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DAHAR

DaHar – Danube Inland Harbour Development

State of the art study

Navigability and environmental protection

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Table of Content

Abbreviations

DaHar	Danube Inland Harbour Development
dwcc	Deadweight cargo capacity

1 Introduction

Environmental impacts [7]

Inland navigation can contribute to making transport more sustainable, particularly where it substitutes for road transport, but inland shipping and especially the development of waterways for navigation can have considerable environmental impacts. Waterway development works for inland navigation can have significant impacts on the ecological value and water quality of water bodies. The nature and extent of the impacts depend on the kind of works concerned and, to a large degree, on the characteristics of the water body itself. The kinds of mitigation techniques that can be employed can also differ markedly, for example between sections of river with rocky bed and banks, and reaches with sandy or muddy bottoms situated in flood plains. In some cases new works for navigation can be designed to improve water quality or biodiversity and create valuable habitats.

1.1 The Danube River

The Danube River Basin is Europe's second largest river basin, with a total area of 801,463 km². More than 80 million people from 19 countries share the Danube catchment area, making it the world's most international river basin. Based on its gradients, the Danube River Basin can be divided into three sub-regions: the Upper, Middle and Lower Basins (the latter including the Danube Delta). The Upper Basin extends from the source of the Danube in Germany to Bratislava in Slovakia. The Middle Basin is the largest of the three sub-regions, extending from Bratislava to the dams of the Iron Gate Gorge on the border between Serbia and Romania. The low-lands, plateaus and mountains of Romania and Bulgaria form the Lower Basin of the River Danube. Before reaching the Black Sea, the river divides into three main branches, forming the Danube Delta, which covers an area of about 6,750 km².

The Danube is the major waterway in Europe with a large potential for transporting goods. Ships can navigate the Danube from 2,411 kilometres upstream all the way down to the Delta. This is 87% of the river's total length. The ships can call in at 78 ports located along the Danube between Kelheim and the Black Sea.

The shipping industry is focusing on further development of the Danube navigation channel through new dams and regulations projects, as well as construction of new artificial waterways. The EU supports these developments, providing substantial co-funding to inland navigation within the framework of the Trans-European Transport Networks (TEN-T). The Danube as the Pan-European Transport Corridor VII is the backbone of the east-west waterway connection providing, together with the Rhine River, a link between the North Sea and the Black Sea.

At the same time the Danube still retains much of its outstanding ecological quality today. It is considered as one of the most valuable ecoregions with unique biodiversity. Over 2,000 plant species and 5,000 animal species live in or by the waters of the Danube, a habitat which hosts about 2,000 vascular plants, over 40 mammals, approximately 100 fish species as well as important bird sanctuaries for species such as the Dalmatian pelican.

The challenge before us is to contribute to solutions that will promote the competitiveness of inland navigation and improvement of the Danube's ecological status. But we have to take into the consideration that a single inland navigation vessel can carry the same volume of goods as 93 railway wagons or 173 trucks. Inland navigation can contribute to making transport more environmentally sustainable, particularly where it substitutes for road transport.

1.2 What is navigability?

A body of water, such as a river, canal or lake, is **navigable** if it is deep, wide and slow enough for a vessel to pass. Preferably there are few obstructions such as rocks or trees to avoid. Bridges must have sufficient vertical clearance. High water speed may make a channel un-navigable. Waters may be un-navigable because of ice, particularly in winter.

Navigability depends on context: A small river may be navigable by smaller craft, such as a motor boat or a kayak, but un-navigable by a cruise ship. Shallow rivers may be made navigable by the installation of locks that increase and regulate water depth, or by dredging.

Glossary for transport statistics, the document prepared by the Intersecretariat Working Group on Transport Statistics further elaborates the definitions concerning the navigability on inland waterways:

Navigable inland waterway - A stretch of water, not part of the sea, over which vessels of a carrying capacity of not less than 50 tonnes can navigate when normally loaded. This term covers both navigable rivers and lakes and navigable canals.
Categories of navigable inland waterways - The categories of navigable inland waterways are defined with reference to international classification systems such as those drawn up by the United Nations Economic Commission for Europe or by the European Conference of Ministers of Transport.
Navigable river - Natural waterway open for navigation, irrespective of whether it has been improved for that purpose.
Navigable lake - Natural expanse of water open for navigation.
Navigable canal - Waterway built primarily for navigation.
Navigable inland waterway network - All navigable inland waterways open for public navigation in a given area.

Navigable inland waterways regularly used for transport - Waterways over which an amount of transport is performed each year; this amount, expressed as tonne-kilometres per kilometre of waterway, is determined by the authority concerned in the light of conditions prevailing on that country's waterway network.

1.3 What is environmental protection?

Environmental protection are policies and procedures aimed at conserving the natural resources, preserving the current state of natural environment and, where possible, reversing its degradation.

Discussion concerning environmental protection often focuses on the role of government, legislation and enforcement. However, in its broadest sense, environmental protection may be seen to be the responsibility of all people and not simply that of government. Decisions that impact the environment will ideally involve a broad range of stakeholders, including industry, indigenous groups, environmental group and community representatives. Gradually, environmental decision-making processes are evolving to reflect this broad base of stakeholders and are becoming more collaborative in many countries.

1.4 International agreements on Danube fairway parameters and environmental protection

The legal framework for navigation and environment issues in the Danube river basin includes international conventions between countries as well as relevant EU law, policies and action plans.

The Danube River Protection Convention is the major legal instrument for cooperation and trans-boundary water management in the Danube river basin.

Another important document is the Convention regarding the Regime of Navigation on the Danube (**Belgrade Convention**), which forms the framework for governing navigation between 11 Member States. The Convention, which is coordinated by the Danube Commission, aims to strengthen economic relations in the region and addresses the need for maintaining the entire Danube navigable.

In addition several EU policies build the legal framework for water and river basin management in Europe, with the EU Water Framework Directive 2000/60/EC (**EU WFD**) as most significant regarding the protection of surface waters and groundwater. This includes a requirement for the development of the first river basin management plan for the entire Danube river basin by 2009.

By 2015 the main environmental objectives of the Directive have to be achieved by the implementation of the programmes of measures, which i.a. address hydro morphological alterations caused by navigation.

Many other environmental directives, policies and conventions interface with the EU WFD and need to be considered for comprehensive policy integration related to IWT development, including the EU Habitats and Birds Directives (**Natura 2000 ecological network**) and the Bern Convention (Emerald network).

The European Action Programme for the Promotion of Inland Waterway Transport **NAIADES** sets an important frame for actions. These include a better integration of IWT in the logistic chain, improving the environmental performance of the fleet and using modern information and communication technologies (e.g. for River Information Services) to improve navigation. For its support, the EU PLATINA project (Platform for the Implementation of NAIADES) was started in 2008.

At a wider scale the European Agreement on Main Inland Waterways of International Importance (**AGN**) lays down guidelines for the navigability characteristics of inland waterways carrying international traffic. This international agreement has entered into force in a number of Danube countries.

The implementation and integration of all relevant policies is crucial for an appropriate development of IWT and the achievement of the environmental objectives in the Danube river basin. This is the only way in which conditions for IWT and the environment can be improved and protected.

In the Danube region the **Joint Statement** on Guiding Principles for the Development of Inland Navigation and Environmental Protection in the Danube River Basin , endorsed in 2007 by the **ICPDR** (International Commission for the Protection of the Danube River), **Danube Commission** and the International Sava River Basin Commission (ISRBC), is a key tool providing guidance for the planning and implementation of waterway projects.

2 Current navigability situation on the Danube

The Danube is a beautiful large river, but its bed is rather shallow for such a long and extensive natural feature and it is liable to sediment accumulation. The Danube delta was created by the excessive quantity of sediments transported by water, not only near its estuary to the sea, but also in so-called inland delta in the area of its transition from the upper stream to the middle stream.

Critical for navigation are water levels approaching the lower regulation level, which occurs very often, and their statistics will be even less favourable due to the climatic changes. For these water levels the whole flow is concentrated in the streamline which creates obstacles to navigation:

- Difficult overcoming of places with increased velocity of flow;
- Narrowing of the fairway, which creates the risk of collision, or delay and slowdown of navigation in case of prohibition of ship passing by, but especially
- Limited draught of vessels, and hence their limited loading.

In these situations many shipping companies and particular entrepreneurs in water transport are forced to announce the interruption of shipping operations several times in the year, because the trade balance of such operations shows a deficit, the navigation is risky and the fulfilment of contract conditions nearly impossible.

On the contrary, sections with backwater achieved thanks to cascades guarantee the maximum draught all the year (365 days in a year), the time loss caused by navigation through sluices can be easily made up on the slowed-down flow of the backwater level, and which is most important, the hydrodynamic regime of navigation is effective for the driving gear, and hence environmentally friendly, low-wearing, safe and having less collision. The corresponding positive financial effect creating the conditions for the offer of competitive transport tariffs and hence for the competitiveness of water transport, is essential.

These facts are defined in the recommendation of the Danube Commission in the strategy of development of the Danube fleet until the year 2020: „Economic effectiveness of future vessels should be supported by future positive changes in the navigation infrastructure and by permission of maximum draught for full utilization of their capacity.

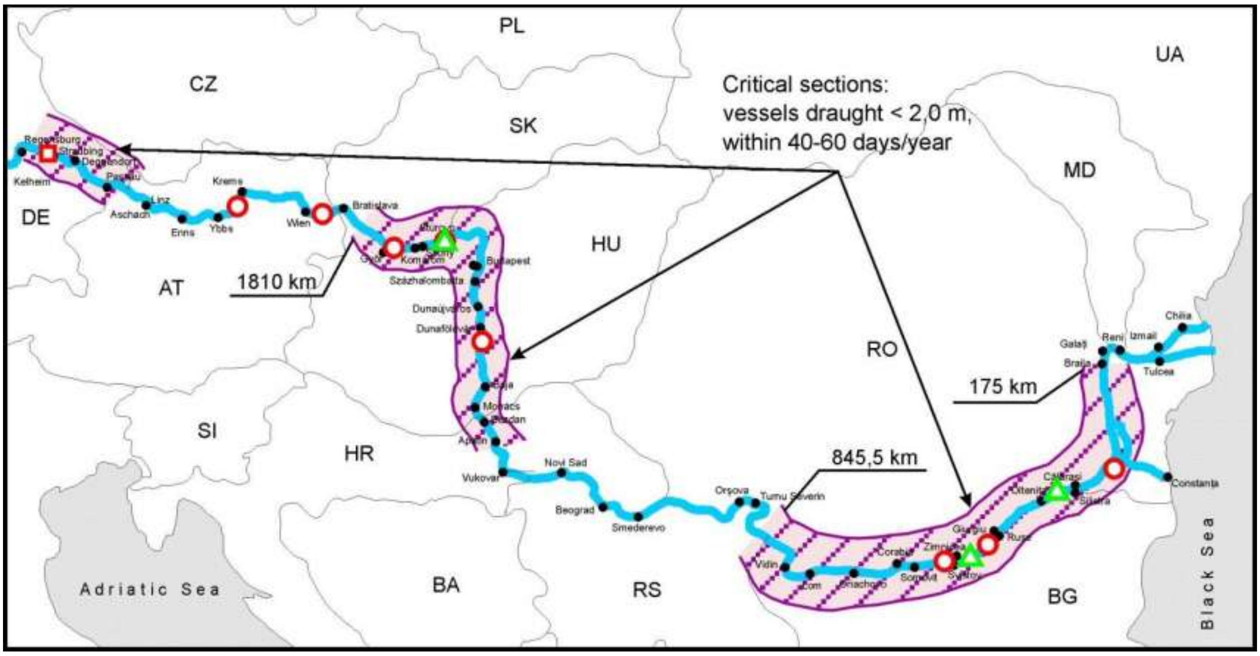
This aim may not be far from the reality, because by backwater through cascades on the Danube a high-quality waterway has been built that would create, with exception of two short 30 km sections near Wilshofen and Wachau, a continuous 500 km long waterway from Vienna to Regensburg of class VI C. And after the completion of the initially planned two waterworks between Budapest and Vienna, another section in the length of 200 km with class VII will be added.

All the waterworks on the Danube were constructed in the 20th century and the rest to be built has been the subject of speculations for at least 30 years.

The project 18.2 TEN-T (Trans European Transport Network – European Institute for Promotion of Development of Important European transport networks) deals with the section under construction between Vienna and Bratislava. From the study and analysis of the project it is however evident that it resolves the problem of water transport only partially because it deals mostly with environmental problems, such as water supply to the branching system of the Danube also at the lower regulation water level, whereby the limit of the lower regulation water level should be modified from the initial 25 dm to 27 dm. This should be achieved exclusively by adjustments in the river bed.

Here it is necessary to stress that we have to respect the environmental conditions and the environmental assessment of any works. But the waterway on the Danube requires the solution of the full functionality of satisfactory and effective navigation according to international criteria, and that our aim is to respect and have consideration for nature.

We can see the current navigability situation on the following picture.



Classification of the waterways (CD/SES 53/33)

	stretch	class
1	Kelheim - Regensburg	Vb
2	Regensburg - Wien	VIb
3	Wien - Belgrad	VIc
4	Belgrad - Sulina	VII

From the water depht point of view, the pictures in subsequent chapters show the navigability situation in Danube countries in more details. They cover the situation from Germany-Austria border to the delta of Danube with TEN-T priority areas.

Below each picture, the existing bottlenecks and missing links relevant only to the Danube River as defined in [6] and updated in [8] are mentioned.

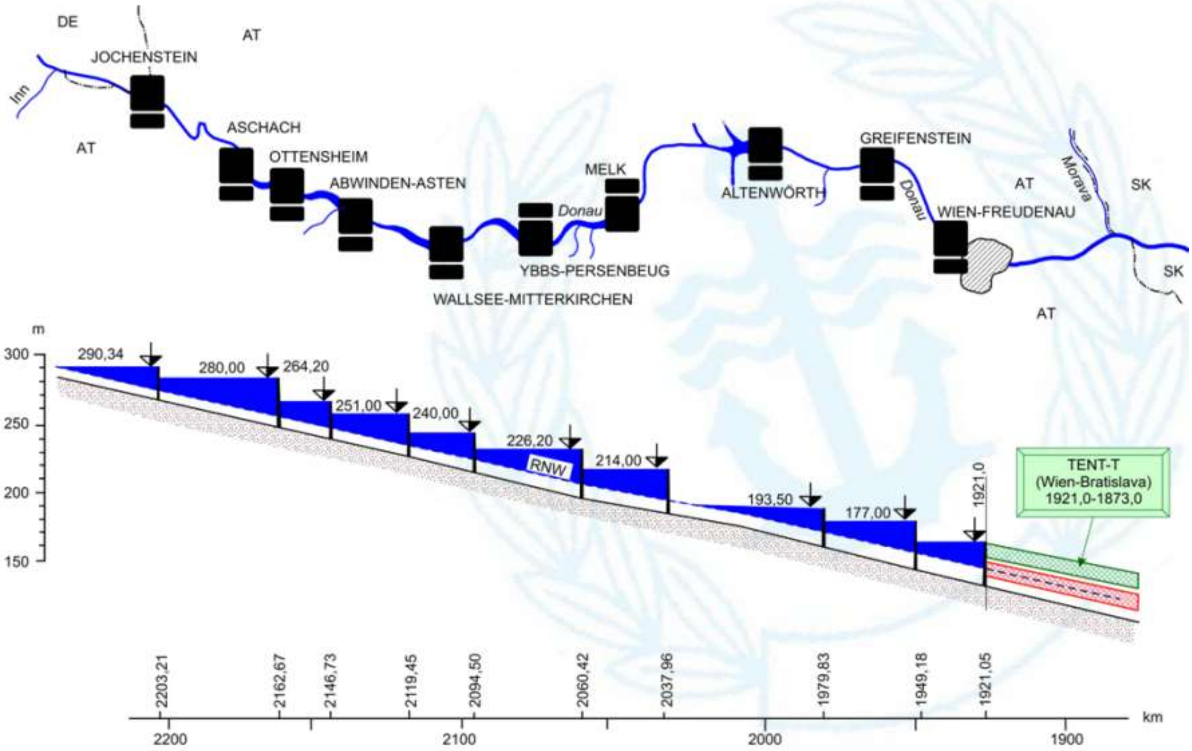
The following definitions are used in the "Blue Book" [9] for bottlenecks and missing links:

Basic bottlenecks - are the sections of E waterways whose parameters at the present time are not in conformity with the requirements applicable to inland waterways of international importance in accordance with the new classification of European inland waterways (class IV);

Strategic bottlenecks - are other sections satisfying the basic requirements of the class IV but which, nevertheless, ought to be modernized in order to improve the structure of the network or to increase the economic capacity of inland navigation traffic.

Missing links - are such parts of the future network of inland waterways of international importance which do not exist at present.

2.1 Austria



Strategic bottlenecks

Danube (E 80) km 2,037.0 – 2,005.0

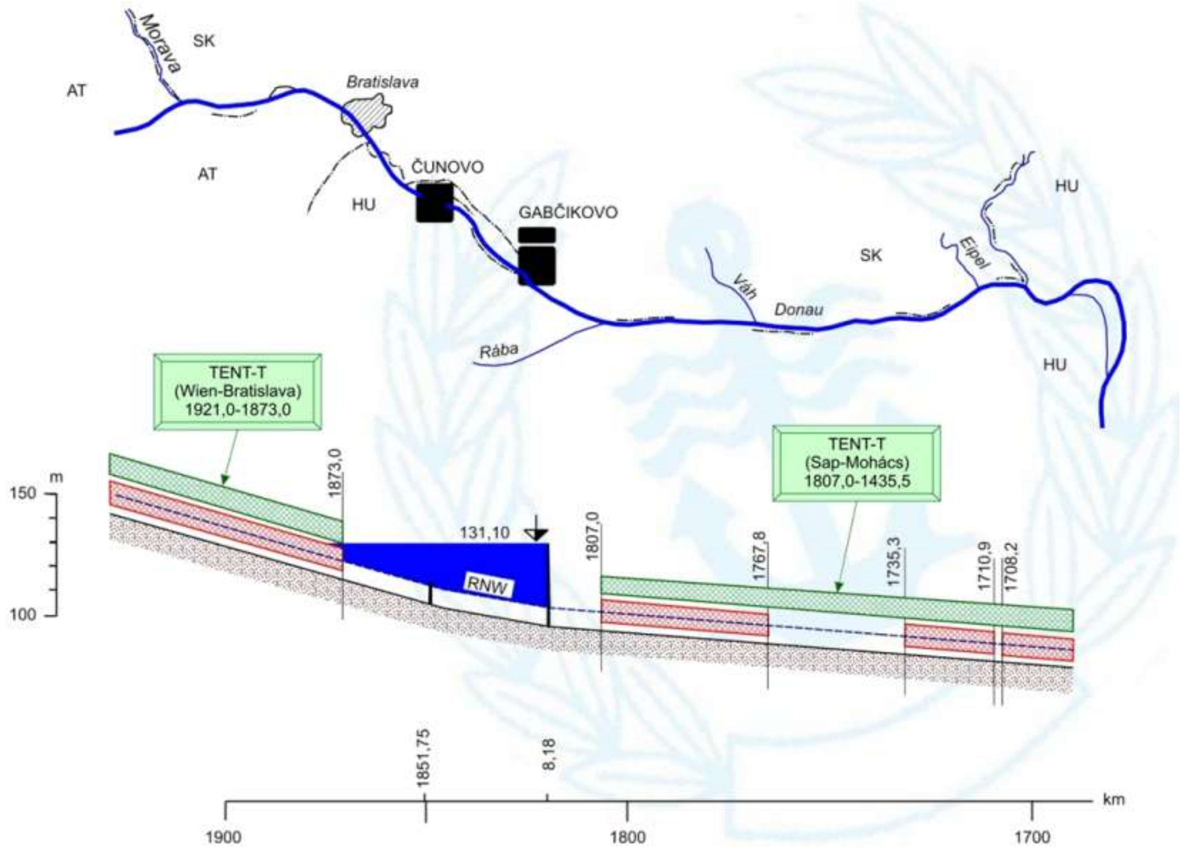
Description of the bottleneck	On the free-flowing section in the Wachau valley restricted fairway depths are limited to three critical fords on a total length of three kilometres. Technical surveys on the improvement of navigability were produced in 2005 and 2007. The bottleneck can be eliminated by maintenance works in combination with ecological measures, no river engineering works will be necessary. The project is included in the Transport Master Plan Austria (2002) and in the National Action Plan Danube Navigation (2006).
Type of physical problem(s)	Fairway depth and/or width (shallow water)
Type of shipping problem(s)	Reduced draught of vessels (due to shallow water)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	Construction works: 65.4 million EUR
Co-financing by the EU	No

Danube (E 80) km 1,921.0 – 1,872.7

Description of the bottleneck	The project aims to improve the ecological conditions in the Danube Floodplain National Park as well as the fairway conditions in this free-flowing section of the Danube between Vienna and the Austrian-Slovakian border. Common planning principles were established on the basis

	of an interdisciplinary experts agreement in 2004. The project's interdisciplinary planning approach is widely recognized as "best practice". Model experiments for river engineering measures were undertaken from 2005 to 2008 at the Technical University Vienna. Pilot projects have been realized since late 2007. A comprehensive monitoring program was started in 2005. Completion of Environmental Impact Assessment (EIA – general allowance) is expected in 2010. The project is included in the Transport Master Plan Austria (2002), in the Federal Waterways Act (2004) in the National Action Plan Danube Navigation (2006) and is also part of TEN-T Priority Project 18, thus receiving European co-funding.
Type of physical problem(s)	Fairway depth and/or width (shallow water)
Type of shipping problem(s)	Reduced draught of vessels (due to shallow water)
Status of solution	- Project defined and agreed upon - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	Approx. 220 million EUR (2006 estimation)
Co-financing by the EU	Yes (for studies and construction works: TEN-T)

2.2 Slovakia



Strategic bottlenecks

Danube (E 80) km 1,880.26 – 1,867.0

Description of the bottleneck	Upgrading of the Danube waterway between Devin and Bratislava from class VI B to class VI C when going downstream (Blue Book also mentions upgrade to class VIc when going upstream in its Table 1). Insufficient height under Stary Most bridge in Bratislava (see below). This bottleneck is included in the national "Concept for the Development of Waterway Transport" and the "Transport Policy of the Slovak Republic until 2015" where it is subsumed under the measure "creates conditions for completion of construction of projects included in TEN-T". The cross-border section between Vienna and Bratislava is included in the TENT as part of Priority Project 18. According to the 2009 General Programme for the Implementation of NAIADES in the Slovak Republic, a long-term improvement of fairway parameters on this river section can only be achieved by erecting a retaining dam at Wolfsthal or Pečenský les. A proposal for a dam at Pečenský les (project and research) as well as the preparation of documents for the associated environmental impact assessment shall be finished by 2013.
Type of physical problem(s)	- Fairway depth and/or width (shallow water) - Bridge clearance
Type of shipping problem(s)	- Reduced draught of vessels (due to shallow water) - Reduced container capacity per vessel (mainly due to low vertical bridge clearance)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	Studies (for Pečenský les hydraulic complex): 1.5 million EUR (project plans, research, EIA)
Co-financing by the EU	Unknown

Danube (E 80) km 1,868.14

Description of the bottleneck	Insufficient height under Starý Most bridge in Bratislava (7.59 m); upgrading to 9.10 m is required to meet the AGN bottleneck waterway class parameters for this section. This bottleneck only affects vessels transporting four layers of containers. The construction of a new road bridge in Bratislava as a replacement of the "Starý Most" bridge is mentioned in the 2003 update of the "Concept for the Development of Waterway Transport". Due to a lack of financial means by the City of Bratislava, only necessary repair work (including lifting of the bridge) will be performed. Project documentation for the reconstruction of the old bridge (including the necessary technical specifications) is currently being drafted and was finished in May 2011. This study and an environmental impact assessment study are co-financed by the TEN-T budget.
Type of physical problem(s)	- Bridge clearance
Type of shipping problem(s)	- Reduced container capacity per vessel (due to low

	bridge clearance)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	• Study: 1.15 million EUR • Construction works: 50 million EUR
Co-financing by the EU	Yes (for study: TEN-T)

Figure 1: Old Bridge Bratislava and winning proposal for the new bridge

Danube (E 80) km 1,826.55 and 1,819.3

Description of the bottleneck	Insufficient height under bridges (8.90 m) at locks of the Gabčíkovo hydro-electrical power complex; upgrading to 9.10 m is required to meet the AGN waterway class parameters for this section. This bottleneck only affects vessels transporting four layers of containers. No projects for its elimination are currently known.
Type of physical problem(s)	- Bridge clearance
Type of shipping problem(s)	- Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

Danube (E 80) km 1,810.0 – 1,708.2

Description of the bottleneck	Insufficient depth at low water levels and insufficient height under bridges (cf. "Bottlenecks not listed in the UNECE Blue Book" below). This bottleneck pertains to the entire Slovak-Hungarian border section of the Danube downstream of the Gabčíkovo bypass canal near Sap (the former town of Palkovičovo) to the confluence of the Ipel with the Danube. This bottleneck is included in the national "Concept for the Development of Waterway Transport" and the "Transport Policy of the Slovak Republic until 2015" where it is subsumed under the measure "creates conditions for completion of construction of projects included in TEN-T". According to the 2009 General Programme for the

	Implementation of NAIADES in the Slovak Republic, the improvement of fairway parameters between km 1,797 and 1,790 (model research, project, realisation) shall be realised by 2013. This waterway section is part of the larger section "Palkovičovo-Mohács" (downstream of Gabčíkovo power plant to the southern state border of Hungary) which is included in the TEN-T as part of Priority Project 18. A TEN-T-co-financed feasibility study for the improvement of faiway conditions on this common border stretch was finalised by Hungary in 2007.
Type of physical problem(s)	- Fairway depth and/or width (shallow water) - Bridge clearance
Type of shipping problem(s)	- Reduced draught of vessels (due to shallow water) - Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025 (fairway conditions)
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

Danube (E 80) km 1,806.35

Description of the bottleneck	Insufficient height under Medved'ov road bridge (8.80 m); upgrading to 9.10 m is required to meet the AGN waterway class parameters for this section. This bridge is listed as a bottleneck for Hungary in the UNECE "Blue Book", but it is not mentioned for Slovakia. According to the current waterway classification of this section this bridge would require upgrade as its vertical bridge clearance affects vessels transporting four layers of containers at highest navigable water level. There is currently no knowledge of any projects or plans related to the elimination of this bottleneck.
Type of physical problem(s)	- Bridge clearance
Type of shipping problem(s)	- Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

Danube (E 80) km 1,770.4

Description of the bottleneck	Insufficient height under Komárno railway bridge (8.13 m); upgrading to 9.10 m is required to meet the AGN waterway class parameters for this section. This bridge is listed as a bottleneck for Hungary in the UNECE "Blue Book", but it is not mentioned for Slovakia. According to the current waterway classification of this

	section this bridge would require upgrade as its vertical bridge clearance affects vessels transporting four layers of containers at highest navigable water level. There is currently no knowledge of any projects or plans related to the elimination of this bottleneck.
Type of physical problem(s)	- Bridge clearance
Type of shipping problem(s)	- Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

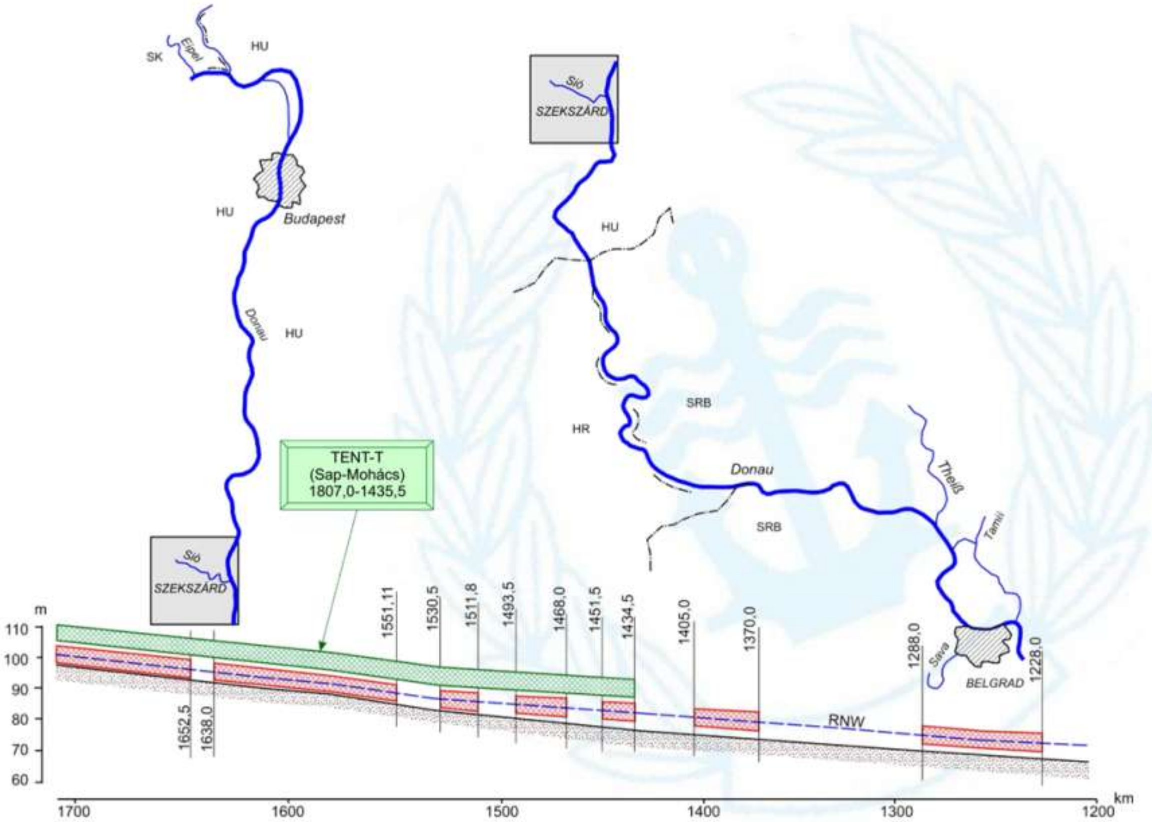
Figure 2: Komárno railway Bridge

Danube (E 80) km 1,767.8

Description of the bottleneck	Insufficient height under Komárno road bridge (7.75 m); upgrading to 9.10 m is required to meet the AGN waterway class parameters for this section. This bridge is listed as a bottleneck for Hungary in the UNECE "Blue Book", but it is not mentioned for Slovakia. According to the current waterway classification of this section this bridge would require upgrade as its vertical bridge clearance affects vessels transporting four layers of containers at highest navigable water level. There is currently no knowledge of any projects or plans related to the elimination of this bottleneck. There is currently no knowledge of any projects or plans related to the elimination of this bottleneck.
Type of physical problem(s)	- Bridge clearance
Type of shipping problem(s)	- Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

Figure 3: Komárno road bridge

2.3 Hungary



Strategic bottlenecks:

Danube (E 80) km 1,810.0 – 1,708.0

Description of the bottleneck	Low maximum draught at dry seasons and height under bridges. This bottleneck pertains to the entire Slovak-Hungarian border section of the Danube downstream of the Gabčíkovo bypass canal near Sap (former town of Palkovičovo) to the confluence of the Ipel with the Danube. The bottleneck is included as a long-term priority in the "Hungarian Transport Policy 2003–2015" and the "Transport Operational Programme 2007–2013". As part of the section Palkovičovo-Mohács this bottleneck is also included in the TEN-T Priority Project 18.

	The 2007 "Feasibility Study for the Improvement of the Navigability of the Danube" identifies 16 locations with limited fairway depth and/or width on this section of the Danube. Construction works are expected to be executed until 2013.
Type of physical problem(s)	- Fairway depth and/or width (shallow water) - Bridge clearance
Type of shipping problem(s)	- Reduced draught of vessels (due to shallow water) - Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	Construction works: Approx. 40 million EUR
Co-financing by the EU	Yes (for feasibility study: TEN-T as part of the section Palkovičovo-Mohács)

Danube (E 80) km 1,806.35

Description of the bottleneck	Height under Medved'ov road bridge (8.85 m); upgrading to 9.10 m is required with regard to the waterway class foreseen for this section in the AGN. This bottleneck only affects vessels transporting four layers of containers at highest navigable water level. No projects for its elimination are currently known. This bottleneck on the common Hungarian-Slovakian border section of the Danube is listed as a "strategic bottleneck" for Hungary in the UNECE "Blue Book" but is not identified as a bottleneck for Slovakia.
Type of physical problem(s)	Bridge clearance
Type of shipping problem(s)	Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

Danube (E 80) km 1,770.4

Description of the bottleneck	Height under Komárom railway bridge (8.10–8.15 m); upgrading to 9.10 m is required with regard to the waterway class foreseen for this section in the AGN. This bottleneck only affects vessels transporting four layers of containers at highest navigable water level. No projects for its elimination are currently known. This bottleneck on the common Hungarian-Slovakian border section of the Danube is listed as a "strategic bottleneck" for Hungary in the UNECE "Blue Book" but is not identified as a bottleneck for Slovakia.
Type of physical problem(s)	Bridge clearance
Type of shipping	Reduced container capacity per vessel (due to low bridge

problem(s)	clearance)
Status of solution	Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

Danube (E 80) km 1,767.8

Description of the bottleneck	Height under Komárom road bridge (7.75 m); upgrading to 9.10 m is required with regard to the waterway class foreseen for this section in the AGN. This bottleneck only affects vessels transporting four layers of containers at highest navigable water level. No projects for its elimination are currently known. This bottleneck on the common Hungarian-Slovakian border section of the Danube is listed as a "strategic bottleneck" for Hungary in the UNECE "Blue Book" but is not identified as a bottleneck for Slovakia.
Type of physical problem(s)	Bridge clearance
Type of shipping problem(s)	Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

Danube (E 80) km 1,708.0 – 1,433.0

Description of the bottleneck	This bottleneck is only partially included as a "strategic bottleneck" in the UNECE "Blue Book", i.e. section from km 1,708.0 (Slovakian-Hungarian border) to km 1,652.0 (Budapest). The Feasibility Study for the Improvement of the Navigability on the Danube (2007) identifies 33 locations with limited fairway depth and/or width on this section of the Danube. On the basis of this study, an Intermediate Stud has been finished in August 2009 which identifies 31 locations in need of dredging and/or river training works (groynes and training walls). These spots are grouped into 20 construction sites with a cumulative length of some 52 km. Works on these sites are foreseen to be accomplished between 2010 and 2013. This bottleneck is included as a long-term priority in the "Hungarian Transport Policy 2003–2015" and the "Transport Operational Programme 2007–2013". As part of the section "Palkovicovo-Mohács", this bottleneck is also included in the TEN-T Priority Project 18.
Type of physical problem(s)	- Fairway depth and/or width (shallow water) - Bridge clearance
Type of shipping problem(s)	- Reduced draught of vessels (due to shallow water) - Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy

	document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	Construction works: Approx. 45–60 million EUR
Co-financing by the EU	Yes (for feasibility study: TEN-T)

Danube (E 80) km 1,652.0 – 1,433.0

Description of the bottleneck	The Hungarian section of the Danube from Budapest (km 1,652.0) to the southern state border with Croatian and Serbia (km 1,433.0) is currently not included as a bottleneck in the UNECE "Blue Book", but it is covered by the 2007 "Feasibility Study for the Improvement of the Navigability of the Danube". This section is also included in the "Transport Operational Programme 2007–2013", in the "Hungarian Transport Policy 2003–2015" and in TEN-T Priority Project 18 as part of the section Palkovicovo-Mohács. For details on this bottleneck see information on bottleneck "Danube (E 80) km 1,708.0 – 1,433.0" above of which it is a part.

Danube (E 80) km 1,648.7

Description of the bottleneck	Insufficient height under Margit road bridge in Budapest (5.85 m); upgrading to 7.00 m is required with regard to the waterway class foreseen for this section in the AGN. This bottleneck is not mentioned in the UNECE "Blue Book", yet according to the current waterway classification of this section, this bridge would require upgrade as its vertical bridge clearance affects vessels transporting three layers of containers at highest navigable water level. There is currently no knowledge of any projects or plans related to the elimination of this bottleneck.
Type of physical problem(s)	Bridge clearance
Type of shipping problem(s)	Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

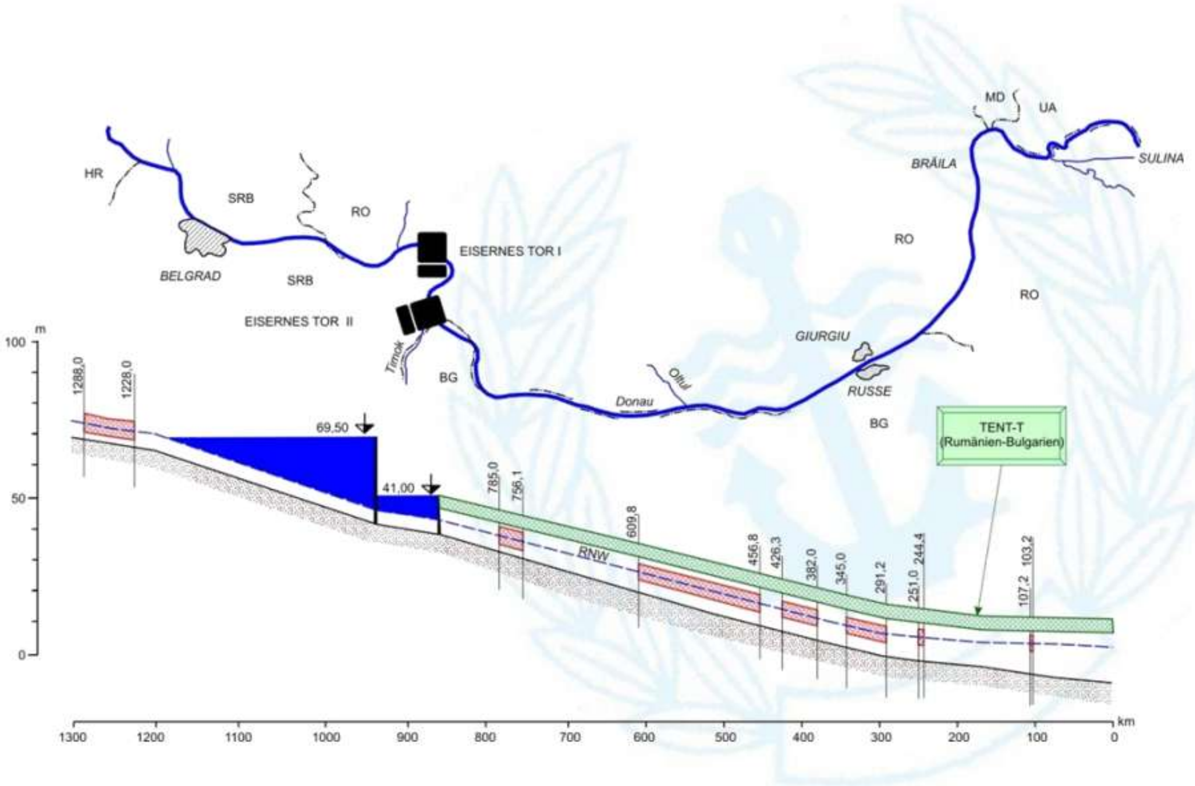
Danube (E 80) km 1,560.55

Description of the bottleneck	Insufficient height under road/rail bridge at Dunaföldvár (8.73 m); upgrading to 9.10 m is required with regard to the waterway class foreseen for this section in the AGN. This bottleneck is not mentioned in the UNECE "Blue Book", yet according to the current waterway classification of this section, this bridge would require upgrade as its vertical bridge clearance affects vessels transporting four layers of containers at highest navigable water level. There is currently no knowledge of any projects or plans related to the elimination of this bottleneck.

Type of physical problem(s)	Bridge clearance
Type of shipping problem(s)	Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

Danube (E 80) km 1,480.22

Description of the bottleneck	Insufficient height under road/rail bridge at Baja (8.09 m); upgrading to 9.10m is required with regard to the waterway class foreseen for this section in the AGN. This bottleneck is not listed in UNECE Resolution No. 49 (corresponding to Section 2 of the UNECE "Blue Book"), but is mentioned in Note 77 for Table 1 of the "Blue Book" (Navigational Characteristics of Main Inland Waterways of International Importance). It affects vessels transporting four layers of containers at highest navigable water level. There is currently no knowledge of any projects or plans related to the elimination of this bottleneck.
Type of physical problem(s)	Bridge clearance
Type of shipping problem(s)	Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown



2.4 Croatia

Strategic bottlenecks: for the river Danube, there are currently none strategic bottlenecks known according to the [9]. Basic bottleneck exists on river Sava (E80-12) km 583.0 – 207.0, which is not in the scope of the DaHar project.

2.5 Serbia

Strategic bottlenecks

Danube (E 80) km 1,254.25

Description of the bottleneck	Low height and insufficient fairway width under a temporary road/railway bridge at Novi Sad (6.82 m); 9.10 m is required with regard to the waterway class foreseen for this section in the AGN. Construction of a new road and rail bridge across the Danube in Novi Sad instead of the provisional Žeželj bridge which was destroyed during the 1999 NATO bombings. Bottleneck is defined as a high priority project in the Serbian IWT Master Plan and is also included in the Development Strategy for Railway, Road, Water, Air and Inter-modal Transport in the Republic of Serbia 2008-2015. Design documents were tendered in Spring 2010. Technical assistance was offered by the former European Agency for Reconstruction (EAR).
Type of physical problem(s)	Bridge clearance
Type of shipping problem(s)	Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Project defined and agreed upon - Incorporated in national transport master plan/strategy document

Planning horizon for removal of bottleneck	Project realised before 2025
Costs for removal of bottleneck	Construction works: 35 million EUR
Co-financing by the EU	Yes (for design and tender documents: CARDS 2004; for construction works: IPA 2009)

Danube (E 80) km 863.0 – 845.5

Description of the bottleneck	Low fairway depth at dry seasons on this common Romanian-Serbian border section of the Danube. At Prahovo, downstream of the Đerdap II hydroelectric power plant, several wrecks of inland vessels are situated in or close to the fairway which can endanger navigation. A detailed field investigation was carried out to establish the exact location of the vessels and their conditions. A total of 20 vessels have been identified for removal. A detailed design and a removal method were established, followed by the preparation of tender documentation, allowing the Serbian Authority to launch the tender for the removal of the vessels. Removal of part of the wrecks on km 860.5 is defined as a high priority project in the Serbian IWT Master Plan. Project implementation is foreseen for the year 2011. This section is also part of Project Group 17 of the SEETO Multi-Annual Plan 2008–2012 ("Danube riverbed restoration of five sections").
Type of physical problem(s)	- Fairway depth and/or width (shallow water) - Wrecks of inland vessels endangering navigation
Type of shipping problem(s)	- Reduced draught of vessels (due to shallow water) - Safety issues because of ship wrecks in or near the fairway
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project realised before 2025
Costs for removal of bottleneck	For removal of sunken vessels: 29 million EUR
Co-financing by the EU	Yes (IPA 2011, planned)

Danube (E 80) km 1,405.6 – 1,227.9

Description of the bottleneck	The Serbian IWT Master Plan has identified seven sections on the Danube with narrow fairway conditions as high priority projects: Five sections are located on the common Croatian-Serbian border section (Apatin: km 1,405.6-1,401.7; Vermelj and Petreš: km 1,391.0-1,389.6; Staklar: km 1,375.9-1,372.3; Sotin: km 1,323.3-1,320.7; Mohovo: km 1,309.9-1,309.1), the remaining sections are located at Arankina Ada (km 1,248.0-1,246.0) and at Beška (km 1,229.7-1,227.9). An elimination of these bottlenecks can be achieved by dredging, river engineering, bank protection, bank excavation to increase bend radius and by removal of rocky material. Projects have been identified and terms of reference prepared. Apart from the sections at Sotin and Arankina Ada the other five sections are also part of Project Group 17 of the SEETO

	Multi-Annual Plan 2008–2012 ("Danube riverbed restoration of five sections").
Type of physical problem(s)	- Fairway depth and/or width (shallow water) - Bridge clearance - Sharp river bend
Type of shipping problem(s)	- Reduced draught of vessels (due to shallow water) - Prolonged travel times (due to speed limits, overtaking and/or bypassing bans) - Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	Construction works: 28 million EUR
Co-financing by the EU	Yes (for construction works: IPA 2010)

Danube (E 80) km 942.6 and 863.7

Description of the bottleneck	Rehabilitation and modernisation of the Serbian Đerdap I and Đerdap II locks on the right bank of the river Danube. The Đerdap I and II locks have been in operation for around 30 years without significant overhaul. Thus, major overhaul and rehabilitation are urgently required. The modernisation of both locks is also defined as a part of the Serbian IWT Master Plan. A detailed inspection of the electrical, mechanical and civil installations of both navigation lock systems was undertaken. This was followed by a design phase and the preparation of a full set of tender documentation to enable the Serbian Authorities to launch the tender.
Type of physical problem(s)	Lock capacity
Type of shipping problem(s)	Prolonged travel times (due to restricted locks capacity)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	Construction works: 90 million EUR
Co-financing by the EU	Yes (for design and tender documents: CARDS 2005; for construction works: IPA 2010)

Danube (E 80) km 1,366.50

Description of the bottleneck	Insufficient height under railway bridge at Bogojevo (8.15 m); upgrading to 9.10 m is required with regard to the waterway class foreseen for this section in the AGN. This bottleneck is not mentioned in the UNECE "Blue Book", yet according to the current waterway classification of this section, this bridge would require upgrade as its vertical bridge clearance affects vessels transporting four layers of containers at highest navigable water level.

	There is currently no knowledge of any projects or plans related to the elimination of this bottleneck.
Type of physical problem(s)	Bridge clearance
Type of shipping problem(s)	Reduced container capacity per vessel (due to low bridge clearance)
Status of solution	Not under preparation
Planning horizon for removal of bottleneck	Unknown
Costs for removal of bottleneck	To be determined
Co-financing by the EU	Unknown

2.6 Bulgaria

Strategic bottlenecks

Danube (E 80) km 845.5 – 375.0

Description of the bottleneck	Low fairway depths at dry seasons (below 2.50 m; value recommended by the Danube Commission) at several critical sections on the common Bulgarian-Romanian border stretch of the Danube (Iron Gate II – Călărasi). Project is mentioned in the Sectoral Operational Programme on Transport 2007–2013 and in the Strategy for the Development of Transport Infrastructure of the Republic of Bulgaria until 2015. According to the SOPT, fairway improvements on the Danube are foreseen on two critical sections (Batin at km 530.0–520.0 and Belene at km 576.0–560.0) with a cumulative length of 26 km. Indicative interventions provided by the project include: groins, bank protection, bottom sills and dredging. The two sections are considered as two lots within the common Bulgarian-Romanian infrastructure project between Iron Gate II and Călărasi (also see reference in Romanian data sheet). A technical draft feasibility study was finalised in September 2008 for the entire border stretch between km 845.5 and 375.0, outlining 38 critical sections, of which 29 require training works and/or dredging in order to improve navigation conditions. The final technical feasibility report is planned to be finished at the beginning of 2010. On the basis of this report the Romanian and Bulgarian authorities will decide on the technical variant to be implemented. The necessary EIA is foreseen to be carried out in parallel.
Type of physical problem(s)	Fairway depth and/or width (shallow water)
Type of shipping problem(s)	Reduced draught of vessels (due to shallow water)
Status of solution	- Pre-project phase (project identification/validation) - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	Construction works: 138 million EUR
Co-financing by the EU	Yes (for construction works: ERDF)

2.7 Romania

Strategic bottlenecks

Danube (E 80) km 863.0 – 175.0

Description of the bottleneck	Low fairway depths at dry seasons (below 2.50 m, value recommended by the Danube Commission) at several critical sections. The elimination of this bottleneck is part of the Romanian Sectoral Operational Programme – Transport (SOPT) for the years 2007–2013. The improvement of this Danube stretch is also included as a priority in the draft version of the Romanian General Transport Master Plan (GTMP). This section is also part of TEN-T Priority Project 18, which includes "bottlenecks in Romania and Bulgaria". Currently there are two ongoing projects, which are co-funded by the European Commission via the former ISPA Programme (Technical assistance for the improvement of navigation conditions on the Romanian-Bulgarian common sector resp. on the Romanian sector of the Danube): - Iron Gate II (km 863) – Călărasi (km 375), equal to the Romanian-Bulgarian border section of the Danube - Călărasi (km 375) – Brăila (km 175) on the Romanian sector of the Danube The improvement of the stretch between Iron Gate II and Călărasi will be carried out as a common Romania-Bulgarian project. A technical draft feasibility report was finalised in December 2008, outlining 38 critical sections, of which 24 require training works and/or dredging in order to improve the navigation conditions from which 6 critical sections have been established as prioritary. The final feasibility and EIA studies are currently being drafted. On the basis of these studies the Romanian and Bulgarian authorities will decide on the technical variant to be implemented. The second project foresees an improvement of navigation conditions on the Romanian Danube stretch between Călărasi and Brăila. The technical feasibility study and technical design were finalised in 2007, outlining 10 critical sections. In the first implementation phase technical works are only foreseen on the following three critical sections: Bala Branch and Caragheorghe (km 347-343), Epurasu Branch area (km 342.7-341.6) and the Ostrovo Lupu area (km 197-195). Further works in the other seven critical sections are foreseen in a second phase, should the accompanying monitoring programme for phase one prove the necessity of additional works. Construction works of phase one are depending on the positive evaluation of the EIA which is currently under way.
Type of physical problem(s)	Fairway depth and/or width (shallow water)
Type of shipping problem(s)	Reduced draught of vessels (due to shallow water)
Status of solution	- Project defined and agreed upon - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025

Costs for removal of bottleneck	- Construction works (on stretch km 845.5–375.0): 120 million EUR (Romanian share) - Construction works (for phase I on stretch km 375.0–175.0): 40 million EUR
Co-financing by the EU	Yes (for feasibility study: ISPA; for construction works: Cohesion Fund)

Danube (E 80) km 170.0 – 0.0

Description of the bottleneck	Low fairway depths at dry seasons at several critical points as well as at the Sulina bar at the mouth of the Sulina Canal where it meets the Black Sea. This stretch between Brăila (km 170) and the Black Sea represents the aritime part of the Danube, which foresees a minimum fairway depth of 7.30 m (recommended by the Danube Commission). The rehabilitation and improvement of the Danube's Sulina river banks is an ongoing project. From 1984 to 2008 nearly 71 km of bank protection was completed, of which 35.8 km in the period 2004–2008 with EIB funding. Another 35 km of bank protection is foreseen and planned in the SOPT. The project preparation (feasibility study) has been completed under EIB funding in 2007, the completion of works is foreseen until 2013 (also included as recommendation of the draft GTMP). A technical feasibility study was elaborated for the so called "Tulcea sector" (nm 43–34 on the Danube river). This study aims to improve the nautical situation on the river curve near Tulcea in order to increase the safety margins for sea-going vessels. This study was co-funded by the EU via the former ISPA Programme. The draft version of the Romanian General Transport Master Plan (GTMP) foresees the improvement of this sector, although works are recommended to start not before 2013.
Type of physical problem(s)	- Fairway depth and/or width (shallow water) - Canal bank protection
Type of shipping problem(s)	Reduced draught of vessels (due to shallow water)
Status of solution	- Project defined and agreed upon - Incorporated in national transport master plan/strategy document
Planning horizon for removal of bottleneck	Project finalised before 2025
Costs for removal of bottleneck	Construction works (for banks protection on Sulina Canal, phases I and II): 143 million EUR
Co-financing by the EU	Yes (for construction works: Cohesion Fund)

3 Relevant EU projects

WANDA

The core objectives of WANDA are the protection of the river Danube from pollution in order to preserve its valuable ecosystem and water resources and the establishment of a cross-border coordinated ship waste management system along the Danube.
The following key activities are to be set up and implemented by the project:
Preparation of coordinated ship waste management concepts on national level.

- Development of pilot activities for the collection and disposal of hazardous and non-hazardous ship waste.
- Creation of a basis for the elaboration and implementation of an international financing model for oily and greasy ship waste.
- Promotion of cross-border communication and knowledge transfer through harmonization activities.

NEWADA

NEWADA, Network of Danube Waterway Administrations aims at increasing the efficiency of the Danube as the European Transport Corridor VII by intensifying cooperation between waterway administrations to promote inland navigation as a cost-effective and environmentally friendly mode of transport.

- Cooperation on hydrological and hydrographical tasks will be intensified in order to achieve a higher impact. The efficiency of daily work has to be increased through the exchange of know-how among experts as well as through the identification of best practise cases.
- Physical accessibility of the waterway infrastructure will be improved. National action plans, feasibility studies, bilateral projects and implementation guidelines for improving waterway maintenance and river engineering will be worked out in cooperation with other Danube countries.
- Access to ICT (Information and Communication Technology) networks and services will be enhanced in order to overcome shortcomings. Up-to-date waterway related data will be provided to waterway administrations of neighbouring countries, third parties and users.
- Responsible stakeholders will be integrated and cooperation will be fostered. The communication between waterway administrations, development agencies and Ministries of Transport shall be enhanced. Waterway administrations shall be transformed into service oriented organizations in order to meet user demands.

PLATINA

The main objective of PLATINA is to support the European Commission, Member States and third countries in the implementation of the NAIADES action programme. PLATINA brings together all the relevant actors in the inland waterway sector in a multi-disciplinary knowledge network. Most members of the consortium already play an active role in transport policy in their countries, thus the contribution of the project to the promotion of inland waterway transport in Europe is maximized.

These NAIADES objectives are achieved by:

- Providing technical, organizational and financial support for targeted policy actions: Together with the European Commission, PLATINA identifies the necessary policy actions, brings together the required stakeholders (working groups, expert meetings)

and develops the necessary knowledge and tools. Key experts and stakeholders elaborate technical proposals for policy actions in the five NAIADES action areas.
- Building on strong interrelations with existing expert groups, projects and initiatives: The European added value of PLATINA is the creation of synergies at the European level through networking and knowledge exchange. Through the multi-disciplinary composition of its working programme and consortium, PLATINA is a flexible platform that can react to emerging policy needs in the field of inland waterway transport.

IRIS Europe 1 – SWP3.1 Feasibility study for Waste Management
The conclusion of this research is that River Information Services can support but not enforce proper waste management for inland shipping. All the countries involved agree that RIS should be used primarily for information exchange. This information can support the skippers as well as the authorities and third parties. The first step in using RIS for waste management for inland shipping should focus on the use of defined standards and available services.

Examples of this are:
- Definition of standard messages for waste management in Notice to The Skippers (NTS). NTS can be used to spread all kinds of relevant information to the skippers, such as any breakdown in the waste collection installations, or to provide internationally travelling vessels with correct and up-to-date information in their own language on how to dispose different types of ships' waste produced during navigation in the country actually visited.
- Adding of the locations of waste collection points, including the types of waste that can be discharged to the inland ECDIS charts. Information about the location of waste facilities in harbours and on locks can be provided through RIS.
- Equipping bilge boats/ waste collecting vessels with AIS in order to enable communication between the bilge boat and the skippers and to facilitate the planning of the disposal of waste during navigation. This can bring waste disposal within the reach of more skippers. AIS can also be used for berth planning or terminal planning. This increases the number of berths available for the disposal of cargo waste by making it possible to plan capacity.

4 Best practices / Ways to support the navigability on the Danube

Many past generations realized that a lot of work would have to be done before to achieve the good navigability of Danube. Their primary effort was to stabilize the Danube bed against its „wandering“ alongside the branching system of river arms. According to the projects drawn up by Enea Lafrancony people were reinforcing the river banks by ripraps and regulated the maximum-surface-velocity streamline by wind dams. The oldest waterworks on the Danube stem from the beginning of the 20th century. Twelve of them were gradually constructed in the territory of Bavaria and Austria and, moreover, the channel part was established between Kelheim and Bamberg.

The most recent waterworks are Gabčíkovo and Freudenau. The cascades of Djerdap I. and Djerdap II. in the border region of Romania, Serbia and Bulgaria are examples of successful international cooperation aimed to create favourable conditions for navigation. Also other waterworks upstream the Danube were motivated by this primary aim, although they were supported by the prospect of high energy gain offered by this large river.

In places, where these works were not constructed and where only natural or regulated stream with shore and direction adjustments remained, the bottom becomes deeper, while unreinforced banks are eroding and drifted by the current, especially during floods. Today we know that only sections with cascades and sufficient backwater-level ensure the stabilization of the river bed, reliable flood protection and guaranteed sailing conditions.

The erosion of bridge piers in Bratislava and sailing into wet docks in Bratislava was seriously endangered by deepening of the Danube. By construction of the waterworks Gabčíkovo this problem was completely resolved for 365 days in the year. We cannot say the same about sections that were modified exclusively by regulation adjustments of the river bed.

5 Conclusion / Summary

Inland waterway transport considered most environmental friendly method of delivering goods. It works mainly for bulk, general and project cargoes, which are transported in ship sizes (min/abt 1000mt dwcc and more). It can be reliable mode of transport if waterways will be navigable with 2,5m draft in at least 320 days in a year. In this case we can expect increased usage of river transport, however if navigability will remain uncertain and ships can carry in average less cargo than 80% of their capacity, than shippers, receivers shall use alternative ways. Even nowadays railways can offer similar freight rate on certain routes, and if they have return cargo, than they are very competitive. In absence of proper waterways we can expect large reduction of inland shipping industry.

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