High & Heavy Transports on Inland Waterways

Things to know about the transport of heavy and oversized cargo by inland vessel

viadonau

Imprint

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Contents

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viadonau is a subsidiary of the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology. Our common goal is the careful and sustainable development of the Danube as a living and economic habitat. In cooperation with national and international partners, viadonau works on the increased use and modernization of Danube navigation and actively supports interactive learning between waterway administrations and users of the waterway.

www.viadonau.org/en

Introduction

The Danube River flows through a total of ten riparian states and, together with the Main-Danube Canal and the Rhine, forms a transport axis across Europe.

This axis connects not only the North Sea ports with the Black Sea but also numerous conurbations and commercial and industrial centres.

Danube navigation is characterized by high loading capacities, low transport costs and environmental friendliness, which makes it the ideal mode of transport for high & heavy cargo. For special transports of high-value products such as tanks, systems and parts for the energy industry, the waterway is often the first choice and not simply another alternative.

With regard to the greening of the European transport system, a number of facts clearly speak in favor of inland waterway transport: For example, it has the lowest specific energy consumption and the lowest external costs of all land transport modes. Increased use of inland navigation can reduce climate gases, air pollutants, accidents and noise. This is an important contribution to achieving the transport and environmental policy goals of the Austrian federal government and the European Union.

Advantages of high & heavy transports by inland vessel

Owing to the large dimensions and high weights of these parts, heavy and oversized cargo can take full advantage of the Danube navigation.

Inland vessels are offering an enormous cargo hold capacity

The cargo hold of a large motor vessel on the Danube can easily reach a length of 100 meters and a width of 10 meters. For particularly heavy goods, vessels with specially enhance loading decks are also available.

No time restrictions in transport

The locks on the Danube operate 24 hours a day, seven days a week. In Austria, all Danube locks have two chambers, so that ships can be locked in the other chamber in case of a maintenance or repair closure. There are no weekend or night navigation bans on the waterway.

Duty-free use of the infrastructure

In principle, no charges are collected for the use of the waterway and the locks. However, the handling and use of the infrastructure in ports is subject to charges.

Hardly any restrictions in the clearance gauge

The bridges on the Danube offer sufficient clearance and only pose a restriction in exceptional cases. Traffic signs, tunnels or overhead lines are non-existent and therefore do not have to be considered when transporting goods on the Danube, in contrast to road or rail transport.

No transport accompaniment necessary

Since transport by inland vessel is primarily a regular transport, no accompaniment is necessary. There is no need to dismantle traffic signs or to measure the road infrastructure. Bridges or other structures do not have to be inspected or measured for their payload capacity.

© Ennshafen

No special permits required

Project cargoes that have to be operated as special transports on road and rail are considered regular cargo on the Danube in most cases. No special permits are required for such transports via inland vessel.

Environmentally friendly mode of transport

Compared to other modes of transport such as truck and rail, inland navigation features low external costs and good environmental performance. Referring to one ton of cargo, an inland vessel consumes only about ¼ of the amount of energy used for a transport by truck (Manual on Danube Navigation 2019, viadonau S.18f).

Low infrastructure costs

Infrastructure costs consist of the costs for the construction and maintenance of transport routes. In the case of inland waterway transport, these costs are correspondingly low because mostly natural infrastructure is used. In contrast to road transport, there is no excessive wear of the infrastructure recorded for transporting high & heavy products on the Danube.

Multifunctional mode of transport

Heavy and oversized cargo is mostly transported on the Danube by standardized dry cargo vessels, which are also used for the transport of bulk cargoes. This facilitates the search for a suitable return cargo in the transport planning. Road transport with special equipment often does not result in a suitable return cargo. The proportion of empty runs is therefore significantly lower on the waterway, with positive ecological effects.

Basic information for planning a transport on the Danube

Infrastructural characteristics

Since the opening of the Main-Danube Canal in 1992, the Rhine-Main-Danube waterway connects 14 European countries with a total length of 3,504 km between the mouth of the Danube at the Black Sea and the mouth of the Rhine at the North Sea.

The Rhine-Main-Danube Inland Waterway Axis © viadonau

The Danube itself is navigable for international freight traffic over a length of almost 2,415 km between Kelheim (Germany) and Sulina (Romania).

The most important parameters for inland waterway transport planning along the Danube are summarized in the following chapter. They usually determine the use of the right type of vessel, the maximum payload and the maximum possible fixed-point height when passing under bridges.

In the case of inland waterway transport of high & heavy products, which is not a special transport (i.e. the entire cargo can be accommodated in the vessels' cargo hold), primarily the current fairway depth must be considered.

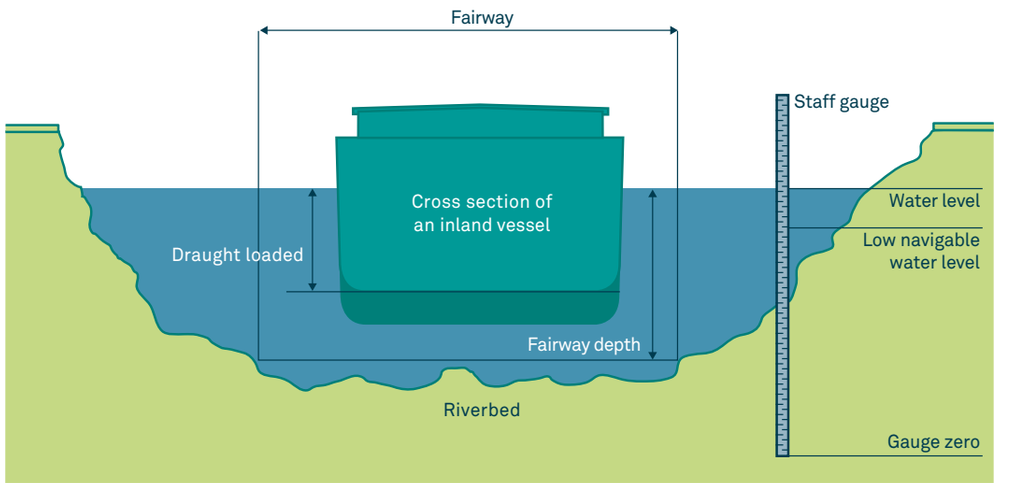
However, typical high & heavy goods such as construction machinery, generators, etc., do not represent weight-critical cargo for a vessel. Therefore, comparatively low draughts of the vessels are generally achieved.

In the case of oversized transports, which exceed the vessel's cargo hold, special attention must be paid to the bridge clearance heights at critical points. In some cases, inland vessels with oversized cargoes are ballasted; the draught of the vessel is increased by loading ballast water into ballast tanks or by loading solid ballast in order to reduce the fixed-point height and to be able to pass under bridges with sufficient clearance.

Fairway parameters

The following parameters of the waterway determine the planning and execution of an inland waterway transport.

- Fairway
- Bridges
- Availability of the Danube waterway



Fairway parameters (schematic presentation) © viadonau

Fairway

Water levels

A **water gauge** is commonly used to measure the water level at a specific point. It should be noted that the water level measured at a gauge does not necessarily indicate the actual water depth of a river and hence the current fairway depth, since the **zero point of the gauge** does not necessarily correspond to the position of the **river bottom**.

When determining the currently available **fairway depths**, shipping is guided by so-called gauges of reference, which are relevant for certain stretches of river. The water levels at a gauge of reference are authoritative for the **draught loaded** of the ship, the clearance height of bridges and the ban of navigation during high water.

Reference water levels

As the water level at a **gauge** changes continually, **reference water levels** have been defined. Reference water levels are statistical reference values for average water levels, which have been registered at a certain gauge over a longer period of time. The most important reference water levels for inland waterway transport are:

- **Low navigable water level** (LNWL)
- **Highest navigable water level** (HNWL)

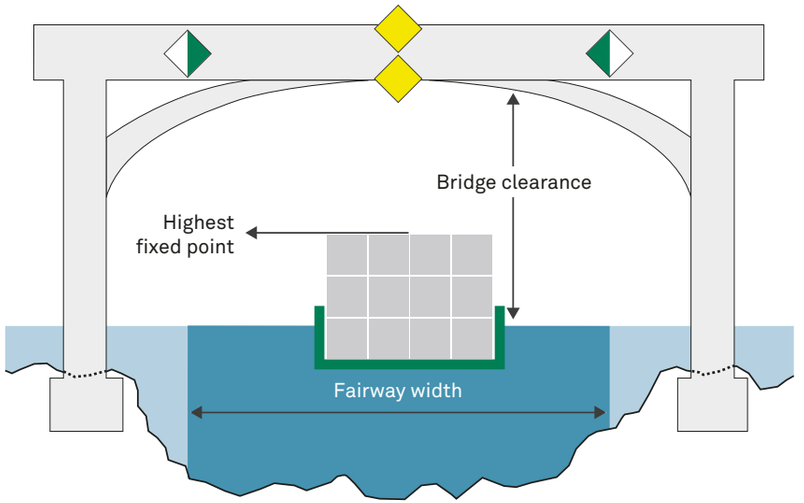
Fairway and fairway depth

The **fairway** is the area of a waterway for which maintenance of certain fairway depths and widths is preserved to enable navigation. For the Danube, the fairway depth determined for a "minimal" cross section refers to low navigable water level (LNWL). The width and course of the fairway are indicated by fairway markings.

Draught loaded

A decisive economic criterion for freight shipping is the available **fairway depth** within the fairway. The resulting **draught loaded** corresponds to the respective draught of a vessel at rest under a certain loading condition. Higher draughts mean a higher loading capacity for inland waterway transports.

In the case of high & heavy transports, the maximum draught loaded of an inland vessel and thus the maximum loading depth are only very rarely reached. These transports are therefore comparatively less affected of low water situations. Flat deck barges or roll-on/roll-off vessels generally have a shallower draft and can also be used at low water levels.



Highest fixed point of a vessel and bridge clearance as determining parameter for passages under bridges.
© viadonau

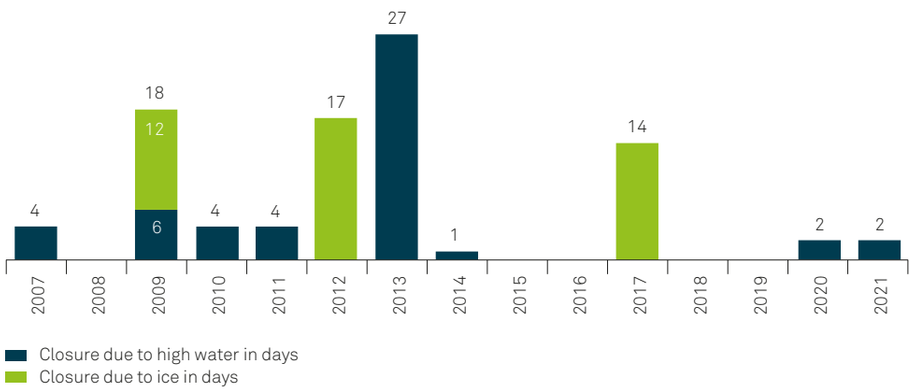
Bridges

Bridges can span a waterway, a port entrance or a river power plant and thus a lock facility.

On the Danube, there are around 130 bridges along a stretch of 2,415 kilometers from Kelheim in southern Germany to Sulina on the Romanian Black Sea coast.

The possibility of passing under a bridge depends primarily on the **bridge clearance** above the water level and the **fixed point height** of the ship. The fixed point height is the vertical distance between the waterline and the highest immovable point of a ship after movable parts such as masts, radar or wheelhouse have been folded down or lowered. The fixed point height of a ship can be reduced by ballasting the ship.

When planning and executing high & heavy transports by inland vessel, the bridge clearance height can play a significant role for particularly large oversize transports such as tanks.



Navigational closures due to high water and ice 2007-2021. © viadonau

Availability of the Danube waterway

In principle, the Danube waterway is available around the clock.

The locks along the Danube operate 24 hours a day, seven days a week. In contrast to road freight traffic, there are no weekend or night driving bans.

Official closures can be imposed in extreme weather-related situations, namely **high water** and heavy **ice formation**. Over a 15-year annual average from 2007 to 2021, the availability of the Austrian section of the Danube waterway was 98.3%, or approximately 359 days per year.

Apart from closures due to high water and ice, official closures of the waterway can also occur due to traffic accidents, lock malfunctions, water pollution, construction work or events. In 2021, the total duration of these closures was four days and 22 hours. Total lock closures (the parallel closure of both lock chambers) accounted for a duration of approximately 2.5 days in 2021 (in addition to the closure due to high water in July already mentioned) and affected four of the ten lock facilities on the Austrian Danube section.

Ports for the transhipment of high & heavy cargo

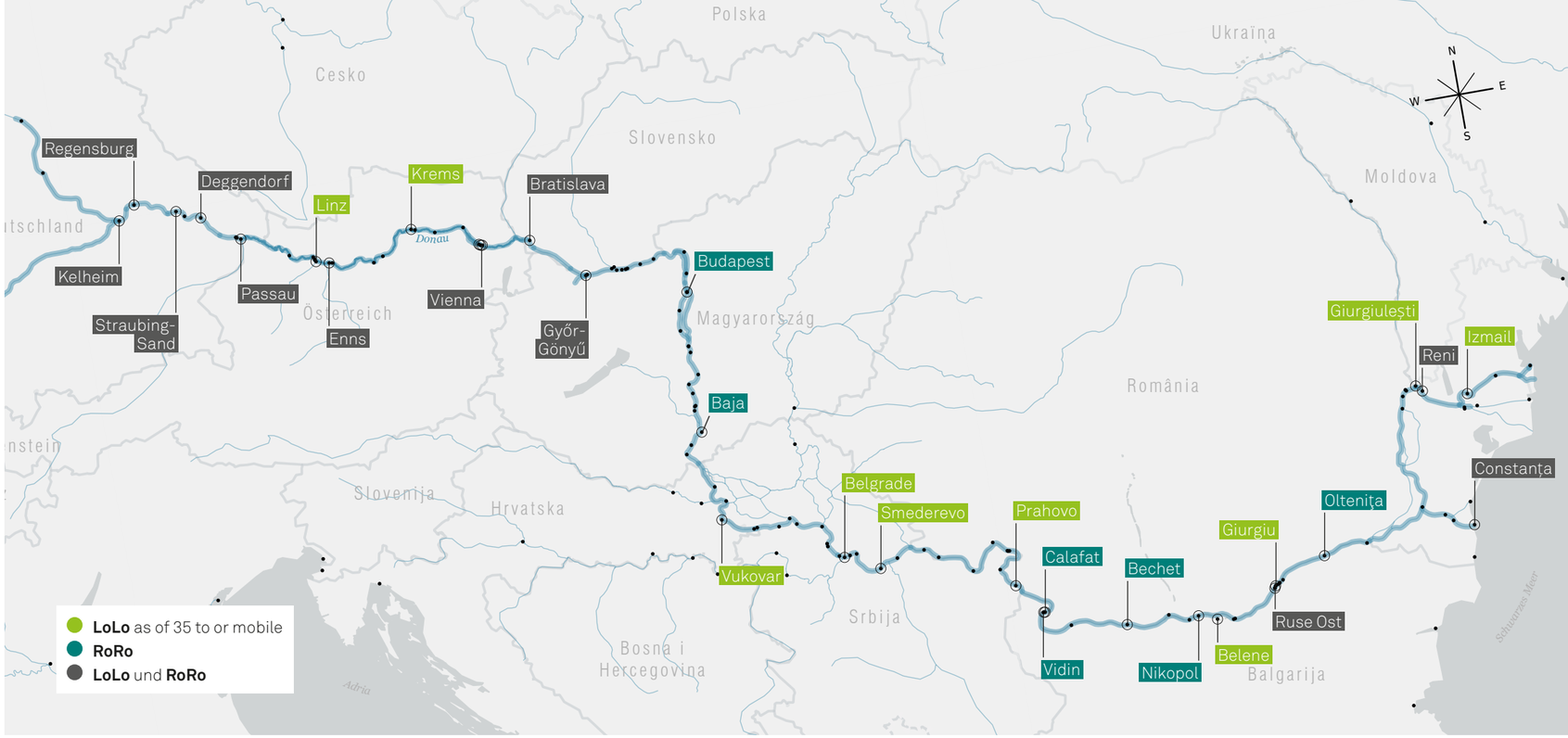
In many cases, source and destination of the transport as well as the locations of the interim storage facility and final assembly are not situated along the waterway. Therefore, the transhipment of the transported high & heavy cargo is usually necessary.

The transhipment of high & heavy cargo requires special port infrastructure and superstructure, such as quay walls and platforms, which can absorb high ground pressures for mobile transhipment facilities, heavy cargo cranes or ramps for the loading of rolling cargo. In the best case, this equipment is available on a stationary basis.

Along the Danube, there are numerous ports and terminals where different types of heavy-lift transhipment can be carried out. An up-to-date list of transhipment possibilities starting from 35 tons is available at the info area "High & heavy transports by inland vessel" on the viadonau website.

Heavy-lift ports with a stationary lifting capacity of more than 200 tons are located in Linz (AT), in Bratislava (SK), in Constanta (RO) and in Reni (UA). Ramps are mainly located on the Upper Danube and on the joint Bulgarian-Romanian section of the Danube.

Basically, "**vertical handling (lift on/lift off)**" and "**horizontal handling (roll on/roll off)**" can be distinguished. Depending on the equipment and transhipped goods, there are further categories, which you can find below the map.



Transhipment possibilities along the Danube for high & heavy cargo.
© viadonau. Map: OpenStreetMap, Esri

Vertical transhipment – lift-on/lift-off (LoLo)

In ports or at terminals using stationary cranes

© viadonau

In ports and terminals using mobile cranes

© EHG Ennshafen

Along the Danube using mobile cranes

© viadonau

Horizontal transhipment – roll-on/roll-off (RoRo)

Rolling cargo on their own wheels

© EHG Ennshafen

Non-rolling cargo loaded on trailers

© viadonau

Danube Ports

Danube Ports is a platform that provides information on more than 60 ports and transhipment sites along the Danube between Kelheim in Germany and the Black Sea as well as adjacent rivers and canals.

In addition to general information about the ports, the extensive port profiles contain further details such as contact details of port operators, port authorities, important data on infrastructure and superstructure for storage and handling facilities as well as an overview of local logistics service providers.

www.danube-logistics.info/danube-ports

Inland vessels for high & heavy transport

Examples of inland vessels – cargo hold dimensions and carrying capacity

Dry cargo vessels

Dry cargo vessels are used to transport a wide variety of goods, including steel cylinders (coils), agricultural bulk goods as well as ores and metal goods. These ships are also suitable to transport large, long and oversized break bulk. Due to universal deployment of dry cargo vessels, empty journeys can be reduced to a minimum.

The dimensions within the different vessel classes can vary from ship to ship. Summarized below, you can find a few examples of dry cargo vessels operating along the Danube.

Small motor vessel "M/S Rubiships XIII"

© Rubiships

Cargo hold dimension Small motor vessel			Cargo hold volume in m³	Max. capacity in tons
Length in m	Width in m	Height in m		
67.30	7.64	3.80	2,200	1,710

Large motor vessel (110 m) "M/S Pieter Senior"

© Pieter Bos

Cargo hold dimension (110 m)			Cargo hold volume in m³	Max. capacity in tons
Length in m	Width in m	Height in m		
80.00	10.10	4.33	3,500	2,854

Large motor vessel (135 m) "M/S ALLIANCE"

© van Vliet

Cargo hold dimension (135 m)			Cargo hold volume in m³	Max. capacity in tons
Length in m	Width in m	Height in m		
105	10.1	4.5	5,000	4,005

Pushed convoy (pusher + 2 lighters)

Pushed convoy © viadonau

Schiff	Cargo hold dimension			Cargo hold volume in m³	Max. capacity in tons
	Length in m	Width in m	Height in m		
Lighter 1	65.00	9.00	3.70	2,164.5	1,700
Lighter 2	65.00	9.00	3.70	2,164.5	1,700

Special vessels

Roll-on/roll-off vessel

Roll-on/roll-off transhipment means that the transported objects are loaded (without a crane) either on their own wheels or on trailers/low loaders and via ramps belonging to the port and/or the ship itself. The most important cargo transported via roll-on/roll-off include, for example, construction machinery and agricultural machines, mobile cranes and other heavy and oversized goods.

Roll-on/roll-off vessels usually provide a deck offering a broad, continuous loading space for rolling cargo. Dry cargo vessels can be equipped with ramps and partly with modules for several loading decks, which enables the roll-on/roll-off transportation of cars.

RoRo vessel „Horst Felix“. © Felbermayr

Deck dimension Horst Felix	
Length in m	Width in m
60.00	9.00

RoRo vessel Jumbo. © Rubi Trans

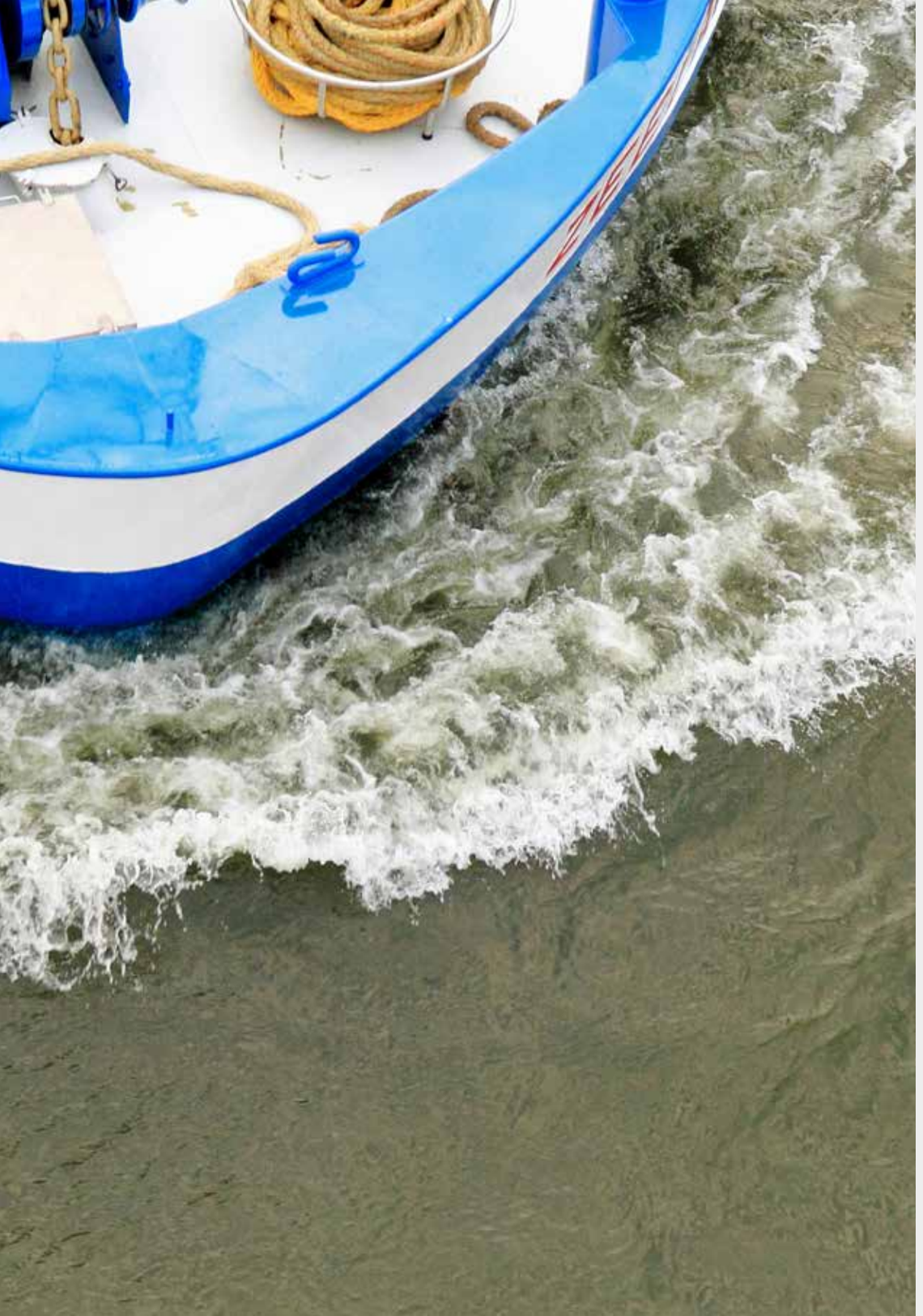
Deck dimension Jumbo III	
Length in m	Width in m
70.00	19.50

Special vessel with an enhanced loading deck

For the transport of particularly heavy break bulk, barges with an enhanced loading deck can be used to carry the high loading pressure per sqm. The pushed barge displayed underneath is optimized for the transportation of containers (with a cargo hold of 10.05 m width, 4 ISO containers can be shipped next to each other) and has in addition an enhanced loading deck designed for the transportation of heavy break bulk.

Lighter with enhanced loading deck. © First DDSG

Cargo hold dimension Special pushed lighter		Cargo hold volume in m³	Max. capacity in tons
Length in m	Width in m		
73.00	10.00	3,285	2,300



Shipping companies for high & heavy transports

In contrast to traditional shipment of raw materials, break bulk cargo usually consists of high-valued and unique products with high logistics requirements. Transport delays or damages on the transported cargo during transhipment must absolutely be avoided.

Not every shipping company is specialized to undertake the transport of such cargo. A list of shipping companies and brokers, offering inland waterway transportation of high & heavy goods and additional services within this field, can be found at the info area “High & heavy transports by inland vessel“ on the viadonau website.

The Blue Pages

The Blue Pages is a comprehensive directory of shipping companies and brokers operating on the Danube. Since 2009, the Blue Pages is an indispensable reference tool for industry and commercial companies in the Danube region. Shipping companies and brokers can create an extensive company profile for free and can be contacted directly for transport requests.

www.danube-logistics.info/the-blue-pages

Heavy transport of reactor components, Aschach lock.
© viadonau

Transport of wind turbine blades.
© viadonau

Specific characteristics of high & heavy transports by inland vessel

Large and heavy parts or several pieces in a bundle are usually managed as a whole load, which means that nothing is added and rarely – due to time-bound processes – driven in a convoy.

For smaller parts, however, the transports can also be combined with other partial loads or within a convoy.

In the case of complex projects, several parts are often loaded in one ship because, in contrast to road transport, there is no need to rely on the smallest non-dividable cargo. Past examples from the wind power sector show that the transport of a whole tower or several blades in one run works smoothly.

The challenges of the transport chain in such shipments are the timing of the processes in the entire chain. In many cases, intermediate storage takes place at the port or terminal to buffer the individual components for loading. In some ports there is also the possibility of carrying out final assembly and thus transporting the complete unit on the ship (e.g. to the seaport) that would not find room on the road or rail network.

Transport comparisons road – inland vessel

What are the specific advantages of transporting goods by inland waterway?

Using two transport cases from the past, we would like to show the advantages of a transport via inland vessel and what decision parameters are decisive when comparing road and inland waterway transport.

Inland waterway transport costs:

- Transport costs main run via vessel
- Transhipment costs in ports/terminals or additional mobile equipment
- Transport costs for pre- and post-haulage

Road transport costs:

- Costs for special road transport
- Costs for transport accompaniment
- Administrative costs (bridge attestation, measuring activities)
- Toll charge and other road fees

© viadonau/Pilo Pichler

Transport comparison A: continental transport

This is the transport case of concrete parts for wind turbines from Germany to Austria and vice versa, which were shipped by the German manufacturer from 2011 to 2017 via the port of Krems and the transhipment site located in Bad Deutsch-Altenburg. The parts had unit weights of 25-50 tons, a height of 3.80 m and a width of 2.50-5.00 m. The parts were tightly stowed in the cargo hold of the motor cargo vessel. At good water levels, a whole concrete tower could be transported per ship.

© viadonau

A continental transport	 **Transport by inland vessel**	 **Transport by road**
Transport time	7-10 days	2-3 days (depending on the region of departure)
Price	80%	100%
CO_2 emissions	Over the entire project period, the use of inland vessels saved a total of around 20,000 tons of CO_2.	
Other important decision parameters	The transported quantity per ship was 1,000-1,200 tons. Mostly motor vessels have been used.	The cargo of one ship is equivalent to 40 low-bed truck trips and 40 empty trips back. In addition, the large pieces also required transport escort.

Transport comparison B: seaport/hinterland transport

This example focuses on the export of hydropower plant components from Austria to Africa via the seaport of Antwerp.

The transport starts at the Austrian producer, followed by pre-carriage by truck and an intermediate storage (consolidation) in the port of Krems. For transport by inland vessel to the port of Antwerp, the parts were seaworthily packed in heavy-lift boxes. These heavy-lift boxes had dimensions of 5-15 m length, 2-6 m width and 1-4 m height. The unit weights of the packed parts were up to 120 tons.

© Rhenus Donauhafen Krems

B seaport/hinterland transport	 **Transport by inland vessel**	 **Transport by road**
Transport time	12 days	2-3 days
Price	90%	100%
CO_2 emissions	With modern inland vessels, a CO_2 reduction of 40% is possible (40 trucks vs. 1 MGS), with the advantage that the dry cargo ship can flexibly take return cargo that a special truck is very unlikely to be able to generate. In addition, necessary escort services and other additional trips are also eliminated.	
Other important decision parameters	Soft transport without shunting impacts and with low force effects, no special lashings are necessary.	Depending on the route, road transport with widths of more than 5.0 m and weights of more than 80 tons is difficult to carry out due to construction zones on the way through Germany. Obtaining the necessary special road transport permits can also be time-consuming and difficult.

Conclusion

As the practical examples described show, there are numerous advantages of using inland vessels.

Total costs can be reduced thanks to the combination of several freight units in the ship and because empty and escort trips are dispensed with. The longer transit times for transport by inland vessel are often put into perspective in light of the fact that a permit must be obtained for road transport, and extensive preparatory work must be carried out (route planning, preliminary studies, etc.). This is also associated with corresponding time and cost expenditures.

From an overall economic and environmental point of view, the use of inland waterways offers opportunities for reducing emissions of climate-damaging substances such as CO_2. In addition, the shift to inland shipping significantly reduces the traffic load on the road infrastructure and thus increases road safety.

Are you interested to learn more?

viadonau offers advice and support for shippers and forwarders who want to learn more about the possibilities and advantages of transport by inland waterway vessel.

We are happy to answer all your questions, whether in a personal conversation, by e-mail or by telephone.

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Links

Austria

Info area “High & heavy transports by inland vessel”
at the viadonau website
www.viadonau.org/high-heavy-en

Fairway information
www.doris.bmk.gv.at/en

Bridge clearance
www.viadonau.org/en/economy/the-danube-transport-axis/bridges

International

Fairway information
www.danubeportal.com

Bridges along the Danube River
www.viadonau.org/en/economy/the-danube-transport-axis/bridges

Shipping companies and ship brokers
www.danube-logistics.info/the-blue-pages

Danube Ports and Terminals
www.danube-logistics.info/danube-ports

www.viadonau.org/high-heavy-en

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