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Research & Education in Inland Waterway Logistics

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# READER – INLAND VESSELS AS PART OF A TRANSPORT CHAIN

Extract of relevant passages from the „Manual of Danube Navigation", via donau (2019) and of relevant passages from the "Annual report on Danube Navigation", viadonau (2018).

Pictures: viadonau in Manual on Danube Navigation (2019), p. 79, 106

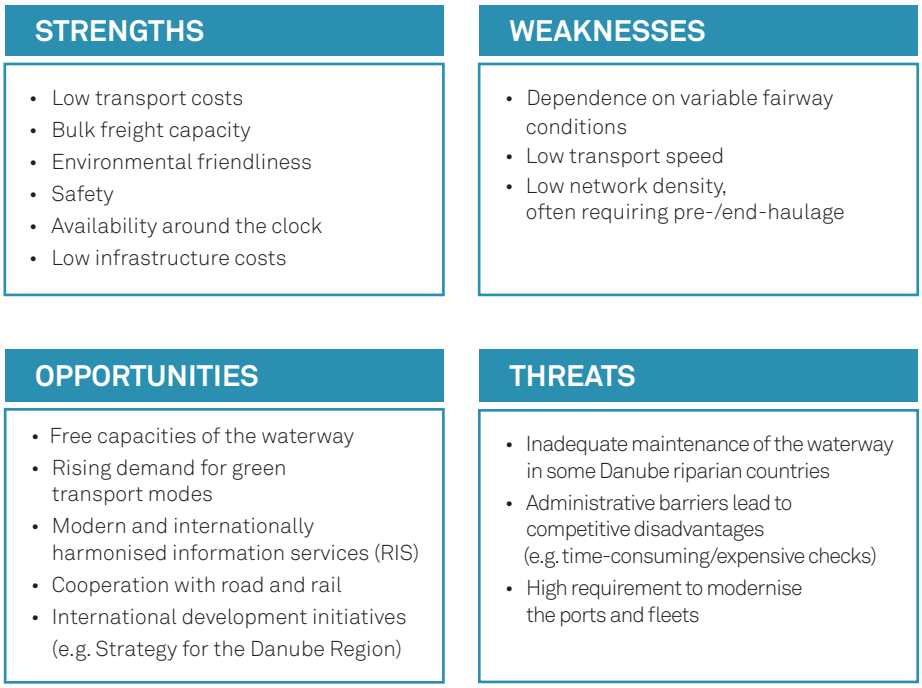
## Strengths and weaknesses of Danube navigation

The principal **strengths** of Danube navigation are the ability to transport large quantities of goods per vessel unit, its low transport costs and its environmental friendliness. Furthermore, it is available around the clock, with no prohibition on driving at weekends or during the night and can provide a high degree of safety and low infrastructure costs.

The **weaknesses** lie in its dependence on fluctuating fairway conditions and the consequent, varying degree of the vessel load factor, the low transport speed and network density, which often necessitate pre- and end-haulage by road or rail.

The **opportunities** of Danube navigation are the high free capacities of the waterway, international development initiatives such as the Strategy for the Danube Region, the internalisation of external costs at European level, cooperation with road and rail, as well as the use of modern and harmonised River Information Services (RIS).

The **threats** to Danube navigation are found in the different political and hence budgetary importance assigned to this transport mode in the individual Danube states, as well as in the need to modernise many Danube ports and parts of the Danube fleet.




SWOT analysis of Danube navigation

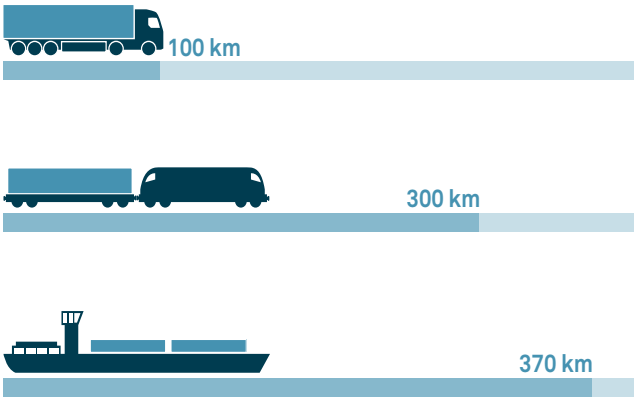
Source: viadonau

## Danube navigation compared to other transport modes

Some facts speak clearly in favour of inland navigation in comparison with other transport modes: For instance, it has the lowest specific energy consumption and the lowest external costs of all inland transport modes. In addition, it has a high bulk freight capacity and low investment requirements for maintaining and expanding the infrastructure.

### Specific energy consumption

In regard **to specific energy consumption**, inland navigation can be described as the most efficient and hence environmentally friendly transport mode. Inland vessels can transport one ton of cargo almost four times as far as a truck with the same energy consumption.



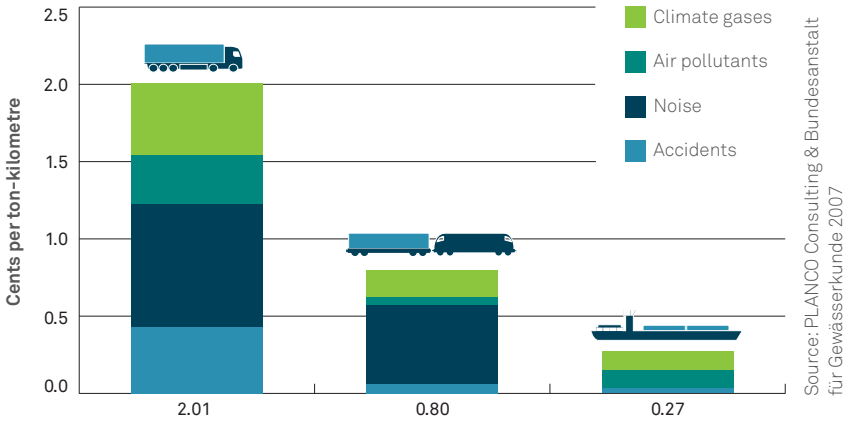

Transport distances for one ton of cargo requiring the same amount of energy

### External costs

Inland navigation also accounts for the lowest **external costs**, so those costs associated with climate gases, air pollutants, accidents and noise. $CO_2$ emissions are comparatively low in particular, which means that inland navigation can contribute to achieving the European Union climate targets.

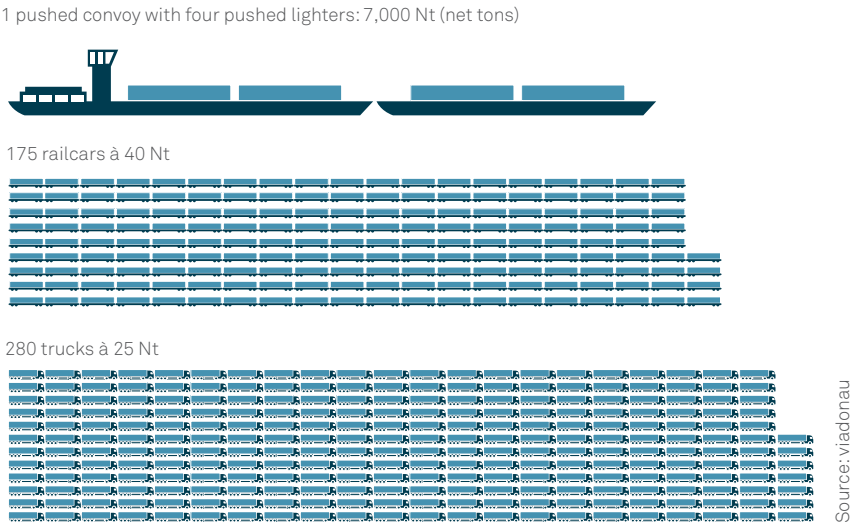
### Bulk freight capacity

Compared to other land transport modes, Danube navigation offers a significantly higher **transport capacity per transport unit**. For instance, a single convoy with four pushed lighters can transport around 7,000 tons of goods – equivalent to the cargo carried by 175 railcars (with 40 net tons each) or 280 trucks (with 25 net tons each). Hence, increasing cargo transport on the Danube means a significant reduction in congestion, noise emissions, environmental pollutions, road accidents and the burden on the rail system.




Source: PLANCO Consulting & Bundesanstalt für Gewässerkunde 2007

The sum of external costs for inland vessels is by far the lowest (average values for selected transports of bulk goods)




Source: viadonau

Inland vessels beat rail and trucks for transport capacity


Source: PLANCO Consulting & Bundesanstalt für Gewässerkunde 2007

Comparison of infrastructure costs (example of German inland transport modes)

### Infrastructure costs

Infrastructure costs are comprised of the **costs for building and maintaining transport routes**. As in most cases it is possible to make use of the inland waterways as natural infrastructure, the infrastructure costs are low for inland navigation. Detailed comparisons with land transport modes in Germany are available: They indicate that the infrastructure costs per tonne-kilometre for road and rail are four times higher than for waterways (📄 PLANCO Consulting & Bundesanstalt für Gewässerkunde, 2007).

Current cost estimates of infrastructure projects in the riparian states suggest that improving the complete infrastructure of the 2,415 km Danube waterway would cost 1.2 billion Euros in total. This is more or less equivalent to the costs of constructing around 50 km of road or rail infrastructure. Current European rail tunnel projects each cost 10 to 20 billion Euros.

## Relevance of Danube navigation

### Danube waterway transport in a European comparison

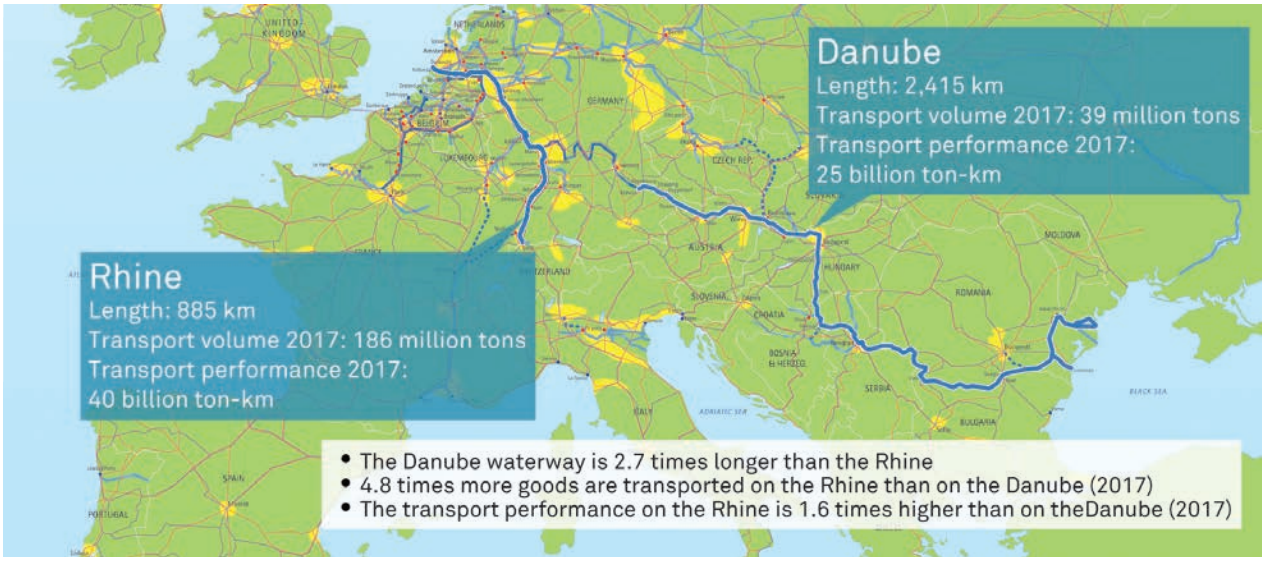
ⓘ Statistical data for the EU-28 countries were taken from the online database of Eurostat, the statistical office of the European Union: ec.europa.eu/eurostat; this comprises of estimated and preliminary values. Values for the Danube region are based on enquiries by viadonau, which were conducted on the basis of national statistics.

In total, 558 million tons of goods were transported on **the inland waterways of the European Union** in 2017. The transport performance was 147 billion ton-kilometres. Accordingly, the average distance of waterway freight transport was 263 km.

The **Main-Danube Canal** creates an important basis for the 3,500 km, central Rhine-Main-Danube inland waterway, which extends through all of European mainland from the Port of Rotterdam on the North Sea to the Seaport of Constanţa on the Black Sea. With a transport volume of 186 million tons, the **Rhine** has significantly higher utilisation than the **Danube**, which was used to transport 39 million tons in 2017. Nonetheless, goods are transported for longer distances on the Danube, as shown by the transport performance for these two key European waterways: 25 billion ton-kilometres on the Danube (mean transport distance approx. 600 km) compared to 40 billion ton-kilometres on the Rhine (mean transport distance approx. 200 km).

If one considers the **transport volumes** along the Danube waterway and its navigable tributaries **in the individual Danube riparian states**, by far the largest transport volume for 2017 was recorded by Romania with 19.1 million tons, followed by Serbia with 12.5 million tons and Austria with 9.5 million tons.

**Maritime transport on the Danube**, i.e. transport on river-sea or sea-going vessels on the Lower Danube (Romania and Ukraine), accounted for 5.8 million tons in 2017, whereby the majority was transported via the Sulina Canal.




Source: viadonau, Central Commission for the Navigation of the Rhine

The European inland waterways Rhine and Danube in comparison

## Modal split

In the **28 countries of the European Union**, waterways made up a 6.0% share of the modal split in 2017 – which means that 6.0% of all freight ton-kilometres were handled on waterways. This share differs sharply in the individual EU states. The Netherlands, for instance, have important seaports and a highly integrated inland waterway network which is divided into small sections. This results in the highest inland navigation share of the 28 EU countries (44.7% in 2017).

The infrastructural circumstances in the **Danube region** are different: Goods transport by waterway is concentrated on one main river. While it is able to transport very large quantities of freight to some extent, the small number of branches also means that it can only be used in focused regional areas. The Danube is therefore confined to a limited form of transport requiring longer pre- and end-haulage by road and rail. This is why the waterways tend to account for a smaller share of the national modal split in the countries of the Danube region.

@ Detailed statistics on the topic of transportation in the European Union: epp.eurostat.ec.europa.eu

@ Statistics on Danube navigation from the Danube Commission: www.danubecommission.org

@ Annual reports on Danube navigation in Austria are published by viadonau and are available to download at www.viadonau.org

### Danube freight transport in Austria

In a longtime average, around 10 million tons of goods are transported on the Austrian Danube each year. Around a third of these goods are ores and scrap metals, while petroleum products, agricultural products and forestry products each account for around one eighth of the transported goods.

The waterway share in the modal split in the Austrian Danube corridor is roughly 10%. The Danube plays an important role mainly in upstream transport, especially in imports via the eastern border. In this area, the Danube is approximately neck and neck with rail transports.

## The Danube economic region

### The Danube as an axis of economic development

In its function as a transport axis the Danube connects key procurement, production and sales markets that have significant European importance. The **gradual integration of the Danube riparian states into the European Union** has led to the establishment of dynamic economic regions and trading links along the waterway. Slovakia's and Hungary's accession to the EU in the year 2004 followed by Bulgaria and Romania in 2007, as well as Croatia's accession in 2013, marked the start of a new phase of economic development in the Danube region. Serbia was given accession candidate status in 2012. Accession negotiations with the European Union started in 2014.

With approximately **90 million inhabitants**, the Danube region is of great economic interest. The focus of this economic development lies in the capital cities of the Danube countries. Other urban areas are also playing an ever increasing role, in particular as consumer and sales markets. The Danube waterway as a transport mode can make a major contribution here with the provision of these centres with raw materials, semi-finished and finished products as well as the disposal of used materials and waste.

The Danube is of particular importance as a transport mode for the **industrial sites** that are located along the Danube corridor. Bulk freight capacity, the proximity to raw material markets, large free transport capacities and low transport costs all add up to make inland navigation the logical partner for resource-intensive industries. Many production facilities for the steel, paper, petroleum and chemical industries along with the mechanical engineering and automotive industry are to be found within the catchment area of the Danube. Project cargo and high-quality general cargo are now being transported on the Danube in ever increasing numbers in addition to traditional bulk cargo.

Due to its fertile soil, the Danube region is an important area for the cultivation of **agricultural raw materials**. These not only serve to ensure the sustainable provision of the conurbations in the vicinity of the Danube, but are also transported along the logistical axis of the Danube to be further processed. The ports and transhipment sites along the Danube play an important role here as locations for storage and processing and as goods collection points and distribution centres. A not inconsiderable part of these agricultural goods is exported overseas via the Rhine-Main-Danube axis and the respective seaports (North Sea and Black Sea).

FIGURES DATA FACTS

# Transport volumes by commodity groups on the Austrian Danube 2018

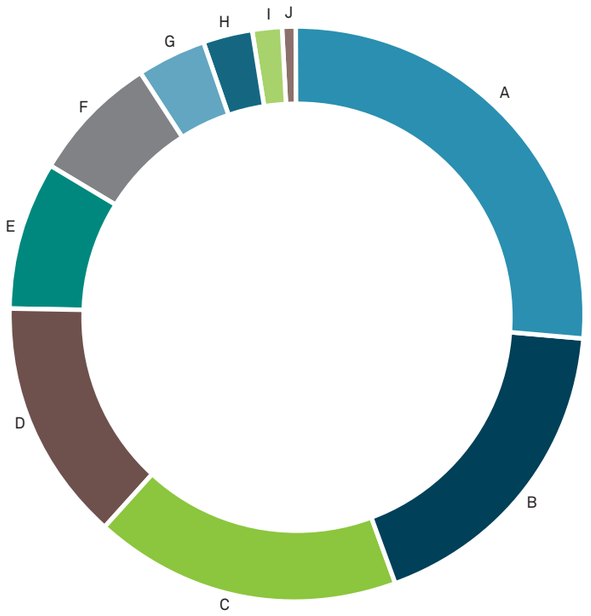
J
Chemical products
0.4%

I
Solid fuels
1.4%

H
Machinery, vehicles, and other articles
2.8%

G
Foodstuffs and animal fodder
3.8%

F
Fertilisers
7.3%




A
Ores and metal waste
26.7%

B
Petroleum products
18.0%

C
Agricultural and forestry products
17.3%

D
Metal products
14.0%

E
Crude and manufactured minerals
8.3%

| Goods classification according to NST/R* | Domestic | Import | Export | Transit | Total 2018 | Change |
|---|---|---|---|---|---|---|
| Agricultural and forestry products | 3,495 | 583,645 | 79,723 | 578,281 | 1,245,144 | –25.4% |
| Foodstuffs and animal fodder | 1,988 | 150,884 | 43,324 | 76,505 | 272,701 | –33.1% |
| Solid fuels | 424 | 80,466 | – | 23,845 | 104,735 | –63.3% |
| Petroleum products | 188,877 | 563,538 | 537,131 | 10,365 | 1,299,911 | –5.0% |
| Ores and metal waste | – | 1,912,590 | 7,943 | – | 1,920,533 | –25.5% |
| Metal products | 1,686 | 212,469 | 551,733 | 243,093 | 1,008,981 | –18.4% |
| Crude and manufactured minerals, building materials | 77,262 | 224,403 | 204,313 | 88,267 | 594,245 | –31.4% |
| Fertilisers | 2,995 | 50,717 | 327,983 | 143,144 | 524,839 | –40.8% |
| Chemical products | – | 0 | – | 26,354 | 26,354 | –39.9% |
| Machinery, vehicles and other articles | 20 | 14,652 | 24,543 | 165,710 | 204,925 | –25.9% |
| **Total** | **276,747** | **3,793,364** | **1,776,693** | **1,355,564** | 7,202,368 | **–25.1%** |

* NST/R = Standard Goods Classification for Transport Statistics/revised.

Source: Statistics Austria, adapted by viadonau



COMMODITY GROUPS

# Ores and metal waste strongest group
## Petroleum products defy low water

- Declines in transport volumes across all commodity groups due to low water levels
- Petroleum products register smallest decreases

In 2018, ores and metal waste remained the largest commodity group with just under 1.9 million tons. Compared to the previous year, the transport volume within the product group dropped by 25.5% due to low water levels.

With a 5.0% decline in transport volumes, petroleum products showed a relatively high resilience under these difficult conditions. In terms of export volume, this product group even recorded an increase of 64,600 tons, an increase by 13.7% over the previous year. Overall, the group of petroleum products came second in terms of percentage share.

Agricultural and forestry products were the third-strongest commodity group in terms of transport volume, accounting for 17.3% of the total volume as in the previous year. A total of around 1.2 million tons were shipped on the Austrian Danube within this product group. Compared with the previous year, the volume of agricultural and forestry products transported declined by 25.4% or 423,005 tons.

Imports of metal products increased by 15,203 tons compared with the previous year, which corresponds to a change of 7.7%. Here too, however, the total volume of goods transported fell by 18.4% to just over 1 million tons. In terms of percentage, metal products came in fourth.

Domestic transport of crude and manufactured minerals suffered a sharp decline. The additional losses in imports, exports and transit led to an overall decrease in transport volumes of 31.4%.

Declines in transport volumes against the previous year were also observed for foodstuffs and animal fodder as well as machinery, vehicles and other articles. These, too, were attributable to the difficult overall conditions. There was a slight increase in domestic shipments of fertilisers. This was offset, however, by a decline in imports, exports and transit traffic.
Solid fuels suffered the strongest decline in freight transport. Overall, the decrease in the transport volume amounted to 63.3%.

In 2018, 26,354 tons of chemical products were transported exclusively in transit. In terms of volume, they therefore continue to represent the smallest group of goods transported on the Austrian Danube.

PASSENGER TRANSPORT

# Number of passengers slightly declining
# River cruises continue to boom

- 3.3% more passengers on river cruises
- Six new cruise ships in operation on the Danube
- Liner and non-scheduled services declining

For the first time in four years, passenger transport on the Austrian Danube section recorded a decline in 2018. A total of approximately 1,260,000 passengers were transported, representing a decrease of 0.4% against 2017.

The number of river cruises continued to rise in 2018, exceeding last year's record with 465,000 passengers transported (+3.3 % against 2017). A total of six newly constructed vessels were brought into service on the Austrian section of the Danube, thereby increasing the number of operational cabin vessels to 182 (+4.6%). In total, 5,197 journeys (+4.4%) were completed. Due to the continuing growth of the existing fleet, the capacity for river cruises increased to 37,000 passengers (+7.6 %), which corresponds to an average of 203 passenger places per ship.

In 2018, liner services carried approximately 700,000 people (–0.7%). DDSG Blue Danube Schiffahrt GmbH recorded a total of 272,300 passengers (+9.1%) transported in the Wachau and Vienna. A total of 147,777 passengers (±0.0%) were transported between Vienna and Bratislava on the two Twin City Liners. 41,338 passengers (–18.8%) took advantage of the services offered by Donau-Schifffahrts-Gesellschaft mbH (formerly known as Donau Touristik). The Slovakian hydrofoils operating between Vienna and Bratislava recorded the largest decrease due to the low water level, carrying only 3,627 passengers (–80.4%) in 2018.

Non-scheduled services carried approximately 95,000 passengers (–13.6 %) in 2018. DDSG Blue Danube Schiffahrt GmbH carried 46,600 passengers (–19.9 %) on theme, special and charter cruises, while MS Kaiserin Elisabeth (owned by the Donau-Schiffahrts-Gesellschaft mbh) recorded 10,680 (+8.0 %) passengers on non-scheduled trips. MS Donaunixe and MS Maria, owned by Donauschiffahrt Ardagger GmbH, recorded approximately 5,543 passengers (–6.6%).

Passenger traffic volumes for companies which carried less than 5,000 passengers in 2018 are not reported separately here. There are no figures available for this reporting period for other scheduled and non-scheduled services operated on the Austrian section of the Danube.



FIGURES DATA FACTS

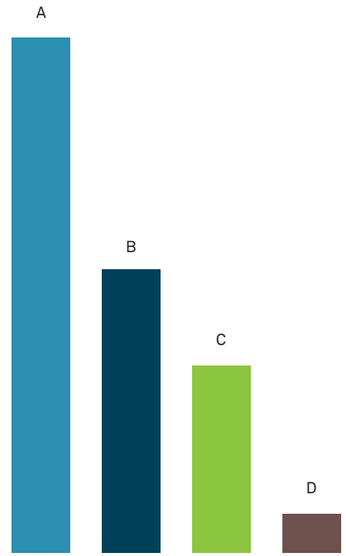
# Passengers on the Austrian Danube 2018[1]

A
**Total**
1,260,000

B
**Liner services**
700,000

C
**River cruises**
465,000

D
**Non-scheduled services**
95,000



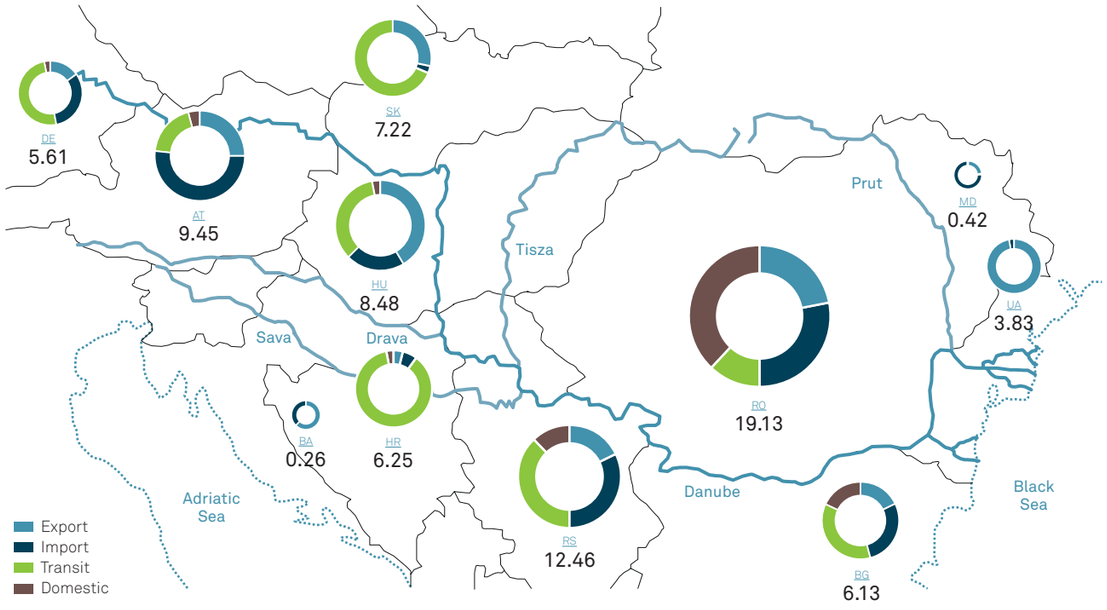

| Dockings and passengers at passenger ports in Vienna[2] | Dockings ships | % to previous year | Passengers processed | % to previous year |
|---|---|---|---|---|
| 2018 | 7,606 | +1.6 | 709,185 | +2.1 |
| 2017 | 7,484 | +2.0 | 694,848 | +3.9 |
| 2016 | 7,337 | +7.8 | 668,805 | +6.6 |
| 2015 | 6,805 | –1.6 | 627,194 | +4.6 |

1 Due to the fact that passenger traffic on the Danube ceased to be statistically compiled in Austria in 2003 (due to a change in legislative basis), the above figures include additional estimates in passenger numbers on liner services and non-scheduled traffic, based on an assumed average capacity utilisation of 40% on passenger ships. The calculation of the total number of passengers on cabin vessels is based on the number of trips these ships made through the locks at Aschach and Freudenau, with an assumed average capacity utilisation of 75%, whereby a deduction of 30% for double counting has been estimated.
2 Landing stages at Handelskai, Danube Canal and Nussdorf, including cabin vessels and the Twin City Liners.

Sources: 1. Wiener Bootstaxi, Brigitte Wilhelm, Central Danube Region Marketing & Development GmbH, DDSG Blue Danube Schiffahrt GmbH, Donauschiffahrt Ardagger GmbH, Donauschifffahrt Wurm & Noé GmbH & Co. OHG, DSGL – Donau-Schifffahrts-Gesellschaft mbH, Event-Schifffahrt Haider e. U., Genuss-Schiffahrt GmbH/Donauparadies Gierlinger, MAHART PassNave Ltd., Nostalgie Tours Video & Consulting GesmbH, ÖGEG Österreichische Gesellschaft für Eisenbahngeschichte GmbH, Schiffahrtsunternehmen Wilhelm Stift GmbH, Slovak Shipping and Ports – Passenger Shipping JSC (SPaP-LOD, a. s.), viadonau, WGD Donau Oberösterreich Tourismus GmbH, Wiener Donauraum Länden und Ufer Betriebs- und Entwicklungs GmbH, Wikingerabenteuer – Koblmüller Alois

FIGURES DATA FACTS

# Freight transport on the entire Danube 2017




| In millions of tons | DE | AT | SK | HU | HR | BA | RS | RO | BG | MD | UA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Export | 0.84 | 2.40 | 2.09 | 3.50 | 0.19 | 0.17 | 2.30 | 4.21 | 1.11 | 0.10 | 3.67 |
| Import | 1.81 | 4.82 | 0.10 | 1.81 | 0.33 | 0.09 | 3.96 | 5.40 | 1.73 | 0.32 | 0.15 |
| Transit | 2.78 | 1.84 | 5.01 | 2.92 | 5.67 | 0.00 | 4.76 | 2.20 | 2.20 | 0.00 | 0.00 |
| Domestic | 0.18 | 0.39 | 0.02 | 0.25 | 0.06 | 0.00 | 1.44 | 7.32 | 1.09 | 0.00 | 0.01 |
| **Total** | **5.61** | **9.45** | **7.22** | **8.48** | **6.25** | **0.26** | **12.46** | **19.13** | **6.13** | **0.42** | **3.83** |

Source: Eurostat, national traffic statistics, viadonau, adapted by viadonau



FREIGHT TRANSPORT ON THE ENTIRE DANUBE 2017

# 39.3 million tons in 2017
## Increase in maritime Danube transport

The most current available figures regarding the volume of freight transport on inland waterways in the Danube region are from the year 2017. This year saw 39.3 million tons of goods transported on the Danube waterway and its tributaries – a slight decrease of 0.8% or approximately 300,000 tons compared to 2016.

In a separate analysis of inland waterway transport on the Danube (including tributaries) and river-sea transport on the maritime Danube route, however, the development of the quantities of goods transported presents itself differently: Cross-border traffic between the Danube countries decreased by 5.6% or almost 2 million tons compared to 2016, while the maritime traffic on the lower Danube recorded a remarkable increase of 40.2% or almost 1.7 million tons – from 4.2 to 5.8 million tons.

The decline in the volume of cross-border traffic between Danube riparian countries compared to 2016 results from an average decrease in the volume of goods transported by inland waterway in the countries of the middle and lower Danube downstream from Hungary by 9.3%. By contrast, the volume of goods transported on the upper Danube and in Hungary increased by an average of 4.6%.

As in previous years, Romania again recorded by far the largest transport volume on the Danube in 2017 with just over 19 million tons, followed by Serbia with 12.5 million tons and Austria with 9.5 million tons.

With 4.2 million tons of goods shipped (+1.9%), Romania was the largest exporter on the Danube in 2017, followed by the Ukraine with 3.7 million tons (–13.0%) and Hungary with 3.5 million tons (+2.6%).

In terms of imports, Romania is also in the lead with 5.4 million tons (–23.8%). In second and third place are Austria (+10.6% or 4.8 million tons) and Serbia (–2.0% or 4.0 million tons).

On the Romanian Danube-Black Sea Canal (including its side channel), a total of 13.8 million tons were transported in 2017 (including river-sea traffic of around 57,000 tons). Compared to 2016, this represents a decrease of 5.4% or around 0.8 million tons of goods transported.

In maritime transport on the Danube via river-sea vessels or sea-going vessels, 4.3 million tons of goods were transported via the Romanian Sulina Canal (+14.4% compared to 2016) and 1.5 million tons via the Ukrainian Kilia-Bystroe arm – a remarkable increase of 362.1% compared to 2016.

- Total transport volumes on the Danube at the level of 2016 (–0.8%)
- Romania was the most important exporter and importer on the waterway
- Approximately 5.8 million tons of goods in maritime transport on the Danube (+40.2% compared to 2016)

## Demand side of Danube navigation

The demand side of the inland waterway transport market firstly includes, for the most part, cargo owners, i.e. industrial companies that receive or convey goods. Secondly there are forwarders and logistics service providers operating in this field who carry out transport for third parties as well.

### Traditional markets of Danube navigation

Due to the large volume of goods that can be transported on a vessel unit, inland navigation vessels are ideally suited to the transport of bulk cargo. If planned and carried out correctly, transport costs can be reduced in comparison to road and rail and this in turn compensates for longer transport times. The inland vessel is especially suitable for the transport of large quantities of cargo over long distances.

However, the system requires the availability of high-quality logistics services along the waterway (transhipment, storage, processing, collection and/or distribution). Many companies use Danube navigation as a fixed part of their logistics chain. Currently, the great bulk freight capacity of inland vessels is utilised predominantly by the metal industry, agriculture and forestry and the petroleum industry.

Inland navigation is a vital transport mode for the **steel industry**. Iron ore accounts for example for 25-30% of the total transport volume shipped on the Austrian stretch of the Danube. Due to their heavy weight, semi-finished and finished goods such as steel coils can also be transported economically using inland navigation.

The most important steel plant in Austria is voestalpine, which is headquartered in Linz. This company operates a private port on its own premises that has an annual waterside transhipment of 3-4 million tons. This is also Austria's most important port in that it has handled almost half of all waterside transhipment in Austria in recent years.

Source: viadonau

Transhipment of steel coils

Other major steel plants in the Danube region are located in Dunaújváros/Hungary (ISD Dunaferr Group), Smederevo/Serbia (HBIS Group) and Galaţi/Romania (Arcelor-Mittal).

The demand and, therefore, also the flow of goods from the **agriculture and forestry sector** can fluctuate greatly from one year to the next. Agriculture is dependent to a great extent on weather conditions (precipitation, temperature, days of sunshine per year). Crop failures in a region due to bad weather conditions can lead to a fluctuation in the volume of transported goods required to cover the needs of the affected region. Grain and oilseed are the main products transported on the Danube. Wood transports (for instance logs, pellets) vary greatly, depending on the regional raw material availability.

Agricultural and forestry products together account for around 20% of the total volume of goods transported annually on the Austrian stretch of the Danube. Many Austrian companies trading in agricultural products or involved in the processing of such goods (i.e. starch, foodstuffs and animal fodder, biogenic fuel) have settled directly on the waterway. Many companies have already established factory transhipment sites or have settled in a port where they operate their silos or processing facilities. This enables transport on inland vessels with no pre- or end-haulage, thereby enabling companies to benefit from particularly low transport costs.

Source: Voies navigables de France

Transhipment of agricultural goods

Petroleum products from the **mineral oil industry** account for a large share of total transport volumes on the Austrian stretch of the Danube and therefore constitute a key market. In the Danube region there are many refineries located either on or near the waterway.

Due to their great bulk freight capacity, low transport costs and high level of safety, inland vessels are absolutely ideal as a significant means of transport for petroleum products in addition to pipelines. The fuel tanks of around 20,000 cars can be filled up with the cargo of a single tanker. As a transport axis, the Danube waterway therefore makes an important contribution to the security of supply in the region.

Petroleum products and their derivatives are classed as hazardous goods and for this reason are transported in special vessel units equipped with the respective safety equipment. European regulations and national hazardous goods legislation have particular relevance for tanker shipping.

### Other branch-specific potential for Danube navigation

In addition to traditional bulk cargo transport, there are numerous sectors involved in the transport of high-value goods, which, due to their specific requirements, represent a great challenge but at the same time a substantial potential for the development of logistics services along the waterway.

Due to their size and/or their weight, as well as the available infrastructure, inland vessels are ideally suited for special transport such as **heavy goods or oversized cargo** (high & heavy), e.g. construction machinery, generators, turbines or wind power plants. The greatest advantages here compared to conventional road transport are that no special authorisations or modifications are needed along the route, e.g. the dismantling of traffic lights and traffic signs or protective covers for plants. In addition, charges such as toll or axle load taxes are not levied on international waterways like the Danube. Another benefit is the fact that there is no inconvenience to the general public due to street closures, restrictions on overtaking or noise when such goods are transported by inland vessel.


Source: viadonau

High & heavy transport by inland vessels

The increasing scarcity of non-renewable raw materials and the requirements introduced by the European Commission to increase the proportion of final energy consumption through renewable energies necessitate innovative logistics solutions for the inclusion of **renewable resources**.

Today already, the Danube is a logistics axis of pan-European significance for the bundling, storage and processing of renewable raw materials (for instance grain, oilseed and timber). Cultivation areas for renewables are readily available along the entire course of the river. Numerous companies from the biomass sector – producers, traders, processors and consumers – are located close to the Danube and represent an immense potential for inland navigation. In addition, there is a large number of Danube ports with efficient equipment for the transhipment and storage of renewable resources existing already.

Source: viadonau

Storage of rapeseed

The recycling sector is also becoming an increasingly important economic factor for Danube logistics due to the progressive, global scarcity of resources and the simultaneous, immense demand for secondary raw materials. Cost-efficient planning and execution of transports are essential factors due to the high price sensitivity associated with **recycling products**. With its capacity to handle bulk transports and the consequent low of cost of transport itself, inland navigation is a useful transport solution for the recycling sector. This is among the most important arguments for transport by inland navigation, combined with the significant prevalence of recycling products in the Danube riparian states. The major urban areas located directly on the Danube (e.g. Vienna, Bratislava, Budapest and Belgrade) are reliable suppliers of secondary raw materials. Moreover, the Danube region is home to numerous companies that process recycling products and that would be able to integrate inland navigation as a crucial link in their logistics chains.

Old metals and scrap, old glass and old plastics are particularly suitable for transport as bulk or general cargo on inland vessels.

Source: viadonau

Scrap metal warehouses close to the Danube

The **construction materials sector** is also a promising industry for Danube transports: The transport of mineral raw materials, as well as products and semi-finished products that are used in the building industry, has particularly significant potential for relocation to the waterways. Numerous infrastructure projects along the Danube corridor present an opportunity for inland navigation as well. Included in this category are bridge building and roadworks projects in Austria, Hungary, Bulgaria and Romania. Other ventures with relevance for Danube logistics are railway and port infrastructure projects along the Middle and Lower Danube.

Inland vessels can be used for (dry) bulk cargo, general cargo (for instance concrete components) and for rolling cargo (e.g. construction machinery and cranes).

Source: viadonau

Transport of construction materials by inland vessel

The **chemical and petrochemical industry** is another important sector for shipping.

Large quantities of fertilisers in particular are currently being transported on the Danube. They account for approximately 10% of the total transport volume on the Austrian stretch of the Danube.

Plants from the petrochemical industry are often found in the immediate vicinity of refineries; these plants manufacture plastics and other oil-based products from the oil derivatives. Due to its great bulk freight capacity Danube navigation is also the ideal solution for this market segment. The development of cost-efficient concepts for pre- and end-haulage as well as the establishment of warehouse space for bulk cargo are auspicious opportunities to improve the integration of inland navigation within the logistics chains of the chemical industry along the entire transport corridor.

Source: viadonau

Storage of chemical products

### Types of contract and transport solutions

Transport companies offer cargo space either in its entirety (full load) or as part of the available cargo hold (part load). However, the freight contract concluded with the client can also apply to the transport of individual 'packages'. This is known as general cargo transport. The transport of heavy and oversized goods (project cargo) differs from traditional shipping of general cargo primarily due to the need for special vessel and transhipment equipment and long-term transport planning.

This chapter was developed together with the LOGISTIKUM, the logistics research institution of the Upper Austrian University of Applied Sciences and is partially based on content from the Manual on Intermodal Transport (Gronalt et al., 2010), Intermodal Transport in Europe (Posset et al., 2014) and the Yearbook of Logistics research (Dörner et al., 2017).

## Introduction

A 2015 study by the European Commission predicts that cargo transport volumes in the 28 states of the European Union will rise by 1.6% each year between 2020 and 2030. The reasons for the predicted sharp rise in cargo transport volume lie with the **internationalisation of production activities** and the **high level of consumption** in Europe.

Production facilities will be moved to cheaper regions that will usually be located at some distance. In particular, this will affect the production of labour-intensive goods in low wage countries. Due to the fact that single product components have to be combined into one joint product, transport of the components to a suitable location is necessary. Another reason for an increase in traffic volume is the trend towards a **minimisation of warehousing** in order to cut costs. This requires just-in-time delivery and will lead to a reduction in delivery quantities. Warehousing usually takes place on route – motorways, for instance, are often called 'the Storehouse of Europe'.

In order to minimise the negative results of rising traffic volumes on society and the environment, a **shift towards more environmentally friendly transport modes** such as waterways and rail is absolutely necessary. This shift can reduce negative results such as noise or $CO_2$ emissions significantly. An improvement of the situation can be consequently achieved by multimodal transport solutions, i.e. the ideal combination of vessels, rail and trucks.

Source: Port of Linz

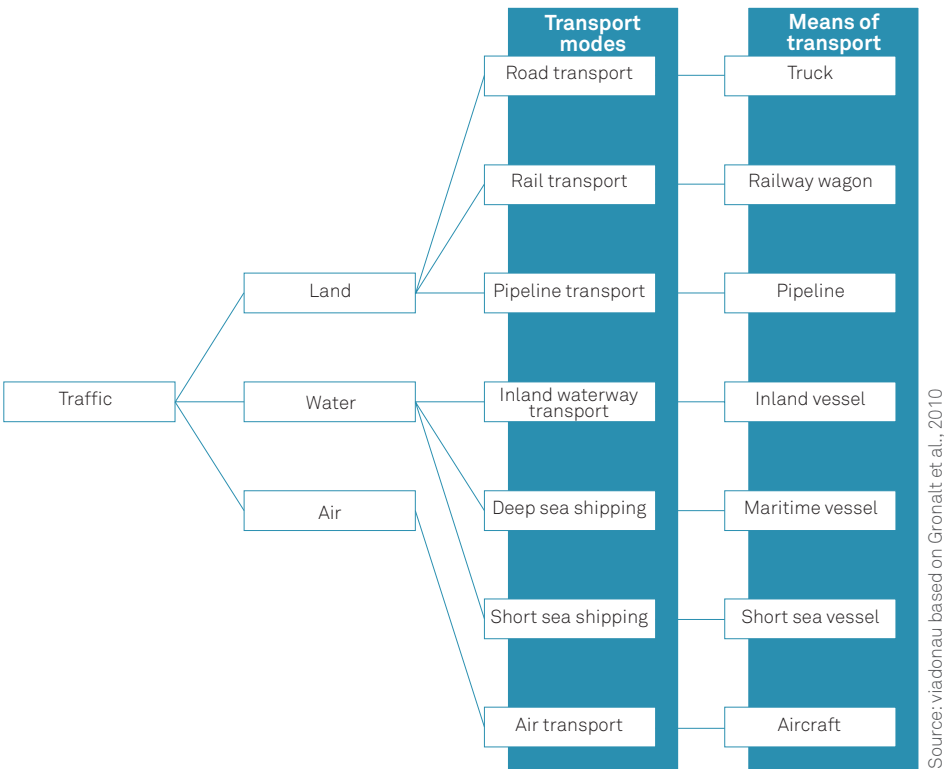
Transhipment in the Port of Linz

# Terminology

## Modes and means of transport

There are several transport modes and means of transport. A **transport mode** provides the necessary infrastructure for using a certain means of transport. Without this infrastructure, no transport would be possible. The transport modes are situated on land, on the water and in the air. Road, rail and pipeline transports are among the land-based transports. Inland waterway transport, deep sea and short sea shipping are among the modes of water transport. Air traffic accounts for transports by air.

**Means of transport** are technical facilities and equipment for the transport of people or goods. Means of transport in freight transport are, for example, inland vessels, trucks or aeroplanes. Due to the fact that transport cannot usually be handled using a single mode or means of transport (e.g. because of geographic conditions), varying forms of transport have been developed, which are described in the following.




Overview of the transport modes and means of transport

### Transport processes

Transport can be processed in several forms (e.g. either directly or by making use of several modes of transport) and it is therefore necessary to further specify these processes.

Transport processes can be initially classified into direct and non-direct transport. In the case of a **non-direct transport process**, goods are transhipped, whereas in **direct transport** no transhipment is needed.

In **direct transport** (single-stage transport chain), goods are transported directly from a point of departure to the destination. For this reason, it is also called door-to-door transport. In this case, the means of transport (e.g. vessel, truck or railway) is not changed and there is also no change of transport mode (e.g. rail or inland waterway). In short, direct transport can always be classified as **unimodal** (goods are transferred from the starting point to the end point by one means of transport). An example is port-port transport by inland vessel (e.g. transport of mineral oil from storage facility A to storage facility B).


Source: Günthner 2001

Direct transport by inland vessel

**Multimodal transport** is characterised by the transport of goods using two or more different transport modes (e.g. change from waterway to rail). In order to change the means of transport, transhipment of the goods is required. In doing this, the strengths of the several individual transport modes can be used and the cheapest and most environmentally friendly combination can be chosen. Since each transhipment involves additional time and causes additional cost, multimodal transport is often used for long-distance transport where delivery time is not an important factor.


Source: Günthner 2001

Multimodal transport by inland vessel

The first part in a transport chain is called **pre-haulage** and constitutes the delivery of a cargo to the first point of transhipment (such as a port). Pre-haulage is often carried out by trucks. Nevertheless, if companies have access to the railway network, they are also able to use the railway for pre-haulage.

**Transhipment** means the switching of the cargo or intermodal loading unit from one means of transport to another. A shift of transport modes, e.g. from road to inland waterway (multimodal transport) can also take place.

The term **main leg** describes the transport of goods or loading units from the consignor's transhipment point to the consignee's transhipment point. The word 'main' results from the fact that the longest part of the transport is performed between these points. Ships or rail are mostly used in this case.

**End-haulage** describes the delivery of the cargo from the consignee's point of transhipment to the consignee's location. Usually, end-haulage is carried out by trucks.

Pre- and end-haulage activities should be kept to a minimum, due to the fact that their costs are especially high. Additionally, handling during transhipment itself should be optimised as far as possible in order to save on time and costs.

## Types of multimodal transport

### Split transport

In split transport, two or more different means of transport or transport modes are used and the cargo itself is transhipped. This is the main difference compared to intermodal transport: in the latter case, it is not the cargo itself, but only the loading units (including cargo) that are transhipped.

Based on the type of cargo, split transport can be distinguished into split bulk cargo transport and general cargo transport:

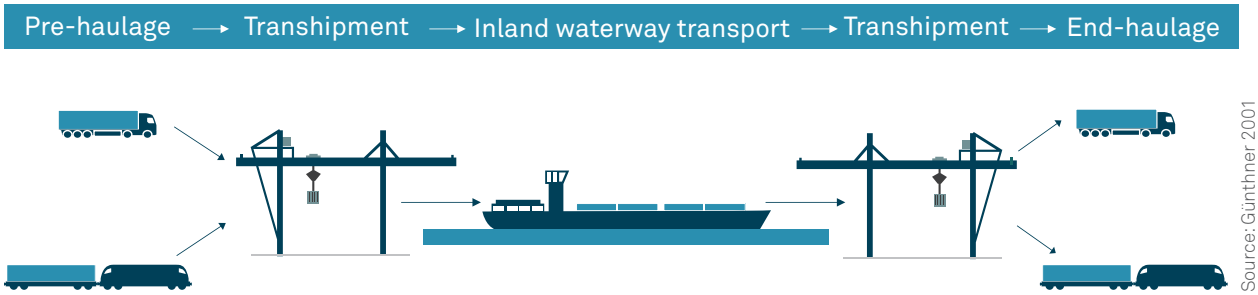
- **Split bulk cargo transport** is classified as the transport of fragmented, granular, powdery, liquid or gaseous unpacked goods. As bulk cargo cannot be transported individually, it is generally measured in units such as tons or litres. Grain, coal and ore are good examples of dry bulk, while oil products or bio diesel can be classified as liquid bulk.

- In contrast, **traditional general cargo** means the transport of distinguishable and individualised goods. The goods can be handled individually, whereby the inventories can be quantified in units such as pieces or packages (bales, pallets, boxes). In fact, everything which is transported as single units without special containers can be classified as general cargo. The transport of machinery, pallets or heavy and/or oversized cargo are good examples of general cargo.

### Intermodal and combined transport

Intermodal transport is a special form of multimodal transport. Here, the goods are transported in the same loading unit or with the same road vehicle on two or more modes of transport. This means that, when changing transport means, only the loading units or the road vehicles are switched, while the goods remain in the same transport receptacles (such as containers or swap bodies). Since only loading units or the road vehicles (and not the goods themselves) are reloaded, this method saves time and cost.

In addition, the risk of damage to the goods during transhipment is minimised.




Source: Günthner 2001

Intermodal or combined transport using the example of container transport

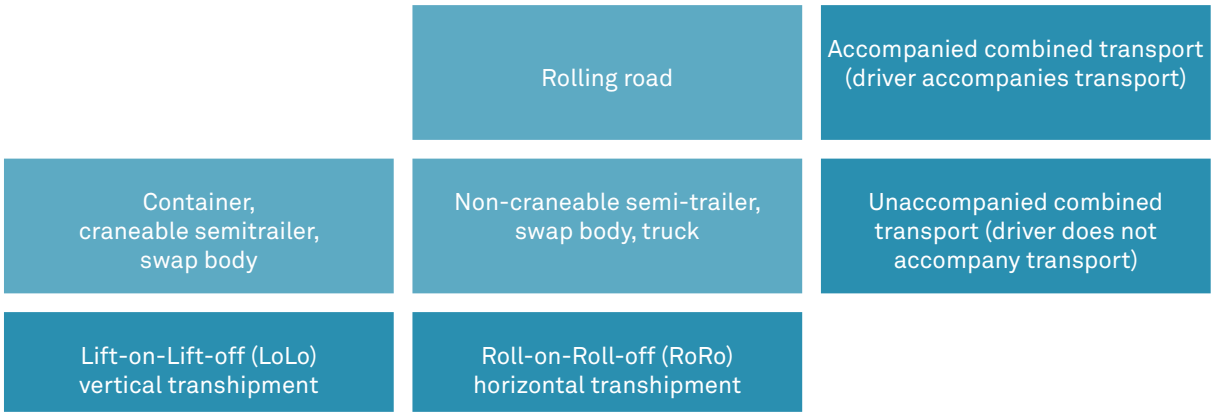
But besides the benefits of intermodal transport outlined above, compared to standard unimodal transport, intermodal transport must also cope with other challenges. Among these challenges is the greater complexity of intermodal transport due to the necessary coordination between the individual actors in the transport chain.

The substandard transport management systems (TMS) that are used for transport planning and execution belong to the other challenges. Most of these systems are designed for road transport and inadequately support intermodal alternatives. For instance they neglect $CO_2$ emissions and do not consider other criteria such as safety, flexibility and reliability.

Digitalisation of transport and logistics may provide approaches to resolve this situation. After all, traffic and transport management can be improved if more precise information is provided. Moreover, improved access to and the sharing of digital transport data along the supply chain would enable an end-to-end flow of information.

**Combined transport** is a special type of intermodal transport in which the major part of the trip is performed by inland vessel or railway and any pre- and/or end-haulage carried out by truck is minimised. When rail or waterway transport is used for the main leg, combined transport represents an environmentally friendly transport alternative. One example of this is the transport of a container from a Viennese company to the Port of Vienna by truck. This is followed by transport of the container to Romania by inland vessel. Once it has arrived there, the consignee takes possession of the container and transports it to the company location by truck.

The following chart provides an overview of the different **forms of combined transport**.




Source: viadonau

Forms of combined transport

Transhipment can be divided into processes in which intermodal loading units are lifted and processes in which units are not lifted:

- **Lift-on-Lift-off** (Lo-Lo) is defined as the vertical form of transhipment. In a terminal, the loading unit or semi-trailer is lifted by crane or reach stacker from one means of transport to another.

- In contrast, in the case of **Roll-on-Roll-off** (Ro-Ro) transhipment, loading units or semi-trailers are exclusively rolled in horizontally. The main advantage here lies in the fact that loading units can be transhipped without cranes or reach stackers (e.g. loading units are rolled onto a vehicle via a ramp).

Combined transport can be further classified depending on whether it is accompanied by a driver or not:

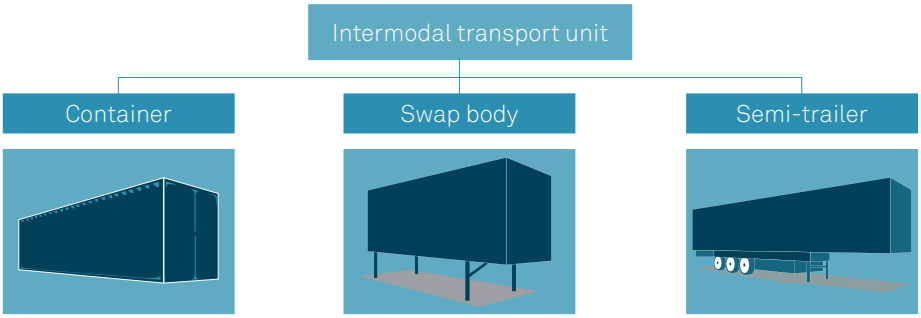
- The rolling road is the best known type of **accompanied combined transport**. Articulated vehicles are rolled onto low-floor wagons via a ramp using their own wheels. The vehicles' drivers accompany the trip in an extra sleeping wagon, where they can spend their legally mandatory rest periods.

- In contrast, the vehicle's driver does not accompany the loading units during **unaccompanied combined transport**. This method includes transport operations which include containers, swap bodies and semi-trailers. The transport of complete trucks on inland vessels ('floating road') is usually carried out without being accompanied by drivers due to legal and security reasons. The majority of combined transport operations are carried out unaccompanied.

Transhipment facilities are described in greater detail in the chapter 'System elements of Danube Navigation: Ports and terminals'.

### Intermodal loading units

Each transhipment is associated with time and costs. This is why **standardised loading units** are used in intermodal transport during the transhipment process. Because of the standardisation of the loading units' size and the necessary equipment (spreaders), easier handling, better scheduling and higher exploitation of space (stackability of containers) can be achieved. Intermodal loading units – also: intermodal transport units (ITUs) – are transhipped between road, rail and waterway using specialised facilities.




Source: viadonau

Classification of intermodal loading units

**Containers** are standardised receptacles made of metal and available in different sizes and forms. Their main advantages are their extreme robustness and high stackability, resulting in optimum utilisation of space. In addition, the container protects its load from damage and to an extent from theft as well.

Containers can be classified into different types:

- **ISO containers** are the best-known and most frequently-used loading units. A basic distinction is made between 20-foot and 40-foot containers. They are used for road, rail and waterway transport. Unfortunately, they do not efficiently match the size of euro-pallets and are therefore mainly used for maritime or overseas transports in the international exchange of goods.

- **Continental containers** have been designed according to the UIC standard to fit the size of euro-pallets. As a result, these containers are usually used for continental intermodal transport in Europe.

- In general, containers are available in numerous **special forms**, e.g. containers for reefer cargo or liquid cargo.

An important international term for container transport is the **Twenty-foot Equivalent Unit** (TEU). This standardised unit is used to calculate a cargo vessel's maximum loading capacity (e.g. the number of 20-foot containers that fit onto a vessel). A 40-foot container is the precise equivalent of two TEUs.

**Swap bodies** (also known as swap trailers or swap containers), are trailers for trucks without a chassis and fully compatible with euro-pallets. The sizes of swap bodies are standardised in principle, although many companies use various company-specific lengths. Essentially, a distinction can be made between a box body (made of metal and wood) and a tarpaulin body (light-alloy frame with tarpaulin structure).
The main advantage of a swap body is its ability to stand freely using four foldable legs that enable easy loading and unloading. However, swap bodies are not often used for inland waterway transport because – unlike containers – they are difficult to stack.

**Semi-trailers** are non-motorised vehicles used for the carriage of goods intended to be coupled to an articulated vehicle. They can be divided into craneable and non-craneable models:

- **Craneable semi-trailers** are equipped with biting edges which enable them to be grabbed by a transhipment device (e.g. a crane or a reach stacker) for loading purposes. This means that they can be used in intermodal transport.

- In contrast, **non-craneable semi-trailers** cannot (or only by using special equipment) be lifted, as they do not have biting edges. As a result, an articulated vehicle is required to roll them onto an inland vessel ('floating road') or a special low-floor wagon ('rolling road').

### Organisation of intermodal transport

As a rule, logistics service providers will organise and carry out intermodal transport, although the first stage may also involve the consignor's internal departments.

In practice, the planning and implementation of continental intermodal and combined transports are provided by a variety of actors in differing degrees. For instance, a freight forwarder may complete pre- and end-haulage on behalf of a major forwarding company, which also purchases other transport services directly from rail providers and inland navigation companies on behalf of its customers. The rail or inland waterway networks are used for the main leg of intermodal transports.

For decision guidance concerning the composition of combined transport chains please refer to the book 'Intermodaler Verkehr in Europa' (Posset et al., 2014)

## Digitalisation in multimodal transport

New and innovative transport concepts are changing the way that logistics works and therefore how it is organised. The following section addresses current trends within logistics that are influencing multimodal transport.

Digitalisation is one trend that is affecting all areas of our lives and therefore logistics as well. Within logistics, digitalisation mainly enables **improvements** within traffic and transport management, for instance by ensuring an **improved flow of information on traffic and infrastructural conditions**, as well as on the **precise location of means of transport and goods**. Improved access to and the sharing of digital transport data along the supply chain enable an end-to-end flow of information.

The Port of Rotterdam with its Barge Performance Monitor is one example of improved access to transport information. The Barge Performance Monitor was developed by the Port of Rotterdam and its partners for inland container vessels that are travelling to or from the port. The system displays the reliability of clearance for inland container vessel navigation and provides information on current performance over the past week, as well as over recent months. In addition, the Barge Performance Monitor compares the dwell time of vessels at the port with the average dwell time from the previous year. Anyone interested in remaining up to date on the current clearance performance for inland container vessel navigation at the Port of Rotterdam can subscribe to the Barge Performance Monitor mailing list.

The **Physical Internet** is a new concept that builds on the basic principles of the world wide web. It is an open, global logistics system that uses physical, digital and operative connections between things (interconnectivity). A good way of imagining how it works is that goods in the Physical Internet select their own ideal transport route and the best possible means of transport. So-called 'synchromodality' is a key requirements of implementation of the Physical Internet.

**Synchromodality** comprises several elements and enables efficient and eco-friendly transport chains with switches in transport mode in real time. Synchromodal transport chains allow real-time switches in transport mode; consignors book their transport regardless of the mode, which means that they only define the framework conditions, but not the means of transport that will be used. Horizontal cooperation is another important aspect of synchromodality; it describes collaboration between companies that could actually be competitors. The aim of synchromodality is to improve capacity utilisation of transport modes and to increase the quota of transports conducted by rail and inland waterway.

**Blockchain** is another revolutionary, innovative concept. Blockchain describes a system that enables direct transactions without an intermediary, for instance a bank. The system is internet-based and can co-exist with other internet technologies.

## Multimodal transport in practice

Source: LITHOS Industrial Minerals GmbH

Unloading the talc raw materials at the Ennshafen

### Transhipment of mineral raw material at the Ennshafen

| | |
|---|---|
| Source and destination | From Asia to Ennsdorf (AT)<br>via Rotterdam (NL) |
| Means of transport | Maritime vessel, inland vessel |
| Type of transport process | Split multimodal transport<br>(switch of transport mode) |
| Cargo | Talc stone (bulk cargo) |

The company LITHOS Industrial Minerals GmbH received a consignment of raw materials by inland vessel in November 2017. 6,000 tons of talc stone were loaded onto a maritime vessel in Asia and then moved to inland vessels in Rotterdam. Transport from Rotterdam to Ennsdorf took roughly two weeks.

The vessels were unloaded using a crane and two wheel loaders in cooperation with the neighbouring transhipment company Fuchshuber Agrarhandel GmbH. Employees at the Ennshafen were responsible for weighing the inland vessels. LITHOS replenished all of its stocks with this single raw material delivery.

The entire fulfilment process was monitored and checked by LITHOS employees. They were on site during every important event along the transport route. Unloading the inland vessels and transport by wheel loader took approximately one week.


Source: Borealis L.A.T.

Loading of fertiliser at the port of Rouen, France

## Fertilisers

| | |
|---|---|
| Source and destination | From the Grand Quevilly plant (FR) to a variety of locations in Eastern Europe (RO, BG, RS, HU) |
| Means of transport | Maritime vessel, inland vessel |
| Type of transport process | Multimodal transport |
| Cargo | Fertilisers |

Borealis L.A.T. produces nitrogen fertilisers and technical nitrogen products at several locations in Europe.

Vessels with a loading capacity of up to 15,000 tons can dock and tranship at the company's quay. Some of the ammonium nitrate production is transported to Constanţa by maritime vessel and moved directly to inland vessels by floating crane.

These inland vessels then supply the distribution warehouses in Romania, Bulgaria, Serbia and Hungary.

Transporting products right across western Europe is difficult, as ammonium nitrate is always classified as a Class 5.1. hazardous good and transport by lighter is not always possible in cases of low water.

Source: TTS

Transport of steel scrap on the Danube

**Steel scrap**

| | |
|---|---|
| Source and destination | Entire Danube |
| Means of transport | Maritime vessel, inland vessel, rail, truck |
| Type of transport process | Split multimodal transport, including transhipment and storage |
| Cargo | Steel scrap |

Headquartered in Bucharest, Romania, the company TTS (Transport Trade Services) SA. has been specialised in complicated transport chains and full-service solutions on behalf of its customers for more than ten years.

Deliveries of steel scrap to numerous ports, among others Vienna, Budapest and Vukovar, are organised by rail or truck. After temporary storage and sorting in some cases, the scrap is loaded onto non-motorised barges of the company's own fleet (430 barges, 52 push boats) and taken to Constanţa.

Steel scrap arrives there continuously, where it is stored separately, depending on the quality.

Blending of qualities does not take place until the goods have been sold to the export markets (Greece, Turkey, Spain etc.). Then the ordered goods are loaded onto maritime vessels.

Huge investments in proprietary, high-performance ports and transhipment facilities enables simultaneous transhipment from land/quay, as well as from inland vessels onto the maritime vessel using floating cranes at the port of Constanţa. This leads to reduced depletion due to direct transhipment, as well as a reduction in costs by avoiding the transhipment process from the inland vessel to the quay, and from there to the seagoing vessel.

Source: Rhenus Donauhafen Krems

Rhenus Donauhafen Krems (on the left) and storage of the concrete segments (on the right)

**Concrete segments**

| | |
|---|---|
| Source and destination | 1) North Germany (DE) –Krems/BDA – Wind Park (AT)<br>2) Zurndorf – Krems /BDA –Germany (DE) |
| Means of transport | Inland vessel and truck |
| Type of transport process | Split multimodal transport (switch of transport mode) |
| Cargo | Concrete segments (tower parts) for wind turbines |

The company Rhenus Donauhafen Krems (previously Mierka Donauhafen Krems) has been a 100% subsidiary of the Rhenus Group since 2018 and offers its customers trimodal logistics solutions at the heart of Europe.

Concrete tower segments for wind parks have been transhipped at the Krems site since 2011. Here, the Port of Krems teams up with the company Prangl as part of a cooperative project. Produced in Northern Germany, the concrete segments were, in the initial years, transported in complete ship loads to Krems, where Rhenus unloaded the vessels, placed the segments in storage and then loaded them onto trucks for onward transport. The Rhenus Donauhafen Krems has a warehouse and crane capacity for this purpose that is unrivalled elsewhere on the Danube. Later on the customer built a factory in Austria; this turned what had previously been imports from Germany to Austria into export of the concrete parts to Germany.

Since mid-2012, transhipment has been ongoing for the same manufacturer at a special viadonau transhipment site in Bad Deutsch-Altenburg (BDA). Prangl supports Rhenus with a 400-ton crawler crane and also conducts pre- and end-haulage.

More than 4,000 segments were loaded in Krems and BDA in 2017 alone, whereby the majority of inland shipping transports were conducted by Rhenus Danube Shipping. A complete tower, consisting of 50 parts, can be transported in a single vessel, thus preventing 50 special transports by road.

Source: BOLK Transport GmbH
www.bolk-transport.com

Combined transport of brewery tanks

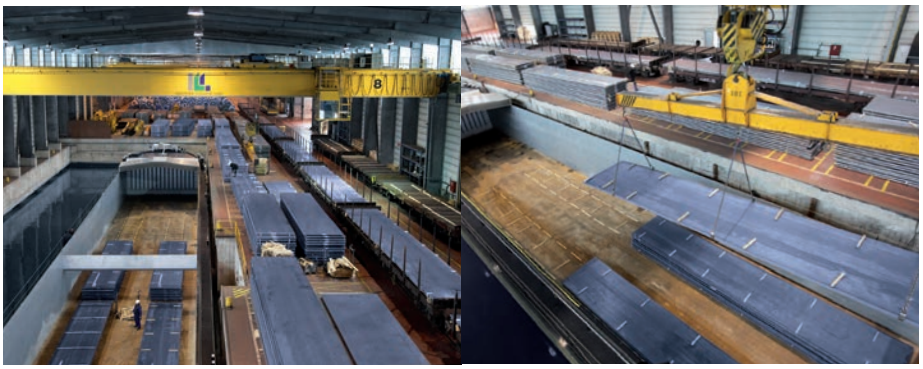
**Brewery tanks**

| | |
|---|---|
| Source and destination | From Drachten (NL) – Rhine-Main-Danube Canal – Passau (DE) – Danube – Port of Prahovo (SRB) – Zajecar (SRB) |
| Means of transport | Truck, inland vessel |
| Type of transport process | Combined transport, main leg by inland vessel, pre- and end haulage by truck |
| Cargo | Brewery tanks 25 tons/unit (7 x 17 m) |

BOLK Transport GmbH was commissioned with the transport of several beer tanks from Drachten (NL) to Zajecar (SRB) for the expansion of the Serbian branch of an international brewery. With a diameter of 7 m, a length of 20 m and a weight of 25 tons per unit, the tanks are not suitable for special transport exclusively by truck over such a long distance. The road variant would be too intricate (e.g. road blocks, obstructions, authorisations), complex and far too expensive. Given that the starting point and the destination are both situated close to the Danube waterway, combined transport by inland navigation seemed the best option for this project.

Short pre- and end-haulage distances by truck save money and effort. Simultaneous loading of all cargos on the inland vessel means immense savings in time and costs compared to road transport. The logistics chain offered relatively simple handling and a high level of safety.

Thanks to its decades of collaboration with an international brewery group, the BOLK Group possesses a wealth of experience and a reliable partner network to manage this kind of project routinely and securely.



Source: Industrie-Logistik-Linz (ILL)

Transhipment of steel products in the covered transhipment hall of Industrie-Logistik-Linz

**Steel products**

| | |
|---|---|
| Source and destination | From Linz via Moerdijk (Netherlands) to overseas countries |
| Means of transport | Inland vessel, maritime vessel, truck and railway |
| Type of transport process | Split multimodal transport (switch of transport mode) |
| Cargo | Steel products (general cargo) |

Industrie-Logistik-Linz (ILL) provides its customers with logistics services along the entire supply chain. ILL has company sites in Austria (Linz and Steyr) and in the Netherlands (Moerdijk). Each year, 500,000 tons of steel are transported via inland vessels on the route from Linz to Moerdijk. While ILL organises transhipment in Linz and monitors the transport to the Netherlands, an inland navigation service provider or a partner company is responsible for the physical transport of the cargo by vessel.

The steel products are collected by railway wagons from several warehouses on the company complex. Following this, they are transported to a covered transhipment hall which is located at the private port of voestalpine in Linz. There, the goods are directly transhipped from the wagons onto inland vessels. For this covered transhipment, a gantry crane with a maximum capacity of up to 35 tons is used. Subsequently, the goods are transported to Moerdijk by pushed convoy. There, the steel products are transhipped onto a maritime vessel and then transported to seaports located near the final costumers. The latter are located in countries such as Brazil, the USA, Singapore, India, Malaysia or South Africa. In most cases, end-haulage is done by railway, though sometimes by trucks, as the best matching means of transport also depends on the size of the steel products.

## Legal aspects of combined transport

### European and international legal regulations

An important step in enhancing the use of combined transport has been achieved through the adoption of a **Directive on the establishment of common rules for certain types of combined transport of goods between Member States** by the European Union (European Commission, 1992). This directive aims to increase the attractiveness of combined transport by liberalising pre- and end haulage. Consequently, the main focus is set on simplifying cross-border transport. In addition, tax benefits for combined transport are included.

The Member States of the European Union decided to introduce common infrastructure policies in the early 1990s, which led to the creation of the TEN-T networks as the legal framework in 1996. The TEN-T guidelines have been revised several times, and Regulation No 1315/2013 is the most current version. At the same time, the Connecting Europe Facility (CEF) defines rules for the award of Union funds for the TEN-T networks (Regulation No 1316/2013).

Moreover, further important regulations beyond European level now exist. In the area of inland waterway transport, the **Budapest Convention on the Contract for the Carriage of Goods by Inland Waterway** (CMNI) is applicable. For cross-border and international road transport, the regulations of the **Convention on the Contract for the International Carriage of Goods by Road** (CMR) are mandatory (for Austria: Federal Law Gazette 138/1961). International regulations for rail traffic are enshrined in the Uniform Rules Concerning the Contract for International Carriage of Goods by Rail (CIM).

The international CMR convention supports the use of a **consignment note** to simplify cross-border transportation. A consignment note is a transport document regulating the legal relationship between the carrier and the consignor. Information on the consignor, the consignee, the points of loading and unloading, cargo and delivery conditions are documented. Consignment notes can be utilised for road traffic, rail traffic and inland waterway transport. However, the use of a bill of lading is more common for inland waterway transport.

The **TIR Carnet** is an international customs document which simplifies formalities in international road transport and for monitoring the cross-border transport of goods. However, it is only used if non-EU countries are also involved in the transport route. Basically, the TIR procedures are mainly designed for road traffic, but can also be used for combined transport (road-rail or road-waterway), when at least one part of the transport route is carried out by road.

Specific regulations regarding inland waterway transport are described in more detail in the chapter 'Logistics solutions: The market for Danube navigation'.

German versions of the international agreements on goods transport are available on the website of the German Society for Transport Law (DGTR): www.transportrecht.org

Website of the United Nations Economic Commission for Europe on the TIR (Transports Internationaux Routiers) Convention: www.unece.org/tir

### Legal provisions in Austria

The EU Directive concerning the establishment of common rules for certain types of combined transport of goods between Member States (European Commission, 1992) was implemented in Austria with the Regulation on the exemption of cross-border combined transport from the approvals procedure ('Kombifreistellungs-Verordnung', Federal Law Gazette II 399/1997). Within the framework of national legislation, the following legislative acts in their most recent version are of particular significance to combined transports:

- **Motor Vehicles Act (KFG)** ('Kraftfahrgesetz', Federal Law Gazette 267/1967)
- **Road Traffic Code (StVO)** ('Straßenverkehrsordnung', Federal Law Gazette 159/1960)
- **Railways Act (EisbG)** ('Eisenbahngesetz', Federal Law Gazette 60/1957)
- **Navigation Act (SchFG)** ('Schifffahrtsgesetz', Federal Law Gazette I 62/1997)

Special provisions, especially those that provide for special considerations in combined transport for Austria (e.g. exceptions from the ban on night-time driving), are found in the following section.

## Promotion of combined transport

@ An overview of funding programmes for inland navigation in Europe is contained in the European Funding Database: https://eibip.eu/funding/

Numerous transport policy measures have been taken to encourage the use of combined transport. This is aimed at guaranteeing an early shift towards environmentally friendly modes of transport – meaning a shift from truck to ship or railway. Ways of achieving the enforced use of combined transport consist of various **funding schemes** on a national and international scale as well as **fiscal and regulatory measures.**

Source: viadonau

Combined transport by vessel and truck

@ Website of the International Union of Combined Road-Rail Transport Companies (UIRR): www.uirr.com

An important European organisation operating in the field of combined transport of rail and road is the **International Union of Combined Road-Rail Transport Companies** (UIRR). The UIRR aims to promote the modal shift by means of combined transport and also serves as a contact point for questions in this field. The association is a registered interest group with the European Parliament and the European Commission.

### Promotion of combined transport in Austria

**Financial subsidies:** Special funding programmes are made available under certain circumstances by the Federal Ministry for Transport, Innovation and Technology to provide financial support for the investment and operating costs of combined transports (e.g. terminal support or the innovation programme Combined Cargo Transport).

**Vehicle tax concessions:** Vehicles registered in Austria that engage exclusively in in pre- and end-haulage transport to the closest technically suitable combined transport terminal are exempted entirely from vehicle tax (Motor Vehicles Tax Act, Federal Law Gazette 449/1992).

**Exemption from the ban on night-time driving:** Trucks with a maximum permissible weight of more than 7.5 tons are not permitted to drive between 10:00 pm and 5:00 am; excepted from this provision are tours undertaken in combined transport along precisely defined stretched between border crossings (Road Traffic Code, Federal Law Gazette 159/1960 and Ordinance, Federal Law Gazette 1027/1994).

**Exemption from the ban on weekend and public holiday driving:** As a rule, trucks with a maximum permissible weight of more than 3.5 tons are not permitted to drive between 3:00 pm and 12:00 am on Saturdays or between 12:00 am and 10:00 pm on Sundays and public holidays; excepted from this provision are tours undertaken in combined transport within the vicinity of defined railway stations and ports (Road Traffic Code, Federal Law Gazette 159/1960 and Ordinance, Federal Law Gazette 855/1994).

**Exemption from the ban on driving to facilitate holiday traffic:** Trucks or articulated vehicles with a maximum permissible weight of more than 7.5 tons are not permitted to drive between 8:00 am, i.e. 10:00 am and 3:00 pm on all Saturdays in the holiday months of July and August; excepted from this provision are tours undertaken in combined transport from or to the closest combined transport terminal (Travel Ban Calendar, Federal Law Gazette II 110/2017).

**Compensation of payloads:** An increase in the total weight of a vehicle from 40 to 44 tons is possible in pre- and end-haulage runs within combined transport (Motor Vehicles Act, Federal Law Gazette 267/1967).

**Liberalisations:** Cross-border pre- and end-haulage is liberalised for vehicles registered in EEA states and possessing a community license (Ordinance, Federal Law Gazette II 399/1997). In addition, bilateral authorisation is not required for pre- and end-haulage on road corridors leading to and from the six major rolling road terminals in Austria.

**Rest periods on rolling and floating roads:** According to EU regulations (Regulation (EC) No 561/2006 and the Working Hours Act, Federal Law Gazette 461/1969), the time that truck drivers spend on rolling or floating roads counts toward the mandatory rest periods.

@ Details about the mentioned subsidies and benefits as well as further information can be found on the website of the Federal Ministry for Transport, Innovation and Technology: www.bmvit.gv.at/verkehr/gesamtverkehr/kombiverkehr/foerderung.html

## Sources

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