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Danube Transnational Programme DIONYSUS

**Integrating Danube Region into Smart & Sustainable Multi-
modal & Intermodal Transport Chains**

Gap analysis & Recommendations for corridor enhancement

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3 Abbreviations

Abbreviation	Explanation
DR	Danube region
TEN-T	Trans-European Transport Network
IWT	Inland water transport
GDP	Gross Domestic Product

4 Scope of the document

Four deliverables of the WPT1 (D.T1.1.1, D.T1.1.2, D.T1.1.3 and D.T1.1.4) form the basis for infrastructure planning and interventions for better connectivity at the level of transport corridors and hinterland locations and markets in the Danube region. They are also structured to contribute to the future development of the Danube transport corridors. The analysis of the infrastructure layer looks at the basic infrastructure needs for connections and nodes in the TEN-T corridor and the transport system of the Danube region, with a special focus on the integrated development of port infrastructure, and provides recommendations for improving the corridor and investments at the port level.

5 D.T1.1.1 – Analysis of Core & Comprehensive Network Sections and Nodes of the transport corridors on the Danube Region

20 Danube ports and their existing land and waterway TEN-T connections are subject of investigation. The report identifies the gaps related to Transport routes, corridor nodes and their access links, TEN-T connections in nodes or correlations with other roads, rail and IWT freight corridors.

The following Danube ports are analyzed (in the downstream direction): Ennshafen, Vienna, Bratislava, Komarno, Budapest, Dunaújváros, Baja, Vukovar, Bogojovo, Bačka Palanka, Prahovo, Drobeta Turnu-Severin, Giurgiu, Galati, Constanta, Lom, Ruse, Giurgulesti, Reni and Izmail.

Taking into account the position of the Danube region and directions of TEN-T corridors, Gap analysis is based on all deficiencies which appear in the connections between the Danube ports and the following TEN-T corridors: Rhine-Danube, Orient/East –Med, Mediterranean and Baltic-Adriatic.

5.1 Current Gaps - Identified gaps based on the connection ports with the TEN-T network

Two main gaps identified on core & comprehensive network sections are based on analysis of connections between Danube ports in this report. The first gap is related to absence of required TEN-T core and comprehensive sections between every two downstream ports. The second gap appears on TEN-T corridors and concerns the necessity of upgrading some sections.

TEN-T core and comprehensive sections between every two downstream ports are summarized in Table 5.1.

Table 5.1. TEN-T core and comprehensive sections between every two downstream ports

Nodes links	TEN-T waterway sections	TEN-T railway sections	TEN-T road sections
Ennshafen–Vienna	✓	✓	✓
Vienna– Bratislava	✓	✓	✓
Bratislava–Komarno	✓	✓	✓
Komarno–Budapest	✓	✓	✓
Budapest–Dunaújváros	✓	✓	✓
Dunaújváros–Baja	✓	✓	✓
Baja–Bogojovo	✓	×	×
Bogojovo–Vukovar	✓	×	×

Vukovar–Bačka Palanka	✓	×	×
Bačka Palanka–Drobeta Turnu-Severin	✓	×	×
Drobeta Turnu-Severin–Prahovo	✓	×	×
Prahovo–Lom	✓	×	×
Lom–Giurgiu	✓	×	×
Lom–Ruse	✓	×	×
Giurgiu–Galati	✓	×	×
Giurgu–Constanta	✓	×	×
Ruse–Galati	✓	×	×
Galati–Constanta	✓	×	×
Galati–Giurgulesti	✓	×	×
Giurgulesti–Reni	✓	×	×
Reni–Izmail	✓	×	×
Izmail–Constanta	✓	×	×

✓ Sections existence; × - Sections nonexistence

Table 5.1 shows TEN-T core and comprehensive sections existence. Downstream Danube, there are TEN-T waterway sections between every two ports from Table 5.1. The existence of TEN-T road and railway sections can be found from port of Ennshafen to port of Baja.

Downstream Danube, towards Port of Baja, there are no railway and road links that belong to any of the TEN-T corridors. There are no railway and road corridor connections that belong to any of the TEN-T corridors between Port of Bogojevo and Port of Vukovar. Other sections between two ports (Vukovar–Bačka Palanka, Bačka Palanka–Drobeta Turnu-Severin, Drobeta Turnu-Severin–Prahovo, Prahovo–Lom, Lom–Giurgiu, Lom–Ruse, Giurgiu–Galati, Giurgu–Constanta, Ruse–Galati, Galati–Constanta, Galati–Giurgulesti, Giurgulesti–Reni, Reni–Izmail and Izmail–Constanta) do not contain railway or road corridor connections that belong to any of the TEN-T corridors. The first identified gap is absence of required TEN-T core and comprehensive sections between every two downstream ports.

The second identified gap is incompleteness of the road and railway sections that belong to TEN-T corridors.

In total, 172 sections were analyzed. The status of most sections is defined as completed. Around 25 % of sections have to be upgraded. It can also be concluded that almost 90% of these incomplete sections belong to the railway TEN-T network. Most of them are located on the route Budapest – Arad – Timisoara – Drobeta Turnu Severin, as well as in Romania and Bulgaria. Type of all these sections is defined as conventional railway.

Table 5.2. Incomplete sections on TEN-T corridors

Section	Type	Corridor	Network	Status
<i>Railway TEN-T corridor links between Ennshafen Port and Port of Vienna</i>				
Amstetten – Sarling	High speed	Rhine - Danube	Core Network	To be upgraded
<i>Railway TEN-T corridor links between Port of Vienna and Port of Bratislava</i>				
Wien Stadlau - Marchegg	Conventional	Baltic - Adriatic	Core Network	To be upgraded
Marchegg - Devinska Nova Ves	Conventional	Baltic - Adriatic	Core Network	To be upgraded
Devinska Nova Ves - Bratislava (part 1)	Conventional	Baltic - Adriatic Orient/East - Med	Core Network	To be upgraded
Bratislava -Petrzalka (part 1)	Conventional	Baltic - Adriatic Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Bratislava - Petrzalka (part 2)	Conventional	Baltic - Adriatic Rhine - Danube	Core Network	To be upgraded
Bratislava -Petrzalka (part 1)	Conventional	Baltic - Adriatic Orient/East - Med Rhine - Danube	Core Network	To be upgraded
<i>Railway TEN-T corridor links between Port of Bratislava and Port of Komarno</i>				
Bratislava -Petrzalka (part 1)	Conventional	Baltic - Adriatic Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Rajka - Hegyeshalom	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Hegyeshalom - Gyor (part 2)	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Hegyeshalom - Gyor (part 1)	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Hegyeshalom - Gyor (part 3)	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded

Section	Type	Corridor	Network	Status
Gyor - Komarom	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
<i>Road TEN-T corridor links between Port of Komarno and Port of Budapest</i>				
Budapest (J. M0/M1) - Budapest (part 2)	-	Orient/East - Med Rhine - Danube	Core Network	New Construction
Budapest (J. M0/M1) - Budapest (part 1)	-	Orient/East - Med Rhine - Danube	Core Network	New Construction
Komarom - Tatabanya	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Tatabanya - Budapest Kelenfold	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Budapest Kelenfold - Budapest Ferencvaros	Conventional	Mediterranean Orient/East - Med Rhine - Danube	Core Network	New Construction
<i>Road TEN-T corridor links between Port of Budapest and Port of Dunaujvaros</i>				
Dunavecse - kecskemet (M8)	Motorways		Comprehensive Network	To be upgraded
<i>Railway TEN-T corridor links between Port of Budapest and Dunaujvaros- not directly linked</i>				
Budapest Kelenfold - Budapest Ferencvaros	Conventional	Mediterranean Orient/East - Med Rhine - Danube	Core Network	New Construction
Pusztaszabolcs - Budapest Kelenfold (part 2)	Conventional	Mediterranean	Core Network	To be upgraded
Pusztaszabolcs - Budapest Kelenfold (part 1)	Conventional	Mediterranean	Core Network	To be upgraded
<i>Railway TEN-T corridor links between Port of Lom and Port of Ruse</i>				
Craiova - Calafat	Conventional	Orient/East - Med	Core Network	To be upgraded
Craiova - Caracal	Conventional	Rhine - Danube	Core Network	To be upgraded
Caracal - Rosiori	Conventional	Rhine - Danube	Core Network	To be upgraded
Videle - Bucharest	Conventional	Rhine - Danube	Core Network	To be upgraded

Section	Type	Corridor	Network	Status
Bucharest - Giurgiu	Conventional	-		To be upgraded
<i>Railway TEN-T corridor links between Port of Giurgiu/Bucharest and Port of Constanta</i>				
Bukuresti - Fetesti	Conventional	Rhine - Danube	Core Network	To be upgraded
Fetesti - Constanca	Conventional	Rhine - Danube	Core Network	To be upgraded
Bukuresti - Constanta	High speed	Rhine - Danube	Core Network	New Construction
<i>Road TEN-T corridor links between Port of Budapest and Port of Drobeta Turnu Severin (alternative)</i>				
Mako - Nagylak/Nadlac	Motorways	Orient/East - Med, Rhine - Danube	Core Network	To be upgraded
Timisoara - Lugoj	Motorways	Orient/East - Med, Rhine - Danube	Core Network	To be upgraded
Budapest Ferencvaros - Budapest Rakos (part 2)	Conventional	Mediterranean, Orient/East - Med , Rhine - Danube	Core Network	New Construction
Budapest Ferencvaros - Cegled	Conventional	Mediterranean, Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Cegled-Szolnok	Conventional	Mediterranean, Orient/East - Med, Rhine - Danube	Core Network	To be upgraded
Szolnok - Szajol	Conventional	Mediterranean, Orient/East - Med, Rhine - Danube	Core Network	To be upgraded
Mezotur - Gyoma	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Gyoma - Bekescsaba	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Bekescsaba Lokoshaza	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded

Section	Type	Corridor	Network	Status
Arad - Timisoarqa	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Timisoara - Orsova	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Orsova -Filiasi (Part 1)	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
<i>Road TEN-T corridor links between Port of Drobeta Turnu Severin and Port of Giurgiu (alternative)</i>				
Bukuresti - Giurgiu	National RO5 - Rural road with separate directions			To be upgraded
Orsova - Filasi	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Filasi - Craiova	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Craiova - Caracal	Conventional	Rhine - Danube	Core Network	To be upgraded
Caracal - Rosiori	Conventional	Rhine - Danube	Core Network	To be upgraded
Rosiori - Videle	Conventional	Rhine - Danube	Core Network	To be upgraded
Videle - Bucuresti	Conventional	Rhine - Danube	Core Network	To be upgraded
Bucuresti - Giurgiu	Conventional	-		To be upgraded

shows list of sections on TEN-T corridors which need to be upgraded or a new construction is required.

Table 5.2. Incomplete sections on TEN-T corridors

Section	Type	Corridor	Network	Status
<i>Railway TEN-T corridor links between Ennshafen Port and Port of Vienna</i>				

Section	Type	Corridor	Network	Status
Amstetten – Sarling	High speed	Rhine - Danube	Core Network	To be upgraded
<i>Railway TEN-T corridor links between Port of Vienna and Port of Bratislava</i>				
Wien Stadlau - Marchegg	Conventional	Baltic - Adriatic	Core Network	To be upgraded
Marchegg - Devinska Nova Ves	Conventional	Baltic - Adriatic	Core Network	To be upgraded
Devinska Nova Ves - Bratislava (part 1)	Conventional	Baltic - Adriatic Orient/East - Med	Core Network	To be upgraded
Bratislava -Petrzalka (part 1)	Conventional	Baltic - Adriatic Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Bratislava - Petrzalka (part 2)	Conventional	Baltic - Adriatic Rhine - Danube	Core Network	To be upgraded
Bratislava -Petrzalka (part 1)	Conventional	Baltic - Adriatic Orient/East - Med Rhine - Danube	Core Network	To be upgraded
<i>Railway TEN-T corridor links between Port of Bratislava and Port of Komarno</i>				
Bratislava -Petrzalka (part 1)	Conventional	Baltic - Adriatic Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Rajka - Hegyeshalom	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Hegyeshalom - Gyor (part 2)	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Hegyeshalom - Gyor (part 1)	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Hegyeshalom - Gyor (part 3)	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Gyor - Komarom	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
<i>Road TEN-T corridor links between Port of Komarno and Port of Budapest</i>				

Section	Type	Corridor	Network	Status
Budapest (J. M0/M1) - Budapest (part 2)	-	Orient/East - Med Rhine - Danube	Core Network	New Construction
Budapest (J. M0/M1) - Budapest (part 1)	-	Orient/East - Med Rhine - Danube	Core Network	New Construction
Komarom - Tatabanya	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Tatabanya - Budapest Kelenfold	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Budapest Kelenfold - Budapest Ferencvaros	Conventional	Mediterranean Orient/East - Med Rhine - Danube	Core Network	New Construction
<i>Road TEN-T corridor links between Port of Budapest and Port of Dunaujvaros</i>				
Dunavecse - kecskemet (M8)	Motorways		Comprehensive Network	To be upgraded
<i>Railway TEN-T corridor links between Port of Budapest and Dunaujvaros- not directly linked</i>				
Budapest Kelenfold - Budapest Ferencvaros	Conventional	Mediterranean Orient/East - Med Rhine - Danube	Core Network	New Construction
Pusztaszabolcs - Budapest Kelenfold (part 2)	Conventional	Mediterranean	Core Network	To be upgraded
Pusztaszabolcs - Budapest Kelenfold (part 1)	Conventional	Mediterranean	Core Network	To be upgraded
<i>Railway TEN-T corridor links between Port of Lom and Port of Ruse</i>				
Craiova - Calafat	Conventional	Orient/East - Med	Core Network	To be upgraded
Craiova - Caracal	Conventional	Rhine - Danube	Core Network	To be upgraded
Caracal - Rosiori	Conventional	Rhine - Danube	Core Network	To be upgraded
Videle - Bucharest	Conventional	Rhine - Danube	Core Network	To be upgraded
Bucharest - Giurgiu	Conventional	-		To be upgraded
<i>Railway TEN-T corridor links between Port of Giurgiu/Bucharest and Port of Constanta</i>				

Section	Type	Corridor	Network	Status
Bukuresti - Fetesti	Conventional	Rhine - Danube	Core Network	To be upgraded
Fetesti - Constanca	Conventional	Rhine - Danube	Core Network	To be upgraded
Bukuresti - Constanta	High speed	Rhine - Danube	Core Network	New Construction
<i>Road TEN-T corridor links between Port of Budapest and Port of Drobeta Turnu Severin (alternative)</i>				
Mako - Nagylak/Nadlac	Motorways	Orient/East - Med, Rhine - Danube	Core Network	To be upgraded
Timisoara - Lugoj	Motorways	Orient/East - Med, Rhine - Danube	Core Network	To be upgraded
Budapest Ferencvaros - Budapest Rakos (part 2)	Conventional	Mediterranean, Orient/East - Med , Rhine - Danube	Core Network	New Construction
Budapest Ferencvaros - Cegled	Conventional	Mediterranean, Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Cegled-Szolnok	Conventional	Mediterranean, Orient/East - Med, Rhine - Danube	Core Network	To be upgraded
Szolnok - Szajol	Conventional	Mediterranean, Orient/East - Med, Rhine - Danube	Core Network	To be upgraded
Mezotur - Gyoma	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Gyoma - Bekescsaba	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Bekescsaba - Lokoshaza	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Arad - Timisoarqa	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded

Section	Type	Corridor	Network	Status
Timisoara - Orsova	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
Orsova -Filiasi (Part 1)	Conventional	Orient/East - Med , Rhine - Danube	Core Network	To be upgraded
<i>Road TEN-T corridor links between Port of Drobeta Turnu Severin and Port of Giurgiu (alternative)</i>				
Bukuresti - Giurgiu	National RO5 - Rural road with separate directions			To be upgraded
Orsova - Filasi	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Filasi - Craiova	Conventional	Orient/East - Med Rhine - Danube	Core Network	To be upgraded
Craiova - Caracal	Conventional	Rhine - Danube	Core Network	To be upgraded
Caracal - Rosiori	Conventional	Rhine - Danube	Core Network	To be upgraded
Rosiori - Videle	Conventional	Rhine - Danube	Core Network	To be upgraded
Videle - Bucuresti	Conventional	Rhine - Danube	Core Network	To be upgraded
Bucuresti - Giurgiu	Conventional	-		To be upgraded

5.2 Recommendations for absence and necessity of upgrading some sections

Two main gaps are identified in this report. The first is absence of required TEN-T core and comprehensive sections between every two considered ports on the Danube, in the downstream direction, while the second is incompleteness of the road and railway sections that belong to TEN-T corridors.

In order to fill in the mentioned gaps, three possible solutions can be applied. The first solution is related to building new core and comprehensive sections. The second solution refers to upgrading existing core and comprehensive sections, while the third solution uses existing core and comprehensive sections to link adjacent nodes. The third solution is particularly interesting because

it involves using existing combined core and comprehensive sections. In that way (by implementing all three solutions), building new or revision of existing sections will reinforce present day needs for synergies between infrastructure planning and transport operations and will remove further obstacles for quicker and more efficient rail freight and passenger services. The ultimate goal of these recommendations should bring sustainable connectivity, without physical gaps, bottlenecks or missing links, while the final product is high-quality network.

Some of the expected improvements are: the electrification of the rail network, possibility to run long trains and high line speed for train compositions on rails and lorries on roads. Parallel to building of new and re-building existing sections, there is a need for enhancing digitalisation as well as redesigning of maps in the part of TEN-T network discussed in this report.

Beside the improvement achieved by TEN-T completion, there are lot of benefits, which may emerge from the given recommendations. In short, economic benefits include GDP increase and creation of new jobs, while climate benefits include usage of green means of transport reducing greenhouse gas emissions and air pollution in that way.

And if gaps are filled, it would allow for better interconnectivity between adjacent nodes presented in this report. It will also secure new opportunities, which could fit into TEN-T policy.

6 D.T1.1.2 – Transport Infrastructure Status Quo

6.1 Identified gaps based on the current state of infrastructure in ports

Based on the data about current status of the port infrastructure, several gaps are identified among the consider ports. The following gaps are listed in the following text.

The Port of Vienna has no available space for further development except areas currently occupied by water surface of the port basins. Facilities for supply of alternative clean fuels (e.g. LNG, etc.) and shore-side power supply facilities are not yet available.

In the port of Bratislava storage facilities are not spread proportionally.

The current technical condition of the infrastructure in the port of Komárno area is undesirable. Current status and condition of warehouses in the port of Komarno are not sustainable.

The port of Baja has less modern or low-capacity technologies.

On the territory of Port of Bogojevo there is inoperative rail entrance with a single rail track which connects port to the national railway network, while in Port of Bačka Palanka there are no railways considering it as a major disadvantage of the port.

The only hole in the operation of the Port of Prahovo is that there are no railway tracks on the quay area, along Berths 1, 2 and 3.

Port of Galati posses old quays constructed even before 1900 that need improvements. The road connecting Galați with TEN-T roads has only one single lane per direction and needs improvements. The railway line needs lot of improvements.

In Port of Lom there are risks and problems connected with the fluctuation of the river level due to periods of low water level. Irregular rising and falling of the water level lead to restricted navigation. That reduces the transshipped cargo volumes, usually during the summer period. Other port gap comes from deficiency of clean fuels. When it comes to ecology in port, there is no pretreatment of waste waters and other eco friendly facilities.

In Port of Ruse several gaps are identified. One of them is related to railway connection on one terminal that is currently not in function. There is no availability of clean fuels in the port as well as no waste reception facilities. Currently, the terminal capacities are oversized in relation to the user's requirements. There is no special area for container terminals, although there is actual capacity for handling such type of cargo. Out of 6 existing terminal in port, 2 of them do not have railway access.

Position of Giurgiulesti International Free Port (GIFP) as the southernmost geographical point of the Republic of Moldova is its biggest drawback in terms of connectivity with the hinterland of the country. The M3 highway of international importance (Chiăinău - Giurgiulesti) is the only road connecting the port with the hinterland of the country and with the Danube region of the European Union. With the growth in the volume of cargo transportation from the port by road transport, the difficulty in its restructuring has sharply increased. Due to the strong impact of the water flow, the berths require massive coastal fortifications, as well as annual bottom dredging works. At the moment, the port has about 220 m of the coastline that is not adequately fortified.

The Ro-Ro terminal in the Port of Reni and its adjacent outdoor parking area have not been used since the Ruse line (Bulgaria)-Reni has stopped her work. Most of the handling equipment at the port are at the end of their life cycle.

All the identified gaps are systematized in the Table 6.1 according to the ports in which they were identified.

Table 6.1. List of gaps and port where are identified

Number	Gaps	Ports
1.	No available space for further development	Vienna
2.	lack of facilities for the alternative clean fuels	Vienna, Lom, Ruse, Bogojevo, Bačka Palanka, Prahovo
3.	storage facilities are not spread proportionally	Bratislava
4.	technical condition of the infrastructure and warehouses is undesirable	Komárno, Reni
5.	less modern or low-capacity technologies	Baja, Bačka Palanka
6.	no railways access	Bačka Palanka
7.	no railway tracks on the quay area	Prahovo, Ruse
8.	road or railway line needs improvements	Galati, Bogojevo
9.	the fluctuation of the river level due to periods of low water level	Lom

10.	no pretreatment of waste waters and other eco friendly facilities	Lom, Ruse, Bogojevo, Bačka Palanka, Prahovo
11.	terminal capacities are oversized	Ruse
12.	no special area for container terminals	Ruse
13.	poor connection with the hinterland of the country	Giurgiulesti
14.	coastline is not adequately fortified	Giurgiulesti

6.2 Recommendations for removal of identified gaps

There are lot of various identified gaps that are associated with the port infrastructure. The majority of gaps are diversely categorized, so an attempt is made to make a recommendation about each of them individually in the following text.

The main disadvantage of the Port of Vienna is its unavailability of space for further development except areas currently occupied by water surface of the port basins. The other hole in the port's operation is shortage of facilities for supply of alternative clean fuels (e.g. LNG, etc.) and shore-side power supply facilities. There are no strict recommendations for filling these two gaps, as there are no official plans or future projects which would tackle these two problems, but progress will certainly be made if the plans are taken into consideration decarbonise of the shipping sector in the next 15 or 20 years.

As for the Port of Bratislava, the storage facilities should be distributed more evenly.

Recommendation in the case of Port of Komárno should be moved in the direction of revitalize public port facilities (stairs, coastal walkways, mooring elements, perpendicular transshipment edges, etc.) used by ship's crew and others in public port activities to European standards. Strategically document elaborated recently strongly recommend to build modern warehouses, silos and storage tanks.

In the port of Baja it has become necessary to develop the technological and quantitative services of the port service, especially for railway services. The railway service has been already developed within the framework of an existing EU tender, a new part of the shore wall has been built including the

construction of a heavy loading capacity with a capacity of 100 tons and the construction of a new approach road and truck parking. The technological development of the green port is under way too.

Port of Bogojevo area is planned to be expanded by building a port basin with operational quay. A terminal for storage and transfer of oil and oil derivatives is anticipated in the basin part of the port and it will be territorially separated from the rest of the port. As a consequence, there will be a possibility of supplying vessels with a fuel. In addition to this and as a result of cited gaps, railway tracks within the port territory are necessary. Therefore, reconstruction of the existing railway section “Bogojevo station - Bogojevo port” is needed as well as existing manipulative railway no. 403, “Bogojevo - Danube bank”, all in order to increase the carrying capacity and speed and to remain within the existing railway corridor.

Listed gaps belonging to Port of Bačka Palanka point to construction of liquid cargo terminal, new terminal for sand and gravel, bulk cargo terminal as well as railway tracks which will connect Port with the national railway network. One of the reasons for considering the possibility of constructing a liquid cargo terminal is the advantage of inland waterway transport in terms of specific fuel consumption per ton of transported goods. Given the liberalized market and the presence of numerous foreign companies engaged in the production and distribution of oil and oil derivatives, it can be expected that certain liquid cargo terminal in the region will become the starting points of international flows of this type of cargo to Bačka Palanka.

According to the Strategy for the Development of Waterborne Transport of the Republic of Serbia 2015-2025, the port development plans in Bačka Palanka are strategically oriented towards the construction of a container terminal, liquid cargo terminal and grain terminal. In order to enable the construction of these terminals, it is necessary to build a coastal fortification and a vertical quay.

In addition to previous recommendations new terminal for sand and gravel is also in prospect plan and its completion would be possible during 2025, although cargo operations for this cargo can be carried on this moment.

New handling equipment that would increase the capacities and operational railway tracks connecting the port to the national railway network should also be in mind.

No railway tracks on the quay area, along Berths 1, 2 and 3 suggest incorporation of railway tracks along these berths in the Port of Prahovo. The expansion of capacities of port of Prahovo should include the following:

- Recovery, reconstruction and upgrade of the operational quay;
- Expansion of the port area by conversion of the winter harbour to a new land area;

- Reconstruction and building of new road lanes, truck stations and parking lots for cars within the port;
- Reconstruction of the existing and construction of a new access road to the port;
- Reconstruction and construction of industrial railway tracks;
- Reconstruction and construction of the following parts of port infrastructure: installation of water supply, sewerage, electricity and signal network, outdoor lighting, etc;
- Construction of a terminal (green terminal) for receiving marine oil, bilge water and waste materials.

Recommendations for the Port of Galati include reconstruction of the existing quays and construction of the new quays. The road connecting Galați with TEN-T roads should be improved in a way to contain minimum two lanes per direction. The railway line needs lot of improvements.

The Port of Lom should improve transport infrastructure and consequently carry higher cargo volumes on Danube. The benefits from this activity include: introduction of new port services, increased cargo volume generated by a certain activity and reduced servicing time.

In Port of Lom, the patterns of water-level fluctuations have been recognized for management and restoration schemes. Current climate models affirm that the frequency of irregular water-level fluctuations will increase in the future. Activities are susceptible to any climate-induced disruption to access/onward transport or power supply resulting from flooding or erosion and to extreme heat affecting key road and rail infrastructure. Modern physical assets and equipment in the Port of Lom should typically have a 20-100 year design life and their design should typically have incorporated water level rise. However, port authorities may rely on much older infrastructure, designed to withstand pre-climate change conditions, so quays may therefore need to be checked and raised optionally; VTS, radar and other sensitive equipment relocated if necessary; or cargo-handling or storage facilities modified as water levels rise. Operations and activities such as loading and stacking along with conservancy functions including dredging may also need to be modified.

In Port of Ruse recognized gaps such as railway connection on one terminal that is currently not in function, no availability of clean fuels in the port, no waste reception facilities, oversized capacities in relation to the user's requirements, no special area for container terminals are expected to be overcome by existing plans for building such infrastructure.

There is a quite extensive set of gaps which create obstacles for a normal operational and commercial activity in Giurgiulesti International Free Port. All gaps have an impact on the ability of the port to operate and develop. The reduction of the barriers which arise from gaps would certainly have a

beneficial effect on the entire prosperity of the business entity as it would allow the port to handle much bigger amounts of cargo as well as reduce the waiting times. Today, such a plans exist.

7 D.T1.1.3 – On-going and planned projects on the transport corridors in the DR

This chapter was based on the inventory of transport infrastructure projects in the core network corridor studies and internal databases of port authorities, ministries and other project partners involved in the preparation.

The first category includes projects to improve the capacity of ports, inland waterways, roads, and railways. These projects are not necessarily projects to comply with the TEN -T guidelines, but are either the physical development of new capacity or the modernization (rehabilitation, improvement) of existing infrastructure with the goal of increasing capacity and efficiency, such as expansion of berths in ports, expansion of port railroad tracks, new port terminals, dredging of waterways, axle load on railways, new tracks, electrification, new intermodal terminals for rail and road outside of ports, additional highway lanes, increasing capacity of toll station capacity, etc.

The second category includes all projects that result in improved connectivity of various elements of the transportation network, such as road and rail connections of inland ports with the rest of the network, especially with sections of the TEN -T core network corridors, thereby improving the overall efficiency and attractiveness of ports as hubs of multimodal and intermodal transportation chains.

The last category includes the so-called "soft" projects such as:

- Vessel Traffic Monitoring & Information Systems (VTMIS),
- Automated Identification Systems (AIS),
- River Information Services (RIS),
- Port Community Systems (PCS),
- port management software projects,
- traffic flow management projects,
- safety management projects,
- the European Rail Traffic Management System (ERTMS),
- etc.

The analysis showed that 135 projects are relevant for the Danube ports and the integration of ports and inland waterway transport (IVT) in inter- and multimodal transport chains.

A total of 135 projects were identified (Table 7.1), of which 78 are ongoing and 57 are planned. Of these, the road sector has the most ongoing projects (25), while the inland ports sector shows growing interest and investment in ports and has the most planned projects (17).

Table 7.1 Number of ongoing and planned projects of significance per mode

Country	Status	Road	Rail	IWW	Inland port	Seaport	Total
Austria	on going	2	4	2	2	0	10
	planned	0	0	0	7	0	7
Slovakia	on going	1	1	3	4	0	9
	planned	0	0	1	1	0	2
Hungary	on going	0	0	4	2	0	6
	planned	0	0	0	1	0	1
Croatia	on going	2	0	6	1	0	9
	planned	0	0	0	0	0	0
Serbia	on going	0	0	2	2	0	4
	planned	0	0	1	0	0	1
Romania	on going	8	5	1	3	3	20
	planned	4	5	3	5	5	22
Bulgaria	on going	2	1	0	1	0	4
	planned	4	7	0	2	0	13
Moldova	on going	8	0	0	0	0	8
	planned	1	0	0	1	0	2
Ukraine	on going	2	2	1	0	1	6
	planned	0	0	0	0	8	8
Multi	on going	0	0	2	0	0	2
	planned	0	0	1	0	0	1
Total		34	25	27	32	17	135

In addition to the inventory of ongoing and officially planned projects, the project partners identified gaps in transport infrastructure relevant to the integration of ports and inland waterways into multimodal supply chains. A total of 40 gaps in the transport infrastructure were identified and listed in Table 7.2. These gaps are considered as nuclei for future projects that go beyond the current planning horizon.

Table 7.2. Summary of transport infrastructure gaps and proposed solution

Country (Number of gaps)	Mode (Number of gaps)	Gaps	Proposed solution
Austria (1)	Inland waterway (1)	Navigational bottleneck at Straubing Vilshofen section on the Danube in Germany	Ongoing cooperation with Germany for timely realization of planned projects and further assessments of projected improvements (after realization of started constructions) international discussion.
Slovakia (3)	Ports (1)	Outdated transshipment infrastructure in the ports of Bratislava and Komarno	Modernization taking into accounts the current trends in logistics and (mostly) international inland navigation.
	Railways (1)	Inability of accommodating complete block trains in the ports of Bratislava and Komarno	The design of planned terminals in this regard.
	Inland waterways (1)	Bottleneck removal on the Slovak section of the Danube	Coordination (neighbouring countries) and accessible public funding in the name of the common good
Hungary (8)	Ports (1)	Lack of trimodal capacity	Construction of a new trimodal logistics center in or near the capital city.
	Railways (5)	Insufficient capacity and degraded state of a bridge near Budapest port	Southern connecting railway Danube bridge (DVÖH)
		Insufficient capacity of the circular railway in Budapest	External circular railway developments
		Insufficient capacity of a single railway track to logistic centre south of Budapest	Construction of Soroksári út – Soroksár 2. track
		Insufficient capacity at Ferencváros station	Development of Ferencváros station
		Insufficient capacity at Kelenföld station	Increasing the capacity of Kelenföld station for freight trains
	Roads (1)	Road-rail traffic conflict at the Corvin-node	Conversion of the Corvin-node in Csepel Freeport
Inland waterways (1)	Improving the navigability of the Danube between Szob and the southern border (Mohacs)	The improvement of the navigability of the Danube between Szob and the southern border (Mohacs).	

Croatia (4)	Railways (1)	Passenger rail goes through Vukovar Port (port area decreased for 5,5 ha)	Future conversion into industrial railway and used for port operations
	Port (1)	The port area is not enough for all needs and future development	Enlargement of the port area to the west (upstream, former Borovo factory site).
	Road (2)	Entrance into Vukovar Port is at the same time an exit	Improve the road in the port to have an entrance and an exit
		No bypass road (bypass) in Vukovar, all trucks must pass through the city center, slow traffic	Construction of the ring road (bypass) in Vukovar
Serbia (5)	Port (2)	Insufficient capacity of infrastructure and superstructure in the port of Prahovo	The construction of additional storage capacity, as well as the expansion of the operating port and the procurement of additional gantry cranes in the port of Prahovo.
		Insufficient capacity of infrastructure and superstructure in the port of Bogojevo	The construction of new silos for grain and oilseeds, additional storage capacity, and supporting infrastructure (railway industrial track to connect the port to the national railway network in a length of 2.5 km, and another vertical quay, including a smaller container terminal) in the port of Bogojevo.
	Inland Waterways (3)	Navigational bottlenecks on the Danube sector 1295.5-1433.1 river km	Protection of the banks from further erosion and morphological changes in the riverbed of the Danube River from 1295.5 -1433.1 river km; Increasing the predictability and stability of operations related to navigation and the passage of locks Djerdap I.
		Navigational bottlenecks on the Sava sector 100.5-101.3 river km	Dredging of river sediment and construction of hydro technical facilities on the Sava River from 83-87 and 100.5-101.3 river kilometres.
		Partial Digitalization	Enabling digital monitoring of fairway marks, thereby greatly speeding up detection of misplaced buoys and providing accurate information to navigation users through electronic navigational charts;

			Enabling the collection of up-to-date riverbed data needed for efficient marking and dredging operations; Improving the concept of dynamic channel marking;
Romania (1)	Railways (1)	Braila and Galați connections with the hinterland	Preparation of feasibility studies and financial allocations
Bulgaria (8)	Ports (3)	Transshipment mechanization in the ports is outdated and with low productivity	Investments in modernization of key ports – Lom and Ruse.
		Low quality and efficiency of existing railway services.	Elaborate support measures at the national level to strengthen the position of rail transport.
		Lack of logistics centers / intermodal terminals that provide conditions for various cargoes and are popular with small and medium-sized manufacturing companies.	Development of such centres, supported by an active information campaign. Current ports are actually multimodal hubs, and if their development and modernization includes intermodal facilities, they can become a more cost-effective alternative to investing in newly built inland intermodal terminals. Another option could be the development of dry ports with intermodal facilities near inland industrial centres in the northern part of Bulgaria.
	Railways (3)	Technical conditions of the railway and the facilities do not meet the requirements for efficient and effective intermodal transport.	Investing in rail modernization and intermodal facilities.
		Low level of competition between transport providers, where private licensed providers are very few, and the national one (stated owned) is not market oriented and competitive.	Elaborate support measures at the national level to strengthen the position of rail transport.
		Lack of qualified human resources for the railway sector.	Implement the national rail recruitment strategy.
	Road (2)	Insufficient funding for reconstruction and	Strengthen the planning process with respect to the prior identification and funding of key

		<p>maintenance of the main road network.</p> <p>Long period for the preparation of the investment project, as land acquisition, environmental impact assessment, preparation and approval of the detailed design are required.</p>	<p>roadways directly related to intermodal transportation needs.</p> <p>Timely completion of all procedures before the project starts (there are cases when the project starts but not all land acquisition procedures are completed).</p>
Ukraine (6)	Ports (1)	Low attraction of cargo flows to the ports of Reni and Izmail	Eurointegration of the ports of Reni and Izmail. Improvement of the hinterland connection.
	Railways (3)	Lack of electrification of the Odessa-Izmail railway on the Belgorod-Dnestrovsky-Izmail section	Eurointegration of the ports of Reni and Izmail. Electrification of the critical section.
		Railway Reni-Izmail is absent	Eurointegration of the ports of Reni and Izmail. Connection of the two ports by rail
		The dismantled section of the Berezino-Basarabyaska railway and others has not been restored	Eurointegration of the ports of Reni and Izmail. Reconstruction and rehabilitation of the Berezino-Basarabyaska railway.
	Road (1)	Not implemented Project-"Construction of a bridge across the Danube Orlovka - Isakcha"	Eurointegration of the ports of Reni and Izmail. To include port of Izmail into the TEN-T list of Core ports
	Inland waterways (1)	Deep-Water Navigable Channel - GSH Project (full development), delay since 2007	Completion of the environmental impact assessment examination in a cross-border context and completion of GSH construction of the 2nd stage (full development), Eurointegration of Ukrainian Danube region
Moldova (4)	Ports (1)	Lack of a strategic project to develop and increase the potential of GIFF in the current conditions in the market for transport services.	Elaboration of a project for the integrated development of the Giurgiulesti International Freeport until 2030. The project should include a SWOT analysis of the port's activities, legal and regulatory documents, and the development of ways to improve the port's productivity and efficiency.

	Railways (1)	The development program of the state-owned enterprise "Moldavian Railways" for the period 2018-2030 was prepared on the basis of an optimistic assessment of the current economic situation	Develop the business plan to increase the competitiveness of LJG. Priority investment projects include rehabilitation of rail lines in the Central and Southern Corridors.
	Road (1)	Elaboration of perspectives for the development of the national basic network based on the existing networks and not according to the transport demand.	Revision of the central transport network.
	Inland waterways (1)	Lack of strategic development plans of inland waterways	Evaluation of the potential for the development of navigation on the Prut River in the section Ungheni-Giurgiulesti port.

Hungary and Bulgaria were each found to have eight gaps in their transportation infrastructure. Ukraine was found to have six gaps in its transport infrastructure and Serbia one less. Four gaps in transport infrastructure were identified in Croatia and Moldova, and one less in Slovakia's transport infrastructure. Only Austria and Romania have one gap each in their transport infrastructure.

Among the gaps listed, most gaps are related to rail transport, namely 15. The other gaps are almost evenly distributed per transportation mode (road - 7, inland port - 8, inland waterways - 8 and seaports - 7).

The identified gaps should be understood as nuclei for future projects, which is why their inclusion in the analysis is important. It should be noted that it is not always the rule that the country with the largest number of gaps has a less developed transport infrastructure. It may also be that these countries have conducted a more detailed analysis of the gaps in their transport infrastructure.

8 D.T1.1.4 – Gaps in traffic flows in the Danube corridor

The identified gaps and barriers in traffic flows in the countries of the Danube region are listed in the Table 8.1.

Table 8.1 Summary of gaps and barriers for IWT development in all considered countries

Type of gap or barrier	Gaps and barriers	Proposed solutions
Infrastructure gaps and barriers (23)	Generally inadequate technical state of the infrastructure	<ul style="list-style-type: none"> develop an investment plan for the renewal of the infrastructure and the reserve fund for its ongoing maintenance implement and evaluate measurable performance indicators - investments in infrastructure modernization [mil. EUR]; length of upgraded road and rail infrastructure [km].
	Inadequate technical state of the transshipment technologies	<ul style="list-style-type: none"> implement operational standards in the Operating rules of public ports aimed at the minimal technical level of transshipment technologies implement and evaluate measurable performance indicators - the speed of transshipment of one ton of bulk goods [s]; loading speed of one container [s]; number of transshipment technologies meeting standards [n]
	Insufficient parking space for trucks	<ul style="list-style-type: none"> define parking spaces for trucks in the port and in the Operating rules establish and evaluate measurable performance indicators - area for truck parking [m²]
	Problematic railway system in the port of Bratislava	<ul style="list-style-type: none"> assess the possibility of a technical solution for alternative railway system in the port
	Railway connection with the port	<ul style="list-style-type: none"> Upgrading and electrification of the railway line from Vinkovci to Vukovar
	Road connection with the port	<ul style="list-style-type: none"> Implementation of regional spatial plans that include investments in regional transport infrastructure
	Port area lack of space	<ul style="list-style-type: none"> Construction of port roads, storage, and manipulative areas within unused port area
	Navigation restrictions in critical sectors of fairways in Serbia	<ul style="list-style-type: none"> Carry out hydrographical riverbed monitoring and surveying
	Dependence of transport from current climatic factors and climate changes	<ul style="list-style-type: none"> Conduct water level measurements and monitoring
	Dynamic changes of hydro-morphological regime	<ul style="list-style-type: none"> Carry out fairway dredging and marking the fairway
	Old handling equipment in ports	<ul style="list-style-type: none"> Improvement of pertaining port infrastructure and superstructure like expanding the port area, acquisition of new handling equipment
	Low connectivity of port area with national railway and access roads	<ul style="list-style-type: none"> Building a new quay and port roads, building more operational railway tracks which can connect ports to the national railway network

Type of gap or barrier	Gaps and barriers	Proposed solutions
	Lack of port storage facilities and short length of operational quay	<ul style="list-style-type: none"> Building open-space storage facilities
	Poor condition of port infrastructure on the Danube River	<ul style="list-style-type: none"> Rehabilitation and modernisation of the existing terminals and construction of new ones both for freight transportation and passenger services
	Lack of high-speed roads in the Danube Region	<ul style="list-style-type: none"> Construction of motorways to connect the cities of Sofia and Varna, and Ruse and Veliko Tarnovo
	Poor condition of lower-class roads in the Danube Region	<ul style="list-style-type: none"> Large-scale modernisation and development of the network of secondary roads in the districts of Vidin, Montana, Vratsa, Pleven, Veliko Tarnovo, Ruse and Silistra; construction of additional bridges over the Danube
	Poor condition and insufficient density of railroad infrastructure in the Danube Region	<ul style="list-style-type: none"> Rehabilitation of the Vidin – Sofia, Ruse – Gorna Oryahovitsa and Ruse – Varna lines; expansion of the national railway network in the area of Tutrakan; modernisation of train stations
	Navigational bottleneck at Straubing Vilshofen section on the Danube in Germany	<ul style="list-style-type: none"> Ongoing international discussion
	Infrastructure	<ul style="list-style-type: none"> Lack of a sufficient number of State Service of Ukraine for Transport Safety inspectors
	Infrastructure	<ul style="list-style-type: none"> Lack of weighing complexes
	Infrastructure	<ul style="list-style-type: none"> Deteriorated railway infrastructure
	Infrastructure	<ul style="list-style-type: none"> Obsolete equipment and railway transport itself
Logistic and transport gaps and barriers (13)	Infrastructure	<ul style="list-style-type: none"> Wear and tear of port infrastructure and rolling stock
	Several strategically important enterprises that produce commodities exported abroad	<ul style="list-style-type: none"> to remove critical bottlenecks according to the action plan It is recommended to establish and regularly assess measurable performance indicators to monitor the navigability of the Váh river - number of navigable kilometres [km]
	Absence of necessary data (VPAS)	<ul style="list-style-type: none"> maintain a relationship and implement data interfaces with tenants in the port for the collection and statistical evaluation of relevant data.
	Port Community system	<ul style="list-style-type: none"> Harmonization of port administration procedure through unique electronic platform
	Lack of RIS and Port Information Systems	<ul style="list-style-type: none"> Installing to promote sharing of information about navigation
	Lack of Single Window applications	<ul style="list-style-type: none"> Create political will and inter part collaboration with activities of government and high-level strategic decision makers
Lack of transport/traffic	<ul style="list-style-type: none"> Installation of transport/traffic management platforms in order to encourage operational exchange of transport/traffic data related to cross-border information services 	

Type of gap or barrier	Gaps and barriers	Proposed solutions
	management platforms	
	Lack of adequate vessels, fleet age	<ul style="list-style-type: none"> Innovations in propulsion plants and fuels (including innovative energy sources and innovative propulsion systems) and modern design concept of ships
	Lack of automation in port operations	<ul style="list-style-type: none"> Organizing labor which covers introduction of labormen with their interests and possible gains
	Missing of ship operations	<ul style="list-style-type: none"> Installing new equipment that will overcome the existing shortcomings
	Capacity reserves of fleet	<ul style="list-style-type: none"> Introducing operational rationalization potentials like reduction of port waiting times, reduction of non-productive empty trips, extension of lock-operating periods and use of modern communication technology
	Poorly equipped workplaces	<ul style="list-style-type: none"> Radical digitization from scratch
	Significant delays in the movement of goods, insufficient capacity of rail and road transport to the ports of the Danube region	<ul style="list-style-type: none"> Timely delivery of the fleet and increase monthly throughput capacity so that the shipping company can constantly increase the monthly freight rate
	Delayed paperwork cargo clearance processes	<ul style="list-style-type: none"> Automation of all work and data exchange processes, accounting and management within the terminal itself
Political and legal gaps and barriers (10)	Insufficient support for the development of inland waterway transport	<ul style="list-style-type: none"> promote water transport as a sustainable mode of transport, which has the potential to bring economic benefits, e.g. due to the high capacity of the goods transport. develop a long-term concept of inland waterway development, establishing action plans and allocating sufficient resources establish and ongoingly evaluate measurable performance indicators - investments in inland waterway transport [mil. EUR]; number of promotional materials produced [n]
	No internal competition in the port	<ul style="list-style-type: none"> create a formal contractual ownership relationship to port infrastructure search proactively for new operators for unused port capacities.
	Cross sector strategic documents validity period harmonization	<ul style="list-style-type: none"> Strategic documents from water and inland sector should be harmonized in the period of their validity
	Methodology for sector specific projects coordination	<ul style="list-style-type: none"> Projects that are of interest for both, water and inland navigation sector should be up to date and coordinated.
	Lack of harmonization of national legislation with the EU legislation	<ul style="list-style-type: none"> Courageous political decisions that will be in line with Strategy for sustainable and smart mobility in the western Balkans
	Administrative restrictions	<ul style="list-style-type: none"> Improvement of administrative capacities and administrative simplification

Type of gap or barrier	Gaps and barriers	Proposed solutions
	Complicated border procedures for crossing into/out of EU	<ul style="list-style-type: none"> Improvement and standardization of the inspection services in charge of navigation safety control procedures for all types of foreign and local vessels
	Outdated regulations	<ul style="list-style-type: none"> Changing rules and amending resolutions enough times in order to be in accordance with the development of new technology; making resolutions effective and translating them into the official national language; adopting resolutions by the government branch
	Inconsistency in the implementation of large-scale projects due to high political dynamics	<ul style="list-style-type: none"> Elaboration of long-term strategic documents for the development of the transport sector
	Imperfect Law of Ukraine "On Inland Water Transport"	<ul style="list-style-type: none"> Amending the adopted law
Trade gaps and barriers (6)	Decrease in iron ore transshipment segment	<ul style="list-style-type: none"> mines to be fully operational again.
	Lack of trade agreements	<ul style="list-style-type: none"> Lowering tariffs, making legislative and regulatory measures with detail analysis and consultation with private sector
	Lack of diversity of transported goods	<ul style="list-style-type: none"> Increasing the use of container on the Danube river; construction of new container terminals, securing own container flows
	Large share of agricultural products	<ul style="list-style-type: none"> Including as many types of cargos as possible in transport by IWT fleet
	Bureaucracy in the process of obtaining permits for export	<ul style="list-style-type: none"> Simplification of permitting procedures.
	Lack of information about institutions and organizations that promote export	<ul style="list-style-type: none"> Assistance in establishing relations with trade representatives abroad; Search for partners in target markets
Economic gaps and barriers (5)	Unstable navigability on the Danube River	<ul style="list-style-type: none"> develop an action plan to address navigability at national level. allocate financial resources to remove critical bottlenecks according to the action plan. implement and evaluate measurable performance indicators to monitor Danube navigability - number of full navigation days in year [n / year].
	Lack of competitiveness of IWT	<ul style="list-style-type: none"> Invest in marketing which could provide profitable freight contracts in IWT, bring skilled personnel and select cost-effective service providers
	Insufficient investments in ports and waterway maintenance	<ul style="list-style-type: none"> Investments in mobile equipment and superstructures, such as new quay cranes and safety and security of handling processes; modernizing old equipment and installation of aid units
	Lack of competitiveness of IWT enterprises	<ul style="list-style-type: none"> Establishing unions of small enterprises in order to be more competitive on transport market; avoiding further dependence on shipping firms, forwarders and charterage companies
	Wear and tear of the fleet and underfunding of	<ul style="list-style-type: none"> It is necessary to have a clear allocation of income to finance all expenses and investments

Type of gap or barrier	Gaps and barriers	Proposed solutions
	repairs over a long period of time	
Socio-economic and environmental gaps and barriers (8)	Human resources and technical skills	<ul style="list-style-type: none"> promote the training of water transport workers, in particular crew members.
	Safety aspect of ship operations	<ul style="list-style-type: none"> Return on investment, wining well-paying freight contracts, minimizing damage on cargo, keeping on schedule, operating and maintaining vessel, attracting competent personnel, selecting efficient service providers and minimizing unplanned off-hire
	Uncertain business environment	<ul style="list-style-type: none"> Solution through the new Strategy on waterborne transport development of the Republic of Serbia in cooperation with the relevant EU organizations
	IWT labour market attractiveness	<ul style="list-style-type: none"> Joint cooperation between employers and trade unions; employers and workers to find mutual interest like organizing longer periods of rest after longer periods of work; workers to join trade unions which can enable them understanding of the sector's developments and range of job opportunities
	Poor socio-economic conditions in the Danube Region	<ul style="list-style-type: none"> Implementation of social policies for citizens living in areas with poor socio-economic conditions, including tax relief, free education, access to funding etc.; elaboration of financial tools in support of small and medium-sized enterprises.
	Insufficient efforts for environmental protection of river areas	<ul style="list-style-type: none"> Introduction of emission regulations; establishment of institutions for monitoring and control of pollution; construction of charging infrastructure for alternative fuels in ports; development of exhaust gas cleaning systems; fleet renewal
	Existence of current foreign debts	<ul style="list-style-type: none"> Prompt payment of all debts
	Obsolescence of the management system and personnel	<ul style="list-style-type: none"> Control of the staff age group

Gaps and barriers and their proposed solutions were identified for the most of the countries. The process of identification of the gaps and barriers included their combination, reduction, adjustment and replacement on the basis of their type and proposed solutions:

- 23 listed infrastructure gaps and barriers are reduced to 5 gaps and barriers;
- 13 listed Logistic and transport gaps and barriers are reduced to 2 gaps and barriers;
- 10 listed political and legal gaps and barriers are reduced to 2 gaps and barriers;
- 6 listed trade gaps and barriers are reduced to 1 gap and barrier;
- 5 listed economic gaps and barriers are reduced to 1 gap and barrier;
- 8 listed socio-economic and environmental gaps and barriers are reduced to 3 gaps and barriers.

All new combined gaps and barriers are listed in Table 8.2.

Table 8.2: Classification of combined gaps and barriers for IWT development in all considered countries

Type of gap or barrier	Gaps and barriers	Proposed solutions
<i>Infrastructure gaps and barriers (5)</i>	Poor condition of port infrastructure and inadequate technical state of handling equipment in ports	<ul style="list-style-type: none"> • Renewal, rehabilitation and maintenance, modernization of handling equipment • Construction of port infrastructure
	Insufficient port area space (port storage facilities, length of operational quay and parking for trucks)	<ul style="list-style-type: none"> • Define and build port storage facilities, parking spaces, establish and evaluate measurable performance indicators for parking areas, conversion of unused port area
	Railway system in the port and railway and road accesses	<ul style="list-style-type: none"> • Building a new quay, port roads and more operational railway tracks • upgrading and electrification of the existing railway
	Road connection with the port and poor condition of lower-class roads in the Danube Region	<ul style="list-style-type: none"> • Implementation of regional spatial plans that include investments in regional transport infrastructure. • Large-scale modernisation and development of the network of secondary roads and construction of additional bridges over the Danube.
	Navigation bottlenecks	<ul style="list-style-type: none"> • Carry out hydrographical riverbed monitoring and surveying • allocate financial resources to remove critical bottlenecks. • implement and evaluate measurable performance indicators to monitor Danube navigability.
<i>Logistic and transport gaps and barriers (2)</i>	Port Community system	<ul style="list-style-type: none"> • Harmonization of port administration procedure through unique electronic platform • maintain a relationship and implement data interfaces with tenants in the port for the collection and statistical evaluation of relevant data. • Installing to promote sharing of information about navigation
	Lack of strategically important enterprises that produce commodities exported abroad, Lack of adequate vessels and automation in port operations	<ul style="list-style-type: none"> • Installing new equipment that will overcome the existing shortcomings • Innovations in propulsion plants and fuels • Organizing labor which covers introduction of laborers with their interests and possible gains
	Insufficient support, harmonization, validity documents that are significant for the	<ul style="list-style-type: none"> • develop a long-term concept of inland waterway development, establishing action plans and allocating sufficient resources

Type of gap or barrier	Gaps and barriers	Proposed solutions
<i>Political and legal gaps and barriers (2)</i>	development of inland waterway transport	<ul style="list-style-type: none"> Strategic documents from water and inland sector should be harmonized in the period of their validity Improvement of administrative capacities and administrative simplification Changing rules and amending resolutions enough times in order to be in accordance with the development of new technology
	Inconsistency in the implementation of large-scale projects due to high political dynamics	<ul style="list-style-type: none"> Elaboration of long-term strategic documents for the development of the inland waterway transport sector
<i>Trade gaps and barriers (1)</i>	Lack of trade agreements and lack of diversity of transported goods – Decrease in iron ore transshipment segment	<ul style="list-style-type: none"> Lowering tariffs, making legislative and regulatory measures with detail analysis and consultation with private sector Including as many types of cargos as possible in transport by IWT fleet Increasing the use of container on the Danube river
<i>Economic gaps and barriers (1)</i>	Lack of competitiveness of IWT enterprises, insufficient investments in ports and waterway maintenance	<ul style="list-style-type: none"> Invest in marketing which could provide profitable freight contracts in IWT, bring skilled personnel and select cost-effective service providers Establishing unions of small enterprises in order to be more competitive on transport market; avoiding further dependence on shipping firms, forwarders and charterage companies
<i>Socio-economic and environmental gaps and barriers (3)</i>	Low attractiveness of IWT labour market and lack of labour with certain technical skills	<ul style="list-style-type: none"> Joint cooperation between employers and trade unions; employers and workers to find mutual interest Implementation of social policies for citizens living in areas with poor socio-economic conditions, including tax relief, free education, access to funding etc.; elaboration of financial tools in support of small and medium-sized enterprises.
	Insufficient efforts for environmental protection of river areas	<ul style="list-style-type: none"> Solution through the new Strategy on waterborne transport development in cooperation with the relevant EU organizations Introduction of emission regulations; establishment of institutions for monitoring and control of pollution; construction of charging infrastructure for alternative fuels in ports; development of exhaust gas cleaning systems; fleet renewal
	Improving the energy efficiency of the transport system	<ul style="list-style-type: none"> Development of future studies with aim to analyse specific requirements for energy efficiency in IWT

9 Conclusions

In this report, based on the DIONYSUS deliverables¹, we provide the Gap analysis and Recommendations for the transport corridor enhancement in the Danube Region. Therefore, this document is divided into four parts dealing with different deliverables of the A.T1.1:

- D.T1.1.1 – Analysis of core & comprehensive network sections and nodes of the transport corridors on the Danube Region (DR);
- D.T1.1.1 – Analysis of transport infrastructure Status Quo;
- D.T1.1.1 – Analysis of the on-going and planned projects on the transport corridors in the DR;
- D.T1.1.1 – Identification of gaps in traffic flows in the Danube corridor.

In the first part, we identify the gaps related to transport routes, corridor nodes and their access links, TEN-T connections in nodes or correlations with other roads, rail and IWT freight corridors. In total, 172 sections were analyzed. The status of most sections is defined as completed. Around 25 % of sections have to be upgraded. It can also be concluded that almost 90% of these incomplete sections belong to the railway TEN-T network. Most of them are located on the route Budapest – Arad – Timisoara – Drobeta Turnu Severin, as well as in Romania and Bulgaria. Type of all these sections is defined as conventional railway. In order to fill mentioned gaps, three possible solutions can be applied. The first solution is related to building new core and comprehensive sections. The second solution refers to upgrading existing core and comprehensive sections, while the third solution uses existing core and comprehensive sections to link adjacent nodes. The third solution is particularly interesting because it involves using existing combined core and comprehensive sections.

Analysis of the **Transport Infrastructure Status Quo** includes a lot of various identified gaps that are associated with the port infrastructure. The following gaps were pointed out:

- unavailability of electricity and water supply;
- no available space for further development;
- lack of facilities for the alternative clean fuels;
- storage facilities are not spread proportionally;
- technical condition of the infrastructure and warehouses is undesirable;

¹ Deliverable D.T1.1.1 'Report on the selected Core & Comprehensive Network Sections and Nodes of the transport corridors on the Danube Region.
Deliverable D.T1.1.2 Transport infrastructure Status Quo Report
Deliverable D.T1.1.3 Report on on-going and planned projects on the transport corridors in the DR [For selected Sections & Nodes]
Deliverable D.T1.1.4 Report on traffic flows in the Danube corridor [IWT/Rail/Road]

- less modern or low-capacity technologies;
- no railways access or no railway tracks on the quay area;
- road or railway line needs improvements;
- the fluctuation of the river level due to periods of low water level;
- no pre-treatment of waste waters and other eco friendly facilities;
- terminal capacities are oversized;
- no special area for container terminals;
- poor connection with the hinterland of the country and
- coastline is not adequately fortified.

A total of 135 projects were identified in the analysis of *on-going and planned projects on the transport corridors in the DR*, of which 78 are ongoing and 57 are planned. Of these, the road sector has the most ongoing projects (25), while the inland ports sector shows growing interest and investment in ports and has the most planned projects (17). In addition to the inventory of ongoing and officially planned projects, classified into the several categories, the project partners identified gaps in transport infrastructure relevant to the integration of ports and inland waterways into multimodal supply chains. A total of 40 gaps in the transport infrastructure were identified. These gaps are considered as nuclei for future projects that go beyond the current planning horizon.

Hungary and Bulgaria were each found to have eight gaps in their transportation infrastructure. Ukraine was found to have six gaps in its transport infrastructure and Serbia one less. Four gaps in transport infrastructure were identified in Croatia and Moldova, and one less in Slovakia's transport infrastructure. Only Austria and Romania have one gap each in their transport infrastructure.

Among the identified gaps, most gaps are related to rail transport, namely 15. The other gaps are almost evenly distributed per transportation mode [road (7), inland port (8), inland waterways (8) and seaports (7)].

It should be noted that it is not always the rule that the country with the largest number of gaps has a less developed transport infrastructure. It may also be that these countries have conducted a more detailed analysis of the gaps in their transport infrastructure.

Gaps in traffic flows in the Danube corridor and their proposed solutions were identified for the most of the countries. The process of identification of the gaps and barriers included their combination, reduction, adjustment and replacement on the basis of their type and proposed solutions:

- 23 listed infrastructure gaps and barriers are reduced to 5 gaps and barriers (Poor condition of port infrastructure and inadequate technical state of handling equipment in ports; Insufficient port area space; Railway system in the port and railway and road accesses; Road

connection with the port and poor condition of lower-class roads in the Danube Region; Navigation bottlenecks);

- 13 listed Logistic and transport gaps and barriers are reduced to 2 gaps and barriers (Port Community system; Lack of strategically important enterprises that produce commodities exported abroad and Lack of adequate vessels and automation in port operations);
- 10 listed political and legal gaps and barriers are reduced to 2 gaps and barriers (Insufficient support, harmonization, validity documents that are significant for the development of inland waterway transport; Inconsistency in the implementation of large-scale projects due to high political dynamics);
- 6 listed trade gaps and barriers are reduced to 1 gap and barrier (Lack of trade agreements and lack of diversity of transported goods);
- 5 listed economic gaps and barriers are reduced to 1 gap and barrier (Lack of competitiveness of IWT enterprises, insufficient investments in ports and waterway maintenance);

8 listed socio-economic and environmental gaps and barriers are reduced to 3 gaps and barriers (Low attractiveness of IWT labour market and lack of labour with certain technical skills; Insufficient efforts for environmental protection of river areas; Improving the energy efficiency of the transport system).