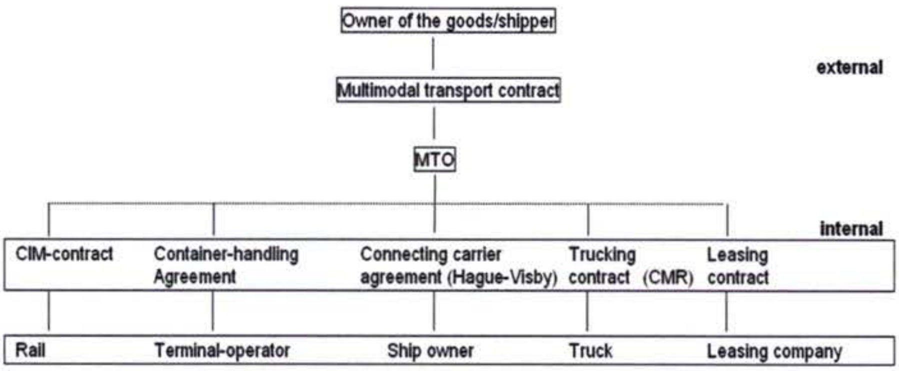
The B/L is a document which proves the contract of affreightments and its contents. It is not the contract itself, because the contract was concluded.
For more information on the B/L see Annex 1

12.3.2 Liability of the MTO

Typical risks of transport, which are elements of liability (and insurance) are: damage, loss, delay. Regarding the legal and liability situation of the MTO we must differentiate between an *internal and external part:*

- External part: concerns the relation with the owner of the goods (shipper).
- Internal part: rules the legal relationship of an MTO with different transport operators (carriers).

Figure 12.8 Internal and External Liability



The internal part is mainly governed by legislation per transport modality:

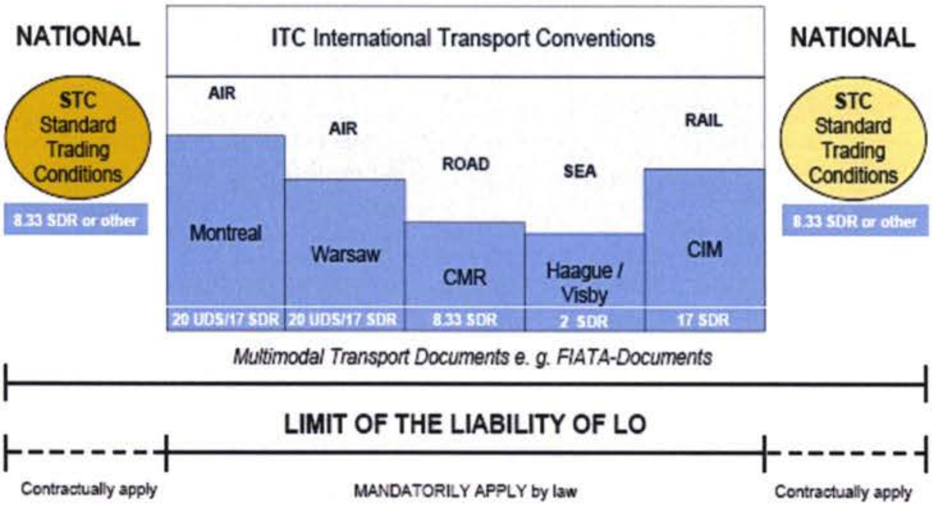
- Air traffic: Warsaw convention (world wide);
- Sea traffic: Hague and Hague-Visby rules / Hamburg rules (world wide);
- Road traffic: CMR or other (depending on the region);
- Rail traffic: COTIF / SMGS (depending on the region).

For ports, terminals and in warehouses there is no international law yet, so damages, losses and delays at these interfaces are regulated according to contractual law (e.g. standard warehousing conditions). Especially in developing countries this sometimes means a non-transparent and risky situation, because the legal situation is unclear for the MTO.

In the external part two main streams can be distinguished:

- *Network-solution:* respecting the rules and laws already developed for the modalities applied. The liability depends on the mode where the damage occurred;
- *Uniform-solution*: MTO as sui - generis; the MTO contract is an own contract, independent from uni-modal agreements. There is one uniform liability, independent from where damage occurred.

Figure 12.9 Different Liabilities per Modality



<u>The Freight Forwarder's liability in case of issuing an FBL</u>

The liability of a Freight Forwarder according to the terms of the FBL is a mixture of the uniform and the network solutions.

Please read FBL_Standard_Conditions.Doc (8. Limitations of the Freight Forwarder's Liability) carefully! (See Annex 1).

Short Summary

The liability is limited to 666.67 SDR2 per package or unit or 2 SDR per kilogram of gross weight of the goods lost or damaged, whichever is higher. If an ad valorem freight rate has been paid then the value as stated in the FBL shall be the limit for compensation.

2 SDR = Special Drawing Right = artificial "basket" currency created by the International

Monetary Fund (IMF) in 1969 to support the exchange rate system and to serve as an internal

accounting currency. The currency basket consists of US$, Euros, Yen and British Pounds.

On April 07th 2006 1 SDR = 1.187 Euro

For actual rates see www.IMF.org

If the multimodal transport does not, according to the contract, include carriage of goods by sea or by inland waterways, the liability of the Freight Forwarder shall be limited to an amount not exceeding 8.33 SDR per kilogram of gross weight of the goods lost or damaged.

When the loss of or damage to the goods occurred during one particular stage of the multimodal transport, in respect to which an applicable international convention or mandatory national law would have provided another limit of liability if a separate contract of carriage had been made for that particular stage of transport, then the limit of the Freight Forwarder's liability for such loss or damage shall be determined by reference to the provisions of such a convention or mandatory national law.

The legal framework for International Multimodal Transport is provided by:

- The UN Conventions on the International Multimodal Transport of Goods (MT-convention) signed in 1980. *The MT-Convention is not in force yet!*
- UNCTAD/ICC Rules for Multimodal Transport Documents

For further information on the development of the Multimodal Standard Contracts and documents according to UNCTAD/ICC rules see www.bimco.dk
For further information on multimodal transport contracts and liability see: UNCTAD_MMT_RULES.en.PDF

13 Interoperability in Transport

Learning Objectives for Lecture 13:

- To define interoperability in general, in IT, in transportation.
- To understand Interoperability in the railways sector
- To learn about the role of UIC (International Union of Railways) in interoperability).

13.1 Interoperability Definitions

Interoperability is a property referring to the ability of diverse systems and organizations to work together (inter-operate). The term is often used in a technical systems engineering sense, or alternatively in a broad sense, taking into account social, political, and organizational factors that impact system to system performance.

Interoperability is the ability of a system or a product to work with other systems or products without special effort on the part of the customer. Interoperability becomes a quality of increasing importance for information technology products as the concept that "The network is the computer" becomes a reality. Such products achieve interoperability with other products using either or both of two approaches:

- By adhering to published interface standards
- By making use of a "broker" of services that can convert one product's interface into another product's interface "on the fly"

A good example of the first approach is the set of standards that have been developed for the World Wide Web. These standards include TCP/IP, Hypertext Transfer Protocol, and HTML. *Compatibility* is a related term. A product is compatible with a standard but interoperable with other products that meet the same standard (or achieve interoperability through a broker).

In transportation, interoperability is mainly met as a term in railways, where one may distinguish in hard interoperability related to physical specifications (e.g. different gauge) and in soft interoperability (ITC used for control etc).

13.2 Rail Transport and Interoperability

During the last 20 years the European Union has worked to provide the appropriate legislation (directives) for the harmonization of rail systems in order to obtain interoperability in the TEN-T.

Opening up national freight and passenger markets to cross-border competition is a major step towards the creation of an integrated European railway area and of a genuine EU internal market for rail. Greater technical harmonisation of rail systems and the development of key cross-border rail routes are also helping to break down barriers to a more competitive rail sector, along with better connections between EU and neighbouring markets.

Greater competition makes for a more efficient and customer-responsive industry. EU rail legislation has consistently encouraged competitiveness and market opening, with the first major law in this direction dating back to 1991.

The legislation is based on a distinction between infrastructure managers who run the network and the railway companies that use it for transporting passengers or goods. Different organisational entities must be set up for transport operations on the one hand and infrastructure management on the other. Essential functions such as allocation of rail capacity (the "train paths" that companies need to be able to operate trains on the network), infrastructure charging and licensing must be separated from the operation of transport services and performed in a neutral fashion to give new rail operators fair access to the market.

EU Member States must also have regulatory bodies in place to monitor railway markets and to act as an appeal body for rail companies if they believe they have been unfairly treated.

Opening markets Europe-wide

As well as encouraging greater competition within national markets, EU legislation gives rail operators the ability to run services in and between other EU countries, opening up competition in a cross-border sense.

Rail freight transport has been completely liberalised in the EU since the start of 2007, for both national and international services. This means that any licensed EU railway company with the necessary safety certification can apply for capacity and offer national and international freight services by rail throughout the EU.

The EU will liberalise the market for international rail passenger services from 1 January 2010. Any licensed, certified rail company established in the EU will in principle be able to offer such services, and in doing so have the right to pick up and set down passengers at any station along the international route. The market for purely national rail passenger services is not yet being opened up to cross-border competition, though this could change in the future.

Interoperability & safety

The creation of an integrated European railway area also calls for improved "interoperability" - or technical compatibility - of infrastructure, rolling stock, signalling and other rail systems, as well as less complex procedures for approving rolling stock for use across the European rail network.
Over the years national rail networks have developed different technical specifications for infrastructure. Different gauge widths, electrification standards and safety and signalling systems all make it more difficult and more costly to run a train from one country to another. Specific EU legislation exists to promote interoperability and overcome such differences.

The European Railway Agency: promoting safety and interoperability

The European Railway Agency plays a central role in promoting interoperability and harmonising technical standards, a process in which cooperation between EU Member States and rail stakeholders is essential.

The European Railway Agency (ERA) in Valenciennes, France, helps to build an integrated European railway area by reinforcing rail safety and promoting interoperability. Set up in 2006, ERA develops common technical standards and common approaches to safety, working closely with stakeholders from the rail sector as well as with national authorities, the EU institutions and other interested parties. Featuring a dedicated Safety Unit, ERA also monitors and reports on rail safety in the EU.

ERTMS - European Rail Traffic Management System
ERTMS ("European Rail Traffic Management System") is a major industrial project being implemented by Europe, a project which will serve to make rail transport safer and more competitive. One component of ERTMS, the European Train Control System (ETCS), guarantees a common standard that enables trains to cross national borders and enhances safety.

Following an intense ten year phase of research and development, validation of the ETCS standard was carried out from 2000 to 2007 with real scale projects underway in parallel. Since 2005, feedback from projects prompted the need to fine tune the specifications in order to move from local to global compatibility and ensure interoperability between all projects in Europe. The specification, as modified by a Commission Decision on 23 April 2008, now guarantees that Europe's trains equipped with ETCS can travel on any line equipped with ETCS.

In 2005 the European Commission and the rail industry (manufacturers, infrastructure managers and undertakings) signed a memorandum of understanding on the deployment of ERTMS on a key part of the European network with an emphasis on six freight corridors. Deployment of ETCS across key freight corridors and high speed lines will greatly improve the competitiveness of European railways.

Summaries of legislation
about the Interoperability of the trans-European high-speed rail system

- Decision 2008/386/EC of 23/04/2008 modifying Annex A to Decision 2006/679/EC of 28 March 2006 concerning the technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European **conventional** rail system and Annex A to Decision 2006/860/EC of 7 November 2006 concerning the technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European **high speed rail system**.

- Decision of 6 March 2007 modifying Annex A to Decision 2006/679/EC concerning the technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European **conventional rail** system and Annex A to Decision 2006/860/EC concerning the technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European **high speed rail** system [2007/153/EC]

- Decision 2006/860/EC of 07/11/2006 concerning a technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European **High Speed** rail system and modifying Annex A to decision 2006/679/EC of 28 March 2006 concerning the technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European **conventional rail system**.

- Communication on the deployment of the European rail signalling system ERTMS/ETCS [COM(2005)298]

- Annex to the Communication [SEC(2005)903]

- Decision 2001/260/EC of 21 March 2001 on the basic parameters of the command-control and signalling subsystem of the trans-European high-speed rail system referred to as "ERTMS characteristics" in Annex II(3) to Directive 96/48/EC

The new Interoperability Directive 2008/57/EC
The new railway interoperability Directive 2008/57/EC of 17 June 2008 sets out to establish the conditions to be met to achieve interoperability within the Community rail system. These conditions concern the design, construction, placing in service, upgrading, renewal, operation and maintenance of the parts of this system as well as the professional qualifications and health and safety conditions of the staff who contribute to its operation and maintenance. The new Directive will repeal with effect from 19 July 2010 Directive 96/48/EC on the interoperability of the European high-speed rail system as well as Directive 2001/16/EC on the interoperability of the European conventional rail system.

Background

Interoperability of the trans-European conventional rail system
Directive 2001/16/EC on the interoperability of the conventional rail system adopted on 19 March 2001, like that on the high-speed system, introduced Community procedures for the preparation and adoption of TSIs and common rules for assessing conformity to these specifications.

The directive required a first group of priority TSIs to be adopted within three years in the following areas: control/command and signalling; telemetric applications for freight services; traffic operation and management (including staff qualifications for cross-border services); freight wagons; and noise problems deriving from rolling stock and infrastructure.

Interoperability of the trans-European high-speed rail system
Under the EC Treaty (Articles 154 and 155), the Community has the task of contributing to the establishment and development of trans-European networks in the area of transport. In order to achieve these objectives, the Community must take the necessary measures to ensure the interoperability of the networks, particularly in the field of technical standardization.

An initial measure was taken in the rail sector by the Council on 23 July 1996 when it adopted Directive 96/48/EC on the interoperability of the trans-European high-speed rail system.

In order to achieve the objectives of that directive, technical specifications for interoperability (TSIs) were drawn up by the European Association for Railway Interoperability (AEIF), which acted as the joint representative body defined in the directive, bringing together representatives of the infrastructure managers, railway companies and industry.

A number of tools and methodologies had to be developed in order to prepare the TSIs. Pending the adoption of TSIs, and in order to guide the technical choices made in the projects in progress in several Member States, the Commission adopted two instruments: Decision 2001/260/EC on the characteristics of the European Rail Traffic Management System (ERTMS) and Recommendation 2001/290/EC on the basic parameters of the trans-European high-speed rail system.

A programme to develop the corresponding European standards was launched in 1998 and is regularly updated to reflect the work on TSIs.

Summaries of Legislation
about the Interoperability of the trans-European conventional rail system

Legislation
Decision 2008/164/EC of 21 December 2007 concerning the technical specification of interoperability relating to "persons with reduced mobility" in the trans-European conventional and high speed rail system

Decision 2008/163/EC of 20 December 2007 concerning the technical specification of interoperability relating to "safety in railway tunnels" in the trans-European conventional and high speed rail system

Directive 2001/16/EC of the European Parliament and of the Council of 19 March 2001 on the interoperability of the trans-European conventional rail system

Adopted TSIs for the conventional trans-European rail system
Rolling Stock - Noise

'TAF' : Telematic Applications for freight

Control-Command and signalling

Rolling Stock - Freight Wagons

Traffic Operation and Management

Notified bodies
Directive 2001/16/EC for the trans-European conventional rail system

Progress report:
Progress report 2000 to 2005 on the implementation of the Interoperability Directives (96/48/EC for high speed rail and 2001/16/EC for conventional rail) [COM(2006)660]

Railway Safety
Europe's railways are among the safest in the world. The EU is looking to maintain high standards and to harmonise safety requirements EU-wide.

As well as ensuring optimal safety, harmonisation in this area helps improve the compatibility – the interoperability – of national rail systems. Different national safety rules are a major hindrance for new railway companies looking to establish themselves on the market or indeed for any company wanting to use rail infrastructure in different countries.

EU legislation sets the framework for a harmonised approach to rail safety in the EU. It lays down the conditions for granting the safety certification that every railway company must obtain before it can run trains on the European network. Furthermore, it obliges EU Member States to set up national railway safety authorities and independent accident investigation bodies.

Related Legislation
DIRECTIVE 2004/49/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 April 2004 on safety on the Community's railways and amending Council Directive 95/18/EC on the licensing of railway undertakings and Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification (Railway Safety Directive)

Cross acceptance of rolling stock:
On 13 December 2006, the European Commission adopted a series of measures to support the revitalisation of the railway sector by removing obstacles to the circulation of trains throughout the European rail network. The measures included a Communication on the simplification of certification of railway vehicles, a proposal to recast the existing Railway Interoperability Directives and to modify the Regulation establishing a European Railway Agency and the Railway Safety Directive.

Environment

Noise
The principal source of rail noise is the rail-wheel interaction. This problem concerns of course both the transport of passengers and freight, but it is much acute for freight wagons.

To reduce rail noise at its source the Commission adopted in 2002 a decision concerning the technical specification for interoperability relating to the "Rolling stock" including noise limit values for high speed trains.

For the conventional rail, the Commission adopted on 23 December 2005 a decision concerning the technical specification for interoperability relating to the noise of rolling stock, published in OJ L 37 of 8 February 2006. This Decision introduced for the first time noise limits for rolling stock used in the European Union. These limits apply to new and renewed rolling stock including freight wagons. New freight wagons have to be equipped with low-noise brake blocks (such as so-called K-blocks) reducing the noise by about 50%.

However, due to the long lifetime of rolling stock (and the logarithmic nature of noise), it will take several years before the overall noise emissions from freight trains can be reduced significantly if no additional measures addressing the existing fleet are introduced.

In this context the European Commission recently adopted a Communication on rail noise abatement measures addressing the existing fleet as part of the 'Greening Transport' package.

Workshop on low-noise brake block technology and homologation
As follow-up activity of the Communication the Commission convened a workshop on 29 September 2008. Its objective was to discuss and clarify the state of play of the development and homologation of LL-blocks as well as the authorisation procedures for composite blocks (K and LL) and for putting into service of retrofitted wagons.

Infrastructure
The construction of the trans-European transport network (TEN-T), based on the interconnection and interoperability of national transport networks, including rail, is of great importance for the EU's economic competitiveness and its balanced and sustainable development. As part of the EU's TEN-T programme, a number of European Coordinators are tasked with facilitating the implementation of certain multi-country rail projects (six including ERTMS) that are seen as a high priority for the network.

One of the EU's aims for the rail sector is to upgrade by 2012–2015 a number of important freight routes by deploying ERTMS systems along them. The six routes carry around a fifth of Europe's rail freight traffic.

The EU is also working towards the creation of a rail network giving priority to freight, including the realisation of a number of international freight-oriented "corridors" - at least one in each EU Member State by 2012.

13.3 Intermodality and Interoperability of Transport Systems, "I2V" – Austrian R&D programme

I2V is the Austrian impulse programme to **promote cooperative research and development projects** in the area of **intermodal and interoperability of transport systems**. The goal is to increase the efficiency of the overall transport system by improving the smooth interoperation of different modes of transport, increasing integration of environmentally sustainable modes of transport and more efficient use of the existing infrastructure. New technologies and system solutions are to be developed and tested, both for goods transport and for passenger transport.

The forecast growth in transport presents the entire transport system with major challenges. Accordingly, the themes of intermodal/co-modality and interoperability of transport systems currently stand right at the top of the agendas in national and international transport policy. In the European Transport White Paper and in its mid-term review, the importance of innovative intermodal transport networks and of the interoperable transport systems needed for this is emphasised.

In the Seventh Research Framework Programme (FP7), the approach adopted is to link innovation activities in the transport sector with the policy challenges for a sustainable, European, total transport system. The conclusions of the European Council regarding a European energy strategy in the transport sector make reference inter alia to promoting measures across all transport modes for optimal linking of the individual modes of transport. In practical terms, the further growth in transport is to be managed by creating high-performance European transport corridors and increasing the use of intermodal transport chains and integrated routes. In technological terms, it is hoped for instance that the spread of RFID and other possibilities for automating goods logistics will result in a similar technical revolution to that achieved 50 years ago with the introduction of the standard container. The increased use of intermodal transport chains and integrated routes is also intended to make a key contribution to solving transport-related environmental problems in Europe.

In the programme line I2V, encouraging implementation of already-existing Research and Development (R&D) outcomes from the forerunner programme IV2Splus is a major focus, particularly by transferring results from pilot schemes which have already been carried through successfully into flagship projects and thus implementing them as convincing reference applications. Support is also to be given to R&D projects, to the development of new system components and national and international research co-operations, for example under the framework of ERA-NET TRANSPORT. In recent years, an active research community has developed in Austria in the field of transport telemetric. In addition, the country has seen long-standing activities in the area of combined transport and has expertise in integrated transport and logistics solutions. To date, however, there has been relatively little systematic networking between the various research communities involved. Accordingly, one strategic goal of the programme line I2V is to drive forward the systematic integration of what to date has been a relatively fragmented research community under the research priority of intermodal and interoperability.

13.4 UIC

A new working group dealing with interoperability, harmonization, operational systems: the Operations Focus Group (OFG) was established by UIC, during the Infrastructure Forum of UIC held in May 2008.

This group aims to:
- Provide a transverse working group including both RU and IM for representatives
- Deal with operational matters at the interface between IM and RUs, with a view to develop interoperability and harmonization within the framework created by the EU
- Be able to deal with topics ranging from train planning to post operational matters, as well as relating to technical matters critical for the operations (rolling stock, infrastructure...)
- Report to the Infrastructure and Railway Undertakings for and be governed like any other working group: chairman, vice-chairman, secretary ...

The mains issues to be dealt with by the group will be:
- Interoperability :
  - Provide a forum to solve matters related to interoperability issues
  - Solve issues which cannot be solved at ERA level (voluntary versus mandatory)
  - Identify areas where further interoperability or harmonisation would be beneficial
  - Identify areas of research which would facilitate interoperability

- Harmonisation:
  - Develop recommendations which would provide workable harmonised solutions within the framework of TSI's
  - Monitor standards development in relation with their impact on operations
- Other issues :
  - Development of new operational systems, third party risks,
  - Liaise with other groups such as ERTMS, RST.

In order to achieve the group organisation, the UIC Infrastructure Department is inviting all networks to participate at this newly created working group.

The experts' group is expected to produce a deliverable before the next Infrastructure Forum (in October 2008) including a working program and a list of priorities of the needs to come for the next years.

A second very important recent development is that the green light for the establishment of TAF (Telemetric Applications for Freight) -TSI (Technical Specifications for Interoperability) Deployment - Common Components Group (CCG) was given.

The TAF-TSI Steering Board recently took the first step toward realisation by reaffirming the creation of the TAF-TSI Common Components Group (CCG). This will allow the industry to adhere to the planned schedule for developing the building blocks necessary for implementing the Technical Specification for Interoperability. The Common Components will serve as the communications backbone to allow secure and efficient data exchange.

The Steering Board is made up of representatives of stakeholders and includes members of the UIC, CER, EIM, ERFA, UIP, RNE and other representative organisations.

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13.5 Case: Progress in the field of Rail Interoperability

(Source: Walenberg F.T.M., TE PAS R.B., paper presented in IRS Turkey 2008)

The European Commission has assigned in 2006 to "DHV" and "Kema" (NL) to study the progress in the field of Rail Interoperability. Their basic conclusion was that now, under the new situation of separation between infrastructure management and train operations, making train and track to work together becomes more difficult.

The main obstacle for new market entrants in concrete terms is still perceived to be the persisting diversity in technical and operational requirements for trains, staff and operations.

In 2001 E.C. has assigned the so called "Graband" study, to study the progress on interoperability. The new study of DHV - Kema builds upon the 2001 Graband study and determines progress made since 2001 in both high speed and conventional rail interoperability. 27 countries are involved (E.U. minus Cyprus & Malta as they don't have railways and plus Switzerland and Norway).

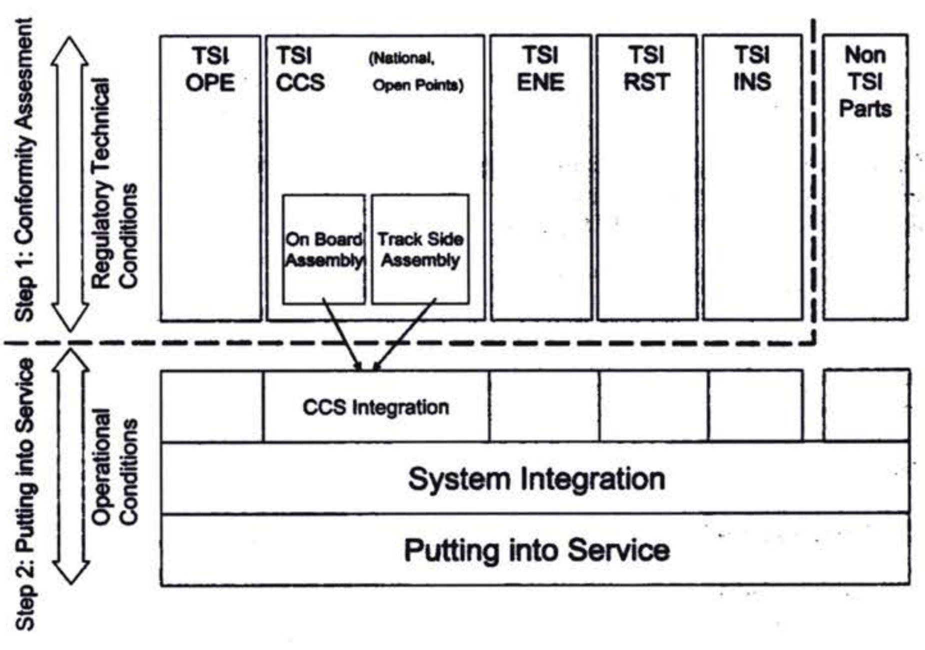
Once (a part of) the railway network is constructed or upgraded to interoperability, the interoperability must be demonstrated and accepted. According to the processes described in the HSD (High Speed Directive) and CRD (Conventional Rail Directive), interoperability must be verified in two steps.

The first step of the check on interoperability is the verification of technical conformity. Constituents and Subsystems are checked by Notified Bodies against the requirements written in Annex III of the interoperability directives: the Essential Requirements. These Essential Requirements are the basis for the basic parameters in the TSIs and their requirements in chapter IV and V of the TSIs. The second step is different for interoperability Constituents and subsystems.

The second step for constituents is placing on the market. There are little incentives for placing constituents with a certificate on the market. When the railway industry and system integrators don't request that their colleagues suppliers of Interoperability Constituents deliver certificates for components in the subsystems, the need for certification is effectively not present.

The second step for subsystems is the authorization for putting into service. For this step the contracting entity (Railway Undertaking, Infrastructure Manager) asks the Member State to give a license for the putting into service of the subsystem. In this way the interoperability Directives give the Member State the task to monitor the process of certification of the conformity with the Essential Requirements.

Figure 13.1 **Structure of the TSI Subsystem approach**



The whole process of creating interoperability can be illustrated by the figure below:

Figure 13.2 **Progress of developing interoperability by use of metrics**

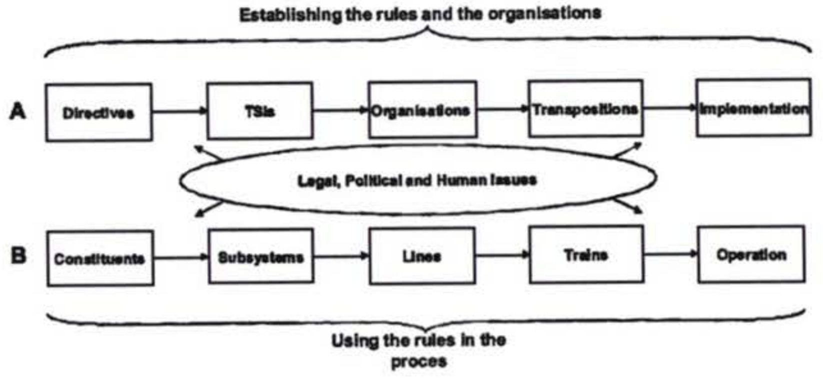


Figure 13.3 **The progress of establishing the rules**

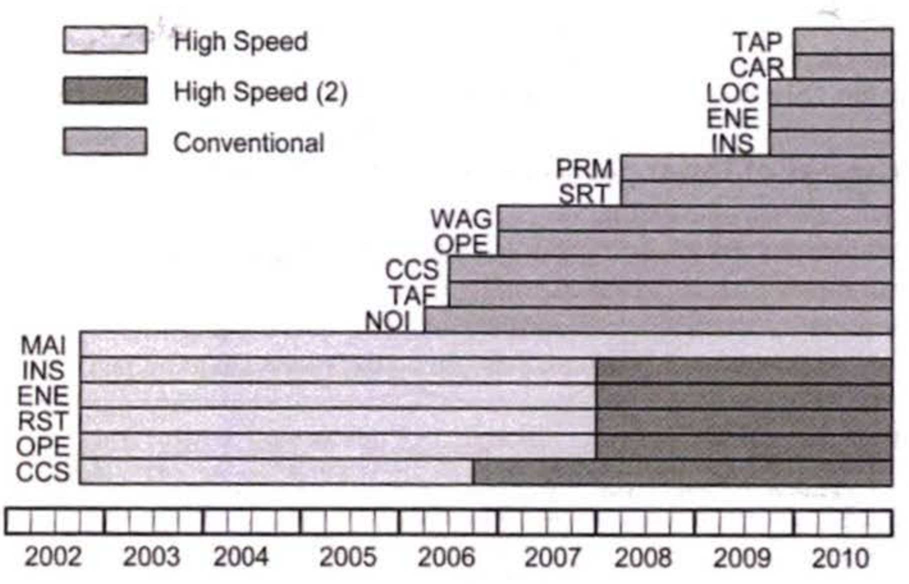
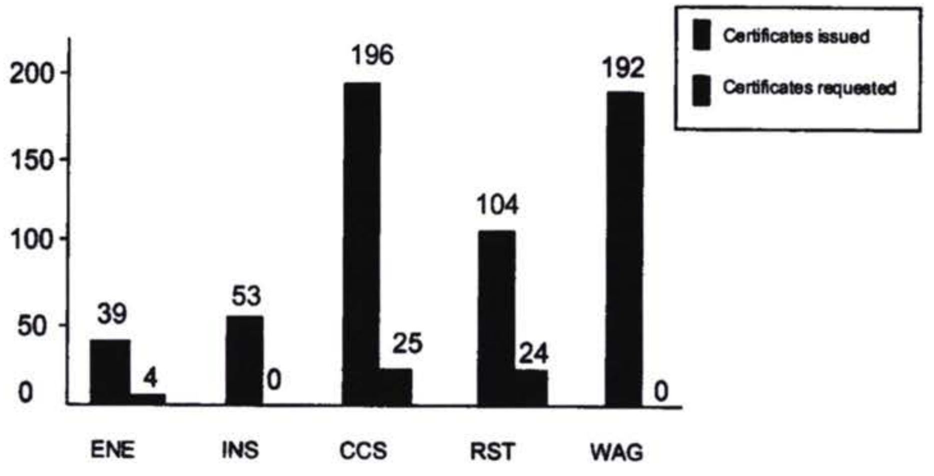


Figure 13.4 Requests and Certificates for Interoperability Constituents



It can however be conclude that interoperability is progressing. The legal system is in place. Implementations in the Member States are nearly completed. The institutions in the Member States and on European level have largely been established. A large part of the TSIs is available. The first interoperable parts of the network have been put in operation. Interoperable traffic on these lines is starting to take place. Interoperability now can grow further from "pragmatic" to "full".

ERTMS is the most important driver of interoperability. The start of interoperability is clearly visible in this area. The next steps must be to develop a probably global market for ERTMS / ETCS equipment and systems. The development of this market is seen an important incentive for European industries to improve their competitiveness.

The separation of responsibilities for infrastructure management and operations is a corner stone in railway policy, which aims at improving the attractiveness and competitiveness of the railways. As consequences of this approach the new notions of interoperability, TSIs and certification must restore the systems structure. In order to reach a stable structure a strict application of these instruments is needed.

A subsystem or interoperability constituent is only really interoperable after its interoperability is demonstrated through certification. This is another consequence of the introduction of separation of infrastructure and operations.

Status of Rail Interoperability in Bulgaria

There is no notified body for interoperability in Bulgaria. Spec's for rolling stock should be reviewed if it coincides with UIC terms for interoperability. Energy, signalling, infrastructure are the 3 subsystems for interoperability (tunnel spec's too).

ERGOSE, Greece

In Greece there is a big programme for upgrading the rail network, going on during the last years, funded from E.U.

In power supply the UIC standards are applied, but it is not certified yet as a system. There is no Notified Body yet in Greece. In control and signalling there are 3 different firmware standards (of ECTS level I) applied, in 3 big sections of the network, which are not currently interoperable.

There is a plan to pass to ERTMS level II with wireless GSMR communications.

13.6 Glossary (mainly from MINIMISE) and Abbreviations for Chapter 13

Glossary of Technical Terms

Term	Definition
AC	Alternating current
barrier to interoperability (stress point)	Barriers to interoperability should be identified with reference to the four dimensions of interoperability (technical, corporate, legal and cultural).
bilateral agreement	Covers a formal agreement between two governments covering trade in air services. The phase is often used to refer to an air service agreement between two countries.
bottlenecks	A physical barrier to interoperability which limits the capacity of the transport network
capacity	In general the capacity of a transport system can be defined as the maximum transport demand that can be serviced by the system over a period of time (e.g. the maximum through-put of demand). Since this servicing of demand is constrained by not only the number and size of vehicles available but also the make-up of the infrastructure on which those vehicles will travel, capacity of a transport system can be sub-divided into: operating capacity and infrastructure capacity.
capacity management measures	These are economic, organisational and planning measures to improve the capacity situation. There are two different forms of capacity management measures:- Quantitative capacity management that influences the scale of capacity.- Qualitative capacity management to increase the productivity of capacity utilisation.
CCG	Common Components Group
CEE, CEEC	Central and Eastern European countries
CEN	European Committee for Standardisation
CENELEC	European Electro technical Standardisation Organisation
CER	Community of European Railway
code-sharing	A marketing arrangement between airlines allowing them to sell seats on each other's flights under their own designator code.
combined transport	Intermodal transport where the major part of the European journey is by rail, inland waterways or sea and any initial and/or final leg carried out by road as short as possible.
CONFETRA	Confederazione Generale Italiana del Traffico e dei Trasporti
container	A special box to carry freight, strengthened and stackable allowing horizontal or vertical transfer.
corporate dimension of interoperability	Corporate interoperability occurs when different organisations are willing and able to co-operate to provide transport services for users.
cultural dimension of interoperability	Interoperability arising from differing social factors such as regional or national, linguistic or cultural barriers.
deregulation	The partial or complete relaxation of some aspects of regulation.

Term	Definition
door-to-door	A transport service passenger or freight offering a complete package for transport users from initial point of origin to final destination including changes of vehicle or mode as appropriate.
EC	European Commission
ECMT	European Conference of Ministers of Transport
economic efficiency (1)	The economic efficiency of the transport system(s), whether measured in terms of tonne (passenger)-km per unit of time or of currency or in some other quantifiable measure, provides a general indication of the system's performance in economic terms.
economic efficiency (2)	A measure of the performance of a particular transport system and to the total cost of (both direct and indirect costs) of the movement of freight/passengers between origin and destination. The most important conditions are the current degree of competition, the capacity situation and the level of interoperability. Changes in these three system conditions will influence the economic efficiency of the transport system and this can be measured by changes in the cost or time effort of transportation.
electronic data interchange (EDI)	The direct computer-to-computer communication of business documents and information in machine readable, structured format that permits data to be processed by the receiver without rekeying.
EIM	European Rail Infrastructure Managers
ERA	European railway agency
ERFA	
ERTMS	European rail traffic management system
ETSI	European Telecommunications Standardisation Organisation
EU	European Union
European train control system (ECTS)	A common railway signalling system currently being developed to enable suitably equipped trains to run on the main lines of different European national railways.
event	A change to one or more of the policy frameworks (corporate, regulatory, technical, regional) which influence transport system organisation.
express service	A professional delivery service which carries goods from sender to addressee by assembling large numbers of units and distribute them internally in accordance to a flexible transport programme with guaranteed delivery times. In Germany, same day or next day delivery (24 hours) is applied usually to all distances.
feeder	Ships / services used for traffic to/from a hub port served by mother ships.
franchise market environment (public transport)	Intermediate between open access deregulated and regulated market environments. Most transport companies are privately owned. Public authorities encourage competition for the market through renewable tendering for the network or a fixed group of routes (off-the-road competition), but authorities attempt to maintain an integrated public transport system by allocating routes, generally providing fixed subsidies and through the regulation of the fares and routes
Freedoms of the Skies (1st Freedom)	The right of an airline of one country to fly over the territory of another country without landing.
freeport	Zone where goods can be stored without payment of relevant duties and taxes until leaving the zone.
freight village	A single large site which includes a terminal, other technical and administrative facilities associated with combined transport (agents, shippers, customs etc.) and accommodation for companies engaged in combined transport.

Term	Definition
full interoperability	The maximum degree of interoperability among the operators and operations (by the given technological state) in the different levels and in the different dimensions at each scale. This can be realised if there is no trade-off between interoperability and economic efficiency.
function	The flow of traffic defined with reference to the nature of its cargo i.e.. freight or passengers.
gantry crane	An overhead crane comprising a horizontal gantry mounted on legs which are either fixed, run in fixed tracks or on rubber tires with relatively limited manoeuvre in one plane. Such cranes normally straddle a road/rail or ship/shore interchange. Rubber-tiered gantries are more mobile than gantry cranes and are used for stacking and moving containers, usually in rows, in storage areas.
GNP	Gross National Product
ground handling	Ground handling is a term which is often used generically. IATA, however, in its Standard Ground Handling Agreement isolates specific components: - ground administration and supervision; passenger handling; baggage handling; cargo and mail handling; ramp services; cleaning; fuelling; aircraft maintenance; flight operations and crew administration; service transport; and catering services.
GSM	Groupe Spéciale Mobile
GSM-R	Global System for Mobile Communications - Railway
high cube container	Container of standard ISO length and width but with extra height -9'6" (2,9m) instead of 8' (2,44m). For the time being, this applies only to 40' containers.
horizontal level of interoperability	The interoperability within the individual transport markets (operations, telematics, and infrastructure).
HST	High-speed train
hub	Central point for the collection, sorting and distribution for a particular region or area.
hub and spoke	The merchandise (and passenger) distribution system characterised by a big central transhipment point and by more widespread services to smaller distribution centres or customers.
ICAO	International Civil Aviation Authority
IEEE	Institute of Electrical and Electronics Engineers.
IM	
impediments to interoperability	A lack of interoperability within or between transport system(s) which may be expressed in terms of specific technical, corporate, legal and/or cultural barriers.
infrastructure capacity	The maximum number of vehicles which can utilise the transport system infrastructure network over a period of time (measured in veh/h). The infrastructure capacity for a transport system is, in general, determined by the capacity of the weakest link in that system. This is usually where flows interact with each other in some way, such as at junctions for car traffic, stations for bus/train traffic, and terminals for freight.
infrastructure market	Refers to installations and facilities that provide a framework for the transport system e.g. power supplies, public utilities.
infrastructure stock	The quantity of existing infrastructure (measured at a particular point in time).
initial state of interoperability and economic efficiency	The state of interoperability and economic efficiency existing prior to an "event" occurring.

Term	Definition
integrators	A freight transport operator offering a range of services, integrating different transport modes and sectors into one or more logistic systems (e.g. UPS is considered to be an integrator in offering parcel and express services)
inter-city express	A limited-stop transport service linking city centre at a national scale
interchange	The act of moving passengers and/or freight between different vehicles or the point or node at which this transfer takes place.
interconnectivity	The physical linkage and co-ordination of transport systems, either within or between modes, to facilitate the transfer of freight or passengers. Interconnectivity is a pre-requisite of interoperability.
intermodal (1)	(1) a characteristic of a transport network which allows the use of at least two different transport modes for at least one single trip from origin to destination. (2) a characteristic of a trip which uses at least two different modes from origin to destination. (3) a characteristic of a nodal point (=terminal) which allows the transfer between at least two different transport modes.
intermodal (2)	Indicates that the route of an individual passenger or goods unit consists of a combined chain from origin to destination involving at least two different modes. For freight transport in particular intermodal transport indicates the transport between two points in which several modes of transport are used in succession without handling of the goods during mode changing operations. A transport network or route serving passengers and/or goods is intermodal if it is established by means of more than one mode. [Strategic Research - Additional Information, P. 89, 1995]
intermodal transport	The movement of goods in one and the same loading unit or vehicle which uses successively several modes of transport without handling the goods themselves in changing modes.
IT&T	Information Technology and Telematics
ITU	Intermodal transport unit; containers, swap bodies and semi-trailers suitable for intermodal transport.
interoperability (1)	The ability of two or more given systems to operate effectively together in accordance with a prescribed method. In a narrower sense this is the ability of national transport systems (or sub-systems) to co-operate across national borders (and across their socio-economical, legislative, organisational, technical, geographical and physical barriers). Interoperability is a multi-faceted concept, which can be distinguished by different levels, dimensions and scales.
interoperability (2)	A quality of two or more interacting transport systems. It is the ability of transport systems to offer harmonised interfaces and an acceptable level of service thus giving easy access to operators. Interoperability reduces barriers between transport systems (e.g. institutional, legislative, financial, physical, technical, cultural or political barriers).
JIT	Just-in-time
legal dimension of interoperability	Legal interoperability occurs when impediments to interoperability such as national anti-trust laws, and differing implementation of EU directives by nation states are removed or harmonised
lift-on - lift-off "LO-LO"	Loading and unloading of ITU using lifting equipment.
lighter- aboard ship (LASH)	A ship-borne system, in which the barges are loaded, linked together and pushed down an inland waterway to point that can be reached by a ship, where the barges are lifted onto the mother ship with the use of gantry cranes. Variants: FLASH/SPLASH.

Term	Definition
load containers	Standardised container according to the International Railways Union norms (UIC), for an optimal use mainly in rail road combined transport.
load factor	Loaded percentage with respect to the loading capacity of a vehicle or load unit.
loading track	Track on which goods are loaded, unloaded, transhipped from wagons onto the platform or road vehicles.
loading unit	Container or swap body.
low-loader wagon	A rail wagon with a low loading platform specially built to carry intermodal transport equipment.
maritime container	A container conforming to standards that enable it to be used in a cellular ship. Most maritime containers conform to International Standards Organisation (ISO) standards.
market environment	A system organisation defined according to common characteristics relating to type of ownership, fare regulation, quality of licensing, nature of access by the operator to the market, the level of planning, the regulatory mechanism, entitlement to run services and nature of subsidies.
market structure	The structure of transport markets are dependant on the nature of the transport services, the technical conditions to provide them, the number of participants within a market the interaction of demand and supply within each market and the regulative conditions.
maximum capacity	The maximum number of passengers or volume of freight (per unit time) which can be accommodated by the maximum number of available vehicles.
multi-modal level of interoperability	The interoperability among the different modes of a transport system.
multimodal	The traditional definition of multimodal transport refers to the situation when passengers or goods are carried by at least two different modes of transport (see also "intermodal transport"). The term multimodal or multimodality may also indicate an analysis, an approach or a choice which consider more than one mode, e.g. that passengers and freight consignors are able to choose from among at least two different modes of transport serving the same route, corridor or network.
multimodality	A characteristic of a transport network in which at least two modes compete for taking trips in the same corridor.
observed capacity	The degree of utilisation of operating stock (or simply the operating flow or capacity utilisation).
OFG	Operations Focus Group
open access market environment (public transport)	Public transport services are established by privately owned operators according to market demand and fares are set by the operating company with no regulation. There is free entry to the market and there is very little public interference or subsidy (although some socially necessary services are put out to tender and subsidised by local authorities, which may also provide financial support for concessionary fares).
Open Skies	The US policy of liberalising their bilateral air service agreements.
operating capacity	Relates to the capacity and number of available vehicles and is the maximum volume of passengers or freight goods which can be carried by those vehicles.
operating flow	The degree of utilisation of operating stock (measured over a specified time period).
operating stock	The quantity and type of available vehicles (or rolling stock) measured at a particular point in time.

Term	Definition
optimal capacity	A quantitative and qualitative measure which permits the evaluation of both the adequacy and the quality of vehicle service provided by the system under study. A situation where the capacity supply and demand and quality supply and demand are in equilibrium.
optimal interoperability	The highest degree of interoperability that can be attained without incurring more additional costs than benefits. An improvement is probably worth carrying out only where the social cost of providing additional interoperability is less than the social benefits resulting from such an improvement.
optimisation	The process of improving something in accordance with specific goals.
organisational interoperability	Organisational interoperability occurs when different organisations are willing and able to co-operate to provide transport services for consumers.
overpanamax	Ship with dimensions greater than 295m (length) 32,25m (beam overall) or 13,50m (maximum draught).
pallet	A raised platform, normally made of wood, to facilitate the lifting and stacking of goods. Pallets are of standard dimensions - 1000 mm x 1200 mm (ISO) and 800 mm x 1200 mm (CEN).
panamax	Ship with dimensions that allow it to pass through the Panama canal: maximum length 295m, maximum beam overall 32,25m, maximum draught 13,50m.
parcel	Individual goods prepared for transport, with a maximum weight of usually up to 31.5 kg, a maximum length of 175 cm and a maximum girth of 300 cm.
parcel service	A professional delivery service which carries parcels (including documents) from sender to addressee by assembling large numbers of parcels and distribute them internally in accordance to a fixed and definite transport programme, without guaranteed delivery times for all parcels. In Germany, next day delivery (24 hours) is applied usually to all distances less than 600 km, otherwise the two day delivery (48 hours) is applied.
park and ride	A transport system designed to encourage car users to use public transport to gain access to city centres. Park and ride can involve bus, light rail or rail modes and should ideally offer a fast, frequent and high quality service to the CBD from conveniently located parking sites on the main road network.
piggyback transport	Combined transport by rail and road.
policy framework	Transport policy can be categorised into four broad frameworks: see technological framework, corporate framework, regulatory framework and regional framework
postal parcel service	Usually the formerly national parcel service, which delivers parcels that have been brought to post offices, now emerging to a full parcel service.
privatisation	The process of full or partial transfer of ownership from the state to the private sector.
procedural interoperability	The adoption, in different pieces of equipment required to communicate, of a common format of presentation, the same working procedures and data delivery, and common data element definitions for the information to be exchanged
provision of transport services	The combination of infrastructure, transport service operations, and telematics markets which is necessary to realise a certain form of transport.
reach stacker	Tractor vehicle with front lifting equipment for stacking and moving containers or swap bodies.
real-time information	Details of the current location or predicted arrival times of vehicles or services which is constantly updated to provide accurate information for transport operators, passengers or freight customers.

Term	Definition
regional express	A limited stop transport service usually operating within a particular region linking two or more central business districts
regional policy framework	The regional framework of a transport system is defined with reference to current EU regional policies.
regulated market environment (public transport)	The transport network is co-ordinated and integrated by a public body. This enforces a uniform fare policy and regulates entries and exits by means of fixed entitlement, giving operators protection from competition. Operators are usually publicly owned, although some sub-contracting to private operators occurs. Routes may be licensed individually or as a fixed group of routes. Subsidies are generally high and cross-subsidy between profitable and loss-making routes may exist.
regulation	A regime of government and/or legislative control which affects some aspects of the quantity, quality or price of transport services.
regulatory policy framework	The regulatory framework of a transport system is defined with reference to the governmental and legislative organisations and instruments which regulate the provision of transport services.
RNE	
ro-ro ramp	A flat or inclined ramp, usually adjustable, which enables road vehicles to be driven onto or off a ship or a rail wagon.
roll-on - roll-off "ro-ro"	The facility for a road vehicle to be driven on and off a ship or, as in the case of rolling road, a train.
RST	
RU	
scale of interoperability (1)	Three scales of interoperability have been identified for the European transport systems: European; sector and company scales
scale of interoperability (2)	in public transport 5 scales of interoperability have been identified: (intra-) urban, (intra-) regional, regional express, inter-city express and international
seamless transport	A transport service which is without any significant or inconvenient breaks of journey from the point of view of the transport system user. Where such breaks do occur due to interchanges between different services, operators or modes, the time penalties and other inconvenience caused should be kept to a bare minimum in order to achieve as seamless a transport service as possible.
sector scale of interoperability	Separately identifiable transport sectors e.g.. the Parcels Sector, the Urban Passenger Sector etc.
selective vehicle detection (SVD)	Selective vehicle detection. A vehicle detection system which can be used for example to change traffic signals to green as suitably equipped vehicle approach them in order to speed up their journeys.
semi-trailer	Any vehicle without a motive power unit, towed behind an articulated road vehicle. A semi-trailer unit can be handled both with Roll on / Roll off (horizontal handling) and with Lift on / Lift off (vertical handling) operations.
SORT-IT	Strategic Organisation and Regulation in Transport - Interurban Travel
short-sea shipping	Maritime transport services which do not involve an ocean crossing. It includes maritime transport (of passengers and goods) along the coast and the mainland coasts and islands of the European Union and other States in the Baltic Sea, the Black Sea and the Mediterranean areas. It covers purely national transport (cabotage) and cross border services, as well as sea-river transport by coastal vessels to and from ports in the hinterland. Adapted from [COM317, 95].
slots	The right to land and/or take off from an airport at a specified time.

Term	Definition
spreader	The mechanism connecting the lifting cable on a crane or gantry to a container. A spreader has four adjustable fixing points designed to connect with the upper twistlock corners on, usually 20' or 40' containers.
SSS	Short Sea Shipping
stacking	Stacking Intermodal Transport Units (ITU) one over another.
statistical indicators	Each statistical indicator should provide a systematic and consistent measure of a given base level output. Ideally statistical indicators should be quantitative measures in standard units, to facilitate comparisons between different case studies.
stop-on-demand bus	A bus services which stops anywhere along its general corridor of operation to set down passengers as close to their destination as possible even if this is slightly away from the bus's designated route.
straddle carrier	A fully mobile overhead lifting vehicle for moving containers.
stuffing/stripping	Loading and unloading of cargo into or from a ITU.
super high cube container	Container of extra standards ISO length, width and height. These dimensions may fluctuate, reaching lengths of 45' (13,72m), 48' (14,64m) or 53" (16,10m).
swap body	Freight carrying units not strong enough to be stacked, except in some cases when empty, or top-lifted. Used only in rail/road movements.
system capacity	The maximum transport demand which can be serviced by the transport system over a period of time (i.e. the maximum throughput of demand).
system organisation	The nature of a transport system with reference to elements of technical, corporate and regulatory frameworks.
system-inherent advantage	A system-inherent advantage arises when a mode of transport has a recognisable advantage over another mode with respect to one aspect of performance e.g.. speed, distance, quality. This may be described as the mode having a comparative advantage over another mode.
TAF	Telematic Applications for Freight
tare	Weight of ITU or vehicle without cargo.
technical barrier	A different technical standard or specific technical requirement that must be met in order to introduce or operate a transport service.
technical dimension of interoperability	Technical interoperability occurs when there are links between different transport systems through similar and compatible technologies.
technical interoperability	Technical interoperability occurs when there are links between different transport systems through similar and compatible technologies.
technical policy framework	The technical framework of a transport system comprises elements of the physical and technical infrastructure.
telematics market	The combination of information technology and telecommunications.
terminal	A place where a modal change takes place. (see also "hub" entry).
TEN	Trans-European Network
TEN-T	Transeuropean transport networks
TEU	Twenty foot Equivalent Unit (6,10m). A standard unit for counting containers of various lengths and for describing the capacities of container ships or terminals. One standard 40' ISO Series I container equals 2 TEUs.
TGV	High speed train services in France
through ticketing	Public transport tickets available for multi-stage journeys involving at least one change of service. Through ticketing may be available for journeys involving single operators or transport modes or multi-operator or multi-modal journeys depending on the exact nature of the through ticketing scheme.
track sharing	A sharing of rail infrastructure between light and heavy rail services

Term	Definition
trailer	Any non powered vehicle intended to be coupled to a motor vehicle, excluding semi-trailers.
train path	Slots in the timetable for trains to pass without delaying other trains or being delayed.
transferability	Transferability (of results) between different market environments.
transitional market environment (public transport)	The transition from a highly planned socialist model, in which all public transport was determined by the state or local authorities, towards a market economy e.g. Hungary. At present the state may still retain a high degree of control with stringent fare regulation and restricted market entry. The state allocates a fixed collection of routes which are retained by legal entitlement; subsidy levels remain high due to the provision of flexible subsidies. There are limited experiments with private vehicle ownership.
transport (traffic) flow management	This is the organisation of vehicles on the transport infrastructure. The combination of infrastructure and vehicles determines the traffic flow and leads to the capacity and the quality of a transport system (real capacity situation).
transport infrastructure	The fixed physical structures and other common facilities serving the operational parts of a transport system [Strategic Research - Additional Information, P. 89, 1995].
transport quality	A combination of factors which affect the level of service offered by a transport system (including speed, safety, comfort and operating cost). Transport quality has both objective and subjective aspects. Overcoming costs are objective values, but the individual perceptions of the transport users are subjective. Transport quality is therefore extremely difficult to measure accurately and is normally measured as average traffic speed or as transport costs.
transport system	A collection of transport services relating to specific modes and to a specific function which are provided within distinct technical, corporate and regulatory frameworks and which may comprise a combination of subsystems (infrastructure, operating and telematic) within a transport mode (uni-modal transport system) or among different modes (multi-modal transport system).
transport system capacity	The maximum transport demand which can be serviced by the system over a period of time (i.e. the maximum throughput of demand).
twistlock	Standard fixing pieces for securing ITU to the carrying vessel or vehicle.
TSI	Technical specifications for interoperability
TAF	Telematic applications for freight
unaccompanied transport	Transport of road vehicles or part vehicles through an other mode of transport (for example by ferry or train) not accompanied by the driver.
UIC	INTERNATIONAL UNION of RAILWAYS
UIP	
UNIFE	Union des Industries Ferroviaires Européennes
unit load	Pallets and pre-packed unit to be put into a loading unit. Cargo packed or grouped into discrete units which usually conform to pallet dimensions.
vertical level of interoperability	The interoperability between different markets (e.g.. between infrastructure and operations).

13.7 Sources and Links

- EC Directives
- MINIMISE project
- UIC
- IRS TURKEY conference 2008, paper 0100
- WIKIPEDIA
- Rail transport: new agreement to accelerate deployment of the European Railway Traffic Management System (ERTMS) [IP/08/1107, 04/07/2008]
- Commission facilitates interoperability for Europe's trains [IP/08/629, 23/04/2008]
- ERTMS: a major European project for the rail networks [IP/05/321, 17/03/2005]
- **Memorandum of Understanding (MoU):** MoU between the European Commission and the European Railway Associations (CER - UIC - UNIFE - EIM - GSM-R Industry Group - ERFA) concerning the strengthening of cooperation for speeding up the deployment of ERTMS, July 2008 [469 KB]
- ERTMS - Delivering flexible and reliable rail traffic. A major industrial project for Europe. ERTMS in 10 questions [33 KB] All available translations.
- ERTMS
- UNIFE
- Communication of the Commission to the Council and the European Parliament: "Facilitating the movement of locomotives across the European Union", COM(2006)782 final of 13 December 2006
- Proposal for a Directive of the European Parliament and of the Council on the Interoperability of the Community rail system, COM(2006)783 final of 13 December 2006
- Proposal for a Directive of the European Parliament and of the Council, amending Directive 2004/49/EC on safety on the Community's railways, COM(2006)784 final of 13 December 2006
- Proposal for a Directive of the European Parliament and of the Council, amending Regulation (EC) No 881/2004 establishing a European Railway Agency, COM(2006)785 final of 13 December 2006
- Commission staff working document accompanying the Communication from the Commission to the Council and the European Parliament "Facilitating interoperability of locomotives across the European Union", SEC(2006)1640, 1641 and 1642 final of 13 December 2006
- Communication from the Commission to the European Parliament and the Council - Rail noise abatement measures addressing the existing fleet COM(2008)432 of 8/7/2008
- Greening transport Package website
- **The revised interoperability Directive 2008/57/EC of 17.06.2008 has been published in the Official Journal L 191 of 18.07.2008**
- Interoperability and ERTMS
- |Recently adopted new and revised technical specifications for interoperability
- |Mandates to the European Railway Agency
- |Interoperability of the trans-European high-speed rail system
- |TSIs for the trans-European high-speed rail system
- |Notified Bodies in the Member States
- |Interoperability of the trans-European conventional rail system

- |TSIs for the trans-European conventional rail system
- |ERTMS - European Rail Traffic Management System
- |Implementation Interoperability Directives
- |Registers
- Simulation Interoperability Standards Organization (SISO)
- Interoperability. What is it and why should I want it. Ariadne 24 (2000)
- Interoperability Summit

14 Interoperability: MINIMISE Project

Learning Objectives for Lecture 14:

- To learn about an early E.C. project which has studied interoperability problems and impacts in all transport subsectors.
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14.1 Introduction

An economic efficient and well-operating transport system is one main prerequisite for both prosperity and cohesion of an economic and political community. Especially for a growing together community like the European Union the improvement of its transport system is of great importance to be well prepared for worldwide competition. The improvement of the European Transport System therefore is one objective of European policy.

Europe is faced with a rapidly changing transport market and new integrative transport services as well as increased importance of multimodality and intermodality. The different modes have to increase their ability to work together in a more efficient way. This raises the question of how to allow the emerging European Transport System to better operate and thus to increase its capacity. To answer this question, interoperability is introduced as a key objective. It is characterised by adjustment and easing of the transition between different transport modes as well as between different states and regions. A purposeful European transport policy has to support efficient transport processes, improve interconnections between different modes, create interfaces between transport operators and shipping industries, and to promote the co-operation between transport operators and infrastructure managers.

But interoperability does not stand on its own. Further driving forces for a better use of transport systems are competition, deregulation, privatisation, and a better management of available capacity. Interoperability is influenced by changes in those driving forces. Therefore, investigations aiming at the improvement of interoperability have to take the effects arising out of those changes into account since they can influence interoperability in either a positive or negative sense. The Commission of the European Union has therefore structured this problem area and included it in its Transport Research Programme.

The overall objective of *MINIMISE* **(M**anaging **In**teroperability by **Im**provements **i**n Transport **S**ystem Organisation in **E**urope) project was to analyse the European transport market as a whole and to design specific policy measures in order to promote interoperability and economic efficiency of the European Transport System. To reach this, an integrated approach was used encompassing all elements of the transport system.

MINIMISE has analysed different sectors of the European Transport System both in passenger and freight transport to identify impediments to interoperability and to specify measures which may improve interoperability and thus contribute to economic efficiency of the system in accordance with the aims of the Common Transport Policy of the European Union.

The *MINIMISE* research has been structured in three phases, which form the major milestones of the project:

(1) The project started with a preparatory phase to provide a general theoretical basis for the analysis of interoperability in the European Transport System. The three core topics of *MINIMISE* were:

- Competition, Privatisation and Deregulation,
- System Organisation and
- Capacity Management

These therefore have been investigated separately first. Work package A examined the influence of deregulation, privatisation and competition on the achievement of interconnectivity and interoperability, in accordance with Task 23 in the EC's 1994 Transport Research Program. Work package B examined the influence of system organisation on interconnectivity and interoperability (Task 24) and Work package C examined the influence of capacity management strategies on interconnectivity and interoperability (Task 25). The findings of these research Tasks were used for the development of the Common Analytical Framework (AF), which ensured that Case Studies are conducted consistently and systematically, using the same procedure, whilst being sufficiently flexible to take into account actual differences between sectors of the Transport System.

(2) After about 6 month of research work followed the Case Study phase to analyse sample sectors of the European Transport System, to test and further improve the Common Analytical Framework, and to propose Case Study specific improvements of the existing transport system. Seven Case Studies, in which passenger and freight transport are both represented, have been identified to give input to the *MINIMISE* research work. These Case Studies were:

- CS I European Parcel Services
- CS II Trans-European Road Freight Transport
- CS III European Rail Transport
- CS IV European Waterborne Transport
- CS V European Intermodal Transport
- CS VI European Air Transport
- CS VII European Urban/Interurban Public Transport

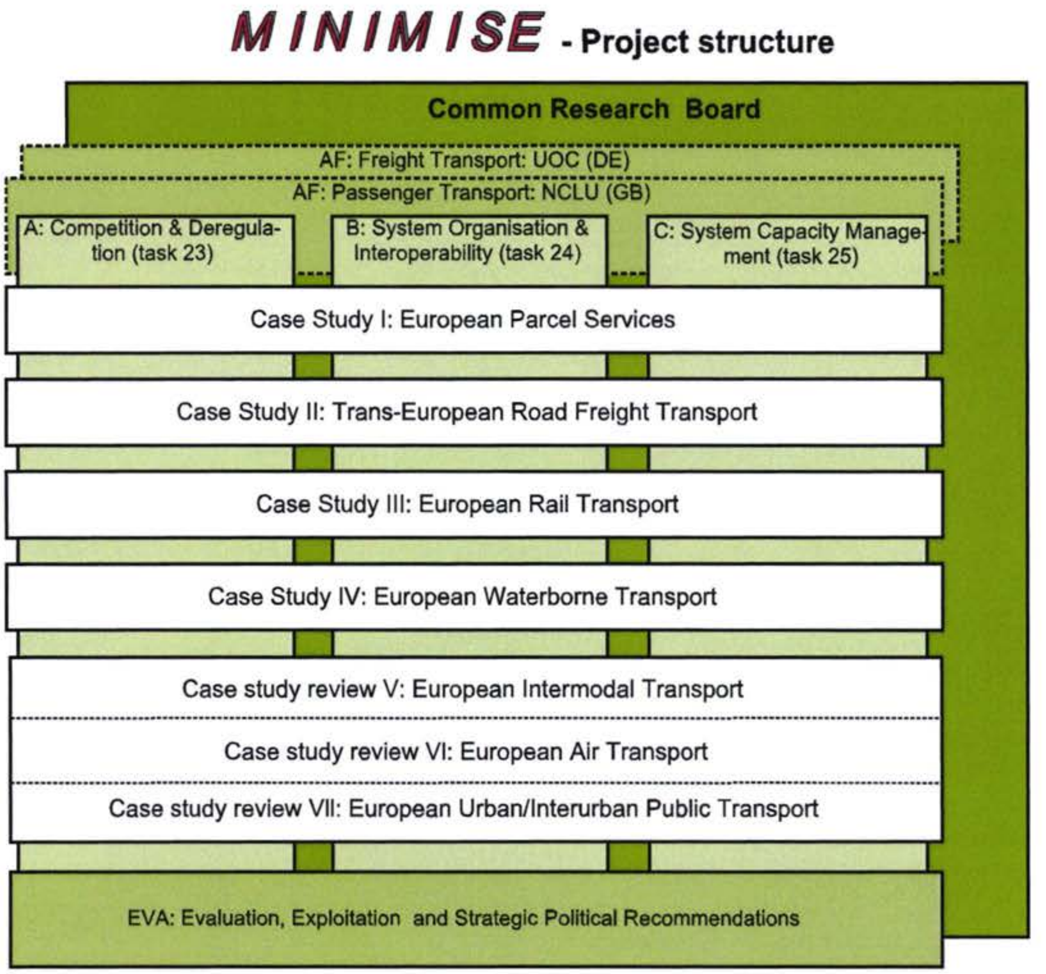
The investigation of interoperability and/or identification of possibilities to improve interoperability is carried out by identifying impediments to interoperability. These impediments could occur from several reasons, e.g. competition/regulation, system organisation or technical reasons. In a first step those impediments were identified and afterwards, policy measures were identified in order to overcome these impediments.

(3) The third phase includes an evaluation phase to bring results from Case Studies together and to formulate recommendations for the overall improvement of the European Transport System. The evaluation methodology includes institutional, economic and distributive filters, to identify the policy measures which are the most efficient. According to different criteria, which represent political strategies, the policy measures are combined to scenarios, for which the total effects are summarised. Finally a Commission strategy for different fields of activity is recommended.

14.2 Interoperability and Economic Efficiency of the European Transport System

Highly developed industrial societies need an effective and efficient transport system. This is all the more true for a community of states, which is going to grow together more and more. Effectiveness and efficiency depend on several factors. Among those factors, competition and organisational effectiveness, system organisation for developing interoperability and system capacity management have been identified as important factors with influence on the European Transport System. These factors are the more important since we have to look at a transport system which consists of several national subsystems with partially different features which sometimes make a co-operation difficult. Different national attitudes to regulation, privatisation and competition have led to national subsystems which range from private to state-owned and from regulated to deregulated. Different technical solutions, different technical state-of-the-art and different systems of capacity management have all influenced the current state of the subsystems.

Figure 14.1 The MINIMISE project structure



Changes in competition, regulation and privatisation as well as system capacity management influence not only each other, but have also direct and strong consequences on interoperability. Taking the different national subsystems into account and the requirement to create one effective and efficient European Transport System, in particular interoperability seems to be the key factor for the improvement of the European Transport System. Interoperability and economic efficiency are seen in close relation and are defined as follows:

- Interoperability is the ability of two or more given systems to operate effectively together in accordance with a prescribed method. In a narrower sense this is the ability of national transport systems (or sub-systems) to co-operate across national borders (and across their socio-economic, legislative, organisational, technical, geographical and physical barriers). Interoperability is a multi-faceted aspect, which can be distinguished by different levels, dimensions and scales.
- Economic Efficiency describes the quality of performance of a transport system in relation to the total cost (both direct and indirect costs) of the movement of freight/passengers between origins and destinations.

Interoperability can be seen as one means to improve the economic efficiency of the European Transport System. The improvement of interoperability is suitable to contribute to a more efficient European Transport System.

14.3 Trans-European Road Freight Transport (Case Study II)

14.3.1 Description of Case Study

This case study focuses on European long distance road freight transport, intra-EU and extra-EU. The aim of this case study is to describe how interoperability in European road freight transport can be improved. A quantitative description of the EU road freight market and especially of the markets in the Netherlands, Germany, Greece and France is given. The next step was to point out impediments, policy measures and trends in road freight transport. The priority of the impediments was determined by interviewing transport companies and authorities.

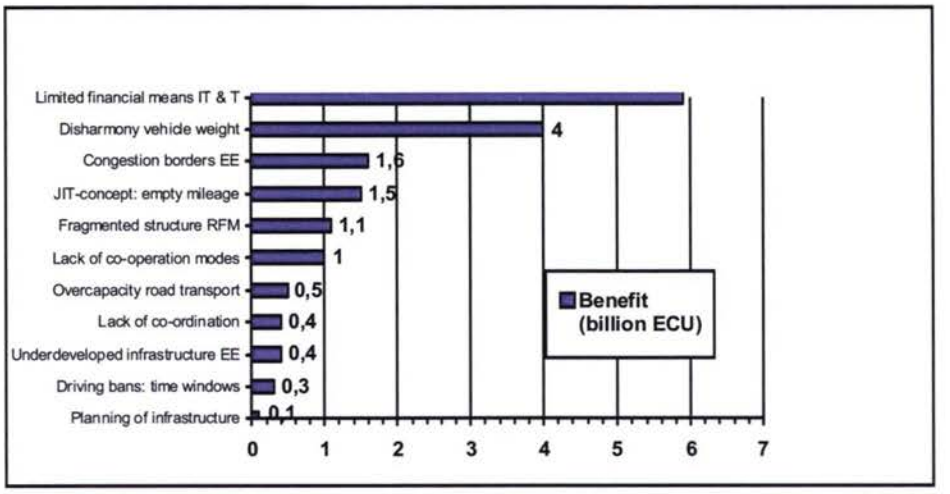
14.3.2 State of the Art and Description of Interoperability Problems (Impediments) and Related Policy Measures

Transport companies regard the legal restrictions concerning measurements, weights, driving and resting times and driving bans as the most important impediments with respect to interoperability in the road freight transport market. Furthermore, from the point of view of both authorities and transport companies in all concerned countries the most important impediments are mainly congestion at borders in eastern Europe and the lack of co-operation between the different transport parties, i.e. co-operation between transport companies, modalities and shippers. The Greek transport companies consider the underdeveloped infrastructure in Eastern Europe and the problems with going through customs as the most serious impediments. French as well as German transport companies and authorities perceive the main impediments in the field of organisation.

The impact of the most important impediments perceived by transport companies and authorities has been quantified. The benefits have been calculated on the basis of statistics from EUROSTAT, several research projects in the field of road transport and different articles in transport magazines. The statistics are related to international EU road freight transport.

The gross economic benefit of the abolition of the impediments is calculated on an annual basis, relating to company and/or society level. The impediments of which the benefits were calculated are shown in the Figure below. The abolition costs are calculated for each impediment and can be defined as the costs which have to be incurred (i.e. invested) in order to realise savings resulting from the abolition of the benefits. These costs are calculated once only, as against the economic benefits, calculated on an annual basis.

Figure 14.2 **Gross annual economic and environmental benefit of the abolition of eleven impediments in Trans-European road freight transport**



14.3.3 Conclusions and Case Study Specific Recommendations

Conclusions have been drawn with respect to the value to be obtained from the abolition of impediments. The feasibility and profitability of seven impediments can be compared, which are given in Table 14.1.

Table 14.1 Cost and benefits of abolition of impediments (all costs and benefits in billion ECU)

Impediment	Action to be undertaken by EC	Costs EC	Costs market	Benefits on annual basis	Social acceptability (high/ medium/low)	Level of impl. regional, national, European
Insufficient application of IT&T	finance investment costs in IT & T	0.3	1.7	5.9	H	European
Disharmony of vehicle weight	change legislation	0	0	4.0	L	European
Congestion's at border crossings in Eastern Europe	finance investment costs in border crossings	>1	0	1.6	H	regional
Over capacity RFM	heightening barriers of entry *	0	0.1	0.5	M	European
Lack of co-ordination shipper and transporter	no	0	?	0.4	L	European
Underdeveloped infrastructure Eastern Europe	finance investment costs in road infrastructure (total: 50 billion ECU) **	12.5	0	0.4	H	regional, national
Driving bans	put pressure upon national governments to adapt driving bans	0	0	0.3	M	national

* *Does not provide a complete solution*

** *Investments are made not only for transport companies, but also benefit private motorists*

14.3.4 Recommendations

Table 5-1 shows that the abolition of four of the impediments has both a high benefit and a high or medium social acceptability. These impediments are:

- insufficient application of IT&T;
- congestion at border crossings with Eastern European countries;
- driving bans;
- over-capacity on the road freight market.

The EC strives for a more efficient (both economic and environmentally) road freight transport sector. This *MINIMISE* case study shows that improving interoperability in road freight transport is both socially acceptable and has a high return on investment for at least 4 policy options, which are:

- Support road freight transport companies in implementing IT&T, for instance by contributing to part of the investment costs. This will speed up the implementation of telematics applications in road freight transport, thus

reducing empty mileage. The major part of the investment costs should still be paid by the companies; the EU or national subsidy could be around 25%.
- Investment in border crossing facilities in Eastern Europe. The delays encountered presently are very high. Therefore annually 1.6 billion ECU on benefits could be achieved. The costs are difficult to estimate, but are estimated to be at least 1 billion as an initial investment and additionally annual operating costs. Improving border crossing facilities should be an action taken by the EU.
- Abolition / adaptation of driving bans. Driving bans make it very difficult for transport companies to make efficient transport planning and causes high costs for the transport companies. Abolition/adaptation of driving bans is a matter of negotiations with the national authorities and should not cost much money, unlike investments in IT&T or border facilities. Annual benefits are estimated to be 0,3 billion ECU.
- Reduction of over capacity on the road freight market. The over capacity on the road freight market results in a lower profitability for companies, as margins are constantly under pressure. The EC could heighten entry barriers to this market; thus reducing the number of market entries and forcing a market shake out.

Other policy options, like increasing vehicle weights, have a high economic potential.

14.4 European Rail Transport (Case Study III)

14.4.1 Description of Case Study and State of the Art

To reverse the decline of European railways, Council Directive 91/440 asked national governments to take appropriate measures to enable the management of national companies to explore competitive advantages of the railways (in both environmental and commercial terms) in order to serve geographically broader and more integrated international markets. It also directed that domestic reforms should have to be framed with regulatory principles set:
- To separate the management of the infrastructure from the operation of train services
- To charge fair rates for the use of the infrastructure
- To open access to national rail networks for international rail undertakings

Despite modest achievements against its key target - to create a single market for rail-based transport services - domestic reforms in adoption of Directive 91/440, as well as for internal purposes, have initiated a major transformation of the European railway industry.
With reference to the most mature reforms of national railways in Europe, four basic models were identified:
- Unbundling and privatisation, as realised in the United Kingdom
- State ownership but with privatisation of train operations alone, as in Sweden
- Vertically integrated, Commercial public holding as in France
- Commercialisation of public utility and third party access

There are many structural reasons behind the difficulties encountered in creating a single market for rail-based services in the European Union. Different from other transport industries (such as civil aviation, road haulage or container shipping, where growth of international traffic preceded market liberalisation) the railways had (and apparently still have) far fewer opportunities to capture a meaningful proportion of the sustained growth of both international trade and business experienced in the last decade in Europe.

With strong traffic imbalances and serious capacity constraints indicating that domestic passenger services are occupying most of the available capacity on main domestic and international corridors, the envisaged development of rail-based international traffic is further constrained by the overall inadequacy of infrastructure services, and especially those required to transport large, steady volumes of unitised freight traffic.

Where both InterCity and regional/commuter services have a vital role as a mass transport system little room is left even for meaningful adjustments in the performance of passenger services. When different train services (each one with its own operational requirements) compete for the use of the track not only is line capacity reduced below its theoretical level, but also the rigidity in rail production is further enhanced. Once all the margins of improved signalling are explored, solutions tend to be considered mainly in the long terms either to specialise existing networks or to implement costly expansion of physical capacity.

In freight transport, where rail market share has become marginal in terms of volumes, and even more so in terms of value of transported goods, reliance in long term solutions are further delaying the achievement of a critical mass in the envisaged development of international services. As a result of poor competitive pressure, a vicious circle is taking place in which, not only incumbent national freight divisions have less incentive to restructure but cosy agreements with both domestic Infrastructure Managers and other national companies remain by far the most comfortable option to reduce the risk of competing among each other or with more efficient new entrants, for relatively small international markets.

In the *MINIMISE* Rail Case Study the prototype software of a simulation tool - Capacity Model - has been developed to analyse the impacts from levying infrastructure charges in a context in which the Infrastructure Manager is a separate entity from train operators. The Capacity Model was developed by means of combining a conventional welfare approach (to measure user's and consumer's surplus) with direct understanding of how railway systems work and state-of-the-art applications in the field of operational research. The intention was to provide quantitative estimates of the impacts of adopting alternative criteria to regulate the Infrastructure Manager.

Without considering possible impacts that are not directly perceived by producers and users of rail services (e.g. environmental externalities) two alternative objective functions were assumed in the regulation of the Infrastructure Manager: either to maximise its profit or to maximise social welfare.

14.4.2 General Conclusions and Case Study Specific Recommendations

A *MINIMISE* Scenario **"Unbundling to promote competition"** was designed to combine regulatory options to ensure socially optimum allocation of rail capacity with policies designed to favour the emergence of as lean as possible rail undertakings. With reference to the British reform, the key measure in the latter area - leasing of rolling stock - was combined with institutional options to force the emergence of a large variety of rail undertakings and to put them all in a position to make their bid to commercialise services in different passenger and freight markets. For this purpose, the creation of a competitive market for "minimum" packages of timetable slots was considered an alternative to competitive allocation of monopolistic rights on a route-by- route basis.

The scenarios feasibility has to do with factors that are organisational and technological in nature. These include information implications/requirements for Infrastructure Managers to develop the necessary abilities to complement neutrality in capacity allocation with advanced timetable planning and traffic management. Conditions and implications will also need to be explored in terms of what a "lean" train operator may look like once its main assets are its ability to buy and commercialise "capacity slots" instead of exploiting an enormous capital asset base and grandfather rights.

While focussing on conditions to level the field for competition, rather than harmonisation, work done in *MINIMISE* would emphasise that the development of commercially sustainable rail-based freight transport industry in Europe should be considered as high priority in terms of community interest. A full application of the competition regime in the single market should therefore be applied, including on subsidies and state aid, to ensure that both incumbent rail freight divisions and new entrants in the markets for international freight transport and logistics have the same financial objectives and share the same commercial freedom, suitable measures should be tailored to create a single market for traction services and leasing of rolling stock. Auctioning capacity on corridors where freight services compete with each other and with passenger services should be considered a non-discriminatory and effective policy in order to increase efficiency in the operation of train services and to give adequate signals on investment priorities.

14.5 European Intermodal Transport (Case Study V)

14.5.1 Description of Case Study and State of the Art

In the last two decades, steady changes in manufacturing and distribution have favoured a smooth integration of industrial logistics and road freight transport. Despite strong public support and substantial subsidisation the share of unitised transport by rail has remained at about 6% of the whole market for inland freight transport in ECMT countries.
The development of international traffic in the single market is expected to result in further increase of rail-based intermodal transport both on the basis of longer haul distances - over which rail transport has competitive advantages - and on going liberalisation of the rail industry.

A large variety of published statistics was reviewed to estimate present market shares in the distribution of seaborne containers by feeder, inland waterways, rail and road services. Quantitative information on present market shares and potential demand in different geographic markets was then used as a "reference scenario" in interviews and discussions with established and potential intermodal operators. As confirmed also by the interest aroused by the Trans European Rail Freight Freeway action, an increasing number and variety of transport and logistics operators are aware that the potential of container transport and distribution is relatively unexplored and consider railways to be an essential component in the establishment of multimodal and intermodal chains at continental level [1].

Results from the *MINIMISE* Case Studies CS II, CS III and CS IV were used to identify new opportunities from on-going liberalisation of road, rail and maritime industries. As far as the railways are concerned new opportunities in the development of rail based mass transport of freight in the Union were considered within the Trans European rail Freight Freeways action, i.e. in absence of legislative changes and substantial investment.

14.5.2 Description of Interoperability Problems (Impediments) and Related Policy Measures

Using guidelines from the *MINIMISE* Analytical Framework, impediments and events in the rail-based container chains were separately identified within each sector: container shipping, port and inland terminals, the railways and railroad distribution over short distances.

Because of over capacity, both Ocean and Short Sea Shipping do not present main impediments. As reported also in Case Study IV, as unitisation and privatisation are increasing the efficiency of container operations at port terminals, main impediments were confirmed in terms of poor development and quality of rail connections.

Key success factors were identified in conditions to extend from ports to rail transport - and therefore at a number of inland terminals both infrastructure and working practices have to be adapted. Industrial procedures to handle large, steady volumes of container traffic, bigger, longer trains and the possibility of mixed trains to transport containers and swap bodies have to be introduced.

Operating requirements in rail transport were identified to reduce "high traction and handling costs": in addition to the possibility of not changing rail crews at the border, significant efficiency gains were estimated from improved, more flexible working practices (including driving hours and work shifts).

[1] According to the Commission (Interim Report of the Multimodal Group, Brussels, March 1996) multimodal transport is made of five components: 1) inland transport to the port - 2) cargo handling in the port - 3) sea transport - 4) cargo handling in the ports of destination - 5) inland transport from the port of destination to the place of final destination.

Other impediments, including time spent at border crossings, were considered less important: maritime containers often travel 2-3 weeks by sea and therefore service regularity is more important than the trip speed as such.

In order to enhance the use of rail capacity, key "events" were identified to combine improved procedures to allocate timetable slots to freight traffic by One-Stop-Shops with selective investment to eliminate localised bottlenecks. In absence of major investment, the latter were identified mainly in terms of limited length of track at stations and marshalling yards, poor rail connections with port and inland terminals.

The impediments "High traction and handling costs to compete with other modes" and "Limited capacity of rail network" have been considered as the most important impediments to interoperability in intermodal transport. They are shown below including the related events (policy measures to overcome the impediments):

High traction and handling costs to compete with other modes

The event includes the following package of measures:
- Increasing of driving hours and reduction of crew changes affects higher productivity and flexibility of staff
- Increase of the length of trains, of load factors and of the wagon use factor affect higher productivity and flexibility of fleet
- Improvement of crane speed and the introduction of fast handling facilities affect higher productivity and flexibility of plants
- Introduction and further use of new/suitable Technologies like mobile cranes, terminal management systems and customer information systems

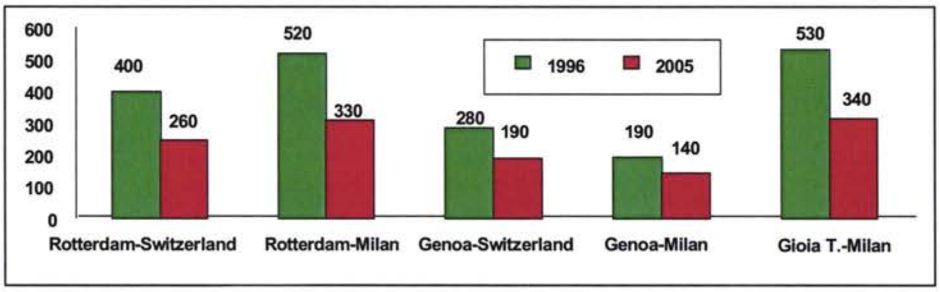
Limited capacity of rail network

The event includes the following package of measures:
- Raising of priority in the allocation of paths to freight trains (One-Stop-Shop)
- Reduced traction costs as a result from more efficient operations of trains
- Selective investments to eliminate localised bottlenecks (including port/terminal connections)
- Implementation of European Rail Traffic Management System
- Specialisation of rail lines for freight
- Construction of new lines

In order to assess the feasibility of mass transport of unitised freight in competition with other modes, a detailed analysis was completed to assess costs and performances of rail based container operations on a sample North-South corridor - Rotterdam-Milan-Genoa-Gioia Tauro. On a number of individual routes along the corridor a simplified, yet quite disaggregated, Cost Efficiency exercise was completed to identify margins for rail based services to become competitive with road haulage.

The following Figure summarises the impacts of events to increase efficiency of train operations in term of reduced cost of the intermodal transport on main corridor sections (routes).

Figure 14.3 **Costs to operate containers by rail as a function of improved operational efficiency and demand growth on selected routes (Unit cost per TEU in ECU including track charges)**



Given practical difficulties to identify local investments on the sample corridor (and therefore to estimate their costs) an "inverse" approach was applied in the assessment: as a joint result from modal diversion and improved efficiency, net revenue was estimated that more efficient service operators could re-invest to provide the capacity and the infrastructure services that are necessary to establish interoperable and efficient intermodal rail-based operations.

In the corridor sections where more efficient rail-based services could compete with all-road transport, 300 MECUs a year of net revenue (after present rail infrastructure charges) would become available from operating a meaningful, yet realistic, proportion (from present 370 000 to 1.850.000 TEU) of the volume of traffic that the main port container terminals of the corridor expect to handle in year 2005.

With quite promising conditions in place on the demand side, poor operational performances of rail freight operations and inadequate quality of rail infrastructure services are key impediments to the establishment of rail based transport of unitised freight in trunk sections of the inland leg of maritime container movements.

With both established rail companies and new types of intermodal operators keen to exploit the potential of such markets, it is pointed out that, from the point of view of new entrants, the present situation could be described as an hostile context i.e. a context in which incumbents are fighting hard to maintain their position unchallenged in order to explore the competitive advantage of the railways within the "opportunity window" opened by the Freeways.

14.5.3 Conclusions and Case Study Specific Recommendations

Measures to increase the degree of competitiveness of international markets for intermodal transport should be designed to ensure that - when establishing a One-Shop-Stop - the track managers of a given Freeway are keeping a neutral attitude in order to grant access right to licensed operators. In some combination with target-specific, non-discriminatory rules to grant subsidies to freight operations (say to divert traffic from less environmentally friendly modes instead of favouring the restructuring of incumbent national freight divisions). The neutrality of Infrastructure Managers for different sections of international corridors should also be considered a requirement for eligibility for investment co-funding of TEN projects.

Where capacity is scarce, as it is in most important European corridors and nodes, the auctioning of timetable slots for freight services should be considered a fair and effective option to select the bidders that are willing to pay more for the use of the track (because they are more efficient, more confident on their ability to attract customers, or both).

Provided that adequate pro-competition rules and powers are on place, a virtuous circle could then be activated in which both track managers and services operators will have an incentive to reduce production costs and to concentrate on a careful selection of the type of infrastructure services that are needed to increase efficiency and to attract traffic.

Competition rules should in any case be strengthened in order to watch over international alliances and mergers that are already taking place among incumbent national freight divisions and a large variety of undertakings to reshape operations at continental scale and to internalise valuable assets and skills in commercial and/or logistics areas.

More generally, the sources reviewed in addition to structured discussions with involved actors and experts in the industry, confirm that rail transport could be a main beneficiary from highly optimistic projections for the development of intermodal transport chains in Europe. At the same time, this may not happen without a dramatic improvement in rail management techniques and forward looking investment.

Findings from the Intermodal Case Study would also indicate that the development of competitive markets for freight and logistics services in Europe should be considered a vital precondition for encouraging the required changes.

14.6 Conclusions

The *MINIMISE* project was designed to investigate the effects of changes in Deregulation/Privatisation, System Organisation and System Capacity on the interoperability of the European Transport System. In particular, the aim was to identify changes which lead to improvements in interoperability. The underlying thesis was that improved interoperability contributes to increased economic efficiency of the European Transport System.

Several sectors (Case Studies) were investigated to identify existing impediments to interoperability, being barriers to the development of a more economically efficient European Transport System. Case Studies identified existing impediments within and between modes on regional, national and European level and concluding that a number of impediments still exist, hindering an efficient European Transport System. Following the identification of impediments and policy measures (events) designed to overcome these impediments and thus contributing to the improvement of interoperability and economic efficiency in the specific sector were developed in the Case Studies. In the last step of the Case Study specific investigations, recommendations to improve interoperability in the specific sector were given. In the following a brief overview of the Case Study specific conclusions and recommendations is given.

Parcel Services

As summarised results from Parcel Service Case Study investigations, European transport policy regarding parcel services should in particular aim at:

- Further liberalisation within the domestic markets of the EU Member States, in particular the letter market. Today, the European parcel market is totally deregulated. But since small parcels and large letters are similar, the distinction sometimes is difficult and thus throughout Europe the range of units which are deregulated differs, making cross-border transportation difficult for private parcel service providers. The deregulation of the letter market would remove this impediment and would improve economic efficiency in this important sector of the European Transport System.
- The facilitation of cross-border transport in export/import as well as of transit transportation (especially through Switzerland and to the CEE countries). In particular the simplification of additional transport documents and/or. the abolition of these documents should be aimed at. And, to reduce waiting times at the borders, EDI-based customs procedures as well as the enlargement of customs capacities in terms of facilities, staff and opening hours should be an aspiration.
- The abolition of national regulations concerning freight transportation of small units (national accompanying documentation, e.g. 'guia di transport' in Spain). These documents, which have to be produced in some countries, reduce economic efficiency substantially in terms of higher costs and the transport quality via longer running times. The EC should negotiate with national authorities to abolish these additional documents.

Road Freight Transport

The EC strives for a more efficient (both economically and environmentally) road freight transport sector. Investigations show that improving interoperability in road freight transport is both socially acceptable and has a high return on investment for at least 4 policy options, which are:

- Support road freight transport companies in implementing IT&T, for instance by contributing to part of the investment costs. This will speed up the implementation of telematics applications in road freight transport, thus reducing empty mileage. The major part of the investment costs should still be paid by the companies, the EU or national subsidy could be around 25%.
- Investment in border crossing facilities in Eastern Europe. The delays encountered presently are very high. 1.6 billion ECU on benefits could be achieved annually. The costs are difficult to estimate, but are estimated to be at least 1 billion as an initial investment with additional annual operating costs. Improving border crossing facilities should be an action taken by the EU.
- Abolition/adaptation of driving bans. Driving bans make it very difficult for transport companies to make efficient transport planning and causes high costs for the transport companies. Abolition/adaptation of driving bans is a matter of negotiation with the national authorities and should incur minimal cost, unlike investments in IT&T or border facilities. Annual benefits are estimated to be 0,3 billion ECU.

- Reduction of over capacity on the road freight market. The over capacity on the road freight market results in a lower profitability for companies, as margins are constantly under pressure. The EC could increase entry barriers to this market in quality terms, thus reducing the number of market entries and forcing a market shake out.

Rail Transport
While focussing on conditions to level the field for competition it is recommended that the development of commercially sustainable rail-based transport of freight in Europe should be considered as a high priority in terms of community interest and be subject to the normal competition rules in the single market. In order to ensure that both, incumbent rail freight divisions and new entrants in a single market for international freight transport and logistics have the same financial objectives and share the same commercial freedom, the key option should be to strengthen competition rules on subsidies and state aid. Suitable measures should be also conceived to create a single market for traction services and leasing of rolling stock. On corridors where freight services compete for capacity among each other and with long distance and regional passenger services (quite a common circumstance on European networks) auctioning capacity to the operator willing to pay more for the use of the track should be considered both a non discriminatory policy and effective for increasing efficiency in the operation of train services and to give adequate signals on investment priorities.

Waterborne Transport
Considering policy recommendations by sector and impediment, it seems that further privatisation of port services would lead to market orientation practices, resulting in faster and better fulfilment of user needs. This could greatly contribute to the elimination of most impediments mentioned in short sea shipping. Under this assumption, the "user pays" principle could be easily applied to the waterborne transport sector permitting all port call costs to be locally, freely and commercially negotiated.

Concerning the type of intervention to be applied, it might be said that most of the proposed interventions for the removal of the impediments are soft measures. From the point of view of the responsible authority in implementing the policy interventions, most of them are expected to be undertaken at the lower level, i.e. by the local/ regional authorities, and /or national level, than at EU level. The specific hard measures, mainly concerning infrastructure, are few and it seems that the anticipated benefits from the removal of these impediments could be small. Taking into account a rather high cost for implementing these measures, it seems necessary to undertake cost benefit analyses.

Concluding, further research should be undertaken in the near future on both aspects, the cost of implementing the necessary policies as well as establishing more exactly the time lost and costs incurred in container handling at terminals due to specific impediments.

Intermodal Transport
Measures to increase the degree of contestability of international markets for intermodal transport should be designed to ensure that - when establishing a

One-Shop-Stop - the track managers of a given Rail Freeway are maintaining a neutral attitude in granting access rights to licensed operators. In some combination with target-specific, non-discriminatory rules to grant subsidies to freight operations (say to divert traffic from less environmentally friendly modes rather than favouring the restructuring of incumbent national freight divisions) the neutrality of Infrastructure Managers of different sections of international corridors should be considered a requirement for eligibility for the co-funding of TEN projects investments.

Where capacity is scarce, as it is in most important European rail corridors and nodes, the auctioning of timetable slots for freight services should be considered a fair and effective option to select the bidders that are willing to pay more for the use of the track (because they are more efficient, more confident on their ability to attract customers, or both).

Provided that adequate pro-competition rules and powers are on place, a virtuous circle could then be activated in which both track managers and services operators will have incentive to reduce production costs and to concentrate on a careful selection of the type of infrastructure services that are needed to increase efficiency and to attract traffic.

Competition rules should in any case be strengthened in order to watch over international alliances and mergers that are already taking place among incumbent national freight divisions and a large variety of undertakings to reshape operations at continental scale and to internalise valuable assets and skills in commercial and/or logistics areas.

More generally, the sources reviewed as well as structured discussions with major participants in the market and experts in the industry would confirm that rail transport could be the main beneficiary from highly optimistic growth projections for the development of intermodal transport chains in Europe. There was also agreement that this may not happen without a dramatic improvement in rail management techniques and forward looking investment.

Findings from the Intermodal Case Study also indicated that the development of competitive markets for freight and logistics services in Europe should be considered vital in order to achieve the required changes.

Air Transport

Air transport is a global industry with common operating standards. Technical obstacles to interoperability are, therefore, less than in many other sectors. A more institutionally based framework would be more appropriate for the sector. Air transport within the EU area is closely linked with air movements into and out of the Union (common airlines; common airports; common travellers; common air traffic control structure). This makes isolating the pure internal interoperability issues difficult.

Air transport policy reform in the EU has been complex: the reforms have been at the domestic level; at the bilateral level and at the EU level. Reforms have not been of the 'Big Bang' type but rather have been incremental and in packages making it difficult to isolate the implications of any individual change for interoperability. It takes time for reforms to impact and many changes have not been fully worked through before another round of changes takes place.

In terms of infrastructure, a major impediment to efficient interoperability is the system of pricing that is used. This is an issue that has yet to be fully tackled within the EU.

There are many issues of interconnectivity, especially involving access to and egress from airports and the co-ordination of the services of different air carriers, that pose major problems and interact with issues of interoperability.

Public Transport

In terms of specific measures to facilitate a seamless, door-to-door public transport service in both the deregulated and regulated markets the following measures are likely to bring the greatest benefit to the public transport user:

- The EU should encourage Deregulation through Franchising of routes or networks, as opposed to an open access market, in order to maintain the coherence of the public transport network, whilst stimulating off-road competition between operators.
- A Common EU Accessibility Standard for Public Transport to ensure that public transport is available to all sections of the community. (The EU could also help both private operators and public bodies to meet this standard through grants for infrastructure improvements where the implementation of low-floor vehicles is impractical).
- The Introduction of Through Ticketing Structures between different operators represents a significant increase in public transport interoperability at relatively low cost. The EU should encourage the establishment of Regional Transport Authorities to manage such ticketing scheme. In open access markets the EU should promote the use of smartcard ticketing systems to overcome private operators' concerns about revenue allocation and could consider subsidising the installation of smartcard equipment throughout the EU.
- The EU should conduct further research into innovative low-cost Measures to Facilitate a Door-to-Door Public Transport Service and promote further application of successful schemes.
- The EU should also encourage other measures that have been proven to improve the interoperability of public transport in specific instances. For example, Park-and-Ride, Real-Time Information, Segregated Infrastructure and Multi-System Vehicles.

On a more general level, the thesis that improvements in interoperability generally lead to improved economic efficiency could not be verified. A predictable relationship between changes in interoperability and economic efficiency could not be observed. Although more interoperable transport systems tend to be more cost efficient, there may be reasons to improve interoperability for reasons other than cost efficiency (political reasons, e.g. to improve safety or to promote public transport etc). But, for most organisations, interoperability is seen as means to improve economic efficiency, thus efforts to improve interoperability are only carried out, if improved economic efficiency is expected.

The Case Study specific recommendations are on the one hand results which could stand on their own, on the other hand they form the basis for evaluation on the level of the European Transport System as a whole.

Scenarios
The results of the evaluation of Case Study results are policy measures, which all have a positive impact on interoperability and economic efficiency of the European Transport System in terms of net benefits and/or. benefit-cost ratio. However, those figures possibly are not sufficient for the decision on implementation. In particular the costs for the implementation for both public sector and private sector differ considerably between the various policy measures and in times of restricted public budgets the costs are important decision criteria.

To provide policy decision makers with information on sets of events regarding net benefit, benefit-cost ratio as well as costs for (public) investments, five scenarios have been defined, each addressing a specific set of events with the following criteria:

- Basic scenario (all events that have passed the filtering procedure successfully: 28 events). The net benefit would be around 15 bill. ECU annually with a total benefit-cost-ratio of 2,6 and a public sector ratio of 6,1.
- Scenario 1 (Positive Benefit-Cost Ratio) includes 26 events. The net benefit would be approximately 14,4 bill ECU with a total benefit-cost-ratio of 3,0 and a public ratio of 5,9.
- Scenario 2 (Low Public Investments) includes 19 events. The net benefit would be ca. 11,6 bill ECU annually with a total benefit-cost-ratio of 3,1 but the highest possible level for the public one.
- Scenario 3 (High Benefit-Cost Ratio for Public Authorities) includes 22 events. The net benefit would be around 13,8 bill. ECU annually with a total benefit-cost-ratio of 3,4 and a high public ratio.
- Scenario 4 (Reduction of External Costs) includes 18 events. The net benefit would be around 13,8 bill. ECU annually with a total cost-benefit-ratio of 2,5 and a public one of 5,8.
- Scenario 5 (Benefits for Producers and Consumers) includes 14 events. It would lead to a net benefit of ca. 5 bill. ECU annually with a total benefit-cost-ratio of 2,5 and a public one of 2,9.

Recommended Fields of Activity for the European Commission
More generally, five fields of activity to encourage moves towards interoperability in the European Transport System were described and recommended as objectives for European transport policy:

- Greater use of telematics improves interoperability in such a way, that would increase the efficiency of the European Transport System significantly. This statement has been verified for different sectors. Transport policy has a number of options stimulating the use of telematics, e.g. internalisation of external cost of transport by tax systems, financial incentives, stimulation of co-operations, increasing the transparency in the market for telematics and the standardisation of telematics equipment
- An improved interconnection and interoperability of transport networks at various scales has positive effects on the efficiency. Therefore, these two aspects should play a more decisive role for infrastructure planning and

project evaluation. New evaluation tools and guidelines have to be developed to fulfil these objectives. The design of transport infrastructure projects should be more flexible in order to minimise possible cost of re-design to reach a higher level of interoperability in a future transport market environment.

- The use of modern transport equipment is one possibility to overcome existing impediments to interoperability. The *MINIMISE* analysis has shown that, in recent years, privatisation has stimulated the use of modern equipment while deregulation without market rules has reduced the incentive to use modern equipment.
  A reform of public transport financing, the establishment of market rules (e.g. interoperability guidelines) in deregulated transport markets and new ways of opening up the public transport (franchising) increase the incentive to use modern transport equipment.
- The harmonisation of different organisational structures is a key strategy to reach an optimal level of interoperability. Several policy measures to achieve common organisational structures are highlighted such as stimulation of co-operation, prevention of separation strategies of transport companies within the competition process, developing guidelines for pricing infrastructure use (especially in rail transport), standardising of transport equipment and further privatisation and deregulation activities in transport related markets. It is pointed out, that the harmonisation of organisational structures has large benefit effect due to low implementation costs for single events.

There is still a range of harmonisation requirements for the regulatory framework between the EU-member states and between the EU and third countries. Examples are the realisation of common customs requirements, common documentation and common regulation regarding driving bans. For a successful harmonisation of the regulatory frameworks different aspects have to be taken into consideration, e.g. the co-operation with the groups affected, the simplification of the regulative norms and the determination of the optimal regulation point by harmonisation

14.7 MINIMISE project Summary

The *MINIMISE* project was designed to investigate the effects of changes in Deregulation/ Privatisation, System Organisation and System Capacity on the interoperability of the European Transport System. In particular, such changes should be identified which lead to improvements in interoperability, whereby the underlying thesis was that improved interoperability contributes to increased economic efficiency of the European Transport System.

Several sectors (Case Studies) were analysed by applying a common Analytical Framework to identify existing impediments to interoperability, being barriers to the development of a more economic efficient European Transport System. Case Studies identified existing impediments within and between modes on regional, national and international level. Following the identification of impediments, policy measures (events), suitable to overcome these impediments were identified and thus contributing to the improvement of interoperability and economic efficiency in the specific sector were created by Case Studies. As result, it can be stated that in particular on European level a lot of impediments exist hindering a more efficient European Transport System.

Here is not the place to repeat results of Case Study investigations[1], only one example will be given to show typical problems: in Parcel Services, a widely deregulated transport sector in Europe, some European countries require specific additional transport documents for national reasons, which have a major impact on the parcel transportation process to and from these countries leading to higher costs and poor economic efficiency.

On a more general level, the thesis that improvements in interoperability generally lead to improved economic efficiency could not be verified. A predictable relationship between changes in interoperability and economic efficiency could not be observed. Although increases in interoperability of transport systems tend to produce greater cost efficiency, there may be objectives to improve interoperability for other reasons than cost efficiency (political reasons, e.g. to improve safety or promote public transport etc). But, for most organisations, interoperability is seen as means to improve economic efficiency, thus efforts to improve interoperability are only carried out, if a rise in economic efficiency is expected.

The Case Study specific recommendations are on the one hand results which could stand on their own, on the other hand they form the basis for evaluation on the level of the European Transport System as a whole. Three steps are carried out in the evaluation and recommendation phase:

Evaluating the policy measures identified by Case Studies within calibration boundaries by the use of a model including a set of filters (policy filter, economic filter, distributive filter) to identify the events on the level of the European Transport System, which are in line with fundamental European policy objectives and contribute to the improvement of economic efficiency of the European Transport System. As result, all events which have passed this filtration process are assessed with a set of criteria (net benefit, benefit-cost ratio etc.) to show their contribution to the improvement of efficiency of the European Transport System.

The results of the evaluation of Case Study results are policy measures, which all have a positive impact on interoperability and economic efficiency of the European Transport System in terms of net benefits and/or benefit-cost ratio. However, those figures possibly are not sufficient for the decision on implementation. In particular the costs for the implementation for both public sector and private sector differ considerably between the various policy measures and in times of restricted public budgets the costs are important decision criteria. To provide policy decision makers with information on sets of events regarding net benefit, benefit-cost ratio as well as costs for (public) investments, five scenarios have been defined, each addressing a specific set of events with the following criteria:

[1] For information on impediments and related policy measures see Case Study chapters in this report or for more detailed information the specific *MINIMISE* Case Study deliverables (D4-10).

- Basic scenario (all events that have passed the filtering procedure successfully: 28 events). The net benefit would be around 15 bill. ECU annually with a total benefit-cost-ratio of 2,6 and a public sector ratio of 6,1.
- Scenario 1 (Positive Benefit-Cost Ratio) includes 26 events. The net benefit would be approximately 14,4 bill ECU with a total benefit-cost-ratio of 3,0 and a public ratio of 5,9.
- Scenario 2 (Low Public Investments) includes 19 events. The net benefit would be ca. 11,6 bill ECU annually with a total benefit-cost-ratio of 3,1 but the highest possible level for the public one.
- Scenario 3 (High Benefit-Cost Ratio for Public Authorities) includes 22 events. The net benefit would be around 13,8 bill. ECU annually with a total benefit-cost-ratio of 3,4 and a high public ratio.
- Scenario 4 (Reduction of External Costs) includes 18 events. The net benefit would be around 13,8 bill. ECU annually with a total cost-benefit-ratio of 2,5 and a public one of 5,8.
- Scenario 5 (Benefits for Producers and Consumers) includes 14 events. It would lead to a net benefit of ca. 5 bill. ECU annually with a total benefit-cost-ratio of 2,5 and a public one of 2,9.

As a last summarising step of the recommendation fields of activities for the European Commission to improve interoperability and economic efficiency of the European Transport System have been identified and described in detail. Those fields are:

- Stimulation of telematics usage;
- Stimulation of the use of modern transport equipment;
- Improving the interconnectivity and interoperability of transport networks;
- Harmonisation of organisational structures;

Harmonisation of the regulatory framework

15 Contracts, Transport Costs, External Costs, Pricing

Learning Objectives for Lecture 15:

- The student should understand the economic benefits of multimodal transport. Why have MTO's emerged? What are their benefits? What are the benefits for their customers?
- The student should understand the components of a cost calculation for a multimodal transport chain. Different contractual options for seaborne multimodal container transport should be understood.
- The student should be able to understand the basic concept of sea freight tariffs and should be able to make a basic calculation of sea freight.
- The student should understand the possibilities for hiring in containers from leasing companies.
- The student should know the meaning of the different commercial terms in container shipping. He/she should have an understanding of the different main types of contracts between intermodal carriers and merchants.
- The student should understand the cost structure of multimodal tariffs and the principles of pricing.
- The student should have a general understanding of inland charges on seaborne container transport. The main rating concepts and most important surcharges in ocean freight should be understood.
- The student should understand principles of the commercial procedure and pricing in combined road-rail transport.

15.1 Benefits of Multi Modal Transport

The economic basis for multimodality is that transport modes can be integrated into a door-to-door transport chain in order to improve the overall efficiency of the transport system. Benefits of multimodal transport are: economics of unitization, economics of scale, environmental effects.

15.1.1 Economics of Unitization

From individual cartons through pallets to containers, reduced handling gives savings in labour, packaging and damage costs. Risk of damage reduces when commodity is handled only two times, regardless of the number of mode changes. Packaging designed for specific mode, container, swap-body etcetera ensures less damage due to broken stowage. Cargo loss is eliminated or greatly reduced due to no pilferage or excessive movement in the transport module.

15.1.2 Economics of Scale

Road haulage: Large modern trucks give increased load capacity, fuel economy and less environmental damage due to the increased number of axles, lower emissions and air suspension systems. Improved efficiency in engine, gearbox and axle designs gives faster highway speeds.

Rail transport: full train loads i.e. container trains on scheduled services operate at maximum payload and computerised signalling systems minimise speed variations. Greater tractive effort from modern locomotives results in longer heavier trains with reduced manning.

Air transport: modern powerful engines give a huge increase in carrying capacity of large "jumbo" and wide body jet aircraft together with increased range. Smaller aircrew numbers with increased computer assistance reduce labour costs. Specially designed automated cargo terminals minimise human input and reduce cost.

River transport: larger vessels with lower crew numbers increases efficiency and computerised engine management systems reduce maintenance costs. Labour saving cargo-handling devices improves vessel turnaround time.

Deep sea vessels: huge savings are made through an increase in ship size. E.g. 6000 TEU post panamax vessels have a 21% cost advantage over 4000 TEU panamax vessels - but only at full slot utilisation. However, economy of scale with bigger ships may mean lower frequency - reduced service, port constraints, and bigger ships means greater costs if breakdowns occur. Big ships can only be filled by using increased transhipment of boxes and this adds to the costs. To achieve full benefit only big operators can provide'; a) ships, b) terminals, c) IT infrastructure, d) combined transport systems. Results are big ships on "around the world" or "pendulum" services between "mega hubs" being supported or fed by local feeder vessels.
Hub & Spoke systems are a precondition to ensure both: the employment of bigger vehicles on the main leg and to offer a door-to-door-network. Additional costs through longer distances via the hub are compensated through less transport costs/units and through better service in time.

15.1.3 Environmental Effects

The increasing success of road transport is resulting in ever worsening conditions also due to the dominance of trucks in freight transport. Transport by truck is unavoidable over very short distances but in middle and long (international) transport distances other modes may be used. The switch from road to environmentally friendly modes may be achieved by raising structural costs and charges of the road freight sector as well as by the enhancement of intermodal / multimodal transport.

15.1.4 Example: Case Study North-South Routes

Comparison of unimodal and multimodal transport – pricing relevant results

The following are given cost estimates from the EU project RECORDIT for three Trans-European corridors:

- the freight freeway between Patras - Brindisi - Milano - Munich - Hamburg and Gothenburg;
- the tri-modal transport chain between Genova - Basel - Rotterdam and Manchester;
- the door-to-door intermodal chain along the corridor Barcelona - Lyon - Torino - Verona – Budapest and Warsaw.

In fact, while the primary objective of the project was to document the cost and price formation mechanisms, and therefore to estimate total real costs, the most interesting results for pricing purposes are those yielded by the comparison of intermodal costs with those of all-road transport on the corresponding routes. More specifically:

- comparing total costs (internal + external) across the two options (intermodal Vs all-road) sheds light on their relative attractiveness, and should therefore contribute to explain their current market position;
- comparing external cost with taxes and charges currently paid allows for identifying market inefficiencies, both within modes and across them.

Summary results from RECORDIT are provided below to this effect.
Total internal costs for the movement of containers (i.e. costs directly borne by the end user, including taxes and charges) are summarised in the table below:

Table: Internal costs of Intermodal vs All-road transport

Corridor				Intermodal		All-road
€/movement	Length (km)	€/km		€/movement	Length (km)	€/km
Genova-Manchester	2315	2134	1.08	2836	1912	1.48
Patras-Gothenburg	3970	4128	0.96	4894	3599	1.36
Barcelona-Warsaw	3350	3270	1.02	3448	2735	1.26

Source: Recordit

The intermodal option turns out to be consistently cheaper than the all-road alternative, despite being longer. Its competitiveness is however severely undermined by the poor performance of intermodal transport in terms of trip duration, which is between 70% (Patras-Gothenburg) and 400% (Genova-Manchester) longer than for all-road.

It is also interesting to note (see figure below) that, whilst main haulage is the most important cost in all cases, the share of movement and transhipment at terminals can increase to over 20%. The shares will vary depending critically on the number of transhipments necessary along the intermodal route, and the length of the pre- and post-haul legs. On very short routes the pre and post haul costs can rise to nearly 50%.

15.2 Contracts and Pricing in Container Transport

15.2.1 Container Leasing

Leasing of containers is an option for container operators and shipping lines in order to:

- increase the container park temporarily, especially for specialized containers (e.g. reefers etc.);
- save financial means (liquidity) for buying own containers;
- avoid the transportation of empty containers and to adjust the container;
- stock in certain relations according to imbalances.

In principle the following leasing arrangements are possible:

- one-way-lease;
- round-trip-lease;
- master lease arrangement = agreement with the leasing company with the possibility to give back a leased container at a destination where the shipping company faces an over-supply and to get new containers in case of under-supply.

For more information on container leasing see http://www.iicl.org/

15.2.2 General Contract Terms

Different types of services and contracts

Whereas the shipping companies in the past where only concentrated on the transport of cargoes on the sea borne section, today's provider of maritime cargo transport services are offering a wide range of additional logistic services even in the inland transport. Various service models are possible:

- **Merchants haulage**
  Organisation of the pre- and post-carriage on the responsibility of the sender. The shipping company provides its own containers for an extra charge (equipment handover charge). The delivery and re-delivery of the container is not included. The sender has to conclude a contract of affreightment with the MTO.
- **Carriers haulage**
  Organisation of the pre- and post-carriage on responsibility of the MTO. The sender is liable to provide the cargoes for loading within a defined time. The sender concludes only one multimodal transport contracts with an MTO.
- **Mixed arrangements**
  All possible combinations of merchants and carriers haulage. For example: Organisation of the pre- and post carriage on responsibility of the sender. The shipping company provides its own containers (for an equipment handover charge) on the point of loading.
- **FCL (Full Container Load)**
  The full container is utilized and booked by the client. Usually FAK or commodity box-rates apply.
- **LCL (Less than Container Load)**
  Parcel Load which does not fill a whole container. Usually commodity rates apply according to W/M weight or measurement in carrier options. Forwarder type-

MTO consolidates high priced cargoes and books lower priced FCL.

- **Single vs. Service Contracts**

  To assure a constant amount of freight for the carrier/MTO and constant service
  levels and freight rates for the sender, it is common to conclude service contracts.
  In these contracts the sender is liable to provide a minimum of cargo within an
  agreed period. On the other hand, the carrier/MTO guarantees constant freight
  rates and pre-defined service-levels for the agreed amount of freight.
  Contents checklist for negotiating service contracts:
  - name of the sender (handled confident);
  - ports of shipment and destination;
  - destinations;
  - kind of freight or FAK (freight all kinds);
  - contracts or scale of rate;
  - opening and final dates;
  - service liabilities for the shipping company/MTO;
  - additional agreements, sanction clauses.

- **Minimum Bill of Lading**

  A minimum bill of lading - minimum billing or minimum charge - is often required in a freight service. In ocean freight, a minimum of usually 2 or 3 CBM (cubic meters) is required. The freight consolidator may specify the minimum requirement in a dollar amount, instead in CBM. In air freight, a minimum of usually 1 kilogram is required. If a consignment is light and small, it is more economical to ship by air rather than by sea considering the benefits of air freight. In road and rail freight, the minimum requirements vary widely among carriers.

15.3 Multimodal Container Transport Tariffs

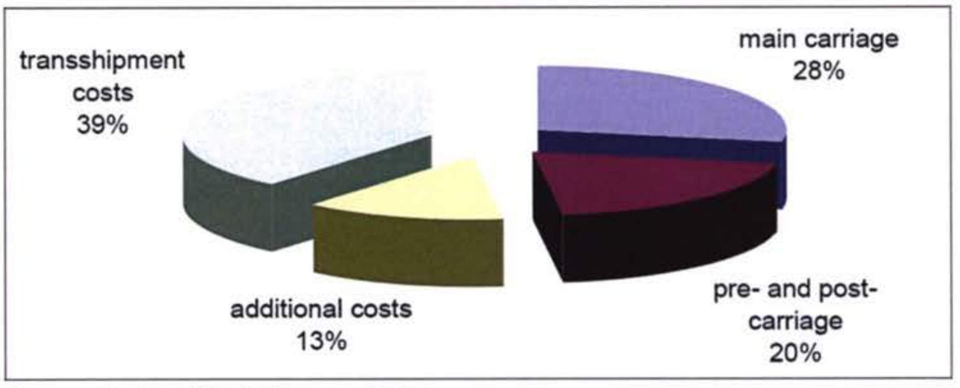
15.3.1 Cost Structures in Maritime Container Transport

The cost structures in maritime container transport cannot be claimed to be transparent. In traditional liner shipping it was common to consider only the sea haulage as a cost factor.
Due to the expanding services provided by modern shipping companies / MTO´s this viewpoint has changed and today the entire container haulage from origin to final destination is defined as a cost factor. The following are different cost types:

- Costs of pre- and post carriage:
  - equipment handling costs;
  - costs for rail- or road haulage or inland shipping on the pre- and post-carriage;
  - costs for transport means in general.
- Costs of transhipment:
  - loading costs;
  - landing charges;
  - terminal costs;

- warehouse-costs.
- Costs of sea transport:
  - fuel costs;
  - port charges;
  - crew costs;
  - insurance;
  - depreciation;
  - repair & maintenance costs.
- additional costs:
  - administration;
  - sales and marketing;
  - costs for IT and communication infrastructure.

Figure 15.1 Costs Structure per TEU of an MTO (Trans Pacific Transport)



Source: Biebig, Althof, Wagener (2004)

15.3.2 Container Tariffs

Multimodal Tariffs can be divided into segmented and integrated tariffs.

Segmented tariffs split the prices of the transport into five parts:

- pre-carriage,
- storage/transhipment in the loading port,
- sea transport,
- storage/transhipment in the unloading port, post-carriage.

Integrated tariffs declare the rates between two defined inland-points only without showing the costs for part performances.

Pre- and post-haulage

Charges for the inland haulage to the loading port and from unloading port to the final destination.

The rates for the inland haulage can either be published separately or integrated within the sea freight. Separate inland tariffs can be calculated on the basis of:

- chosen cities;
- tariff zones (e.g. as European zone charge);
- postal-code lists (e.g. as ZIP-code).

THC (Terminal Handling Charge)
Terminal charges for the transhipment of the containers.
The calculation is made without any rebates and surcharges.

Surcharges and Rebates
The following table sums up common surcharges/rebates in maritime container transport:

Surcharges:
- transhipment / feeder additional;
- equipment additional, special container additional;
- LCL-surcharge (LCL = less than container load);
- terminal handling charge, container handling charge;
- surcharges for transport of non conference-owned containers.

Rebates:
- container allowances:
- FCL/FCL-traffic up to 10% (FCL = full container load);
- FCL/LCL or LCL/FCL-traffic up to 6%;
- rebates for using certain container terminals;
- consolidation allowances;
- volume rebates;
- time-volume-rates.

Examples: up to 2,5 Mio. t freight/a = 5% rebate
2,5 up to 5 Mio. t freight/a = 7,5% rebate
more than 5 Mio. t freight/a = 10% rebate

- service contracts

15.3.3 Case Study

Source: Pawlik (1999), S. 66.

This case study will sum up the statements made before. To show the cost structure and rating systems, some member-companies of the TACA (Transatlantic Conference Agreement) where requested to carry a 20' container with 14 tonnes of books from Kiel (Germany) to Chicago (USA). The received calculation is shown in the following table:

15.4 Haulage Rates (Inland Charges)

Typical Inland charges

Source: Mediterranean Container Ports and Shipping, Drewry Shipping Consultants Ltd).

The following charges are discussed:
- Loading / discharge of transhipment containers (per 20ft and 40ft units);
- Loading / discharge of origin/destination containers (per 20ft and 40ft units);
- Other moves (including re-stows via quay and ship; special gear; hatch cover moves);
- Lashing charges;
- Storage/warehousing activities (including free storage periods; reefer charges);

- Stuffing/unstuffing activities;
- Overtime.

Table Typical Mediterranean container handling charges (US$)*

	Charge per Move		
	Least expensive	Average	Most Expensive
Transshipment Containers (Load or Discharge)**			
20ft Full	20	55	107
20ft Empty	15	50	107
40ft Full	33	55	133
40ft Empty	21	50	133
Origin/Destination Containers (Exports)***			
Loading 20ft Full	57	110	187
Loading 20ft Empty	30	69	147
Loading 40ft Full	57	110	367
Loading 40ft Empty	30	69	187
Origin/Destination Containers (Imports)***			
Discharging 20ft Full	90	135	187
Discharging 20ft Empty	30	69	147
Discharging 40ft Full	90	135	367
Discharging 40ft Empty	30	69	187

* Based on port or terminal tariffs, not including storage charges

** Covers vessel to yard stack (or vice versa)

*** Covers vessel to yard stack to vehicle (or vice versa)

*Table: Typical container storage charges (US$ per teu per day)**

	Least expensive	Average	Most Expensive
Free storage period	20 days	5-10 days	No free days
Origin / destination cargo	$7	$10	$12
Transshipment cargo	$8	$16	$39.5

* After free storage period

Table: Typical miscellaneous handling charges

Service Type	Charge per Move		
	Least expensive	Average	Most Expensive
Restow via quay	USD $ 27	$57	$95
Restow on board	$22	$52	$85
Special gear*	+55%	+50%	+200%
Hatch cover moves	$27	$52	$367

- Special gear charges are a surcharge on the relevant size of the unit handled (for example 20ft or 40ft)

Table: Typical container stuffing / unstuffing charges (US$)

	Least expensive	Average	Most Expensive
20ft container	50	70	130
40ft container	85	140	234

Table: Typical reefer box charges (US$)

	Least expensive	Average	Most Expensive
Charge per reefer unit	25	31	70

Table: Typical lashing charges (US$)

	Least expensive	Average	Most Expensive
Charge per unit	8	10	15

Overtime charges:
Overtime is paid whenever a service is carried out outside the terminal's normal working hours (for example) public holidays or weekends. The rates vary from 50% to 100% uplift on all the vessel and landside operation charges.

Inland Transport Links:
Good quality, competitively priced road and rail access is clearly very important for gateway ports.

15.5 Ocean Freight

15.5.1 Rating Concepts

Basically the calculation of a sea freight rate can be executed in two different ways, as FAK-rate (freight all kinds) and as commodity-based rate.

FAK-rates

To calculate an FAK-rate, the total costs for running a container line (including pre- and post-carriage) are divided through the planned amount of transported TEU´s. The result is the Break-Even per TEU. The freight rate per TEU results if a profit mark-up and possibly a risk mark-up is added. The problem of FAK-rates results from the equal transportation-charge for low and high-valued cargoes in the selling-price calculation. But the senders must be assured; that the money they pay will not drive the price of their goods above the competitive level of the markets where they trade. So for certain commodities a transport to actual costs of transportation is not possible.

Commodity-based rates

Facing this problem, the shipping companies have no choice but to set rates that permit the movement of low-valued commodities even if this means that the carriage is performed at a financial loss to the company. To offset this difficulty, the only solution is to set rates for items of high value which will absorb the loss incurred on the low value commodities, which means a cross subsidisation. The ongoing containerisation has lead to a decrease in shares for commodity class based price differentiation systems. Distance-, time-volume- and zone based rates are of increasing importance.

The employed rating concept depends on:

- the level of homogeneity of the freight volume;
- the level of containerisation;
- concentration ratio of supply and demand (i.e. impact of shipping conferences);
- pricing policy of alternative carriers (rail-, road- haulage, inland shipping).

Surcharges on the basis of Ocean Freight are (the most important ones):

Currency Adjustment Factor (CAF)

In times of unstable currency, the freight rate is often quoted with a **currency adjustment factor** (CAF) to cover an additional charge for currency appreciation. The CAF, if any, is indicated on the bill of lading. The tariff of most international carriers uses the U.S. dollar as the basis of the freight cost calculation. The CAF allows for fluctuations in the value of the dollar against the currency in which the carrier earns its revenues.

Bunker Adjustment Factor (BAF)

The term **bunker** refers to oil. It may also refer to a compartment on a ship for storing fuel, that is, oil in modern ships and coal in old-time steamships. In times of unstable oil prices, the freight is often quoted with a **bunker adjustment factor** (BAF) to cover an oil price hike. The BAF, if any, is indicated on the bill of lading. The BAF allows for fluctuations in the cost of oil.

15.6 Pricing and Tariffs in Combined Transport

15.6.1 Commercial Procedure

The forwarder concludes with the sender a common road transport contract (e.g. CMR waybill). In its relation to the Combined Transport Operator (e.g. Kombiverkehr in Germany) he books the consignment and receives a booking order for combined rail transport. Electronic booking is also possible (see example form at www.kombiverkehr.de)

15.6.2 Pricing

The tariff price of the Combined Transport Operator (e.g. Kombiverkehr) differs between

- Relation (national / international)
- Mode (accompanied, unaccompanied)
- Volume of the traffic of one customer
- Type, size and weight of the loading unit.

Price calculation:
By looking at an example of price components for a 20' Container transport from Offenbach (Germany) to Almaty (Kazachstan) price calculations can be clarified:

Clients order:

- Pick-up at the shipper's location in Offenbach and delivering it free to terminal Almaty (including availability of a rental container).

Cost elements:

- Positioning empty containers on shipper's premises;
- Pick up loaded container on shipper's premises;
- Transhipment to terminal at Frankfurt/Main – Ost;
- Terminal fee at Frankfurt/Main – Ost;
- Train transportation Frankfurt/Main - Ost to Berlin;
- Train composition for appropriate destinations and quality control in Berlin;
- Train transport Berlin to Malaszewicze/Brest;
- Border fee and re-forwarding at Brest;
- Transhipment in Brest;
- Train transportation to Almaty;
- Verification and Tracing of container run in GUS.

15.7 Case Study: North-South Routes

15.7.1 Comparison of unimodal and multimodal transport – pricing relevant results

The following are given cost estimates from the EU project RECORDIT for three Trans-European corridors:

- the freight freeway between Patras - Brindisi - Milano - Munich - Hamburg and Gothenburg;
- the tri-modal transport chain between Genova - Basel - Rotterdam and
- Manchester;

- the door-to-door intermodal chain along the corridor Barcelona - Lyon - Torino - Verona - Budapest and Warsaw.

In fact, while the primary objective of the project was to document the cost and price formation mechanisms, and therefore to estimate total real costs, the most interesting results for pricing purposes are those yielded by the comparison of intermodal costs with those of all-road transport on the corresponding routes.
More specifically:

- comparing total costs (internal + external) across the two options (intermodal Vs
- all-road) sheds light on their relative attractiveness, and should therefore contribute to explain their current market position;
- comparing external cost with taxes and charges currently paid allows for identifying market inefficiencies, both within modes and across them.

Summary results from RECORDIT are provided below to this effect.
Total internal costs for the movement of containers (i.e. costs directly borne by the end user, including taxes and charges) are summarised in the table below:

Table 15.1 Internal costs of Intermodal vs All-road transport

Corridor	*Intermodal*			*All-road*		
	€/trip	Length (km)	€/km	€/trip	Length (km)	€/km
Genova-Manchester	2315	2134	1.08	2836	1912	1.48
Patras-Gothenburg	3970	4128	0.96	4894	3599	1.36
Barcelona-Warsaw	3350	3270	1.02	3448	2735	1.26

Source: RECORDIT

The intermodal option turns out to be consistently cheaper than the all-road alternative, despite being longer. Its competitiveness is however severely undermined by the poor performance of intermodal transport in terms of trip duration, which is between 70% (Patras-Gothenburg) and 400% (Genova-Manchester) longer than for all-road. It is also interesting to note (see figure below) that, whilst main haulage is the most important cost in all cases, the share of movement and transhipment at terminals can increase to over 20%. The shares will vary depending critically on the number of transhipments necessary along the intermodal route, and the length of the pre- and post-haul legs. On very short routes the pre and post haul costs can rise to nearly 50%.

16 Multi Modal Transport Documents

Learning Objectives for Lecture 16:

- The student should understand the various functions of the B/L
- The student should know waybills as a transport document;
- The student should know the difference between a Waybill and a Bill of Lading.
- The student should understand the scope and elements of the standard contract conditions governing the FIATA Multi Modal Transport Bill of Lading.

16.1 Bill of Lading

16.1.1 B/L Development

Among all the documents in relation to sea transport, the bill of lading (B/L) is the central document in line shipping. It is the main document for the regulation of the relationship between the shipper, the carrier and the consignee. It is often filled in by the shipper or by a forwarding agent, and signed by a representative of the carrier. In medieval times, the merchants travelled with their goods and did not need to receive documentation from the carrier, or to give such documentation to the buyer of the goods at a foreign port. The need for a B/L arose when merchants first decided not to accompany their goods any more during maritime transport but, instead, put them in the custody of the master and ship owner for transportation to overseas destinations. With the help of information and telecom services, during the long journey at sea the goods may virtually go through a few sales and purchases before they reach the destination market on shore. Such development in the economic needs and the ocean transport practice has resulted in the B/L document, to which distinctive functions and legal rights have accordingly been attached.

16.1.2 Functions of the B/L

In recent and modern sea transport, the B/L is generally considered to have three functions:

- As a receipt: the carrier acknowledges that he has received the goods, type, quality and quantity as stated (either on board the ship or for shipment) and that they will be delivered to the consignee.
- As evidence of the contract of carriage: between carrier and shipper (holder of the B/L), stating clearly all conditions regarding transport and delivery of the goods.
- As a document of title: the B/L is a document enabling the seller, who has shipped the goods for delivery to the buyer, to transfer the right to obtain delivery of the goods, to the buyer. The holder of the B/L is entitled at the destination to demand delivery of the goods carried.

16.1.3 Negotiable vs. Non-negotiable

Depending on whether the B/L is transferable in terms of the rights and obligations attached to it, the B/L may be regarded as "negotiable", "quasi-negotiable" or "non-negotiable". In practice, the B/L then may be made out to a named person, to a named person or order, to the holder, or to a named person "not to order". When a B/L is transferred, the holder will make this action clear by a so called endorsement.

16.1.4 Endorsement

Endorsement literally means: mention on the reverse side. This means that the holder of the B/L transfers the rights and obligations in the B/L to another person by mentioning the name of his company on the reverse side, provided with an authorised signature.
A blank endorsed B/L is a B/L to the bearer (to order). Anyone who possesses it can claim the right to the goods as a lawful holder of the B/L.
A B/L is fully endorsed when also the name of the beneficiary is mentioned (to order of ...). With a Letter of Credit the bank for example can be mentioned in the B/L formally as the party at the receiving end (to order of ...Bank).

16.1.5 Layout of the B/L

The reverse side of the B/L mentions the transport conditions. Most times these conditions are referred to as the Hague-Visby Rules, or whichever rules have been incorporated.
The front side of the B/L mentions data concerning the cargo, such as:

1. Name of the carrier, in print;
2. The B/L number;
3. Reference of the shipper;
4. Name of the shipper;
5. Name of the receiver;
6. Notification address;
7. Name of the vessel;
8. Port of loading;
9. Port of discharge;
10. Where freight is due;
11. Number of originals (e.g. 3);
12. Specification of the goods (marks, numbers, quantity, type of packaging, description of the goods, weight etc.).

Below is an example of a container bill of lading.

Any Container Line **BILL OF LADING**

SHIPPER/EXPORTER Export-Import Trade Software, Ltd 201 Arnold Ave. Suite J Pt. Pleasant, NJ 06611 UNITED STATES OF AMERICA	BOOKING NUMBER 123WEST BILL OF LADING NUMBER EXPORT REFERENCES Exporter File Number - N-China123456 Transaction Number - 45678TN Letter of Credit Number - BB1234566 Forwarder Reference Number - 40/123NN
CONSIGNEE EXits China Inc. Friendship Hotel Software Road West Bejing 100001 Mao Sector CHINA [MAINLAND]	FORWARDING AGENT FMC NO. CHB NO.
NOTIFY PARTY	ALSO NOTIFY - ROUTING & INSTRUCTIONS Keep cargo dry and away from heat.

VESSEL / VOYAGE / FLAG	PLC OF RECEIPT BY PRECARRIER	RELAY POINT	POINT AND COUNTRY OF ORIGIN OF GOODS
SS Neversink 001 US	PORT OF LOADING NEW YORK, NY	LOADING PIER Shed 1 Pt Newark	TYPE OF MOVE Breakbulk
PORT OF DISCHARGE SHANGHAI, CHINA	PLACE OF DELIVERY BY ON CARRIER	ORIGINALS TO BE RELEASED AT	

PARTICULARS FURNISHED BY SHIPPER

MARKS & NO'S/CONTAINER NO'S	NO. OF PKGS.	DESCRIPTION OF GOODS	WEIGHT	MEASUREMENTS
Cartons 1/15 Freight PrePaid	1	Skid containing 15 cartons 10 ea Quick Assistant Software-6 Diskettes "Smart Software for Exporters" 5 ea Software Kit, For PC's Interlink These commodities, technology or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. Law prohibited. This is a sample B/L generated by the Quick Assistant for Export Documentation Please call EXits, Inc. @732/899/9030 to order your software.	2450.00 lbs	64.00 CF

FREIGHT CHARGES	RATED AS	PER	RATE	TO BE PREPAID IN U.S. DOLLARS	TO BE COLLECTED IN U.S. DOLLARS	FOREIGN CURRENCY
SUBJECT TO SECTION 7 OF CONDITIONS, IF SHIPMENT IS TO BE DELIVERED TO THE CONSIGNEE WITHOUT RECOURSE ON THE CONSIGNOR, THE CONSIGNOR SHALL SIGN THE FOLLOWING STATEMENT; 'THE CARRIER SHALL NOT MAKE DELIVERY OF THIS SHIPMENT WITHOUT PAYMENT OF FREIGHT AND OTHERLAWFUL CHARGES.'			TOTALS			

IN WITNESS WHEREOF THE CARRIER BY ITS AGENT HAS SIGNED

SIGNATURE OF CONSIGNOR ______

RECEIVED THE GOODS OR PACKAGES SHIPPER'S LOAD AND COUNT GOODS HEREINAFTER MENTIONED IN APPARENT GOOD ORDER AND CONDITION UNLESS OTHERWISE INDICATED TO BE RELAYED AS HEREIN PROVIDED. THE RECEIPT, CUSTODY, CARRIAGE, DELIVERY, AND TRANSSHIPPING OF THE GOODS ARE SUBJECT TO THE TERMS APPEARING ON THE FACE AND BACK HEREOF, AND CARRIER'S TARIFFS ON FILE WITH THE INTERSTATE COMMERCE COMMISSION AND/OR THE FEDERAL MARITIME COMMISSION, WASHINGTON, D.C

LIABILITY LIMITED TO AMOUNT SPECIFIED IN SEC 16 UNLESS INCREASED VALUE DECLARED BY SHIPPER AS SPECIFIED BELOW:

DECLARED VALUE ______

*APPLICABLE ONLY WHEN USED AS A THROUGH BILL OF LADING AFTER MENTIONED IN APPARENT GOOD ORDER AND CONDITION UNLESS

**INDICATE WHETHER ANY OF THE CARGO IS HAZARDOUS MATERIAL UNDER DOT, IMCO,OR OTHER REGULATIONS AND INDICATE THE CORRECT COMMODITY NUMBER IN DESCRIPTION OF PACKAGES AND GOODS ABOVE.

ORIGINAL BILLS OF LADING ALL OF THE SAME TENOR AND DATE ONE OF WHICH BEING ACCOMPLISHED THE OTHERS TO STAND VOID.

BY ______ CARRIER

BY ______ FOR SHIPPER

DATE ______

16.1.6 Other Types of B/L

Various types of B/L's can be distinguished, such as:

- Liner B/L: the bill issued by a shipping line that usually offers a regular service, with fixed loading dates at particular ports of call.
- Container B/L: for sea transport of containers.
- Express B/L or Data Freight Receipt: this is electronic information between parties. The outline of the form is identical to the Combined Transport B/L and gives the opportunity to deliver the goods to the receiver, without requesting him/her to present himself/herself as the owner with a signed and dated proof of ownership. This mostly regards transactions between sister companies, which settle accounts by current account and not via documentary bank credits.
- EDI and the electronic B/L: instead of the traditional paper B/L, this B/L is produced and negotiated by electronic means or specifically, via EDI (Electronic Data Interchange). But due to the ambiguity of legal implications of paperless shipping transactions, such as the electronic signature, the EDI or electronic B/L is not yet widely accepted or used in the shipping business. But note, banks have already been applying electronic payments for a longer time and have the necessary infrastructure available to do so. They also have built up vast experience in the fields of EDI.
- Printing of B/L at location: Since the introduction of the electronic B/L is still pending, mainly for legal reasons, some larger carriers such as Maersk have developed intermediate solutions. A shipper is e.g. provided with blank B/L's which can be printed at their location provided the official signature is authorized by the carrier. It remains to be seen whether such a development will prove to be ideal.

16.1.7 Ocean Bill of Lading

Ocean bill of lading is a traditional expression, referring to a document covering the carriage of goods by sea and not, for example, inland carriage stages (e.g. by road, rail or barge).
Ocean B/L is sometimes called "marine bill of lading". It may be referred to on the front of the bill as a "port to port bill of lading", indicating the general period of responsibility of the carrier.

16.1.8 Clean B/L

A B/L that contains no remark with respect to the condition of the goods is called a clean B/L. Due to the terms and conditions of the purchase agreement; the buyer is generally under no duty to pay for an unclean B/L. Under payment by documentary credit the UCP (article 32 in the 500 revision) also prescribes that the bill of lading must be clean. It is therefore clear that the seller/shipper has a great interest in having a clean B/L issued by the carrier, since the buyer will otherwise refuse to pay for the document, or under a documentary credit, the paying banks will refuse to pay against such a document.

16.1.9 FIATA Multimodal Transport Bill of Lading (FIATA FBL)

In contrast to the ocean B/L, if the shipping lines or carriers want to provide an all-round service to their customers they will issue a "multimodal transport B/L", or the so called "combined transport B/L" or "intermodal B/L", under which the carrier assumes contractual responsibilities for the entire period of carriage and not just responsibility for the sea leg. Under a multimodal transport B/L the cargo will be transported by two or more modes of transport.
FIATA Multimodal Transport B/L is such a multimodal B/L developed and recommended by FIATA (International Federation of Freight Forwarders Associations).

16.1.10 Freight Forwarders (House) Bill of Lading

Usually, the B/L is issued by the ship owner or carrier. With the development of the forwarding and logistics business, the service offered by some freight forwarders goes deeper and extends along the entire transport chain. Some big freight forwarding companies go a step further and have developed their own bill of lading, i.e. so called house bill of lading.
Literally the house bill of lading refers to the specific bill personal to a particular operator but in practice, the house bill of lading is reserved for those freight forwarders who do not operate ships themselves, but which group together cargos from different owners and arrange for these to be sent with an actual carrier.
The freight forwarder issues transport documents to individual cargo owners, and then procure a contract of carriage with a carrier covered by an ocean B/L or intermodal B/L.

16.1.11 Through B/L

The through B/L usually refers to a document recording transport by more than one carrier. This type of bill of lading has been in use since the nineteenth century. Through B/L is normally used where there is more than one sea carrier, but is sometimes also used where different modes of transport are involved (for example, road, sea, or rail). When the through B/L is used for different modes of transport, it may overlap with a combined transport B/L, or multimodal B/L or intermodal B/L.

16.1.12 Received B/L (Received for Shipment)

If the bill of lading is to be issued upon receipt of the cargo, which has not yet been loaded on board the vessel, the carrier will issue a "received for shipment bill of lading" (Received B/L). Therefore a Received B/L is an acknowledgement the carrier makes stating it has received goods from somewhere, e.g. at a container depot. It is different from an "on board" or
"shipped" B/L, which shows that the goods have actually bee loaded on board the vessel. Sometimes in the letter of credit it is seen that the banks only accept on board and clean B/L's.

In such a case the Received B/L will be insufficient for the shipper to get the payment from the bank.
The Received B/L has come to play a more and more important role where unity transports, particularly container transports and Ro-Ro traffic, dominate the trade. Traditionally the shipped B/L has been the most common.
A Received B/L may be over stamped with the words "shipped on board" along with a date, in order to convert it into a shipped bill.

16.1.13 Mate's Receipt

The mate's receipt is drawn up by the carrier or his agent at the request of the owner of the goods. This document is issued after the loading of the goods and serves at that moment as proof of receipt. The carrier will not submit a B/L before this document has been returned. In practice the mate's receipt is sometimes used when the supplier must supply an FOB. Then the shipper can only dispose of the goods after having become the owner of the goods by transfer of the mate's receipt (mostly after payment). The shipper returns the mate's receipt to the carrier and then the shipper can give the B/L instructions to the carrier.

16.2 Waybills and Accompanying Documents

16.2.1 General

Sea waybill / Waybill: this is a non-negotiable receipt with a named person which contains contractual terms. A waybill does not operate as a document of title, but it still performs as that of a receipt and that of evidence of the contract of carriage. A waybill is used when there is no need for a negotiable B/L, e.g. the consignee does not want to resell the goods, or when in-house transfer takes place within large multinational companies.

16.2.2 Sea Waybill

It is a simplified document set up by the shipping lines in the early 80's. As on the one hand ship movements are getting faster, while on the other hand document transmission (typical for traditional Negotiable Bill of Lading) has remained slow, the goods very often arrive before the documents required for delivery at the destination. This hindrance can be avoided by means of a sea waybill, which actually enables the goods to be delivered to the consignee named in the document. The latter then may – by proving his identity - take delivery of the goods without producing any title. This document is not a title to the goods and thus may not be negotiated.
The information on it is used to identify the goods loaded as well as the name of the person to whom they will be delivered. A significant gain of time is recorded upon the goods arrival; the consignee can collect them as soon as they arrive, thus saving demurrage or warehousing costs.

EDI (Electronic Data Interchange) transmission: Faced with the need for fast document transmission, the shipping lines have computerised the completion of sea waybills.

The sea waybill is transmitted to their agent at destination by means of EDI; when the computer receives it, the document printed is used as a notification of arrival. One single copy used as a receipt for the shipper is then completed; it is the non negotiable "Data Freight Receipt", a.k.a. computerised bill of lading.

16.2.3 Air Waybill

Loading and unloading are not considered to have finished until the carrier has received the waybill on board, either with or without reservations, and having been duly signed by the shipper, the consignee, or a person designated by them. The airline (#1) - the carrier - is the principal contact that the freight forwarder has, since it is through the airline that the freight forwarder is going to "negotiate" their prices according to the importance of the traffic that they can offer, in terms of volume and of weight, while at the same time respecting the constraints and time limits of their customers. In this way the freight forwarder organises the transport operation with the airline by choosing the best possible routes both in terms of speed and security. They must give the airlines all the necessary information concerning the goods to be transported, their packing and their destination. As soon as they have chosen a carrier this latter will give them the information necessary for the shipment, that is to say the AWB (Air Waybill) number, the document which represents prima facie evidence of the air transport contract, as well as the flight number. They will then prepare the drawing up of the AWB while at the same time informing their customer of the dates and times of departure and arrival at the destination airport. The airline will the be able to confirm that the goods were in fact loaded on board and that they flew, or did not fly, on the booked flight.

16.3 Multi Modal Standard Contracts

This Chapter lists the Standard Conditions (1992) governing the FIATA Multi Modal Transport Bill of Lading.

Definitions

"Freight Forwarder" means the Multimodal Transport Operator who issues this FBL and is named on the face of it and assumes liability for the performance of the multimodal transport contract as a carrier.

"Merchant" means and includes the Shipper, the Consignor, the Consignee, the Holder of this FBL, the Receiver and the Owner of the Goods.

"Consignor" means the person who concludes the multimodal transport contract with the Freight Forwarder.

"Consignee" means the person entitled to receive the goods from the Freight Forwarder. - "Taken in charge" means that the goods have been handed over to and accepted for carriage by the Freight Forwarder at the place of receipt evidenced in this FBL.

"Goods" means any property including live animals as well as containers, pallets or similar articles of transport or packaging not supplied by the Freight Forwarder, irrespective of whether such property is to be or is carried on or under deck.

Applicability
Notwithstanding the heading "FIATA Multimodal Transport Bill of Lading (FBL)" these conditions shall also apply if only one mode of transport is used.

Issuance of this FBL
By issuance of this FBL the Freight Forwarder undertakes to perform and/or in his own name to procure the performance of the entire transport, from the place at which the goods are taken in charge (place of receipt evidenced in this FBL) to the place of delivery designated in this FBL; assumes liability as set out in these conditions. Subject to the conditions of this FBL the Freight Forwarder shall be responsible for the acts and omissions of his servants or agents acting within the scope of their employment, or any other person of whose services he makes use for the performance of the contract evidenced by this FBL, as if such acts and omissions were his own.

Negotiability and title to the goods
This FBL is issued in a negotiable form unless it is marked "non negotiable". It shall constitute title to the goods and the holder, by endorsement of this FBL, shall be entitled to receive or to transfer the goods herein mentioned. The information in this FBL shall be prima facie evidence of the taking in charge by the Freight Forwarder of the goods as described by such information unless a contrary indication, such as "shipper's weight, load and count", "shipper-packed container" or similar expressions, has been made in the printed text or superimposed on this FBL. However, proof to the contrary shall not be admissible when the FBL has been transferred to the consignee for valuable consideration who in good faith has relied and acted thereon.

Dangerous Goods and Indemnity
The Merchant shall comply with rules which are mandatory according to the national law or by reason of International Convention, relating to the carriage of goods of a dangerous nature, and shall in any case inform the Freight Forwarder in writing of the exact nature of the danger, before goods of a dangerous nature are taken in charge by the Freight Forwarder and indicate to him, if need be, the precautions to be taken.
If the Merchant fails to provide such information and the Freight Forwarder is unaware of the dangerous nature of the goods and the necessary precautions to be taken and if, at any time, they are deemed to be a hazard to life or property, they may at any place be unloaded, destroyed or rendered harmless, as circumstances may require, without compensation. The Merchant shall indemnify the Freight Forwarder against all loss, damage, liability, or expense arising out of their being taken in charge, or their carriage, or of any service incidental thereto.
The burden of proving that the Freight Forwarder knew the exact nature of the danger constituted by the carriage of the said goods shall rest on the Merchant.
If any goods shall become a danger to life or property, they may in like manner be unloaded or landed at any place or destroyed or rendered harmless. If such danger was not caused by the fault and neglect of the Freight Forwarder he shall have no liability and the Merchant shall indemnify him against all loss, damage, liability and expense arising there from.

Description of Goods and Merchant's Packing and Inspection

The Consignor shall be deemed to have guaranteed to the Freight Forwarder the accuracy, at the time the goods were taken in charge by the Freight Forwarder, of all particulars relating to the general nature of the goods, their marks, number, weight, volume and quantity and, if applicable, to the dangerous character of the goods, as furnished by him or on his behalf for insertion on the FBL. The Consignor shall indemnify the Freight Forwarder against all loss, damage and expense resulting from any inaccuracy or inadequacy of such particulars.

The Consignor shall remain liable even if the FBL has been transferred by him.

The right of the Freight Forwarder to such an indemnity shall in no way limit this liability under this FBL to any person other than the Consignor.

The Freight Forwarder shall not be liable for any loss, damage or expense caused by defective or insufficient packing of goods or by inadequate loading or packing within containers or other transport units when such loading or packing has been performed by the Merchant or on his behalf by a person other than the Freight Forwarder, or by the defect or unsuitability of the containers or other transport units supplied by the Merchant, or if supplied by the Freight Forwarder if a defect or unsuitability of the container or other transport unit would have been apparent upon reasonable inspection by the Merchant. The Merchant shall indemnify the Freight Forwarder against all loss, damage, liability and expense so caused.

Freight Forwarder's Liability

The responsibility of the Freight Forwarder for the goods under these conditions covers the period from the time the Freight Forwarder has taken the goods in his charge to the time of their delivery. The Freight Forwarder shall be liable for loss of or damage to the goods as well as for delay in delivery if the occurrence which caused the loss, damage or delay in delivery took place while the goods were in his charge as defined in Clause 2.1.a, unless the Freight Forwarder proves that no fault or neglect of his own, his servants or agents or any other person referred to in Clause 2.2., has caused or contributed to such loss, damage or delay. However, the Freight Forwarder shall only be liable for loss following from delay in delivery if the Consignor has made a declaration of interest in timely delivery which has been accepted by the Freight Forwarder and stated in this FBL.

Arrival times are not guaranteed by the Freight Forwarder. However, delay in delivery occurs when the goods have not been delivered within the time expressly agreed upon or, in the absence of such agreement, within the time which would be reasonable to require of a diligent Freight Forwarder, having regard to the circumstances of the case. If the goods have not been delivered within ninety consecutive days following such date of delivery as determined in Clause 6.3., the claimant may, in the absence of evidence to the contrary, treat the goods as lost. When the Freight Forwarder establishes that, in the circumstances of the case, the loss or damage could be attributed to one or more causes or events, specified in a-e of the present clause, it shall be presumed that it was so caused, always provided, however, that the claimant shall be entitled to prove that the loss or damage was not, in fact, caused wholly or partly by one or more of such causes or events: an act or omission of the Merchant, or person other than the Freight Forwarder acting on behalf of the Merchant or from whom the Freight Forwarder took the goods in charge; insufficiency or defective condition of the packaging or marks and/or numbers; handling, loading, stowage or unloading of the goods by the Merchant or any person acting on behalf of the Merchant; inherent vice of the goods; strike, lockout, stoppage or restraint of labour.

Defences for carriage by sea or inland waterways

Notwithstanding Clauses 6.2., 6.3. and 6.4. the Freight Forwarder shall not be liable for loss, damage or delay in delivery with respect to goods carried by sea or inland waterways when such loss, damage or delay during such carriage has been caused by:

- act, neglect, or default of the master, mariner, pilot or the servants of the carrier in the navigation or in the management of the ship,
- fire, unless caused by the actual fault or privity of the carrier, however, always provided that whenever loss or damage has resulted from unsea worthiness of the ship, the Freight Forwarder can prove that due diligence has been exercised to make the ship seaworthy at the commencement of the voyage.

Paramount Clauses

These conditions shall only take effect to the extent that they are not contrary to the mandatory provisions of International Conventions or national law applicable to the contract evidence by this FBL. The Hague Rules contained in the International Convention for the unification of certain rules relating to Bills of Lading, dated Brussels 25th August 1924, or in those countries where they are already in force the Hague-Visby Rules contained in the Protocol of Brussels, dated 23rd February 1968, as enacted in the Country of Shipment, shall apply to all carriage of goods by sea and also to the carriage of goods by inland waterways, and such provisions shall apply to all goods whether carried on deck or under deck.

The Carriage of Goods by Sea Act of the United States of America (COGSA) shall apply to the carriage of goods by sea, whether on deck or under deck, if compulsorily applicable to this FBL or would be applicable but for the goods being carried on deck in accordance with a statement on this FBL.

Limitation of Freight Forwarder's Liability

Assessment of compensation for loss of or damage to the goods shall be made by reference to the value of such goods at the place and time they are delivered to the consignee or at the place and time when, in accordance with this FBL, they should have been so delivered. The value of the goods shall be determined according to the current commodity exchange price or, if there is no such price, according to the current market price or, if there are no such prices, by reference to the normal value of goods of the same name and quality. Subject to the provisions of sub-clauses 8.4. to 8.9. inclusive, the Freight Forwarder shall in no event be or become liable for any loss of or damage to the goods in an amount exceeding the equivalent of 666.67 SDR per package or unit or 2 SDR per kilogramme of gross weight of the goods lost or damaged, whichever is the higher, unless the nature and value of the goods shall have been declared by the Consignor and accepted by the Freight Forwarder before the goods have been taken in his charge, or the ad valorem freight rate paid, and such value is stated in the FBL by him, then such declared value shall be the limit. Where a container, pallet or similar article of transport is loaded with more than one package or unit, the packages or other shipping units enumerated in the FBL as packed in such article of transport are deemed packages or shipping units. Except as aforesaid, such article of transport shall be considered the package or unit. Notwithstanding the above mentioned provisions, if the multimodal transport does not, according to the contract, include carriage of goods by sea or by inland waterways, the liability of the Freight Forwarder shall be limited to an amount not exceeding 8.33 SDR per kilogramme of gross weight of the goods lost or damaged.

When the loss of or damage to the goods occurred during one particular stage of the multimodal transport, in respect of which an applicable international convention or mandatory national law would have provided another limit of liability if a separate contract of carriage had been made for that particular stage of transport, then the limit of the Freight Forwarder's liability for such loss or damage shall be determined by reference to the provisions of such convention or mandatory national law.

Unless the nature and value of the goods shall have been declared by the Merchant and inserted in this FBL, and the ad valorem freight rate paid, the liability of the Freight Forwarder under COGSA, where applicable, shall not exceed USD 500 per package or, in the case of goods not shipped in packages, per customary freight unit.
If the Freight Forwarder is liable in respect of loss following from delay in delivery, or consequential loss or damage other than loss of or damage to the goods, the liability of the Freight Forwarder shall be limited to an amount not exceeding the equivalent of twice the freight under the multimodal contract for the multimodal transport under this FBL. The aggregate liability of Freight Forwarder shall not exceed the limits of liability for total loss of the goods. The Freight Forwarder is not entitled to the benefit of the limitation of liability if it is proved that the loss, damage or delay in delivery resulted from a personal act or omission of the Freight Forwarder done with the intent to cause such loss, damage or delay, or recklessly and with knowledge that such loss, damage or delay would probably result.

Applicability to Actions in Tort
These conditions apply to all claims against the Freight Forwarder relating to the performance of the contract evidenced by this FBL, whether the claim be founded in contract or in tort. Liability of Servants and other Persons These conditions apply whenever claims relating to the performance of the contract evidenced by this FBL are made against any servant, agent or other person (including any independent contractor) whose services have been used in order to perform the contract, whether such claims are founded in contract or in tort, and the aggregate liability of the Freight Forwarder and of such servants, agents or other persons shall not exceed the limits in clause 8. In entering into this contract as evidenced by this FBL, the Freight Forwarder, to the extend of these provisions, does not only act on his own behalf, but also as agent or trustee for such persons, and such persons shall to this extent be or be deemed to be parties to this contract. However, if it is proved that the loss of or such loss or damage to the goods resulted from a personal act or omission of such a person referred to in Clause 10.1., done with intent to cause damage, or recklessly and with

knowledge that damage would probably result, such person shall not be entitled to benefit of limitation of liability provided for in Clause 8.

Amounts
The aggregate of the amounts recoverable from the Freight Forwarder and the persons referred to in Clause 2.2. and 10.1., shall not exceed the limits provided for in these conditions.

Method and Route of Transportation
Without notice to the Merchant, the Freight Forwarder has the liberty to carry the goods on or under deck and to choose or substitute the means, route and procedure to be followed in the handling, stowage, storage and transportation of the goods.

Delivery
Goods shall be deemed to be delivered when they have been handed over or placed at the disposal of the Consignee or his agent in accordance with this FBL, or when the goods have been handed over to any authority or other party to whom, pursuant to the law or regulation applicable at the place of delivery, the goods must be handed over, or such other place at which the Freight Forwarder is entitled to call upon the Merchant to take delivery.
The Freight Forwarder shall also be entitled to store the goods at the sole risk of the Merchant, and the Freight Forwarder's liability shall cease, and the cost of such storage shall be paid, upon demand, by the Merchant to the Freight Forwarder.
If at any time the carriage under this FBL is or is likely to be affected by any hindrance or risk of any kind (including the condition of the goods) not arising from any fault or neglect of the Freight Forwarder or a person referred to in Clause 2.2. and which cannot be avoided by the exercise of reasonable endeavours the Freight Forwarder may:
Abandon the carriage of the goods under this FBL and, where reasonably possible, place the goods or any part of them at the Merchant's disposal at any place which the Freight Forwarder may deem safe and convenient, whereupon delivery shall be deemed to have been made, and the responsibility of the Freight Forwarder in respect of such goods shall cease. In any event, the Freight Forwarder shall be entitled to full freight under this FBL and the Merchant shall pay any additional costs resulting from the above mentioned circumstances

Freight and Charges
Freight shall be paid in cash, without any reduction or deferment on account of any claim, counterclaim or set-off, whether prepaid or payable at destination. Freight shall be considered as earned by the Freight Forwarder at the moment when the goods have been taken in his charge, and not to be returned in any event. Freight and all other amounts mentioned in this FBL are to be paid in the currency named in this FBL or, at the Freight Forwarder's option, in the currency of the country of dispatch or destination at the highest rate of exchange for bankers sight bills current for prepaid freight on the day of dispatch and for freight payable at destination on the day when the Merchant is notified on arrival of the goods there or on the date of withdrawal of the delivery order, whichever rate is the higher, or at the option of the Freight Forwarder on the date of this FBL.

All dues, taxes and charges or other expenses in connection with the goods shall be paid by the Merchant. Where equipment is supplied by the Freight Forwarder, the Merchant shall pay all demurrage and charges which are not due to a fault or neglect of the Freight Forwarder. The Merchant shall reimburse the Freight Forwarder in proportion to the amount of freight for any costs for deviation or delay or any other increase of costs of whatever nature caused by war, warlike operations, epidemics, strikes, government directions or force majeure.

The Merchant warrants the correctness of the declaration of contents, insurance, weight, measurements or value of the goods but the Freight Forwarder has the liberty to have the contents inspected and the weight, measurements or value verified.

If on such inspection it is found that the declaration is not correct it is agreed that a sum equal either to five times the difference between the correct figure and the freight charged, or to double the correct freight less the freight charged, whichever sum is the smaller, shall be payable as liquidated damages to the Freight Forwarder for his inspection costs and losses of freight on other goods notwithstanding any other sum having been stated on this FBL as freight payable. Despite the acceptance by the Freight Forwarder of instructions to collect freight, charges or other expenses from any other person in respect of the transport under this FBL, the Merchant shall remain responsible for such monies on receipt of evidence of demand and the absence of payment for whatever reason.

Lien
The Freight Forwarder shall have a lien on the goods and any documents relating thereto for any amount due at any time to the Freight Forwarder from the Merchant including storage fees and the cost of recovering same, and may enforce such lien in any reasonable manner which he may think fit.

General Average
The Merchant shall indemnify the Freight Forwarder in respect of any claims of a General Average nature which may be made on him and shall provide such security as may be required by the Freight Forwarder in this connection.

<u>Notice</u>
Unless notice of loss or damage to the goods, specifying the general nature of such loss or damage, is given in writing by the consignee to the Freight Forwarder when the goods are delivered to the consignee in accordance with clause 12, such handing over is prima facie evidence of the delivery by the Freight Forwarder of the goods as described in this FBL. Where the loss or damage is not apparent, the same prima facie effect shall apply if notice in writing is not given within 6 consecutive days after the day when the goods were delivered to the consignee in accordance with clause 12.

<u>Time bar</u>
The Freight Forwarder shall, unless otherwise expressly agreed, be discharged of all liability under these conditions unless suit is brought within 9 months after the delivery of the goods, or the date when the goods should have been

delivered, or the date when in accordance with clause 6.4. failure to deliver the goods would give the consignee the right to treat the goods as lost.

Partial Invalidity

If any clause or a part thereof is held to be invalid, the validity of this FBL and the remaining clauses or a part thereof shall not be affected.

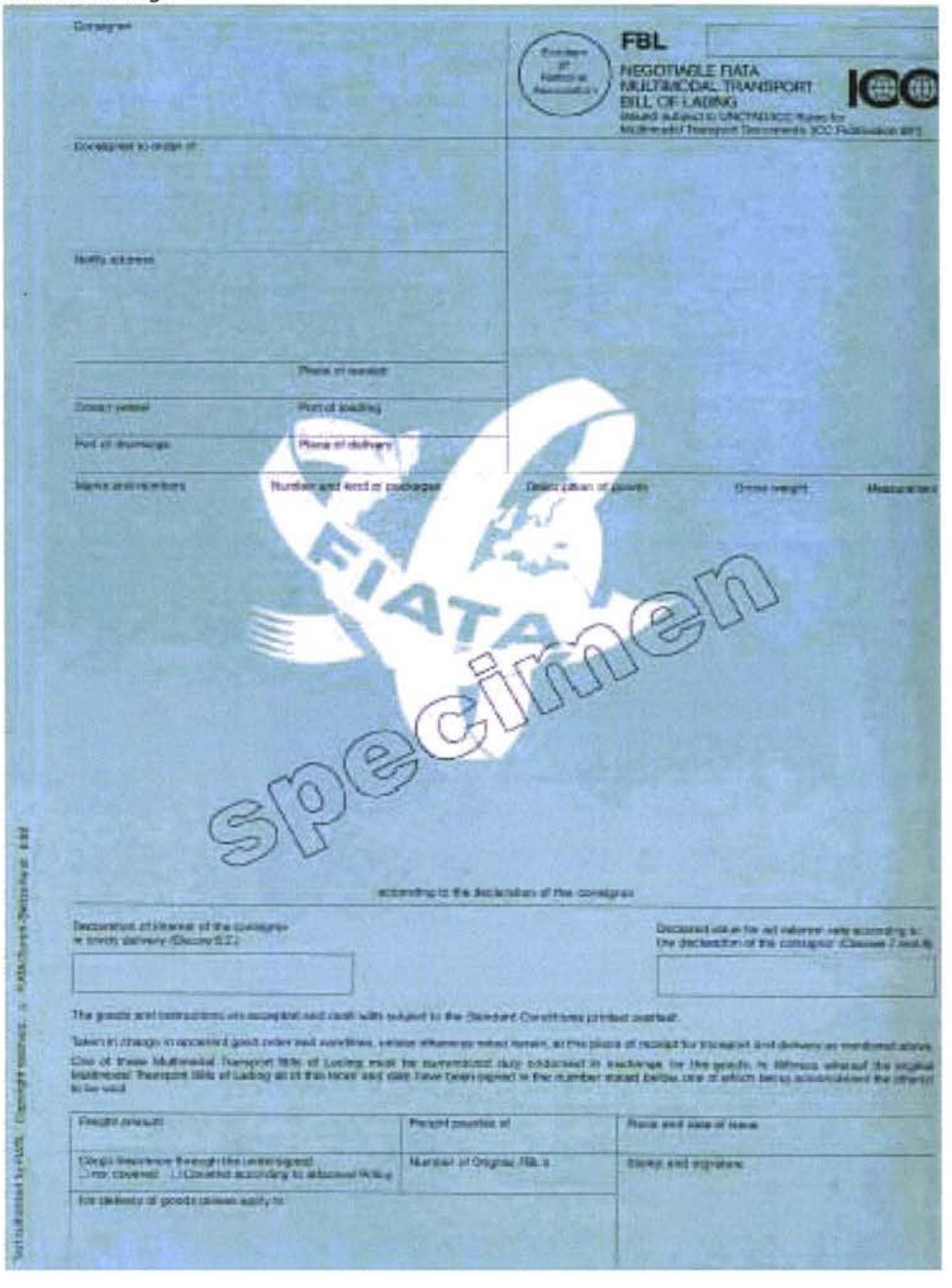
Jurisdiction and applicable law

Actions against the Freight Forwarder may be instituted only in the place where the Freight Forwarder has his place of business as stated on the reverse of this FBL and shall be decided according to the law of the country in which that place of business is situated. The ICC logo denotes that this document has been deemed by the ICC to be in conformity with the UNCTAD/ICC Rules for Multimodal Transport Documents.

The ICC logo does not imply ICC endorsement of the document nor does it in any way make the ICC party to any possible legal action resulting from the use of this document.

16.4 Document Specimen

FBL Cover Page


FBL

NEGOTIABLE FIATA MULTIMODAL TRANSPORT BILL OF LADING

Notify address

Place of receipt

Port of loading

Place of delivery

Marks and numbers

Number and kind of packages

Description of goods

Gross weight

specimen

FCT Cover Page

FWB Cover Page

FWB Second Page

Multiwaybill 95

Code Name: "MULTIWAYBILL"

MT Doc. No.

Consignor

Reference No.

MULTIMODAL TRANSPORT WAYBILL

Issued by The Baltic and International Maritime Council (BIMCO), subject to the UNCTAD/ICC Rules for Multimodal Transport Documents (ICC Publication No. 481) and to the CMI Uniform Rules for Sea Waybills.

Issued 1995

Consignee (not to order)

Notify party/address

Place of receipt

Ocean Vessel | Port of loading

Port of discharge | Place of delivery

Marks and Nos.	Quantity and description of goods	Gross weight, kg. Measurement, m³

Particulars above declared by Consignor

Freight and charges

RECEIVED the goods in apparent good order and condition and, as far as ascertained by reasonable means of checking, as specified above unless otherwise stated.

The MTO, in accordance with and to the extent of the provisions contained in this MT Waybill, and with liberty to sub-contract, undertakes to perform and/or in his own name to procure performance of the multimodal transport and the delivery of the goods, including all services related thereto, from the place and time of taking the goods in charge to the place and time of delivery and accepts responsibility for such transport and such services.

The Consignor shall be entitled to transfer right of control of the cargo to the Consignee, the exercise of such option to be noted on this MT Waybill and to be made no later than the receipt of the cargo by the Carrier.

Consignor's declared value of .....

subject to payment of above extra charge.

Note:

The Merchant's attention is called to the fact that according to Clauses 10 to 12 of this MT Waybill, the liability of the MTO is, in most cases, limited in respect of loss of or damage to the goods.

Freight payable at

Place and date of issue

Signed for the Multimodal Transport Operator (MTO) as Carrier

by ____________

As agent(s) only to the MTO

Printed by the BIMCO Charter Party Editor

p.t.o.

17 ICT Applications, Tracking & Tracing

Learning Objectives for Lecture 17:

- The student shall understand what EDI stands for, how it works, and the benefits of using EDI.
- The student shall understand the basics about bar-code, how it works, and the main symbols used in bar-codes. The student shall have a basic understanding of the roles played by EAN, UCC and GS1, and the composite EAN/UCC bar-codes. The student shall be aware of the bar-code application in transport labels, particularly the IATA air freight label and the Multi-industry Transport Label.
- The student shall understand the new development in RFID, how it works and its application.

17.1 Electronic Data Interchange (EDI)

17.1.1 Basics and Benefits of EDI

Electronic Data Interchange (EDI) is the computer - to - computer exchange of information between companies, using an industry standard format. EDI replaces communication via mail, fax, overnight delivery, etc. The types of documents exchanged by EDI include business transactions such as purchase orders, invoices, delivery advices and payment instructions as part of EFT (electronic funds transfer). There may also be pure information transactions such as a product specification, for example engineering drawings or price lists.

The following characteristics demonstrate EDI's unique attributes:
- EDI is independent of trading partners' internal computerized application systems.
- EDI interfaces with internal application systems rather than being integrated with them.
- EDI is not limited by differences in computer or communications equipment of trading companies.

One of the major goals in creating EDI was to reduce the large volume of business paperwork and clerical tasks involved in processing paper documents. Substantial productivity improvements and/or direct cost savings in company operations have resulted from the use of this technology. In short, the benefits of using EDI can be summarised as the following:

1) Reduction of paperwork: One-time data entry
- Reduced errors, improved error detection
- On-line data storage
- Faster management reporting
- Automatic reconciliation
- Reduced clerical workload

2) More timely communications
- Rapid exchange of business data
- Elimination of mail charges, courier services
- Reduced inventory safety stocks
- Improved production cycle

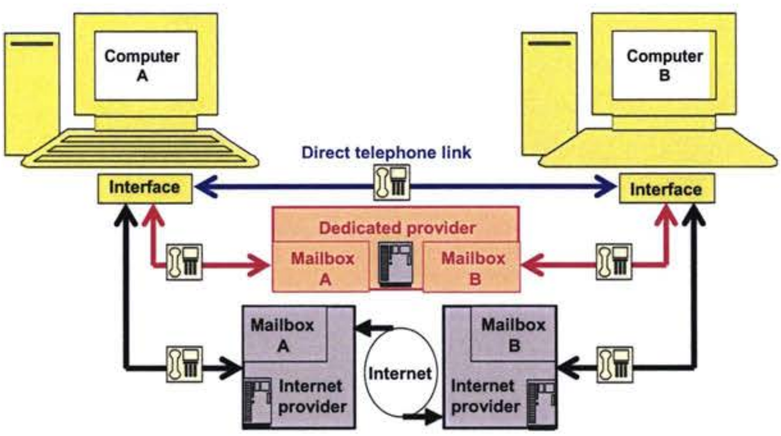
3) Standard communications
- Customers
- Suppliers
- Banks and financial institutions

4) Fewer errors in data entry and less time spent on exception handling in business.

17.1.2 How EDI Works

The essence of EDI is the ability to transfer documents in a form of automated data between computers from different companies. Two basic methods can be used to accomplish this transfer: (1) send the data directly from one computer to the other or (2) send the data to a third party that consolidates and/or converts the data and sends it to the proper location. In
both methods, there are two important considerations: establishing the physical links and transferring data in a format compatible to all users.

Figure 17.1 Computer Connections



17.1.3 Communication Standards

For EDI to work, each company must translate the data into a form that can be understood by the other companies. If each customer uses different EDI definitions, a company will have to have a conversion system for each link, which is usually complicated and expensive. Like the proprietary EDI networks, early EDI was created by the firms using proprietary standards. Proprietary standards involve the hassles of providing data in a proper format for each existing and potential customer, should the latter adopt EDI messages in different standards.

Efforts were made to make the EDI communication forms uniform. Two primary standards exist for EDI messages: The UN's EDIFACT; and the ANSI X 12 definition from the American National Standards Institute of the United States.

17.1.4 EDI Transmission Process

EDI transmission typically involves the following process:

a) The sender assembles the data using its own business application system.
b) This data is translated into an EDI standard format (i.e. transaction set).
c) The transaction set is transmitted either through a value added network (VAN) or directly to the receiver's EDI translation system.
d) The transaction set, in EDI standard format, is translated into files that are usable by the receiver's business application system.
e) The files are processed using the receiver's business application system.

Message standards include many different transaction sets that have replaced common business paper transactions. Below is a listing of commonly used transaction sets:

- Purchase Order;
- Price Change;
- Functional Acknowledgment;
- Statement;
- Remittance Advice;
- Promotion Announcement;
- Invoice;
- Item Maintenance;
- Electronic Funds Transfer.

17.2 Bar-coding

17.2.1 Barcode Basics

A bar-code is the small image of lines (bars) and spaces to represent numbers and other symbols. Different bar and space patterns are used to represent different characters.
Every bar-code begins with a special start character and ends with a special stop character. These codes help the reader detect the bar-code and figure out whether it is being scanned forward or backward.

These printed bar-codes can be "interpreted" by a reader or scanner in a uniform way and be translated back into an identification number (ID). This reference ID does not necessarily contain descriptive data (such as price or origin) but is used by a computer to locate "records", which contain descriptive data linked to this ID and other pertinent information. This mechanism allows the automation of tasks which are based on an ID in diverse fields, ranging from stock management, shipping, pricing of goods to inventory picking, library automation and utility meter reading.

Often these ID's are printed as numerical characters underneath the bar-code, to allow manual data entry in case a bar-code becomes damaged (e.g. the checkout

clerk in a supermarket will occasionally type these ID numbers into her register, instead of scanning it with a bar-code reader).
Bar-codes and readers are most often seen in supermarkets, warehouses and distribution centres.

Figure 17.2 Barcode and Reader

17.2.2 Readers

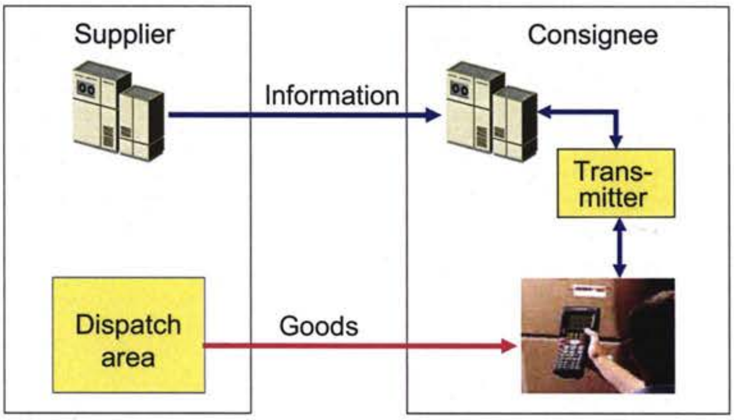
A bar-code reader is used to read the code. The reader uses a laser beam that is sensitive to the reflections from the line and space thickness and variation. The reader translates the reflected light into digital data that is transferred to a computer for immediate action or storage. Readers may be attached to a computer (as they often are in retail store settings) or separate and portable, in which case they store the data they read until it can be fed into a computer.
Types of readers:

- Fixed readers or scanners: remain attached to their host computer and terminal and transmit one data item at a time as the data is scanned.
- Portable batch readers: are battery operated and store data into memory for later batch transfer to a host computer.
- Portable wireless readers: are battery operated and transmit data real-time, on-line. More importantly, the real-time, two-way communication allows the host to instruct the operator what to do next based on what just happened.

17.2.3 How the Barcode Works

When a bar-code reader is passed over the bar-code, the light source from the scanner is absorbed by the dark bars, but it is reflected by the light spaces. A photocell detector in the scanner receives the reflected light and converts the light into an electrical signal. This way the scanner creates a low electrical signal for the spaces (reflected light) and a high electrical signal for the bars (absorbed light); the duration of the electrical signal determines wide versus narrow elements. This signal can be "decoded" by the bar-code reader's decoder into the characters that the bar-code represents. The decoded data is then passed to a computer as an ID in a traditional data format. The supplier has submitted data in advance (maybe using EDI) to the consignee specifying the goods incorporated into the shipment. The computer of the consignee can compare this information with the data from the barcode scanner and can send a notification to the display on the barcode reader if anything is wrong (shortages, wrong part numbers etc.).

Figure 17.3 Barcode Information Flow



17.2.4 Standardisation

EAN is the European Article Numbering System.
UCC is the Uniform Commercial Code in the United States, harmonising commercial transactions within the United States.
Both have developed standards for barcodes, which later have been harmonised.
GS1 based in Brussels, Belgium, is an organisation of worldwide GS1 member organisations.
GS1 now manages the standardised / harmonised EAN.UCC barcode system (and also provides standards for RFID and tracking & tracing).
For more information please refer to www.gs1.org
Below 2 examples of widely implemented standardised barcodes are illustrated:

Figure 17.4 Barcode Standards

EAN-13: 13 Numeric capacity; *for Point-of-Sale scanning*

5 012345 678900

50 = United Kingdom
12345 = EAN User Code
67890 = Product Code
0 = Check Digit

GS1-128: 48 Alphanumeric capacity; *for transport applications*

(00) 0 0123456 123456789 6

(00) = Application Identifier for SSCC
0 = Packaging Type (*)
0123456 = EAN User Code
123456789 = Serial Shipping Container Code
6 = Check digit

17.2.5 IATA & MITL labels

Resolution 606 B of IATA

For the carriage of air cargo, identification labels in the form of a bar-coded label may be used and attached to each package. If not a bar-code label, then a non-bar-coded label shall be used. In either case, the label shall be adjacent to the consignee's name and address where space permits. Resolution 606 B of IATA sets out the detailed requirements and technical specifications in the use of bar-coded label.

Detailed explanation of 606 B Labels

According to IATA resolution 606, labels must be at least 4" x 5" (102mm x 128mm) in size.

The bar-coded labels shall contain the following mandatory information:

- Airline name;
- Air waybill number;
- Destination;
- Primary bar-code.

Bar-coded labels may also contain optional information. For detailed explanation of 606 B Labels, including the information to be mandatory and optionally contained, as well as the layout of the bar-code, please refer to the reference reading "IATA Resolution 606 B" at the end of this chapter.

Multi-industry transport labels

CEN, "Comité Européen de Normalisation", administers the common standardisation work in Europe. During 1995 - 96, CEN decided on several standards that regulate the design of the Multi Industry Transport Label (MITL). The most important standards decided by CEN are listed below:

EN 1573	Multi Industry Transport Label ("the MITL standard")
EN 1572	Rules for unique package identity (Licence Plate)
EN 1571	Rules for data identifiers
EN 799	Symbology Code 128
EN 800	Symbology Code 39
EN 1635	Test specification for bar-codes
EN 12646	Test specification for readers and decoders
EN 12648	Test specification for printers
EN 12647	Test specification for verifiers

The designation "transport label" is a direct translation of the concept MITL (Multi Industry Transport Label). It corresponds most closely to "address label", although the new transport label includes more functions than simply providing an address. It should facilitate automatic data capture of package numbers when tracking packages. It is also intended to be used for automatic sorting at transport terminals. Under certain conditions it should also be possible to use it as a complete set of instructions for a transport consignment, both for domestic and for international transport. The transport label is intended for use together with EDI so that the transfer of the total information mass is done electronically. In practice, however, it has been proven that the necessary communication channels for EDI are not always available. There might therefore be a need for an independent means of transferring data, e.g. using bar-codes, to enable automatic data capture.

Label format, practical limitations
According to the MITL standard, two alternatives for label width are recommended - 105 mm and 148 mm. when a lot of information needs to be printed, the width of 148mm should be chosen. The label can vary in length. In practice, there is a maximum length that should not be exceeded. This length is determined by, among other things, the size of the package, the application method, etc. Experience shows that the practical maximum length is between 200 mm and 250 mm.

Layout in principle – information blocks
The information content of the transport label may be described according to the six blocks below. The blocks should be in the stated order:

1. The From - block (mandatory);
2. The To - block (mandatory);
3. Transport instructions for automatic data capture conditional);
4. Transport instructions in "plain text" (conditional); the line above block 5 is recommended.
5. Article data block (according to the issuer's choice); there shall be a line above block 6.
6. Bar-code block (mandatory).

17.3 RFID – Radio Frequency Identification

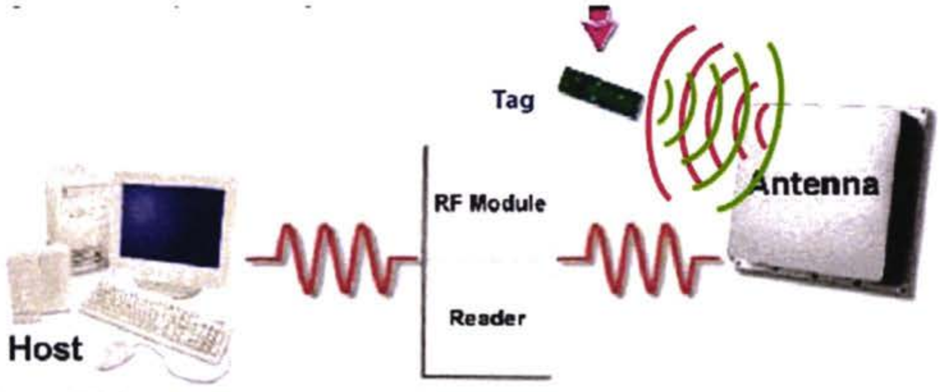
17.3.1 RFID in General

RFID stands for Radio Frequency Identification and refers to small electronic devices that consist of a small chip and an antenna. The chip typically is capable of carrying 2,000 bytes of data or less. RFID can take the form of a portable memory device that contains a microchip. This inexpensive microchip can be embedded in any object and can store basic information concerning the item. With an inexpensive scanner working within a range of a few feet (2 to 5 feet), one can read the information stored in these microchips. Currently this stored information is static but is expected that in future such information can be modified and restored.

17.3.2 RFID Components

RFID employs Radio Frequency Communications to exchange data between the memory microchip and a host computer. An RFID system typically consists of a "Tag/Label/PCB" containing data storage, an Antenna to communicate with the Tag, and a Controller to manage the communication between the Antenna and the PC.

Figure 17.5 RFID Components



Source: QED Systems

Until recently, RFID tags and labels were considered too costly and difficult to implement for mainstream item tracking purposes in the supply chain.
The big change over the past 3 years has been the collaborative work - via the Auto- ID Center of a number of companies and universities to develop the standards and designs for a new range of simple passive tags that can be manufactured in bulk and eventually reduce the cost per tag down to the 10 cents range. At the same time, this research work generated designs for simpler reader technology and for a global structure to enable a simple passive tag holding a serial number to be linked to the company database that holds the history and attributes of the specific item that the tag is attached to.

This concept allows the tag to hold little more than a unique UPC number (albeit one that is specific to a unique item rather than a product type) with the complex changing information about that item held in remote databases. The readers that gather information for a tag will, in practice read that tag many times, and so a rationalization of the data is required. RFID Middleware, takes that role, and uses some of the bits from the tag to look-up, via a system of ONS servers, the location of the latest data on that tag. The data can be held in the original manufacturer's systems, or in databases belonging to the numerous companies that may have handled that item during its track through the supply chain. The integration of these various elements of data is what makes an full implementation complex but ultimately very rewarding.

Source: http://www.rfidexchange.com/rfid101.aspx

17.3.3 How RFID Works

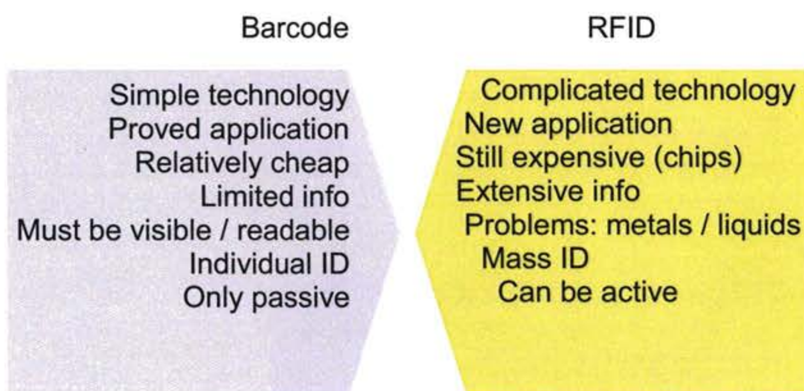
The RFID technology process starts with a "tag", which is made up of a microchip with an antenna, and a reader with an antenna. The reader sends out radio-frequency waves that form a magnetic field when they join with the antenna on the RFID tag.

A passive RFID tag creates power from this magnetic field and uses it to energize the circuits of the RFID chip. The chip in the radio frequency identification tag sends information back to the reader in the radio-frequency waves. The RFID reader converts the new waves into digital information. Semi-passive RFID tags use a battery to run the circuits of the chip, but communicate by drawing power from the RFID reader.

An advantage of RFID devices over bar-code is that they do not need to be positioned precisely in front of a scanner. The situation of checkout clerks having to manually input a bar-code could soon be history.

Barcode and RFID compared
In the following figure the main characteristics of barcode and RFID are compared.

Figure 17.6 Barcode and RFID Compared



The figure indicates some reasons why bar coding already has been widely implemented in logistics, while RFID still is in its infancy: more complicated technology which is not yet fully trusted; still relatively high price of the chips etc. Also still practical problems exist with reflecting RFID signals by metals and liquids.

Main advantages of RFID are: no need for manual scanning; mass identification is possible. RFID chips can be made active: e.g. a reefer container, if provided with a RFID chip and transmitter, can issue a RFID signal itself when it is not timely handled, when temperatures become too high etc.

17.4 Tracking & Tracing

17.4.1 Tracking & Tracing in General

Tracking means: to follow a specific unit from seller to buyer, for appropriate action on logistics problems (delays, damage, loss).

Tracing means: to retrace the origin of a unit or batch, for appropriate action on quality problems (General Food Law, recalls, counterfeiting etc.).

In tracking and tracing the "One Step Up, One Step Down" principle is valid:
each chain party should be able to

- identify the direct recipient.
- trace back to the direct source.

When combining the information from consecutive chain parties the exact history can always be traced back.

17.4.2 Tracking and Tracing Items

The following figure shows a number of different items (levels of detail), which can be subject to tracking & tracing:

Figure 17.7 Tracking and Tracing Items

The level of detail depends mainly on the value of the unit in question.
Nowadays also (returnable) assets, e.g. pallets, containers, are subject to tracking and tracing.

Tracking and tracing can be supported by barcode scanning, as has been illustrated in the following figure:

Figure 17.8 Tracking and Tracing Items and related barcodes

Depending on the unit mostly two standardised barcodes are applied: EAN-13 for individual products and GS1-128 for the other (larger) units.
The mentioned standardised unique numbers, such as GTIN, SSCC and SIN are used for identification; they can be obtained from the GS1 member organisations.
In air transport the Airway Bill (AWB) number is an important tracking and tracing code.
Re. www.gs1.org for standards and more detailed information.

17.4.3 Tracking & Tracing Actions

To enable tracking & tracing throughout the transport chain, chain parties should take following actions:

On manufacturing:

- Provide product items with a barcode label EAN-13;
- Pack products in packaging units (EAN-13 or GS1-128 label).

On dispatch:

- Combine packages into a transport unit;
- Select an unique serial no. (SSCC) for this transport unit, creating a unique link between SSCC, Order no., product ID, quantities etc.);
- Issue an EDI Shipment Message (incl. SSCC) to the receiver;
- Print Shipment Label + attach this to the transport unit (this label may also contain product- and other barcodes);
- Ship the goods.

RESOLUTION 606*

BAR CODED LABEL

CBPP(08)606 Expiry: Indefinite

Type: B

RESOLVED that:

Section 1 — General

1.1 For the carriage of cargo, identification label(s) in the form of a bar coded label may be used and attached to each package, adjacent to the consignee's name and address where space permits. In certain cases, more than one label may be required, such as when shipments have labels applied by different parties, e.g. shippers, forwarders, airlines, or when the amount of optional information does not fit onto the label stock in use.

1.2 For purposes of this Resolution, a bar coded label is one containing bar code(s). The label may be printed automatically on demand, or preprinted.

1.3 A bar code may be primary or secondary. A primary bar code is one which contains the master air waybill and piece number. Secondary bar codes contain other information and may also be included on the same, or separate, label(s).

1.4 Bar coded labels shall contain the following mandatory information:

1.4.1 airline name;

1.4.2 air waybill number;

1.4.3 destination;

1.4.4 primary bar code.

1.5 Bar coded labels may contain optional information; for example:

1.5.1 airline insignia;

1.5.2 transfer points;

1.5.3 piece number;

1.5.4 weight of this piece;

1.5.5 total number of pieces;

1.5.6 total weight of this shipment;

1.5.7 handling information;

1.5.8 house waybill number;

1.5.9 house waybill piece number;

1.5.10 origin;

1.5.11 total number of house waybill pieces;

1.5.12 total weight of house waybill pieces;

1.5.13 product name;

1.5.14 other information;

1.5.15 secondary bar code.

---

* This Resolution is in the hands of all IATA Cargo Agents.

1.6 Bar coded label quality should be of a type with equal or better characteristics than commonly used in preprinted cargo labels. These specific characteristics include:

1.6.1 adhesion holding power;

1.6.2 service temperature range;

1.6.3 moisture resistance.

Section 2 — Technical Specifications

2.1 The layout and minimum dimensions of bar code labels are defined in Attachments 'C' and 'D' of this Resolution.

2.2 Bar coded information shall be in accordance with Recommended Practice 1600t and as shown in Attachments 'A' and 'B' of this Resolution.

2.3 Notwithstanding the provisions of this Resolution, carriers and their customers who use the bar coded labels of different dimensions may continue to use them, provided the data encoding requirements specified in Attachments 'A' and 'B' of this Resolution are met.

Section 3 — Completion

3.1 The circled numbers to the right of the titles below, correspond with the numbers in the boxes of the specimen label illustrated in Attachment 'C' of this Resolution.

3.2 Completion of the mandatory boxes on the labels shall be as shown below:

3.2.1 Airline Name (1)

The airline name.

3.2.2 Air Waybill Number (2)

The airline code and air waybill number of the shipment. The serial number may be shown as two groups of four digits.

3.2.3 Destination (3)

The IATA three-letter code of the airport of destination. When the airport code is unknown or the city is served by more than one airport the IATA three-letter city code may be used.

3.2.4 Primary Bar Code (5)

The primary bar code contains all data elements described in Attachment 'A' of this Resolution. Whenever more than one bar code is printed on a label containing the primary bar code, the primary code must appear first.

3.3 When used, completion of the optional information on the labels shall be as follows:

3.3.1 Airline Insignia (1)

The airline insignia.

3.3.2 Transfer Points (6)

The IATA three-letter code of the airport(s) of transfer. When the airport code is unknown or the city (cities) is (are) served by more than one airport the IATA three-letter city code may be used.

3.3.3 Piece Number (6)

The air waybill piece number.

3.3.4 Weight of this Piece (6)

The weight of the specific package to which the label is attached, together with the unit of weight (K or L).

3.3.5 Total No. of Pieces (4)

The total number of pieces comprising the shipment.

3.3.6 Total Weight of this Shipment (6)

The total weight of the shipment, together with the unit of weight (K or L).

3.3.7 Handling Information (6)

Any information which pertains to the handling of the shipment.

3.3.8 HWB No. (6)

The house waybill (HWB) number.

3.3.9 HWB Piece No. (6)

The house waybill (HWB) piece number.

3.3.10 Origin (6)

The IATA three-letter code of the airport of origin. When the airport code is unknown or the city is served by more than one airport the IATA three-letter city code may be used.

3.3.11 Total No. of HWB Pieces (6)

The total number of pieces comprising the shipment being shipped under this house waybill.

3.3.12 Total Weight of HWB Pieces (6)

The total weight of pieces represented by the house waybills, together with the unit of weight (K or L).

3.3.13 Product Name (6)

The marketing name associated with the type of freight movement.

3.3.14 Other Information (6)

Information which may be added at the user's discretion.

3.3.15 Secondary Bar Code (5)

The secondary bar code(s) is printed in box 6 of Attachment 'C' of this Resolution whenever a primary bar code is included on the label; otherwise it may be printed in box 5. The secondary bar code(s) contains data elements identified in Attachment 'B' of this Resolution.

RESOLUTION 606

Attachment 'A'

Primary Bar Code (Air Waybill/Piece Number Information)

A primary bar code, of sixteen continuous numeric characters, in which the encoded data shall comprise the following fields:

- the three-digit numeric airline prefix;
- the eight-digit numeric air waybill number;
- a single digit separator (shall always be zero);
- a four-digit numeric unique piece number, indicating each individual piece in a multi-piece shipment. If this field is not used, it shall comprise four zeros;

Note: *The bar code may have human readable translation of all digits in the field.*

Examples:

(a.) air waybill 777-12345675, piece number 3: 7771234567500003

(b.) air waybill 777-76543213, piece number 122: 777654321300122

(c.) air waybill 777-32176546, pieces field not used: 7773217654600000

The primary bar code shall be printed on the cargo label as indicated in Attachments 'C' and 'D'. There should be no box around the bar code in order to maximise reading efficiency.

The bar code shall be printed in Code 128 with a minimum width of the narrow bar (× dimension) of 0.5 mm (0.02 in). The bar code shall be printed vertically (picket fence) with a minimum bar height of 21.6 mm (0.85 in).

The bar code includes the following top and bottom quiet zones:

Top quiet zone: minimum 2.54 mm (0.1 in)

7 7 7 1 2 3 4 5 6 7 5 0 0 1 2 2

Bar code: 21.6 mm (0.85 in)

Bottom quiet zone: minimum 6.35 mm (0.25 in)

The side quiet zones shall be as specified in Recommende Practice 1600t.

The optical characteristics of the bar code shall be such a to be readable:

- using a contact scanner (wand reader);
- at a distance of up to 1.80 m (6 ft) using a non-conta scanner;
- using a fixed scanner on a conveyor moving at speed of approximately 1.80 metres per second (6 feet p second) and a depth of field ranging from 12.7 to 803 m (½ to 32 in).

RESOLUTION 606

Attachment 'B'

Secondary Bar Code

Where more than one secondary bar code is printed on a label, the bar code containing the house waybill number shall be printed as the first of these secondary bar codes.

The secondary bar codes can be variable in length, depending on the fields used. One-character field identifiers will be used as specified below. Printing characteristics of the secondary bar code, including narrow bar dimensions, quiet zones and optical characteristics, shall be the same as specified for the primary bar code. The industry standard (AIM) check digit will be the last character in the bar coded string of data.

Symbology

The secondary bar code shall be printed using CODE 128 and using the standard described in Recommended Practice 1600t.

Specifications

Field Identifier

The field identifier shall consist of a single alpha character as defined below:

Field	Identi-fier	Format (Cargo-IMP Standard)
Destination	D	aaa
Total No. of Pieces	P	n[...4]
Transfer Points	C	aaa
Weight of this Piece	W	n[...7]p
Total Weight of this Shipment	T	n[...7]p
Handling Information	B	t[...38]
Origin	O	aaa
HWB No.	H	m[1...12]
HWB Piece No.	Y	n[...4]
Total No. of HWB Pieces	S	n[...4]
Total Weight of HWB Pieces	A	n[...7]p
Carrier/Customer Specific Information*	Z	t(l...65)
Unique Piece Identifier	J	t(l...35)

*Encoding of carrier-/customer-specific information must be the last data encoded.

Field Delimiter

The delimiter shall be the Plus Sign (+).

Remarks: A, W and T fields to include K or L as the last character to denote kilograms or pounds.

Bar Code Format

The format shall consist of the field identifier immediately followed by the field data. The field delimiter immediately follows. This sequence is repeated until all data is encoded. The industry standard (AIM) check digit will be the last character in the bar coded string of data. As with the primary bar code, the check digit will not be printed in human-readable format. There is no continuation character. If the amount of data to be coded is too great to fit on the label in one secondary bar code, then another bar code must be used. Each bar code will contain complete information for the data fields specified by the field identifier.

Examples:

(a.) HWB No.: CHZH8-1234567

(b.) Destination: ABY, Number of HWB Pieces: 99.

This data will not fit onto a 4 in (102 mm) label, so two bar codes are used. The data strings are formatted as follows:

Bar Code No. 1
HCHZH81234567

Bar Code No. 2
DABY+S0099

Bar Code Examples:

Example Number One:

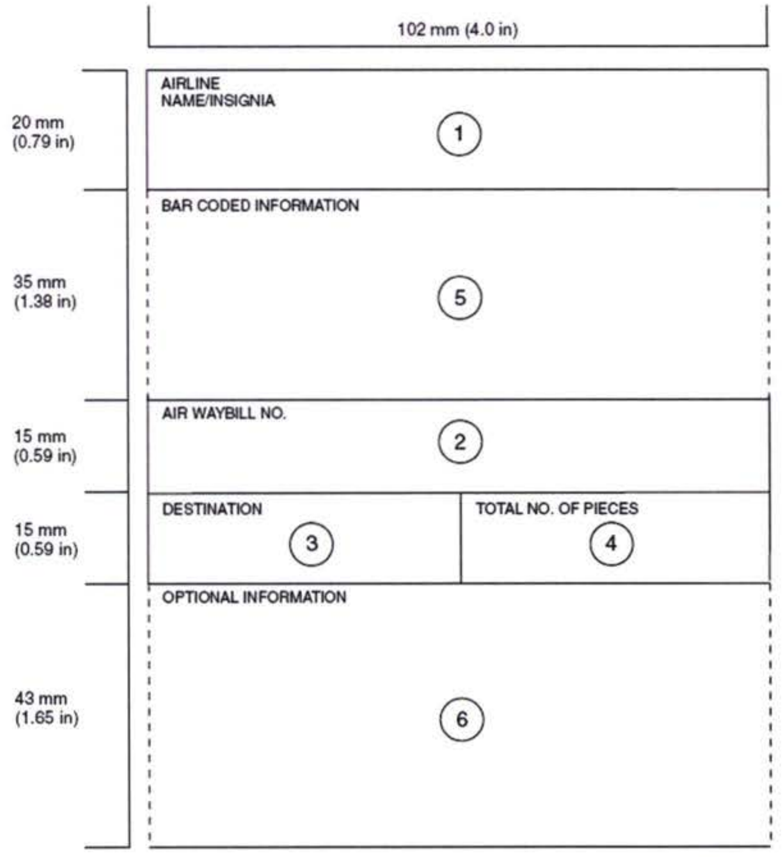
H C H Z H 8 1 2 3 4 5 6 7

Example Number Two:

D A B Y + S 0 0 9 9

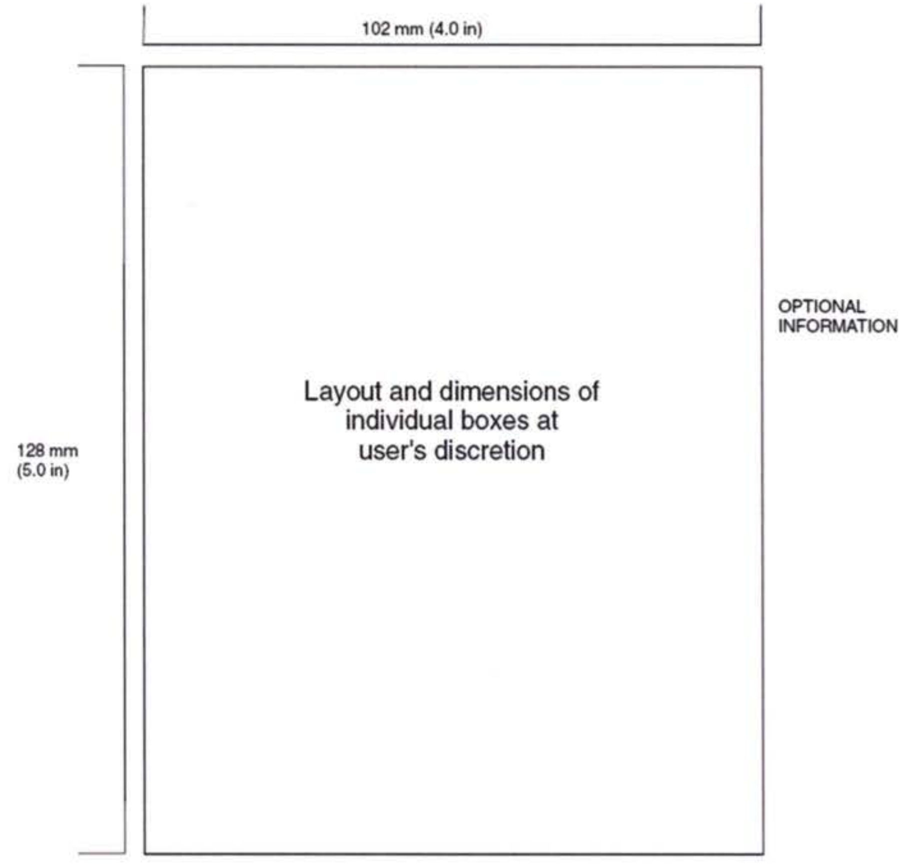
RESOLUTION 606
Attachment 'C'

BAR CODED LABEL



Note: *Boxes containing human readable information must be titled.*

BAR CODED LABEL



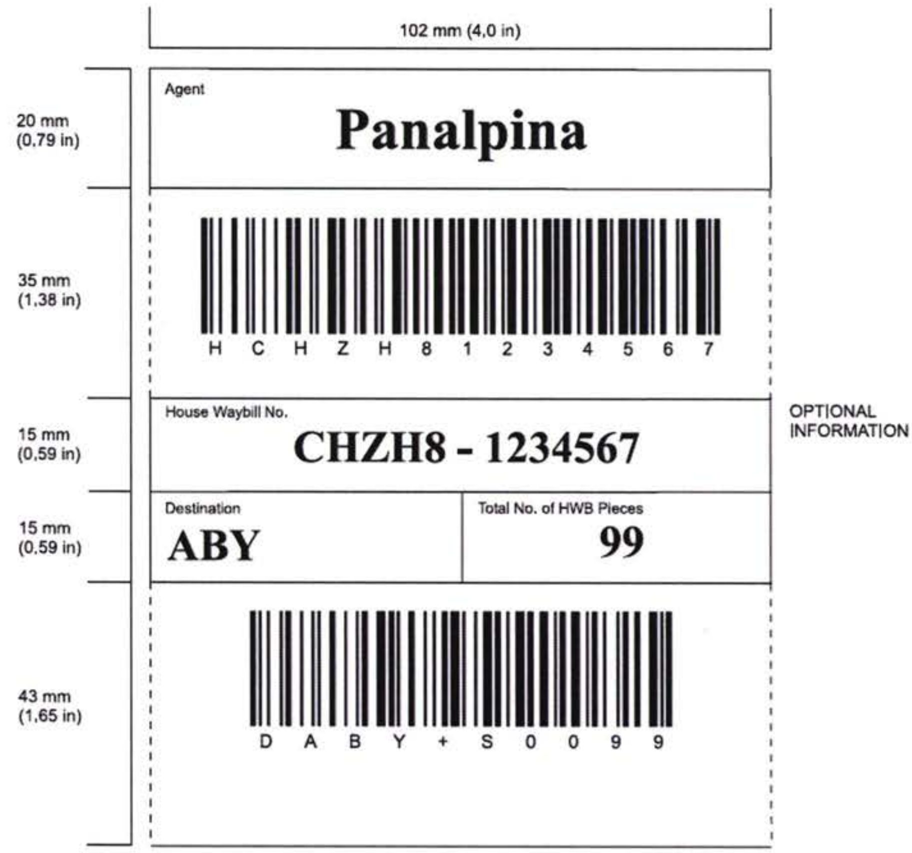
: Boxes containing human readable information must be titled.

RESOLUTION 606
Attachment 'D'

BAR CODED LABEL

Note: *Boxes containing human readable information must be titled.*

BAR CODED LABEL



Boxes containing human readable information must be titled.

18 Hazardous and Perishable Goods Regulations

Learning Objectives for Lecture 18:

- The student should understand the scope of the Orange Book and the dangerous goods regulations of the various transport modalities
- The student should understand the UN classification of dangerous goods, the related labels, packaging standards and required declarations.
- The student should be aware of the main parties involved in the transport and handling of dangerous goods and their responsibilities.

18.1 Principles and Regulations on Dangerous Goods

18.1.1 Definitions

Safety: is the condition of being safe, free from danger, risk, injury or damage; for persons, objects, goods and the environment.

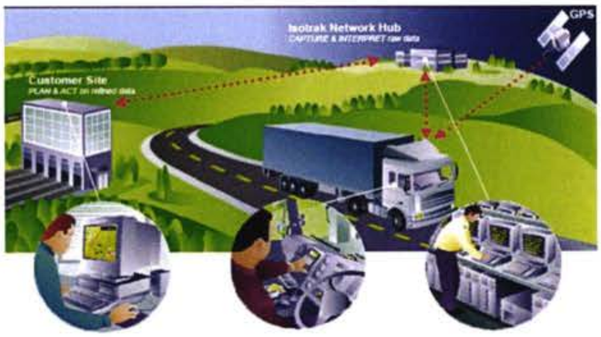
Dangerous Goods: are goods which can damage the health and safety of persons, or which can damage property, the environment, the means of transport and other equipment applied, or other goods.

18.1.2 General Safety Issues

To maintain safe conditions on transport of dangerous goods, some basic conditions must be considered, such as:

- Packaging requirements:
  - packaging must bear normal transport actions;
  - no chemical reaction with contents should occur;
  - packaging's must be well closed: preventing from leakage; no spill of contents.
- Consolidation of cargoes: this is not always allowed, sometimes segregation is requested.
- Information: documents and labels must indicate the kind of dangerous goods.
- Equipment & procedures: must be suitable for international & multi modal transport, handling and storage of dangerous goods.
- Monitoring: GPS based monitoring of transport vehicles in advisable for constant monitoring of (the location of) dangerous cargoes:

Figure 18.1 GPS Based Monitoring



- Transport: sometimes maximum allowed quantities are applicable.
- Staff: must be capable and well trained.
- Safe warehouses: must comply with (EU-) regulations and fire protection levels.

18.1.3 Orange Book

The Orange Book with recommendations to governments on the Transport of Dangerous Goods was published by the United Nations, for the first time in 1956. In 1994 these Recommendations were converted into Model Regulations.
Primary goal of the Model Regulations is: to achieve world-wide uniformity in regulations,
to facilitate international- and multi modal transport.
The Model Regulations cover e.g.:

- Identification of dangerous goods;
- Classification and definition of classes;
- Listing of the main dangerous goods;
- General packing requirements;
- Testing procedures for packaging's;
- Marking, labelling, placarding;
- Transport documents.

Based on (and consistent with) the UN Model Regulations are the following regulations on the transport of dangerous goods:

Modality	*Regulation*	*Organisation*
Air:	DGR, TI	IATA, ICAO
Sea:	IMDG	IMO
Road:	ADR	UNECE
Rail:	RID	OTIF
Inland Water Transport:	ADN-R	UNECE, CCNR

In the following paragraphs the specific regulations per transport modality are explained.

18.1.4 Air Transport

The DGR - Dangerous Goods Regulations are applicable in air transport. These regulations are updated annually by IATA – International Air Transport Association. IATA provides tools for co-operation between airlines, also on dangerous goods, documents, liabilities etc. The DGR includes rules from member states, operators and ICAO - International Civil Aviation Organisation. This organisation of member states concerns international treaties on e.g. logbooks, accidents; staff & equipment requirements, registration etc. Countries have added the DGR rules to their national legislation according to the Chicago Convention.

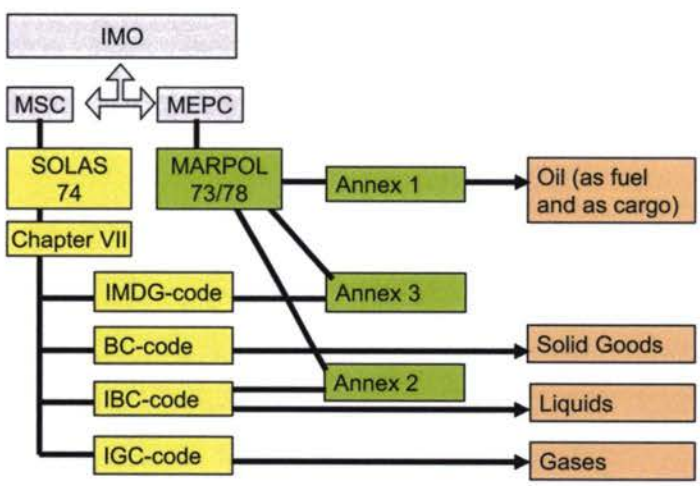
In the DGR rules following issues are covered:

- Applicability, limitations;
- Classification, identification;
- Packing, marking - labelling,
- Documentation;
- Handling;
- Enforcement, inspection.

18.1.5 Sea Transport

IMO – International Maritime Organisation has issued the IMDG Code (International Maritime Dangerous Goods code) as a supplement to SOLAS (the International Convention for the Safety of Life at Sea):

Figure 18.2 IMDG Structure



Amendments to SOLAS, chapter VII (Carriage of Dangerous Goods) adopted in May 2002, make the IMDG Code mandatory from 1 Jan. 2004. However, the following Chapters of the Code remain recommendatory:

1.3 Training;
2.1 Explosives, Introductory Notes 1 to 4 only;
2.3 Section 2.3.3 Determination of flashpoint only;
3.2 Columns 15 and 17 of the Dangerous Goods List only;
3.5 Transport schedule for Class 7 radioactive material only,
5.4 Section 5.4.5 (Multimodal dangerous goods form), insofar as layout of the form is concerned;
7.3 Special requirements in the event of an incident and fire precautions involving dangerous goods only.

18.1.6 Other Transport Modalities

As an example, regional regulations (which are consistent with the Orange Book) exist for:

Road transport: ADR Convention
- Applicable in: Europe, Russia, Morocco.
- Done in 1957 (UNECE), entered into force in 1968.

Rail Transport: RID Convention
- Applicable in: OTIF area = Europe + some countries in Northern Africa & Middle East).
- In force since 1980.

Inland Water Transport: AND Convention
- This regulation is not yet in force, it will cover the whole of Europe;
- Still separate regulations exist for: Rhine (AND-R), Danube (AND-D) etc.

18.1.7 Storage

The general regulation for the storage of dangerous goods in the EU is the "Seveso II Directive 96/82" and related regulations (which are based on the ADR Convention for road transport).
More info: http://ec.europa.eu/environment/seveso/index.htm.

Individual countries have developed national regulations based on and consistent with this EU directive. As an example some highlights are listed from the so-called PGS-15 Guidelines of The Netherlands:
- A starting warehouse dealing with dangerous goods must first notify the competent authority and implement a safety management system & *internal* emergency plan.
- The competent authority develops an *external* emergency plan, to avoid emergencies affecting nearby companies (domino - effect).

The PGS-15 contain general rules for:
- Construction: floors, storage equipment, ventilation, lighting, collection of spilled products and water, etc.;
- Procedures: non-smoking, limited access, emergency plans, escape, fire fighting, first aid provisions etc.;
- Packaging, labelling, separation of goods;
- Distinction is made between in-house and open-air storage;
- PGS15-1: concerns storage volumes between 25 - 10,000 kg.

- PGS15-2: volumes over 10.000 kg.
- In PGS 15-2, three fire protection levels have been determined:

Level 1	Level 2	Level 3
Automatic fire-extinguishing system		
Storage fire-extinguishing water	Storage fire-extinguishing water	
Fire detection	Fire detection	
Product spill storage	Product spill storage	Product spill storage (in certain occasions)
Preventative measures	Preventative measures	Preventative measures
Equipment specifications	Equipment specifications	Equipment specifications

18.2 UN Classification on Dangerous Goods

18.2.1 Introduction

Identification of dangerous goods only *by Name* may be difficult.
Example: are these Dangerous Goods?

- *Dowfume?* = Trade name for methyl bromide.
- *2-Mercaptobenzothiazol?* = Non hazardous for transport.
- *Anhydrol?* = Synonym for ethanol.
- *Waterstof samengeperst?* = Dutch translation of "hydrogen compressed".

It can be concluded that identification *by Name only* is often not well possible.
For appropriate identification the following tools have been developed:

- *UN Number* = 4-digit identification number, assigned to a dangerous good by UN-CETDG;
- Proper Shipping Name (standardized goods name);
- Class.

18.2.2 UN Dangerous Goods List

The Orange Book contains the UN Dangerous Goods List, which serves as a basis for all related dangerous goods regulations. It mentions the UN number, Proper Shipping Name and Class plus other information, such as packaging details, rules for stowage and segregation (if any) etc. Re. next figure for an example of the items listed.

UN No. (1)	Proper Shipping Name (PSN) (2)	Class or Division (3)	Subs. risk(s) (4)	Packing Group (5)	Special provis. (6)	Limited quantities (7)	Packing Instr. (8)	Packing Prov (9)	IBC Instr. (10)	IBC Provisions (11)
2360	DIALLYL ETHER	3	6.1	II	-	1 litre	P001	-	IBC02	-

Tank instructions IMO (12)	Tank instructions UN (13)	Tank instructions Provis. (14)	EmS (15)	Stowage and segregation (16)	Properties and observations (17)	UN No. (18)
T4	T7	TP1 TP13	3-03	Category E	Colourless, volatile liquid with a perceptible odour. Flashpoint: -11°C c.c. Immiscible with water. Toxic if swallowed, by skin contact or by inhalation	2360

18.2.3 UN Classes

The following classes and sub- classes have been identified:

Class 1 - Explosives*

1.1 Explosives with a mass explosion hazard
1.2 Explosives with a projection hazard
1.3 Explosives with predominantly a fire hazard
1.4 Explosives with no significant blast hazard
1.5 Very insensitive explosives blasting agents
1.6 Extremely insensitive detonating articles
*Compatibility Groups A, B, C, D, E, F, G, H, J, K, L, N, or S for mixed shipments

Class 2 - Gases

2.1 Flammable gases
2.2 Non-flammable, non-toxic* compressed gases
2.3 Gases toxic* by inhalation

Class 3 - Flammable Liquids

Flammable liquids (and Combustible liquids in the U.S.A.)

Class 4 - Flammable Solids, Combustible Materials, Dangerous When Wet

4.1 Flammable solids
4.2 Spontaneously combustible materials
4.3 Dangerous when wet materials

Class 5 - Oxidizers and Organic Peroxides

5.1 Oxidizers
5.2 Organic Peroxides

Class 6 - Toxic materials and Infectious substances

6.1 Toxic materials
6.2 Infectious substances

Class 7 - Radioactive Materials

Class 8 - Corrosive Materials

Class 9 - Miscellaneous Dangerous Goods
9.1 Miscellaneous dangerous goods
9.2 Environmentally hazardous substances
9.3 Dangerous wastes

Classes nos. 1, 2, 6 and 7 are so-called Closed Classes: transport is only allowed for specific goods named in the List;
Other classes are Open Classes: only some physical characteristics are listed.

18.2.4 Marks & Labels

For each Class and its Subclasses specific labels have been developed, as illustrated below.

Figure 18.3 UN Class Labels

Class 1 Labels:

** Place for division - to be left blank if explosive is the subsidiary risk.
* Place for compatibility group - to be left blank if explosive is the subsidiary risk

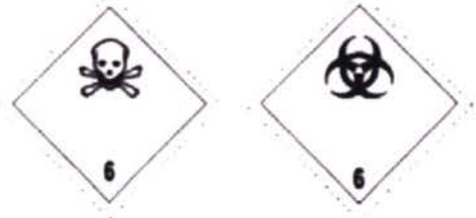
Class 2 Labels:

Class 3 Labels:

Class 4 Labels:

Class 5 Labels:

Class 6 Labels:



Class 7 Labels:

Class 8 Labels:

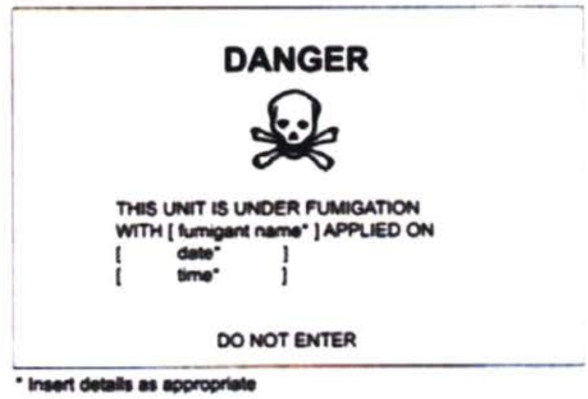
Class 9 Labels:

Additional labels exist for dangerous goods which:

- May cause maritime pollution:

- Are harmful at certain temperature levels:

- Cause special risks due to fumigation (of containers etc.):



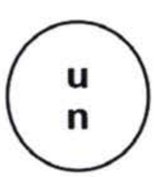
18.2.5 UN Packing Standards

The Orange Book contains the following specifications of packaging's:
- Packing types and specifications.
- UN Packing Groups.
- Testing procedures for competent authorities: Drop tests, Leak-proofness tests, Pressure tests, Stacking tests etc.;
- UN Packaging marks.

Dangerous goods of all Classes other than Classes 1, 2, 4.1 (self-reactive substances), 5.2, 6.2 and 7 have, for packing purposes, been divided among three groups according to the degree of danger they present:

- High danger - packing group I;
- Medium danger - packing group II;
- Low danger - packing group III.

For generic entries in the List and "not otherwise specified" (n.o.s.) entries the relevant packaging group should be determined according to the grouping criteria of the relevant Class.
Below a typical UN- classified packaging and its number is explained:



1A1/Y/1.4/150/98/NL/VL824

1A1	=	Type of packaging (steel drum).
Y	=	Tested for packing groups II and III.
1.4	=	Max. relative density.
150	=	Hydraulic test pressure in kilopascal (kPa).
98	=	Year of manufacturing.
NL	=	State authorising the allocation of the mark.
VL	=	Name of manufacturer (Van Leer).
824	=	Identification number of the packaging specified by the competent authority.

18.2.6 Transport Units and Labels

Kemler Plate
European road vehicles driving under ADR must carry an orange, reflecting plate (Kemler plate), showing a Numerical Hazard Code and the UN product Number.

The Hazard Code is a three-digit code, which indicates the hazards involved in dealing with the material.

The first digit indicates the primary hazard:
2: Gas;
3: Flammable liquid;
4: Flammable solid;
5: Oxidizing material or organic peroxide;
6: toxic substance;
8: corrosive material.

The second + third digits indicate secondary hazards:
0: the first character already adequately describes the total hazard;
2: gas may be given off;
3: fire risk;
5: oxidizing risk;
6: toxic risk;
8: corrosive risk;
9: risk of violent reaction from spontaneous combustion or self polymerisation;
X: prohibition of water.

If the first and second digits are identical, an intensification of the primary hazard is indicated.

Orange plates without any numbers indicate that the vehicle is transporting either dangerous goods or a multi load.

Re. following example:

= Numerical Hazard Code
= UN Product Number

638: 6: primary risk = poisonous
3: secondary risk = flammable
8: secondary risk = corrosive

18.2.7 Placarding

A placard looks very similar to the dangerous goods labels, like an enlarged label. Placards are applied to the outside of a cargo transport unit, indicating dangerous goods inside. Such cargo transport unit includes containers, trucks and trailers, portable tanks/tank containers and tank vehicles. Placarding of an aircraft cargo container or the aircraft itself is not required.

Placarding of vehicles
Subject to exemptions, a freight vehicle containing dangerous goods or residues of dangerous goods shall clearly display the primary risk placard and, if applicable, the subsidiary risk placard(s), as follows:

- A semi-trailer, one on each side and one on each end of the unit;
- Any other freight vehicle, at least on both sides and on the back of the unit.

On freight vehicles carrying explosive substances and articles of more than one division in class 1 only placards indicating the highest risk need be affixed.

Exemptions
Placards are not required on freight vehicles carrying any quantity of:
- Explosives of division 1.4, compatibility group S;
- Excepted packages of radioactive material;
- Dangerous goods in only limited quantities. They shall, however, be suitably marked on the exterior as "LIMITED QUANTITIES" or "LTD QTY" not less than 65 mm high.

Placarding of other transport units or cargo units
Similar to the placarding of vehicles, the other transport unit or cargo unit shall also clearly display the primary risk placard and if applicable the subsidiary risk placard(s) when containing dangerous goods or residues of dangerous goods.

<u>Freight container:</u>
- One on each side and one on each end of the unit.

<u>Portable tank:</u>
- One on each side and one on each end of the unit; and
- A multiple-compartment tank containing more than one dangerous substance or their residues, along each side at the positions of the relevant compartments

<u>Road tank vehicle:</u>
- A semi-trailer, one on each side and one on each end of the unit;

And
- A multiple-compartment tank containing more than one dangerous substance or their residues, along each side at the positions of the relevant compartments.

Bulk container:

- One on each side and one on each end of a freight container or a semi-trailer of a freight vehicle; or
- At least on both sides and on the back of other freight vehicles.

Figure 18.5 Dangerous Goods Placards

Tank Container

Multiple Element Gas Container (MEGC)

18.2.8 Segregation of Incompatible Goods

<u>*Incompatible goods:*</u>
Their stowage together may result in undue hazards in case of leakage or spillage, or any other accident.

<u>*Segregation from other dangerous goods:*</u>
"Away from" each other: goods may be carried in the same transport unit, if a specified safety standard is maintained.
Other goods: not in the same transport unit.

<u>*Segregation from foodstuffs:*</u>
- Class 2.3 + 6.1 (toxic substances and gases, packing groups I and II);
- Class 6.2 (infectious substances);
- Class 7 (radioactive materials).

18.3 Declarations

18.3.1 FIATA Shippers Declaration

Shipper declares that the shipment is in proper condition for transport, according to applicable regulations (accurately described, classified, packaged, marked / labelled / placarded).

18.3.2 Multi Modal Dangerous Goods Form

Multi modal transport document, recommended by UN.

Other Documents:
- Container / vehicle packing certificate;
- Weathering certificate;
- Exemption certificate.

18.3.3 Required Permissions

Class 1 - Explosives:
- License required for transport and storage;
- Import quantities by sea ships are limited;
- Special police permit required for import, export, transport and handling of ammunition.

Class 7 - Radioactive materials:
- Special permit required for transport.

18.3.4 Import / Export Declaration

Regulation nr. 93/75/EU
On Import / export declaration of dangerous goods by sea:

Declaration by Captain or agent to authorities is compulsory for following dangerous goods:
- Class 1 - Explosives;
- Class 5.2 - Organic peroxyds;
- Other classes, if together > 1,000 kg. bruto.

Declaration must comprise:

General Information:
- Vessel name, nationality, length, draught, gross tonnage.
- Agent or broker in port of call.
- Port of call, berth.
- ETA.
- Heating, fire or related suspicion.
- Damage to cargo or ship or related suspicion.
- Possible danger for environment.

Commodity Specific Information:
- UN Shipping name of goods.
- IMDG Class.
- UN number.
- Gross mass in kg.
- Description of packaging.
- Number of packages.
- Stowing plan.
- Action: unloading, or transit without handling.

18.4 Parties & Responsibilities

18.4.1 Parties

IMDG Code Chapter 7.9 mentions addresses of authorities, who are authorised to issue approvals, permissions and certificates

As an example, in Netherlands these are following authorities:

Authorities and Inspections in The Netherlands are:
- Inspection of Ministry of Transport;
- Police (restricted competences);
- Customs (restricted competences);
- Corps Military Inspectors (restricted to military transport);
- Inspection of Ministry of Environment.

For Dutch ports:
- Civilians appointed by municipal or regional ordnances.

For port of Rotterdam:
- Port Authority, Department Dangerous Goods.

18.4.2 Responsibilities

Shipper:	Appropriate packing / info / marking / labelling and documents.
Forwarder:	To select safe ways of transport and handling; to advise shipper about all implications.
Carrier:	Capable staff and appropriate equipment; marks, signs and documentation.
Warehouser:	Capable staff and appropriate storage procedures & equipment, separated if needed

Inspection at interfaces (terminals etc.):
- By appointed authorities
- Of transport, handling & storage
- Non-selective: incidentally,
- Without pre-information
- Selective: focused, with pre-info

Dangerous Goods Safety Advisor:

- Requested by: EU Directive.
- Tasks: Advise management on observance of rules; adequacy of equipment; staff training; checklists, etc.

Person in Charge of Dangerous Goods:

- Requested by: Port- & Customs authorities.
- Tasks: Responsible for notifications / declarations on Dangerous Goods.

Risk Management Steps:
- Select the assets and activities to protect;
- Define the risks and potential consequences;
- Define and implement protective measures;
- Monitor the effectiveness of these measures in practice;
- Adjust the protective measures where needed.

Training Subjects:
- General awareness;
- Function specific issues;
- Safety (avoiding accidents, environment protection, emergency response, first aid).

Training Approach:
- Initial training on recruitment;
- Recurrent training <= every 3 years;
- Record keeping on training history.

Re: "FIATA Introduction on the Regulations for the Safe Handling and Transport of Dangerous Goods"

18.5 Perishable Goods

Perishable goods, e.g. food products, must be handled carefully because of its fragile nature. Food products are susceptible to spoilage, loss of nutrients, contamination, changes in colour, flavour or odour, and even package corrosion and leakage. Environmental control of temperature and humidity is needed to minimise
these changes in food quality during transport. To set requirements and standards the following legislation has been developed.

18.5.1 ATP Agreement

The agreement on the International Carriage of Perishable Foodstuffs and on the special equipment to be used for such carriage, known as the ATP agreement (after its French initials, derived from "Accord relatif aux Transports internationaux de denrees Perissables et aux engins speciaux a utiliser pour ces transports") was drawn up by the Inland Transport Committee of the United Nations Economic Committee for Europe in 1970- 1971. ATP provides a multi-

lateral agreement between Signatory Countries (Contracting Parties) for overland cross-border carriage of perishable foodstuffs. Its purpose is to facilitate international traffic by setting common internationally recognised standards and to preserve the quality of perishable foodstuffs during international transport. This legislation applies exclusively to road transport, rail transport or a combination of the two. The ATP also applies to road and rail transport that includes transport by sea for a distance
of max. 150 km.

The main requirements are with respect to the technical details of the transport means (lorries, trailers, containers, wagons/freight cars, etc.) and test requirement to check for these standards. For that purpose, the transport means are divided into classes (ATP classification) and specify:

- whether there is any means of cooling;
- whether there is a refrigerator or an ice bunker;
- whether there is a simple or a reinforced insulation;
- and for what temperatures the means of transportation is suitable.

18.5.2 Structure of ATP codes

Equipment is certified according to test results, and each ATP certificate issued states the classification under which the equipment is approved. The ATP code is given to approve vehicles. The code is as follows:

- 1st letter: type of cooling or heating unit;
- 2nd letter: degree of insulation;
- 3rd letter: temperature range;
- 4th letter: X = vehicle equipped with mobile or dependent temperature unit.

The letter X indicates the presence of a clip-on-unit.

Figure 18.6 Examples of ATP Codes

Name	Definition	Abbreviation	Remarks
I = Insulated equipment			
Insulated equipment	the case is built with insulating walls making it possible to limit heat transfer between the inside and the outside of the case.	IN =normally insulated equipment IR = heavily insulated equipment	K coefficient ≤ 0.70 W/m2 K K coefficient ≤ 0.40 W/m2 K
R = non mechanical cooling unit			
Refrigerated equipment	using a source of cold other than a mechanical or "absorption" unit	RN = normal insulation RR = reinforced insulation Class A (e.g. RNA) Class B (e.g. RNB) Class C (e.g. RNC) Class D (e.g. RND)	≤ +7 °C ≤ - 10 °C ≤ - 20 °C (most common) ≤ 0 °C
F = mechanical cooling unit			
Mechanically refrigerated equipment	Insulated equipment either fitted with its own refrigerating appliance, or served jointly with other units of transport equipment by such an appliance.	FN = normal insulation FR = reinforced insulation Class A (e.g. FNA) Class B (e.g. FNB) Class C (e.g. FNC) Class D (e.g. FND) Class E (e.g. FNE) Class F (e.g. FNF)	between + 12 °C and 0 °C between + 12 °C and - 10 °C between + 12 °C and - 20 °C ≤ 0 °C ≤ - 10 °C ≤ - 20 °

Vehicles must be in a generally good condition. No daylight must be seen inside with doors closed. Door seals should be good and all repairs carried out with the correct materials. No holes may be found in the bodywork. The unit must pull down to Class temperature within 6 hours. An ATP certificate covering the insulated body and the refrigeration unit is awarded based on positive test results. The test certificate is valid for 6 years. The vehicle must then be re-examined and a second certificate can be issued. The second certificate is valid for 3 years. Thereafter, the certificate can be extended for 1-year periods.
The main requirements to the maximum temperature for the transportation of different products can be found below.

Figure 18.7 Max. Transport Temperatures

Product	Max. Temperature
Red meat offal	+ 3°C
Butter	+ 6°C
Game	+ 4°C
Tank milk (fresh or pasteurized)	+ 4°C
Industrial milk	+ 6°C
Dairy products	+ 4°C
Fish, molluscs and shellfish	Ice slurry
Prepared meat products	+ 6°C
Meat (except red meat offal)	+ 7°C
Poultry and rabbit	+ 4°C
Ice cream	- 20°C
Fish, frozen or deep-frozen molluscs and shellfish and all other deep-frozen foodstuffs	- 18°C
All frozen products (except butter)	- 12°C
Butter	- 10°C
Ice-cream	- 20°C
Frozen or quick-frozen fish, molluscs and shellfish and all other quick-frozen products	-18°C
All frozen product (excl. butter)	-12°C
Butter	-10°C

18.5.3 HACCP

HACCP (Hazard Analysis and Critical Control Points)

At the end of 1995, the EU Food Directives for Food Hygiene were implemented for the purpose of guaranteeing food safety and hygiene. These directives focus on the food industry, but a separate chapter is included for transport. The following HACCP system points are important:

- Setting the required temperature (this must be indicated by the company)
- Checking the temperature.
- Taking measures when (one detects that) there are deviations and recording these.
- Periodically submitting the trailer for the maintenance of the refrigerator motor, container and internal cleaning.
- Personal hygiene.

A transport company must be able to show that it does or has done everything to guarantee food hygiene. The haulier must be able to show that he has satisfactorily carried out his work. The driver and planner must know what they have to pay particular attention to and what critical points there are before they can report them or take precautionary measures.

Phytosanitary regulations

A Phytosanitary health certificate is required by most countries for the import of plants such as trees, shrubs, bulbs and flowers into EU territory. In Holland this certificate is also called a PD document (PD stands *for Plantenziektenkundige Dienst* (Plant Pathology Service). In most countries, a similar institute as the PD issues this certificate. The certificate is issued in the country of origin. For plants that are transported from one EU member state to another, a certificate is needed for the following products:

- Seed potatoes
- Chrysanthemum cuttings
- Prunus Sp or ornamental cuttings

The PD checks the consignment of plants before it is transported. These regulations are enforced to prevent the spread of plant diseases.

Ozone depletion

Many cooling units use CFCs as cooling agents. An international agreement was made to reduce the use of CFCs, because they will cause Global Warming. CFC is the abbreviation of *chlorofluorocarbon*. CFCs contain the elements chlorine, fluorine and carbon. If a CFC also contains hydrogen it is denoted as HCFC. Both damage the ozone layer and are therefore bad for the environment. In addition, there are HFCS. These contain fluorine, carbon and hydrogen. They are harmless to the ozone layer, but do contribute to the global warming.CFCs, HCFCs and HFCs are often denoted with a brand name such as SUVA, FREON, KLEA and FORANE. They are denoted with an R number, e.g. R 22. On the basis of the CFC Resolution, there are also resolutions to ensure that cooling units are leak proof. These resolutions say that cooling units must satisfy certain technical specifications to prevent the leakage of cooling agent.