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1 INTRODUCTION

1.1 European strategies

1.1.1 The Trans-European Transport Network

The Trans-European Transport Network [TEN-T][1]policy addresses the implementation and development of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. The ultimate objective is to close gaps, remove bottlenecks and technical barriers, as well as to strengthen social, economic and territorial cohesion in the EU.

Besides the construction of new physical infrastructure, the TEN-T policy supports the application of innovation, new technologies and digital solutions to all modes of transport. The objective is improved use of infrastructure, reduced environmental impact of transport, enhanced energy efficiency and increased safety.

TEN-T policy also sets requirements that the transport infrastructure must comply with, including on safety, quality for highly performing transport and alignment with environmental objectives.

The policy is a key instrument for the development of coherent, connected and high-quality transport infrastructure across the EU. It incentivizes the sustainable and more efficient transportation of people and goods, ensures access to jobs and services, and enables trade and economic growth. It also strengthens the EU's economic, social and territorial cohesion by creating seamless transport systems across borders, without missing links and bottlenecks.

Revision[2] of the TEN-T Regulation, which is currently ongoing, offers a realistic opportunity to make the Trans-European Transport Network fit for the future, and to align the development of the TEN-T network to the European Green Deal[3] objectives and the climate targets of the EU Climate Law. Cutting greenhouse gas emissions from the transport sector by 90%, compared with 1990 levels, by 2050, is key to achieving climate-neutrality by the same date.

To make such significant emission cuts, the society and industry need a modern, fully-fledged European transport network (1) that makes all transport modes more sustainable by setting firm incentives and requirements for transport infrastructure development and by better integrating the different modes in a multimodal transport system, (2) that ensures that new infrastructure projects on the network are climate-proof and consistent with environmental objectives and (3) that delivers the infrastructure basis for alternative fuel deployment.

At the same time, the TEN-T revision will reinforce the governance and monitoring instruments in place to ensure on-time network completion and exploit synergies between infrastructure planning and transport operations. This includes binding work plans to remove further obstacles for quicker and more efficient rail freight and passenger services.

The TEN-T Regulation supports the development of a reliable and seamless trans-European transport network that offers sustainable connectivity throughout the European Union, without physical gaps, bottlenecks or missing links.

[1] Source: https://ec.europa.eu/transport/themes/infrastructure/ten-t_en

[2] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2021%3A812%3AFIN

[3] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en#documents

This high-quality network shall be gradually completed in three steps: 2030 for the core network, 2040 for the extended core network and 2050 for the comprehensive network. The core and extended core network together form the European Transport Corridors which are the most strategic part of the network with highest EU added value.

The main novelties[4]compared to the 2013 Regulation:

- High infrastructure standards for all modes applied throughout the entire network.
- Nine "European Transport Corridors", representing the main arteries of EU transport, that integrate the former Core Network Corridors with the Rail Freight Corridors.
- Stronger synergies between infrastructure planning and the operation of transport services. Examples include higher speeds for train services across the TEN-T network (160 kilometers per hour for passenger services and 100 kilometers per hour for freight), maximum waiting times at borders of 15 minutes for rail freight. Another example is guaranteed good navigation status per river basin on the inland waterways on the TEN-T network.
- Requirements for the deployment, across the TEN-T network, of the charging and refueling infrastructure needed for alternative transport fuels in line with the Alternative Fuels Infrastructure Regulation. This would mean sufficient charging capacity for cars, vans and trucks at 60 kilometers distance in each direction by 2025 on the core network and by 2030 for the extended core and comprehensive networks.
- Providing safe and secure parking areas for commercial drivers, equipped with alternative fuels infrastructure.
- Use of innovative technologies like 5G to further advance the digitalization of transport infrastructure, further increasing efficiency, and improving the safety, security and resilience of the network.
- Increased resilience of the TEN-T network to natural and human-made disasters via climate-proofing requirements and environmental impact assessments for new projects, and to the implications of an accident or breakdown (e.g. by enabling alternative route alignments to the main network).
- The requirement for 424 major cities ("cities") on the TEN-T network to have sustainable urban mobility plans by 2025, in order to align their mobility developments on the TEN-T network. The SUMPs will contain measures such as the promotion of zero-emission mobility and the greening of the urban fleet.
- More transshipment hubs and multimodal passenger terminals in cities to facilitate multimodality, in particular for the last mile of a passenger or freight journey.
- Connect large airports to rail, where possible high-speed rail.
- Making it possible network-wide for lorries to be transported by trains.

Cities are important points of transfer and last-mile connection within or between different transport modes on the TEN-T. It is important to ensure that neither capacity bottlenecks nor insufficient network connectivity within urban nodes can hamper multimodality along the trans-European transport network.

[4]https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_6725

For this reason, the new provisions introduced through the revised TEN-T Regulation require that by 2040, at least one multimodal passenger hub and one multimodal freight terminal allowing for sufficient transshipment capacity within or in the vicinity of the urban node is in place.

In addition, by 2025, the 424 cities identified in the new TEN-T regulation must develop a Sustainable Urban Mobility Plan (SUMP) that includes measures to integrate the different modes of transport, and to promote zero-emission mobility.

For ports, the new extended version of the definition of a "cross-border" project could be of great importance as higher priorities are given to cross-border projects. Currently, "cross-border" section is defined as the section which ensures the continuity of a project of common interest on both sides of the border, between the closest urban nodes to the border of two Member States or between a Member State and a neighboring country. This definition leaves room for various interpretations, and it is not as clear as it could be. Inland ports, as well as seaports, are true examples of cross-border projects as they spread added value way beyond the borders of the port area and facilitate connectivity not just between mode but also between countries and various destinations in the foreland and hinterland of each port.

In addition, the proposal for the TEN-T revision foresees significant improvement for seaports in terms of their treatment as important nodes of the entire transport network. The proposal states that, being the entry and exit points for the land infrastructure of the trans-European transport network, maritime ports play an important role as cross-border multimodal nodes which serve not only as transport hubs, but also as gateways for trade, industrial clusters and energy hubs, for example with regard to the deployment of off-shore wind installations. Unfortunately, not even close recognition is given to inland ports, which is deemed fully unjustified.

Furthermore, the proposal states that the short sea shipping can make a substantial contribution to the decarbonization of transport by carrying more freight and passengers. The European Maritime Space should be promoted by creating or upgrading short-sea shipping routes and by developing maritime ports and their hinterland connections as to provide an efficient and sustainable integration with other modes of transport. The proposal unfortunately misses to include inland ports here, in spite of the fact that a huge number or short-sea shipping routes are actually sea-river routes where many origin or destination ports (without transshipment) are located on European inland waterways.

1.1.2 Sustainable and Smart Mobility Strategy

On 9 December 2020 the European Commission published the EU Sustainable and Smart Mobility Strategy.

The new Sustainable and Smart Mobility Strategy[5] sets out the EU vision for the transport system of the future and the action plan that will make it happen. It is structured around three key objectives: making the European transport system sustainable, smart and resilient.

Sustainable mobility: involving an irreversible shift to zero-emission mobility by making all transport modes more sustainable, ensuring wide availability of the most sustainable options and giving users incentives to make sustainable choices;

[5] https://eur-lex.europa.eu/resource.html?uri=cellar:5e601657-3b06-11eb-b27b-01aa75ed71a1.0001.02/DOC_1&format=PDF

Smart mobility: supporting sustainable choices by taking advantage of digitalization and automation to achieve seamless, safe and efficient connectivity.

Resilient mobility: bouncing back from the COVID-19 pandemic by creating a Single European Transport Area that is affordable and accessible for all citizens and businesses and resilient against future crises and safety and security challenges.

A clear path is needed to achieve a 90% reduction in transport-related greenhouse gas emissions by 2050. This is the effort required from transport to ensure the EU becomes the first climate-neutral continent by 2050, as outlined in the European Green Deal. Digitalization will become an indispensable driver for the modernization of the entire system, making it seamless and more efficient, while further reducing emissions. In addition, the coronavirus pandemic has shed light on the vulnerabilities of the single market and the need to strengthen its resilience.

The strategy sets out an action plan of concrete policy measures, structured around 10 key areas for action ("flagships") areas that will guide the Commission's work in the years to come. It also sets out milestones that show where we want to be in 10 and 30 years from now.

Various milestones show the path to achieving our objectives of sustainable, smart and resilient mobility (in the road transport environment), such as:

By 2030:

- at least 30 million zero-emission cars will be in operation on European roads
- 100 European cities will be climate neutral.
- scheduled collective travel for journeys under 500 km should be carbon neutral
- automated mobility will be deployed at large scale

By 2050:

- nearly all cars, vans, buses as well as new heavy-duty vehicles will be zero-emission.
- a fully operational, multimodal Trans-European Transport Network (TEN-T) for sustainable and smart transport with high-speed connectivity.

Major highlights of importance for inland ports are the following actions of this Strategy:

- Canals and rivers must ensure good navigation conditions, unhindered for example by water levels, for a minimum number of days per year.
- Calls for more transshipment terminals, improved handling capacity at freight terminals.
- Requires all 424 major cities along the TEN-T network to develop Sustainable Urban Mobility Plans to promote zero-emission mobility and to increase and improve public transport and infrastructure for walking and cycling.
- Decisive action to shift more activity towards more sustainable transport modes.
- Internalization of external costs (by implementing the "polluter pays" and "user pays" principles, in particular through carbon pricing and infrastructure charging mechanisms).
- In addressing its "Flagship 2 - Creation of zero-emission ports and airports", the Strategy states that inland and sea ports have a great potential to become new clean energy hubs for integrated electricity systems, hydrogen and other low-carbon fuels, and testbeds for waste reuse and the circular economy. For backing up this objective, the Commission will incentivize the deployment of renewable and low-carbon fuels and feeding stationed vessels and aircraft with renewable power

instead of fossil energy, incentivizing the development and use of new, cleaner and quieter aircraft and vessels, revising airport charges, greening ground movements at airports as well as port services and operations and optimization of port calls.

- In addressing its "Flagship 4 – Greening freight transport", the Strategy states that the support for the the greening of cargo operations in Europe will require substantial revision of the existing framework for intermodal transport Options to revise the regulatory framework such as the Combined Transport Directive as well as introducing economic incentives for both operations and infrastructure should be considered. Incentive mechanisms should be based on impartial performance monitoring, according to a European framework to measure transport and logistics emissions.
- Moreover, the Strategy rightly claims that the scarcity of transshipment infrastructure, and of inland multimodal terminals in particular, is pronounced in certain parts of Europe, and should be given the highest priority. Missing links in multimodal infrastructure should be closed.

1.1.3 NAIADES III Action plan

The European Commission's new programme the NAIADES III Action Plan[6], is a programme aimed at boosting the role of inland waterway transport in mobility and logistics systems, in line with the European Green Deal and the Sustainable and Smart Mobility Strategy, which set the goal of increasing transport by inland waterways and short sea shipping by 25% by 2030, and by 50% by 2050.

The programme intends to assist the inland waterway managers to ensure a high level of service (Good Navigation Status[7]) along EU inland waterway corridors by 31 December 2030.

The NAIADES III Action plan delivers actions in the following areas:

- shifting more freight to inland waterways;
- transition to zero-emission inland waterway transport;
- smart inland waterway transport;
- more attractive and sustainable jobs in inland waterway transport.

Shifting more freight to inland waterways

This type of actions intends to help inland waterway managers to ensure a high level of service (Good Navigation Status) along EU inland waterway corridors by 31 December 2030. The long-awaited revision of the Combined Transport Directive[8] will have to fully integrate inland waterways as an essential component of intermodal transport. The Commission will also establish an EU framework for measuring and report emissions from logistics and transport. This could increase demand for more sustainable options, including inland waterways where feasible.

Transition to zero-emission inland waterway transport

Compared to other land-based modes of transport, inland waterway transport is energy-efficient, safe, almost congestion-free and silent. The Commission will propose measures to encourage investment in zero-

[6] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2021:324:FIN

[7] European Commission, Directorate-General for Mobility and Transport, Liere, R., Armbrecht, H., Turf, S., et al., Good Navigation Status: guidelines towards achieving a Good Navigation Status, Publications Office, 2018

[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01992L0106-20130701

emission and zero-waste technologies for inland vessels and inland ports and will also support research and innovation.

Smart inland waterway transport

The programme encompasses new measures to help the inland waterway transport sector to keep up with digital developments and improve competitiveness. Both will help the sector become an active part of broader multimodal chains. Further digitalization can play a significant role in improving the efficiency and reliability of navigation and traffic management, better integrating inland waterway transport in logistics processes and multimodal chains, and reducing the administrative burden and costs of complying with and enforcing legislation.

More attractive and sustainable jobs in inland waterway transport

The inland waterways sector relies on a skilled workforce. Included actions will ensure smart and flexible EU crewing rules and provide inland vessel crews with the right skills to deal with the green and digital transitions, cyber-security, synchro modality and the automation of vessels and infrastructure.

1.2 Regional strategies

1.2.1 Strategy for the Danube Region (EUSDR)

The EU Strategy for the Danube Region (EUSDR) is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011. The EU Strategy for the Danube Region, endorsed in June 2011 by the European Council, is the second EU macro-regional strategy after the EU Strategy for the Baltic Sea Region.

The Strategy was jointly developed by the Commission, together with the Danube Region countries and stakeholders, in order to address common challenges together. The Strategy seeks to create synergies and coordination between existing policies and initiatives taking place across the Danube Region.

The Danube Region Strategy addresses a wide range of issues; these are divided among 4 pillars and 12 priority areas. Each priority area is managed by two countries as Priority Area Coordinators (PACs).

Figure 1.1. Priority areas EU Strategy for the Danube Region (EUSDR)[9]

Priority Area 1A — To improve mobility and multimodality: inland waterways of the EU Strategy for the Danube Region. This Priority Area is coordinated by Austria and Romania, with the involvement of a wide network of key players and stakeholders from the 14 countries of the Danube region. Here you can find out about main activities, projects and actions in the field of inland waterways in the Danube region, latest news and upcoming events on the topic. During the period from 01 January 2020 until 31 December 2022 the activities of the Technical Secretariats of Austria and Romania are being co-financed by the Danube Transnational Programme (DTP). [10]

The goals of the Priority Area 1a of the EU Strategy for the Danube Region – "To improve mobility and multimodality: Inland waterways" are to increase the cargo transport on rivers by 20% by 2020 compared to 2010, remove obstacles to navigability taking into account the specific characteristics of each section of the Danube and its navigable tributaries, and to establish efficient inland waterway infrastructure management. For the coordination and discussion on existing and proposed projects which are in line with the objectives set for the Danube Region Strategy's Priority Area 1a and on the realisation of the Priority Area's targets and actions, the Priority Area Coordinators together with the Steering Group establishedsix thematic Working Groups.[11]

[9] Priority Areas - EUSDR - Danube Strategy Point (danube-region.eu)
[10] https://navigation.danube-region.eu
[11] https://navigation.danube-region.eu/working-groups/

Of the six above Working Groups for ports is the most important WG Waterway and port infrastructure & management.

Action 1: Contribute to improve waterway and port infrastructure & management

Although enacted within the framework of the TEN-T Regulation (1315/2013), the "European Agreement on Main Inland Waterways of International Importance" (AGN) (which is ratified by all Danube riparian countries except for Germany) and the "Recommendations on minimum requirements for standard fairway parameters, hydrotechnical and other improvements on the Danube" of the Danube Commission, waterway management as well as upgrading and maintenance of the waterway and related infrastructure are under national responsibility.

Consequently, as the Danube is a linear transport axis, transnational coordination is essential for successful development. PA1a has brought up important milestones in this respect, such as the setting up of the Fairway Rehabilitation and Maintenance Masterplan for the Danube and its navigable tributaries, which continues to be a main element in the coordinated development of Danube navigation.

This working group supports this process by linking stakeholders from all user groups and regions and offering an open, but structured discussion basis on selected topics. Thematic coverage includes improvement of the fairway conditions, shore side and ports infrastructure along the Danube and its navigable tributaries as well as taking actions in a sustainable and environmentally sound way. Innovative fairway maintenance, service-oriented optimisation of lock operations and up-to-date shore side infrastructure, improved mooring places and bridge clearances as well as better multimodal accessibility of inland ports and transhipment sites to other transport modes and their hinterland are discussed and their implementation supported.[12]

1.3 National strategy

1.3.1 Strategy on Development of Waterborne Transport of the Republic of Serbia for the period from 2015 to 2025

All activities related to water transportation in the republic of Serbia have been prescribed by the Law on Navigation and Ports on Inland Waters (The Official Gazette of RS, No. 73/10, 121/12…52/21).

According to Law on Navigation and Ports on Inland Waters, in 2015, a Strategy on waterborne transport development of the Republic of Serbia, 2015-2025 was adopted (The Official Gazette of RS, No. 3/2015-34, 66/2020-10)[13].

The Strategy dealing with broad issues ranging from renewing and modernising the national fleet to developing the economic potential of Serbian ports and harbours, and developing the navigational standard of international and national inland waterways. Action plan for the Strategy has been elaborated and priority projects and activities are set in order to reach targeted values.

Strategy on Development of Waterborne Transport of the Republic of Serbia for the period from 2015 to 2025 lists the most important investments that are defined and initialised including: construction and reconstruction of Serbian ports, eliminating all critical sectors for navigation on the waterway network, further improvement of intelligent waterway transport systems.

[12] WG 1 - WATERWAY AND PORT INFRASTRUCTURE & MANAGEMENT - PA 1A (danube-region.eu)
[13] Strategija vodnog saobracaja - osnovni tekst (aul.gov.rs)

The Development Strategy on Waterborne Transport for the Republic of Serbia 2015-2025 is based on the principles of safety, inter-modality, application of new technologies, complementary use of different transport modes and rational use of available capacities and resources in Serbia. Serbia is currently investing efforts to modernise transport infrastructure and to introduce contemporary standards in all the segments of the transport system. The strategy aims at having the Serbian fluvial infrastructure comply with the overall EU transport policy.

The transport sector naturally includes the inland waterways (IWW), of which Serbia has more than 1600 km split among several categories. The Serbian Government has defined priorities to improve the functioning of the transport system as a generator for the economic and social development. The system's needs are underlined from the national strategic and planning documents as well as from EU accession requirements.

Annex 5 of Strategy on Development of Waterborne Transport of the Republic of Serbia (The Official Gazette of RS, No. 66/2020-10) are defined list of priority projects for the development of inland water traffic for the period from 2015 to 2025 in the field of:

1) Port and port projects

2) Projects in the field of transport infrastructure of inland water transport

3) Projects for the development of intelligent transport systems in inland water transport.

1.3.1.1 *Development plans for Port of Bogojevo*

According to the Strategy the development plans for Port of Bogojevo towards a full port logistics centre should take advantage of the favourable geographic/traffic position of the port and make it a specialized handling and storage terminal for grains and mineral fertilizers, with an intermodal terminal. The plans are primarily concerned with the repair and re-design of the ruined part of the quay, 55 m long, with the construction of the 2.5 km operational railway tracks and their connection to the national railway network. The Bogojevo Municipality town plans and the regional spatial plan of AP Vojvodina include provisions for an intermodal terminal development, which is to be within the port area and treated as a port terminal. A need for new storage facilities and the pertaining port infrastructure has also been recognized (construction of operational railway tracks, connection to the national railway network in a length of 2.5 km, building one more vertical quay, storage facilities up to 100,000 t (the current capacity is 50,000 t). The required investment in the port infrastructure is estimated at 3.2 million euros, and for the port superstructure at 2.4 mill. euros.

The precise level of investment in the expansion of Port of Bogojevo area will be defined after the relevant documentation has been made and adopted. The projection of costs, together with the proposals for financing building designs and port development, will make an integral part of this documentation.

Annex 5 of Strategy on Development of Waterborne Transport of the Republic of Serbia (The Official Gazette of RS, No. 66/2020-10) the construction of new port capacities of the Port of Bogojevo was assessed as a priority project.

1.4 Conclusion

Rhine-Danube Corridor is one of the nine European corridors of the TEN-T network, which is passing through the Republic of Serbia. In the European policy so far, the Danube was a priority corridor on its own, but limited as the waterway. Now the Rhine-Danube corridor is a unique system of waterways, connecting important railways and roads of Central and Southeast Europe to the industrial centers of Germany and France. With this approach it will be possible to connect and integrate transport infrastructure, including ports, and to remove technical and administrative barriers in the multimodal transport and ensure free flow of information in navigation.

The analyzed strategies of the EU indicate that Transport is fundamental for an efficient European economy. Freight traffic is expected to increase by 80% and passenger traffic by 50% by 2050. Areas of Europe cannot thrive without good connections, while the existing network contains infrastructure barriers and bottlenecks.

In this sense, with the transport network consisting of the Danube waterway in the length of 588 km with all its tributaries, along with the road and rail corridors, the Republic of Serbia holds a special importance within the overall European transport policy for the period 2014-2020. The new European policy opens up significant possibilities for better positioning and development of waterway transport in the Republic of Serbia foreseen by the Strategy on Development of Waterborne Transport of the Republic of Serbia, for the period 2015-2025.

Also, further development and construction of new capacities in the Port of Bogojevo enables the port to become qualified for inclusion in the core of the TEN-T river port network.

2 PRESENT SITUATION IN THE PORT OF BOGOJEVO

2.1 Description of the port area

The port of Bogojevo is located on the left bank of the Danube River from km 1366.73 to km 1367.42.

This port is located 4 km west from the village of Bogojevo and 34 km downstream from the town of Apatin. The location of the port of Bogojevo has an extremely favorable position, both in relation to the village of Bogojevo and business entities in the West Bačka District (City of Sombor and the municipalities of Apatin, Odžaci and Kula), and in relation to the wider area and Mali Iđoš in the North Bačka District, as well as the Municipality of Vrbas in the South Bačka District.

Location of Port of Bogojevo is shown in the Figure 2.1.

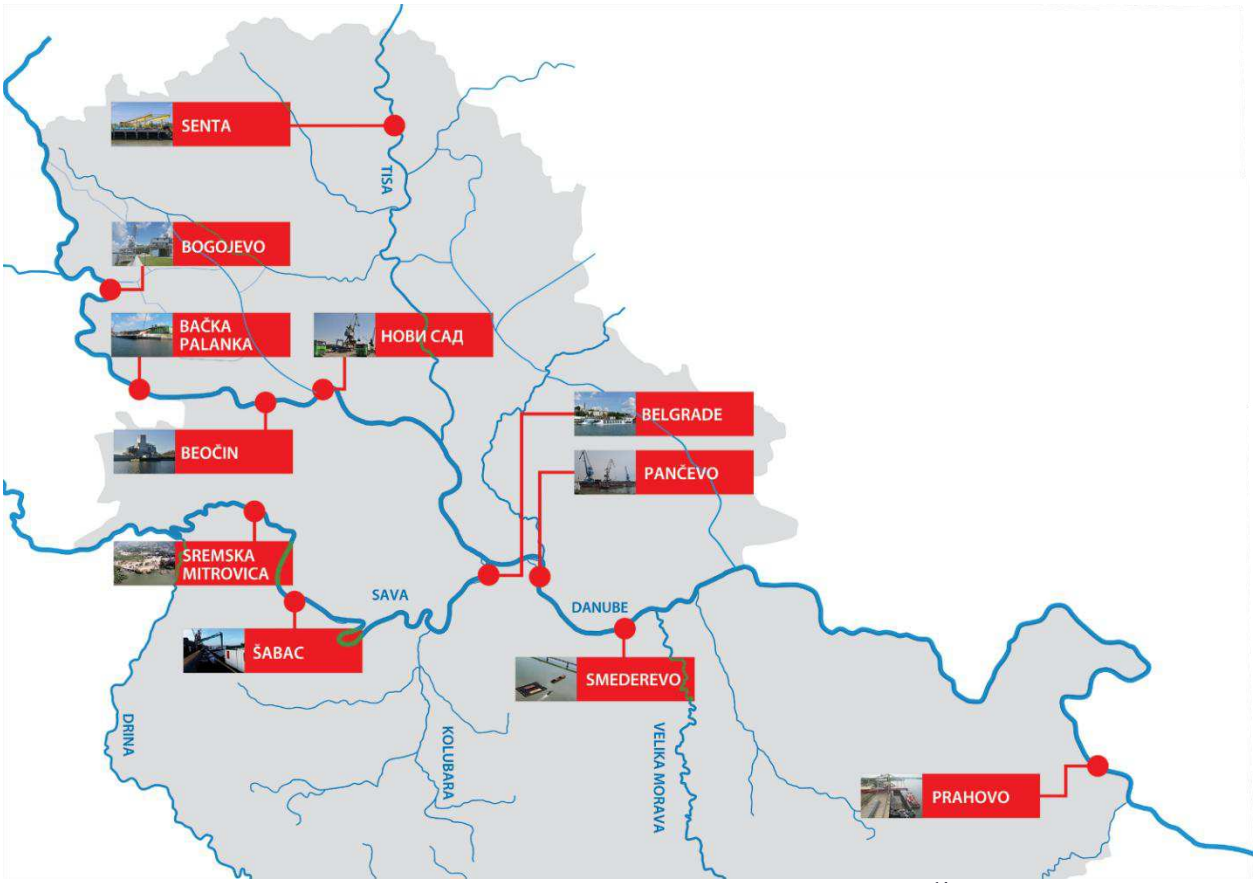

Figure 2.1. Inland Waterways and ports in the Republic of Serbia[14]

[14] PGA www.gov.rs

Figure 2.2. Port of Bogojevo

2.2 Organization and operations

Republic of Serbia is the owner of the port land, while the infrastructure is owned by the private company operating in the port. In 2013 Government of the Republic of Serbia established the Port Governance Agency that is in charge of management and development of all ports and harbors in the Republic of Serbia so it is the case with the Port of Bogojevo as well. Some of regulatory, professional and development tasks which the Agency performs are: issues and revokes the license for performing port activities; concludes a contract on performing port activities on the basis of the obtained approval; concludes the contract of port activities on the basis of the obtained approvals; keep a register of port operators to whom the clearance was issued; charges port dues; adopts and publicly announces port tariffs, etc[15]. Currently, there is one licensed port operator in the Port of Bogojevo - Luka Dunav Bogojevo D.O.O.

2.3 History of development

The first port facilities in the Port of Bogojevo were constructed in the period between 1992 and 1995, but they were not in operation until 2005, when the successful operation begun. Since then, port activities have continued to this date and have been accompanied by plans and projects for development, expansion and introduction of new activities.

In January 2020, the Government of the Republic of Serbia adopted regulation in which the cadastral parcels and anchorage of the port of Bogojevo were declared as a port area in accordance with the STRATEGY ON WATERBORNE TRANSPORT DEVELOPMENT OF THE REPUBLIC OF SERBIA, 2015–2025, spatial and urban planning documents and planning documents related to water management.

[15]"Official Gazette of the Republic of Serbia ", n. 73/2010, 121/2012, 18/2015, 96/2015, 92/2016, 104/2016, 113/2017, 41/2018, 95/2018, 37/2019, 9/2020 and 52/2021

2.4 Main features of the port and port infrastructure, superstructure and equipment

Overview of basic port's features is given in the table 2.1.

Parameters	Explanation / Value
Port land owner (State, Region, Municipality, Private, Other)	State owned
Port authority name	Port Governance Agency
Number of operators (concessionaires, lessors)	1
Total port area (ha)	9.05
Maximum draught (m) - natural or dredged	4
Total number of terminals	1
Heavy lift and out-of-gauge handling capacity (Yes/No)	NO
Ability to handle full block train along the quay (Yes/No)	NO
Ability to handle full block train in the port area (Yes/No)	NO
Transhipment equipment for intermodal transport (Yes/No)	N/A
Total quay length (vertical + sloped) (m)	276
Vertical quay length (m)	98
Sloped quay length (m)	178
Undeveloped quay length (m)	0
Max number of vessels handled at the same time	2
Max capacity of anchorage or waiting area for barges (number)	17
Storage capacity (m^2)	silo of 30,000 tons for cereals and 15,000 tons for fertilizer; closed space place of 14,200 m^2 and open space place of 10,200 m^2
Storage capacity for liquid cargos (m3)	oil and derivatives 20 m^3, natural LPG gas 27 m^3
Storage capacity (TEU)	N/A
Storage capacity (CEU - car equivalent unit, for Ro-Ro terminals)	N/A
Bunkering facilities within the port area (Yes/No)	NO
Shore-side power supply for vessels (Yes/No)	YES
Road connection (Yes/No)	YES
Rail connection (Yes/No)	NO
Number of quay cranes of lifting capacity Q < 10 tons	
Number of quay cranes of lifting capacity 10 < Q < 16 tons	1
Number of quay cranes of lifting capacity 16 < Q < 50 tons	
Number of quay cranes of lifting capacity Q > 50 tons	
Total number of quay cranes	
Telescopic loader	3
Belt conveyor	

Table 2.1. Basic features of the Port of Bogojevo

The port covers surface of approximately 9 ha. Port of Bogojevo is an open-type port with maximum available draft maintained at 4 m. Total quay length is 276 m, out of which vertical quay is approximately 98 m. Two vessels can be simultaneously accommodated and serviced. Anchorage has the capacity for 17 vessels.

There is already a built infrastructure in the port, which ensures the functioning of port activities. On the filled plateau behind the operational shore, a grain silo, a dryer, closed and open warehouses, a truck scale weighing system, an administrative building and gates were built. The face of the operational shore towards the open flow is represented by a vertical quay construction on piles 89 m long, while the operational shore is about 12 m wide at an approximate elevation of 86.56 m above sea level. A gantry crane is used for cargo handling, while the grain is loaded from the silo with a belt conveyor. From the communal infrastructure, there is a water supply and sewerage network, electric power infrastructure with a transformer station, gas supply infrastructure and electronic communication network.

The port has silo of 30,000 tons for cereals and 15,000 tons for fertilizer; closed space place of 14,200 m^2 and open space place of 10,200 m^2 available for port users.

Storage capacity for liquid cargos covers oil and derivatives with 20 m^3 and natural LPG gas with 27 m^3.
The main types of cargo handled in port are grains, chemical fertilizers, gravels and sand with annual reported volumes between 200,000 and 300,000 tonnes.

The port's superstructure includes two roads and one railroad filling hoppers with a total capacity of 700 t/h, a drying plant with a capacity of 40 t/h, a portal crane with a capacity of 20 t, a belt conveyor with an operating capacity of 400 t/h and the required handling and internal transport machinery.

The port does not have facilities for the collection of oily and greasy ship waste.

The access infrastructure in the area of the port of Bogojevo consists of an access road connected to the public road IB of order 17. From the railway station Bogojevo to the port there is an industrial railway track that is not in operation.

2.5 Cargo types and volumes

The throughput cargo data used in the study were obtained from the Port Governance Agency. Data provided by the port of Bogojevo were also available, but the authors opted for the Port Governance Agency data due to its completeness.

The most common cargoes in the port are cereals and fertilizers due to location of the port. Therefore, cereals and fertilizers make up most of the port throughput while natural aggregates and metallurgical products appear to a much lesser extent.

The port of Bogojevo is among the Serbian ports with the largest throughputs of grain. Throughput of other cargoes is being registered every year in the port, among which imported artificial fertilizers make up the largest share. Although a biggest throughput is 536,407 t of various cargoes in 2020, the estimated requests for transportation from the hinterland area of the Port of Bogojevo are much higher and more diverse than the current throughput possibility of this port. Table 2.2. shows cargo types and volumes for the period 2015–2021.

Cargo type	2015	2016	2017	2018	2019	2020	2021
Fertilizers	0.00	0.00	0.00	0.00	19,636.63	57,030.39	24,846.44
Grains	2,019.00	749.00	36,120.00	6,694.00	1,534.00	2,256.00	2,392.00
Grains - export	152,094.30	272,150.33	176,794.24	246,671.15	289,652.65	304,056.32	224,691.41
Oilseeds - export	0.00	0.00	0.00	1,355.00	54,069.50	57,145.07	15,015.00

Oilseeds	0.00	0.00	0.00	0.00	1,094.00	1,025.00	1,027.00
Natural aggregates - export	0.00	18,534.40	0.00	0.00	0.00	73,268.80	0.00
Metallurgical products	0.00	0.00	0.00	0.00	82,083.50	394.00	0.00
Natural aggregates	0.00	89,397.71	130,428.60	0.00	0.00	41,231.80	0.00
Other bulk cargo - export	3,630.00	1,966.00	0.00	6,170.00	0.00	0.00	0.00
Bulk cargo	1,987.00	3747	1,027.00	1,809.19	0.00	0.00	0.00
Total	159,730.30	386,544.44	344,369.84	262,699.34	448,070.28	536,407.38	267,971.85

Table 2.2. Cargo types and volumes in Port of Bogojevo for the period 2015–2021

Based on the data in Table 2.2, we conclude that the growth of the Port of Bogojevo throughput was the highest in 2016, as much as 2.4 times compared to 2015. The next two years saw a decline in throughput of the Port of Bogojevo. Another increase was recorded in 2019, as many as 1.7 times compared to 2018. Throughput continued to grow in 2020 as well and has increased by 1.2 times comparing to 2019. Last year, there was a 50% drop in throughput compared to 2020. Therefore, there is a noticeable lack of consistency in the flow of cargoes through the port of Bogojevo.

Top product handled in the Port of Bogojevo is grains. The share of grains in the port of Bogojevo throughput for the observed period is shown in the Table 2.3.

Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Share of grains (%)	96	71	62	96	65	57	85

Table 2.3. Grains volume shares in the Port of Bogojevo 2015-2021

2.6 Port access

Port of Bogojevo has a single road entrance with two lanes road allowing vehicle access. In port area there is three truck scales that work simultaneously. There is one inoperative rail entrance with a single rail track which connects port to the national railway network. The port is a hub in which land and waterway transport intersect.

2.7 Current and potential user requirements

The largest numbers of users of port services are companies that are primarily registered in the area of Bačka, other districts of AP Vojvodina, Belgrade and other cities in Serbia. Most companies are registered for wholesaling of grains, raw tobacco, seeds and animal food, followed by companies registered for trade in agricultural products, non-specialized wholesaling, grain growing (except rice), legumes and oilseeds, meat processing and canning, suppliers of agricultural seeds, mineral fertilizers and plant protection products, as well as specialized exporters and traders of mercantile goods (soy sunflower, oilseed rape, corn, wheat, etc.).

Current and potential users are divided into grains exporters, mineral fertilizer importers and storing, drying and reloading users. Some of the potential users are: AGRICOM COMP. GROUP, SOMBOR; AGRO DOM TIM, CRVENKA; AGROFINANCE, BELGRADE; AGROGLOBE, NOVI SAD; AL DAHRA SERBIA, SLOPE SCAFFOLDING; ALCOR DLV, NOVI SAD; ALMEX, PANČEVO; ANOVA NNL, SREMSKA KAMENICA; AS AGRO 99, BANATSKO NOVO SELO; AXEREAL SERBIA, NOVI SAD; BCM TRADE, BELGRADE; BIMAL TRADING, BELGRADE; CARGILL; CHS SERBIA, NOVI SAD; ĆIRIĆ AND SON, SAKULE; CONSUL, NOVI SAD; DELTA AGRAR, BELGRADE;

DUMICO, BELGRADE; EUROCHEM, RUSSIA; MAT AGRO, FUTOG; NIDEL AGRAR DOO SOMBOR; PHOSAGRO, RUSSIA; RWA SERBIA, BELGRADE; SOCIETY BALKANS, NOVI SAD; SOLE KOMERC, BELGRADE; TRADING TEAM, NOVI SAD; VIMEXIM, NOVI SAD; VITERRA-GRANOLIS, NOVI SAD; ŽITOPROMET MLINPEK, SREMSKA MITROVICA.

3 HINTERLAND CONNECTIONS

The micro-location of the existing port of Bogojevo is defined by the exit to the water body of the international waterway of the Danube River, with the existing infrastructure and suprastructural capacities on the mainland part of the port.

3.1 Main rail corridors

Port Bogojevo has a connection to the national railway network but railway tracks are not in function.

Within the built capacities of the traffic infrastructure in the port area, there is also a manipulative railway no. 403, “Bogojevo-Dunavska Obala”, with 3 industrial tracks.

The port of Bogojevo is 300 m away from the main railway, and 2520 m from the railway yard.

Railway section from Bogojevo to state border Erdut connects Port of Bogojevo directly with Croatia and indirectly with Hungary over other railway sections. It is a local railway section and is not electrified. The importance of this section is reflected in possibility to connect Port of Bogojevo with Port of Vukovar and further with Port of Budapest over the following railway sections which are part of the Mediterranean corridor: Osijek – Beli Manastir, Beli Manastir (border) / Magyarboly - Pecs, Pecs – Dombovar, Dombovar – Pusztaszabolcs, Pusztaszabolcs - Budapest Kelenfold (part 1) and Pusztaszabolcs - Budapest Kelenfold (part 2). This section is mainly used for transport of bulk cargo and its parameters are presented in Table 3.1.

Section	Parameter	Value	Unit	Reference in Regulation 1315/2013
Bogojevo – state border Erdut	Length	10	km	n/a
	Electrification	no		
	Track gauge 1435mm	yes		
	Line speed >= 100km/h	no		
	Axle load (>=22.5t)	n/a		
	Train length (740m)	n/a		

Table 3.1. Bogojevo-state border Erdut railway section parameters

Railway section from Bogojevo to Subotica-state border Kelebija is consisted of one regional section (Bogojevo-Sombor-Subotica) and one conventional section (Subotica-Kelebija) 183 km of length. It is important for the Port of Bogojevo because it connects it with Budapest over Hungarian railway sections Kiskunhalas – Kelebia, Kunszentmiklos-Tass – Kiskunhalas and Budapest Ferencvaros. This section is mainly used for transport of bulk cargo and its parameters are presented in Table 3.2.

Section	Parameter	Value	Unit	Reference in Regulation 1315/2013
Bogojevo - Subotica-state border Kelebia	Length	183	km	n/a
	Electrification	Yes (Subotica-Kelebia)		
	Track gauge 1435mm	yes		
	Line speed >= 100km/h	no		
	Axle load (>=22.5t)	n/a		
	Train length (740m)	n/a		

Table 3.2. Bogojevo-Subotica-state border Kelebia railway section parameters

3.2 Main road corridors

On the northeast side, the micro location is limited by the existing state road IIa no. 107, Sombor - Apatin - Bogojevo, while on the southeast side there is a road and next to it a railway bridge over the Danube, towards the Republic of Croatia. State road no. 107 is located on the embankment and the defensive line from the flood waters of the Danube. Right next to the road bridge is the border crossing Bogojevo, with minimal capacities and facilities for control and transfer of passenger and freight vehicles. The northwest side of the site of the port of Bogojevo is limited by an uncategorized road and the border of the municipality of Odzaci with the municipality of Apatin (KO Sonta).

The port complex is surrounded by the main road Bogojevo-Erdut in the east, regional road Bogojevo-Senta in the north and local road in the west. The port is connected with the regional road Bogojevo-Apatin-Sombor-Subotica, as well as with the section Bogojevo-Odzaci-Sombor of the main road No. 3, which passes through Serbia.

Across the road bridge, the Port is connected to the section of road No. 3 Erdut-Dalj-Osijek in Croatia. The main road corridor is the main road that turns from the bridge from Croatia to the narrower city zone of Bogojevo, enters the center as a city road and then exits again as a main road in the northeast direction towards Odzaci.

The port is 40 km away from the E75 highway, in the direction Belgrade-Budapest.

Across the road bridge, the Port of Bogojevo is connected to the section of road No. 3 Erdut-Dalj-Osijek in Croatia. The total length of the bridge connecting Bogojevo and Erdut is 670 meters. Figure 3.1 shows Bogojevo to state border Erdut road section while Table 3.3. presents Bogojevo to state border Erdut road section parameters.

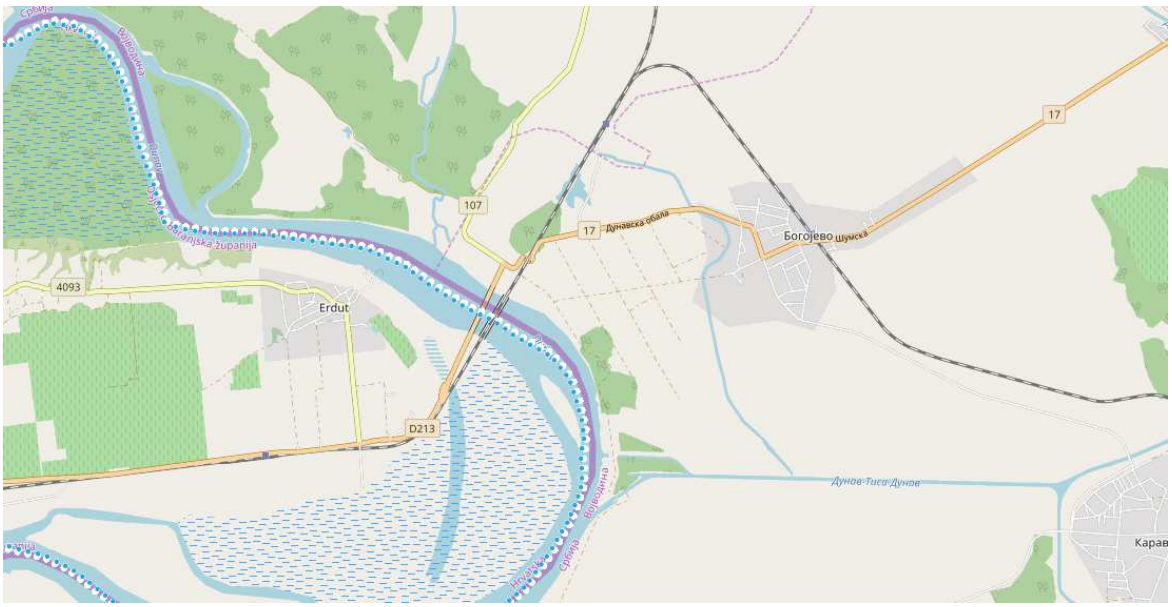

Figure 3.1. Bogojevo to state border Erdut road section

Category / Section	Parameter	Value	Unit
IB – Bogojevo – border Erdut	Length	10.984	km
	Number of lanes (total, in both directions)	2	lanes
	Maximum speed allowed	80	km/h
	Axle load for trucks allowed	10	t/axle

Table 3.3. Bogojevo to state border Erdut road section parameters

Port of Bogojevo is connected to Kelebija with road IB. Section “Bogojevo-Srpski Miletić” is road No. 17, section “Srpski Miletić-Subotica” is road No. 12. (Total length of road No. 12 is 276km). Section “Subotica-Kelebija” is road No. 11 (Total length of road No. 11 is 23,677km). Figure 3.2 shows Bogojevo to Subotica-state border Kelebija road section while Table 3.4 presents Bogojevo to Subotica-state border Kelebija road section parameters.

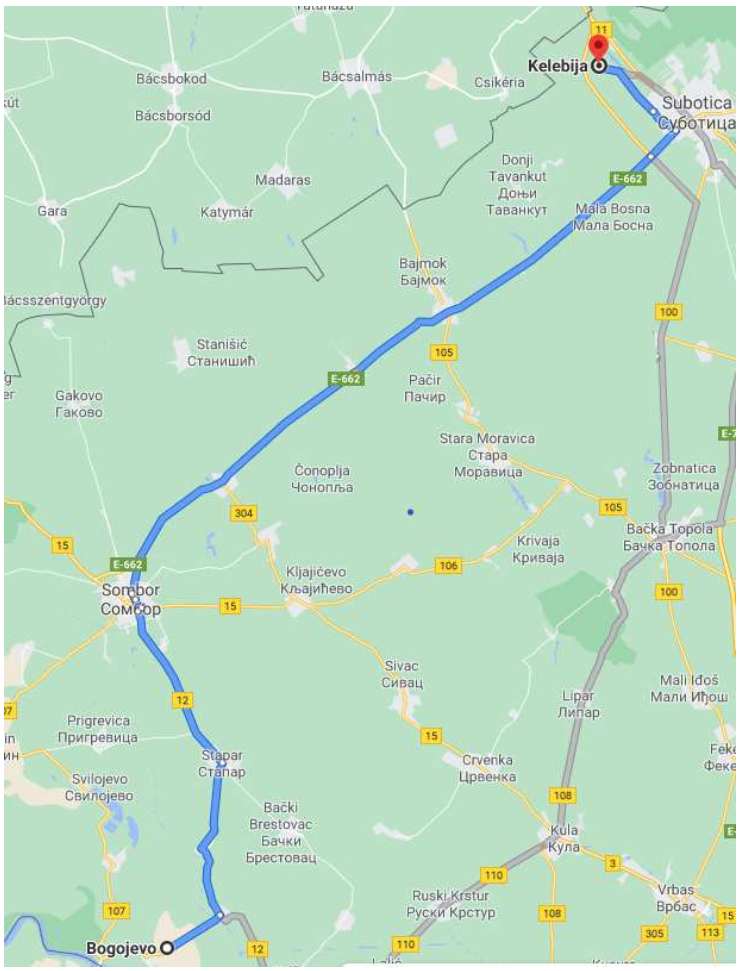

Figure 3.2. Bogojevo to Subotica-state border Kelebija road section

Category / Section	Parameter	Value	Unit
IB/–Bogojevo-Subotica-state border Kelebija	Length	104	km
	Number of lanes (total, in both directions)	2	lanes
	Maximum speed allowed	80	km/h
	Axle load for trucks allowed	10	t/axle

Table 3.4. Bogojevo to Subotica-state border Kelebija road section parameters

4 MARKET ANALYSIS, POTENTIAL USERS, AND DEVELOPMENT PERSPECTIVES

4.1 General economic outlook

COVID 19 and global slowdown, according to available data, had a less severe impact on Serbia compared to most European countries, due to achieved macroeconomic and financial stability, growth momentum, fiscal space created in previous years, large and timely monetary and fiscal package, and structure of the economy

GDP recovery to pre-crisis level was accomplished already in Q1 2021 while according to the SORS data real GDP growth in 2021 stood at 7.4% Such developments are the result of growing activity in industry, construction and the service sectors.

Having in mind new investment cycle, and planned infrastructure projects in following ten years, the NBS projection of real GDP growth for 2022 and the medium term is in the range from 4-5%.

According to the NBS projection, real GDP growth in Q 1 2022 should stand around 4.3% year-on-year (y/y), which includes the materialization of part of the risks related to the emerging crisis due to the Russia - Ukraine conflict.

The adopted economic policy measures (EUR 5.8 bn, about 13% of GDP in 2020) minimized the decline in GDP in

2020 while an additional package of EUR 2.2 bn (4.2% of GDP) in 2021 contributed to further GDP growth and its return to the path of sustainable growth in the medium term

According to NBS February 2022 projection, inflation will be on a declining path throughout 2022. The conflict in Ukraine creates significant upside risks in energy, commodities and food prices.

In 2021 current account deficit of EUR 2.34 bn (-4.4% of GDP) was recorded, with the record inflow of FDI (EUR 3.9 bn)

Owing to product and geographic diversification and export-oriented investments, goods exports in 2021 increased by as much as 29.1% y/y.

Moody's has upgraded Serbia's credit rating (March 2021 while S&P revised upwards the outlook for obtaining an investment rating from stable to positive (December 2021 and Fitch confirmed credit rating in conditions of intensified geopolitical tensions (February 2022) while acknowledging the maintained macroeconomic stability and favourable outlook, as well as adequate economic policy response before and during the pandemic.

4.1.1 Overview of Gross Domestic Product (GDP) growth

Serbia recorded a cumulative growth of real GDP of 6.4% in two pandemic years. According to the SORS[16] data, in 2021, Serbia achieved a real GDP growth of 7.4% driven by recovery in service sectors, as well as growth in construction and industrial production.

NBS projects growth in Q1 2022 of 4.3% y/y, whereby the projection includes the effects of the conflict between Russia and Ukraine, which led to disturbance in production and trade of goods and services worldwide.

[16] Statistical Office of the Republic of Serbia

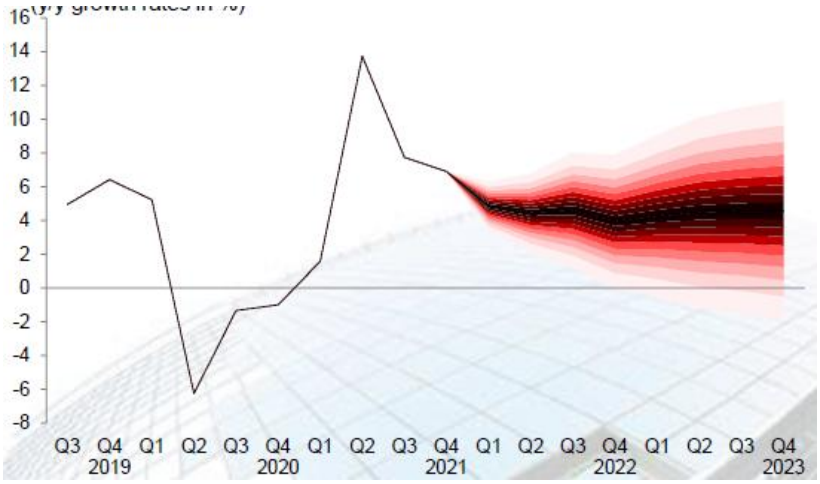

Figure 4.1. GDP forecasts of the National Bank of Serbia (NBS)

According to the International Monetary Fund data, the Serbian GDP variations of the years, since 1996, are given in the following figure.

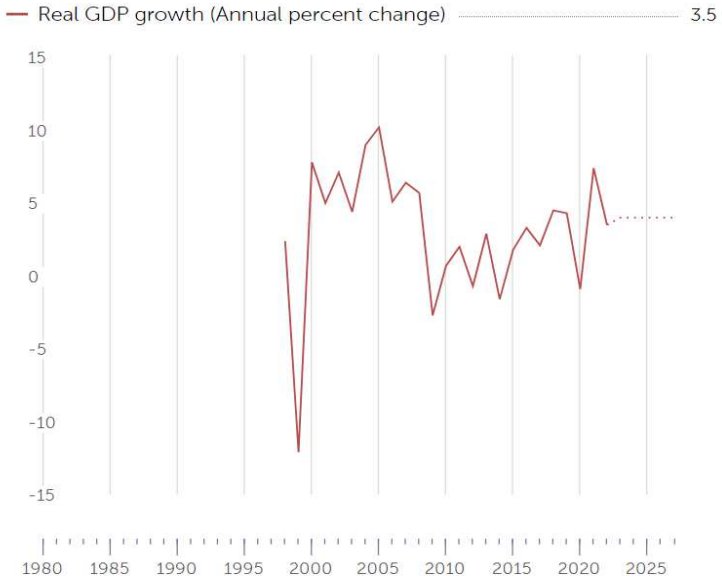

Figure 4.2. Serbian GDP growth since 1996 (IMF data)[17]

GDP reached the pre-crisis level in 2021 Q1, and, according to NBS estimate, in Q4 it is more than 5% above the pre-crisis level.

For 2022 and the medium term, the NBS expects growth to be in a range between 4%-5%, as a result of new investment cycle. This year, it is expected that the growth will be predominantly driven by further developments in service sectors, as well as construction and industrial production.

In light of the conflict between Russia and Ukraine, risks to the projection form international environment particularly those related to supply chain disruption, energy crisis and prices of primary products are asymmetrical to the downside. Since geopolitical situation is changing constantly, and new sanctions are being introduced, it is difficult to determine the economic effects of the conflict on Serbia.

[17] https://www.imf.org/en/Countries/SRB#ataglance , last accessed 27 April 2022.

4.1.2 Overview of investments

In 2015-2019, fixed investments grew at an average annual rate of about 10%, while their cumulative growth was about 64%. The share of fixed investment in GDP increased to 22.5% in 2019.

Despite pandemic, fixed investments cumulatively increased during 2020 and 2021 for around 12%. Thanks to the new investment cycle, the share of fixed investments in nominal GDP should reach the level of around 26% as early as 2024 and move around that level in the medium term.

Government investments reached level of over 7% of GDP and should remain around that level in the medium term.

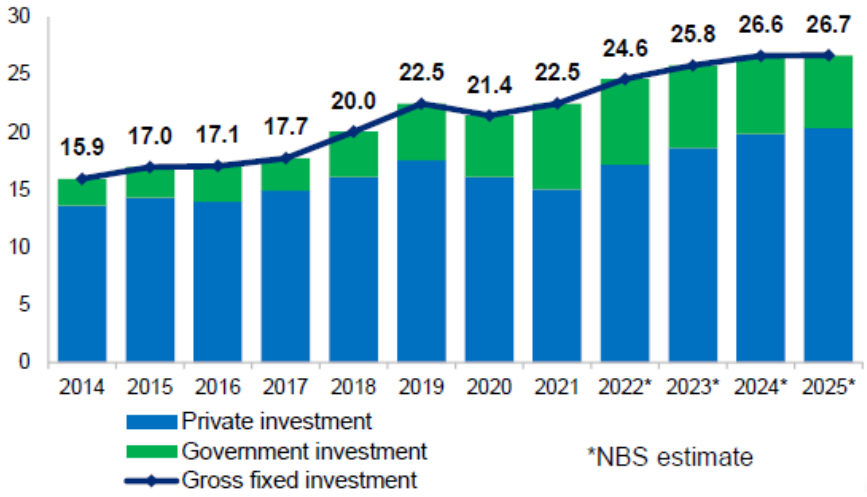

Figure 4.3. Overview of investments in Serbia for the period 2014-2025[18]

In earlier years, investments have largely relied on Foreign Direct Investments (FDI). Owing to maintained macroeconomic and financial stability, exchange rate stability, as well as fiscal consolidation. In recent years, three additional strong pillars for financing investments have been established: multiplied profitability of the economy, investment loans and doubled government investments. On top of that, FDI inflow reached record levels of around 8% of GDP.

[18] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 27 April 2022.

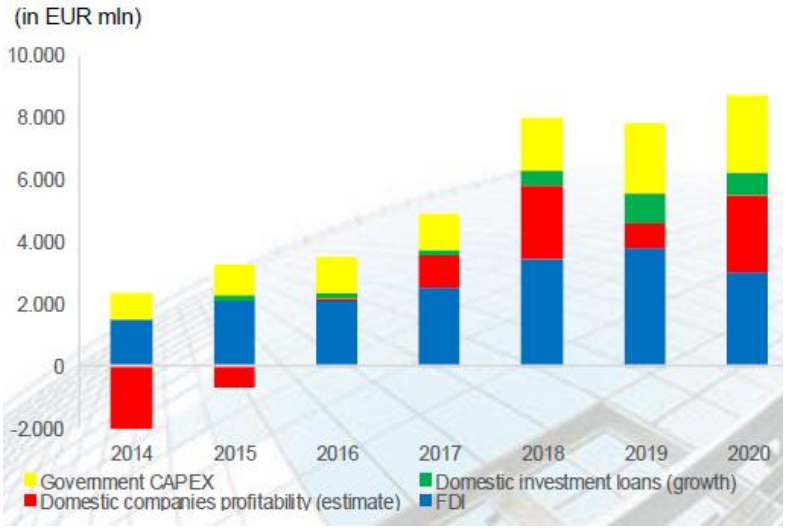

Figure 4.4. Key sources in investment financing[19]

4.1.3 Overview of trade parameters

In 2021, there was an intensive growth of **exports** of goods of 29.1%, driven by the recovery of exports of the manufacturing industry, which would have been even faster if there were no disruptions in global chains.

The growth of exports of services in 2021 amounted to 26% and was driven by exports of ICT services, as well as tourism services, which fully recovered in 2021. During the first two months of 2022, an increase in goods exports of 30.4% y/y was recorded, driven by growth in exports of manufacturing and mining.

Exports of services increased by 32.6% y/y.

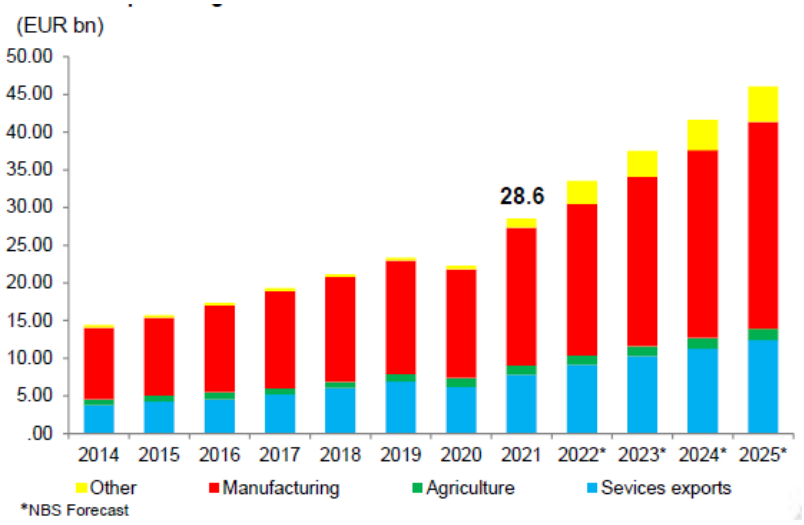

Figure 4.5. Growth and composition of exports[20]

[19] Ibid.
[20] Ibid.

Serbia's exports are largely directed towards EU and countries of the region, and reliant on demand in those countries which were recovering during 2021. In 2020, most of Serbian exports went to the EU, followed by CEFTA[21] countries and CIS[22] countries.

By country, the largest share of exports went to Germany (12.7%), followed by Italy (8.5%), Bosnia and Herzegovina (7.2%), Romania (5.5%), Hungary (5.0%) and Russia (3.9%). Exports to China in 2021 continued to grow compared to 2020, while recording growth even in 2020, so China is highly positioned on the list of Serbian export partners.

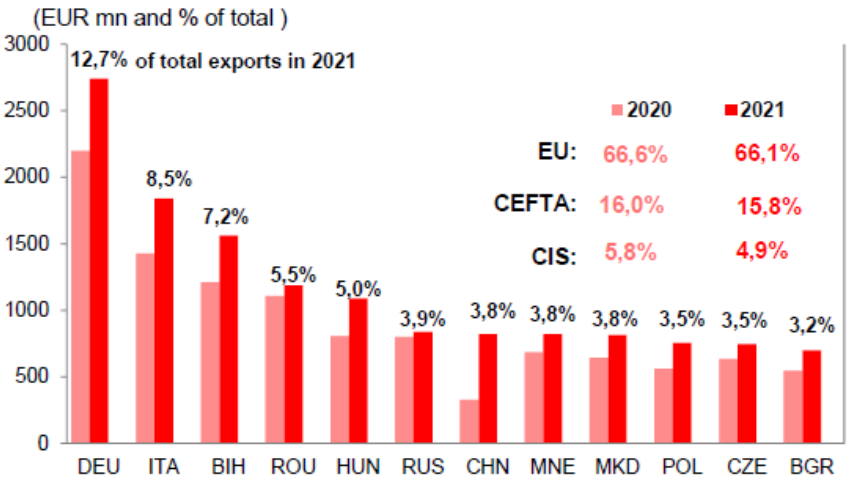

Figure 4.6. Destination countries of Serbian exports[23]

Goods **imports** increased by 25.4% in 2021, driven by intermediate products, of which a significant part relates to energy imports. Imports of equipment and consumer goods continued to grow.

Imports of goods increased by 52.0% y/y during January-February 2022. The biggest contribution came from intermediate goods, partly due to the growth of energy prices.

The agreement reached on a favourable import price of gas during the first half of 2022 is expected to have a positive effect on the balance of payments, as well as on macroeconomic developments as a whole.

[21] Central European Free Trade Agreement - https://cefta.int
[22] Commonwealth of Independent States - https://cis-legislation.com/index.fwx
[23] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 27 April 2022.

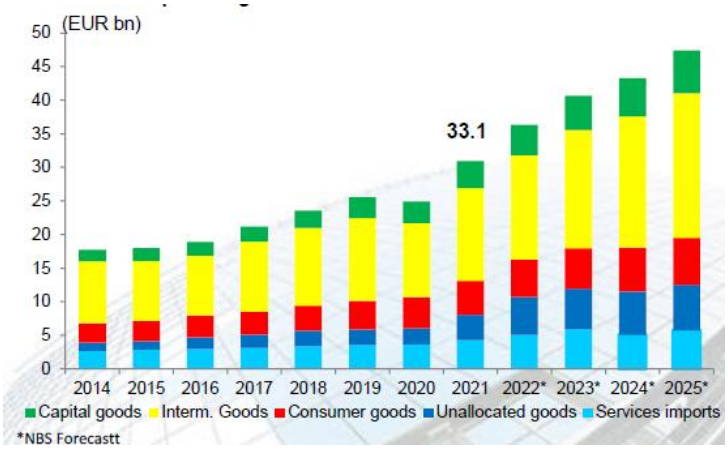

Figure 4.7. Growth and composition of imports[24]

Majority of imports (more than 58% in 2021) come from the EU, followed by CIS and CEFTA. In 2021, compared to 2020, imports (as well as exports) in absolute terms increased in most significant countries.

By country, the largest shares of imports are from Germany (13.2%), whereas the share of imports from China increased from 9.0% in 2019 to 12.5% in 2020 and sits at 12.8% in 2021.

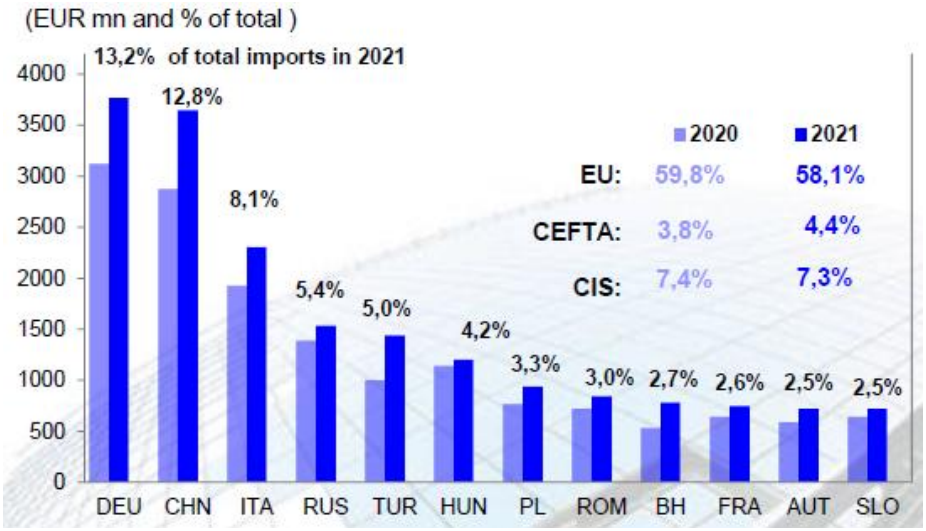

Figure 4.8. Origin countries of Serbian imports

4.2 Modal split of the overall transport volumes

Data about cargo flow in Serbia obtained from the Statistical Office of the Republic of Serbia cannot be considered as an appropriate source of information due to a lack of clear rules about which companies, registered for transport and production activities, are obliged to submit data about quantities of transported goods and transport routes. For that reason, data about volume of transport that are available on Statistical Office of the Republic of Serbia internet site cannot be considered overall or final, but only indicative.

[24] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 27 April 2022.

The volume of transported cargo is presented according to basic quantitative indicators in tons (t) of cargo and tonne-kilometers (tkm), in accordance with the published methodology. The data presented under the term "traffic" refer to the total loading and unloading at terminals, regardless of whether they are realized by means of transport of domestic or foreign operators. In addition, the throughput of port terminals, besides to loading and unloading on/from vessels, includes the cargo throughput that has previously been stored in the port area.

The data presented in this section is taken from the documentation of the Statistical Office of the Republic of Serbia and is processed together with data from other sources like Customs Administration of the Republic of Serbia, Port governance agency, etc.

The total volume of cargo transport in the Republic of Serbia which is expressed in tons in the observed period (2015–2020) ranged from a minimum of 26.684million tons (in 2015) to a maximum of 34.78million tons (in 2019).

Volume of transported cargo by transport modes for the period from 2015 to 2020 is shown in Table 4.1.

Types of transport	**Volume of transported cargo (10^3 t)**					
	2015	2016	2017	2018	2019	2020
Land transport	25143	27415	28555	31667	33092	32061
Railway transport	11887	11896	12352	12317	11506	10499
Road transport	7964	9897	10120	13056	15858	15638
Pipelines transport	5292	5622	6083	6294	5728	5924
Inland waterway transport	1537	2014	1449	1559	1697	1692
Air transport	3.7	4.8	6.7	6.7	5.6	4.2
Total	26684	29434	30011	33233	34780	33663

Table 4.1. Volume of cargo in Republic of Serbia by types of transport from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data from Table 4.1 point out that railway transport had the largest share in the modal split till 2018, where from the road transport takes the lead in sharing. The share of railway transport ranged from a minimum of 31.19% (in 2020) to a maximum of 44.55% (in 2015). It is noticeable that in 2018, for the first time, the volume of cargo transported by road was higher (share of 39.29%) compared to rail (share of 37.06%).

The share of road transport in the modal split shows positive trend in the observed period, i.e. it goes from 29.85% in 2015 to 46.45% in 2020. The volume of cargo transported by road in 2020 was 1.56 times higher than in 2015.

The share of pipeline transport in the modal split showed minimum variation among all transport modes – 19.83% in 2015, 19.10% in 2016, 20.27% in 2017, 18.94% in 2018, 16.46% in 2019, 17.55% in 2020.

The share of inland waterway transport had a pick in 2016 with 6.84%. The quantity of transported cargo in 2016 had about 40% increase from the minimum year of 2017 and about 20% increase from the second best year of 2019. In general, variations in quantity of cargo transported by inland waterway transport are constant with occasional picks every 4 to 5 years. It can be clearly viewed in Table 4.1 that there was a downward trend in the volume of transport from 2015 to 2017 and a slight increase from 2018 onwards.

The share of air traffic during the entire period ranged between 0.01% and 0.02%

An overview of the growth index of freight transport volume (in percentages) by transport modes for the period from 2015 to 2020 is given in Table 4.2.

Types of transport	Growth index (%)				
	2016./ 2015.	2017./ 2016.	2018./ 2017.	2019./ 2018.	2020./ 2019.
Land transport	109.0	104.2	110.9	104.5	96.9
Railway transport	100.1	103.8	99.7	93.4	91.2
Road transport	124.3	102.3	129.0	121.5	98.6
Pipelines transport	106.2	108.2	103.5	91.0	103.4
Inland waterway transport	131.0	71.9	107.6	108.9	99.7
Air transport	129.7	139.6	100.0	83.6	75.0
Total	110.3	102.0	110.7	104.7	96.8

Table 4.2. Growth index of freight transport volume(in tons) by types of transport for the period 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data from Table 4.2 indicate that the growth indices of freight transport volume had the positive trend until 2020 where a slight flattening of the trend line happened. The average annual growth index in the observed period of 5 years for the total volume of transport was 4.76%despite decline of -3% that occurred in the last observed year. According to data from Statistical Office of the Republic of Serbia presented in Table 4.2, the average annual growth rate in land transport was 4.98%. Positive average growth rates were recorded in road (14.45%), air (2.57%), pipeline transport (2.28%) and inland waterway transport (1.94%) while negative average growth rates were recorded in rail transport (-2.45%).

The total volume of transport expressed in achieved tkm in the observed period ranged from a minimum of 8.02 billion tkm (in 2015) to a maximum of 12.8 billion tkm (in 2019).

A comparative overview of achieved tkm by types of transport for the period 2015 – 2020 is shown in Table 4.3.

Types of transport	Achieved tkm (10^6)					
	2015	2016	2017	2018	2019	2020
Land transport	7147	8340	9317	10696	12047	11306
Railway transport	3249	3087	3288	3187	2864	2746
Road transport	2974	4299	4980	6443	8175	7741
Pipelines transport	924	954	1.049	1.056	1.008	819
Inland waterway transport	865	927	725	580	727	558
Air transport	4.7	10.2	20.7	20.1	15.1	15.7
Total	8017	9277	10063	11286	12771	11862

Table 4.3. Achieved tkm by types of transport in the Republic of Serbia for the period 2015-2020 (source: Statistical Office of the Republic of Serbia)

The share of achieved tkm in railway transport ranged from a minimum of 22.39% (in 2019) to a maximum of 40.53% (in 2015).

The share of achieved tkm in road transport ranged from 37.10% in the first observed year to 65.16% in the last observed year. Achieved tkm in 2020 were about 2.6 times higher than in 2015.

The share of achieved tkm in pipeline transport ranged from a minimum of 6.9% (in 2020) to 11.53% (in 2015).

The share of achieved tkm in inland waterway transport was the highest at the beginning of the observed period with 10.79%, while the lowest share was recorded in 2020 and it was only 4.7%. Achieved tkm in 2020 were 2.29 times lower than in 2015.

The share of achieved air transport during the whole period was insignificant in terms of tkm and ranged between 0.01% and 0.02%.

In Table 4.4 an overview of growth index of achieved tkm is given by types of transport in the Republic of Serbia for the period 2015 to 2020.

Types of transport	Growth index of achieved tkm (%)				
	2016/ 2015	2017/ 2016	2018/ 2017	2019/ 2018	2020/ 2019
Land transport	116.7	111.7	114.8	112.6	93.8
Railway transport	95.0	106.6	96.9	89.6	95.9
Road transport	144.6	115.8	129.4	126.9	94.7
Pipelines transport	103.2	110.0	100.7	95.5	81.3
Inland waterway transport	107.2	78.2	80.0	125.3	76.8
Air transport	217.0	202.9	97.1	75.1	104.0
Total	115.7	108.5	112.2	113.1	92.9

Table 4.4. Growth index of achieved tkm by types of transport in the Republic of Serbia for the period 2015 to 2020

Data from Table 4.4 indicate that the growth indices of achieved tkm had the positive trend during period from 2015 to 2019, while there was slight negative trend from 2019 to 2020. The average annual growth rate in the observed period of 5 years for the achieved tkm was 8.15% despite decline of 7% that occurred in the last observed year. It suggests that there was a boost growth index from 2015 to 2019. According to Statistical Office of the Republic of Serbia presented in Table 4.4, the average annual growth rate in land transport was 9.61%. Positive average growth rates were recorded in road (21.09%) and air (27.28%) transport while pipeline transport (with –2.38%), inland waterway transport (with –8.39%) and rail transport (with –3.31%) experienced negative average growth indices. It is indicative that growth indices in inland waterway transport varied, recording positive trends in periods 2015–2016 (7.17%) and 2018–2019 (25.34%). The biggest growth index was noted in air transport for the period 2015–2016 and it is 117.02%. Other significant growth indices appear in road transport among which the biggest is achieved in the period 2015–2016 with 44.55% of growth.

Observed by types of traffic, in the period from 2015 to 2020, there was an increase in the volume of cargo transport in both domestic and foreign transport with small variations recorded by year in some modes of transport, especially in 2020 when there was a decline in the volume of transport due to the consequences of the global pandemic (see Table 4.5).

Types of transport	Volume of transported cargo (10^3 t)					
	2015.	**2016.**	**2017.**	**2018.**	**2019.**	**2020.**
Foreign transport: total	15307	16857	19044	19546	19385	18974
Land transport	14453	15980	18308	19024	18652	18458
Railway transport	7997	8261	9151	8610	8169	7437
Road transport	3138	4016	4890	5919	6331	6758
Pipeline transport	3318	3703	4267	4495	4152	4263
Inland waterway transport	850	872	729	515	727	512
Air transport	3.7	4.9	6.7	6.7	5.6	4.2
Domestic transport: total	11376	12577	10967	13687	15721	14689
Land transport	10689	11435	10247	12643	13721	13599
Railway transport	3890	3635	3201	3707	3337	3062
Road transport	4826	5881	5230	7137	8838	8876
Pipeline transport	1973	1919	1816	1799	1576	1661
Inland waterway transport	687	1142	720	1044	970	1090
Air transport	-	-	-	-	-	-
Total	26684	29434	30011	33233	34780	33663

Table 4.5. Volume of transport by types and modes of transport in the Republic of Serbia for the period from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

4.3 Transport volumes on inland waterways

The data on cargo transport by inland waterways refer to transport activities realized by companies and organizations registered for transport activities, regardless of whether the transport was performed inside or outside the national boundaries and for domestic or foreign users. The inland waterway transport operations are shown in ton-kilometres and reflect operations in transport carried out inside as well as outside the territory of the Republic of Serbia.

Domestic inland waterway cargo transport carried out by vessels under national or foreign flag covers the overall traffic at Serbian river ports, including other loading and unloading places out of ports.

Cargo loading or discharging at river ports and places out of ports refers only to realization of activities performed by companies responsible for cargo handling on the operational quays (apron areas). It is mainly smaller than the overall throughput at river-ports by its volume. Total cargo transport and cargo loading and unloading from 2015. to 2020. in Republic of Serbia are given in Table 4.6.

Years			2015	2016	2017	2018	2019	2020
Ton-kilometers, million			865	927	725	580	727	558
Cargo transport (1000 tons)	National transport		687	1142	720	1045	970	1090
	Exports		126	121	133	151	195	221
	Imports		709	749	591	297	458	276
	Transit		15	2	4	60	64	15
	Traffic between foreign ports		–	–	–	–	10	–
Cargo loading or discharging (1000 tons)	Total cargo	Total	6486	8411	7112	8570	10821	9368
		Loading	2614	3594	2638	3432	4676	4957
		Unloading	3872	4817	4474	5138	6145	4411
	National cargo	Total	1354	2284	1440	2236	2170	2410
		Loading	677	1142	720	1118	1085	1205
		Unloading	677	1142	720	1118	1085	1205
	International cargo	Total	5132	6127	5672	6334	8651	6958
		Exports	1937	2452	1918	2314	3591	3752
		Imports	3195	3675	3754	4020	5060	3206
	Transit cargo	Total	4196	3812	3351	2844	3629	3436
		Upstream	1601	1827	1660	1739	2274	1927
		Downstream	2595	1985	1691	1105	1355	1509

Table 4.6. Transport volumes on inland waterways (source: Statistical Office of the Republic of Serbia)

The throughput of cargo in Serbian river ports from 2015 to 2020 is shown in Table 4.7. Data are gathered from the Statistical Office of the Republic of Serbiainternet site.

Year	Cargo throughput in portsa (10^3 t)									Transit
	Total cargo throughput			Domestic throughput			Foreign throughput			
	Total	*Load*	*Unload*	*Total*	*Load*	*Unload*	*Total*	*Export*	*Import*	
2015	6486	2614	3872	1354	677	677	5132	1937	3195	1595
2016	8411	3594	4817	2284	1142	1142	6127	2452	3675	3808
2017	7111	2637	4474	1439	719	720	5672	1918	3754	3351
2018	8570	3432	5138	2236	1118	1118	6334	2314	4020	2844
2019	10821	4676	6955	2170	1085	1085	8651	3591	5060	3629
2020	9368	4957	4411	2410	1205	1205	6958	3752	3206	3436

Table 4.7. Cargo throughput in Serbian river ports from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data in Table 4.7 indicate constant rise in cargo throughput from 2015 to 2019 and a slight decline in 2020 probably due to global pandemic. In 2019, there was an increase in the cargo throughput in compare with throughput in 2018 by about 26.3%. Growth in numbers was recorded in both domestic and foreign transport. In 2020, compared to 2019, there was a decline of about 13.4%, primarily in foreign throughput.

4.4 Statistical overview for the Port of Bogojevo

As a typical agricultural port, the Port of Bogojevo handled mostly grains and fertilizers, and, to a much smaller extent, determined quantities of natural aggregates (sand and gravel) and metallurgical products.

During the elaboration of this study, statistical data were provided by both Port Governance Agency as a public port governing body and by the Luka Dunav Bogojevo a.d. – a company operating the Port of Bogojevo. Due to the higher availability of details and completeness, the statistical data obtained from the

Port Governance Agency are taken as a basis for all analyses in this study and are therefore presented below[25].

Cargo type	2015	2016	2017	2018	2019	2020	2021
Fertilizers	0.00	0.00	0.00	0.00	19,636.63	57,030.39	24,846.44
Grains	2,019.00	749.00	36,120.00	6,694.00	1,534.00	2,256.00	2,392.00
Grains - export[26]	152,094.30	272,150.33	176,794.24	246,671.15	289,652.65	304,056.32	224,691.41
Oilseeds - export[27]	0.00	0.00	0.00	1,355.00	54,069.50	57,145.07	15,015.00
Oilseeds	0.00	0.00	0.00	0.00	1,094.00	1,025.00	1,027.00
Natural aggregates - export	0.00	18,534.40	0.00	0.00	0.00	73,268.80	0.00
Metallurgical products	0.00	0.00	0.00	0.00	82,083.50	394.00	0.00
Natural aggregates	0.00	89,397.71	130,428.60	0.00	0.00	41,231.80	0.00
Other bulk cargo - export	3,630.00	1,966.00	0.00	6,170.00	0.00	0.00	0.00
Bulk cargo	1,987.00	3747	1,027.00	1,809.19	0.00	0.00	0.00
УКУПНО:	159,730.30	386,544.44	344,369.84	262,699.34	448,070.28	536,407.38	267,971.85

Table 4.8. Throughput of cargo in the Port of Bogojevo 2015-2021

Top three products handled in the Port of Bogojevo are grains, oilseeds and fertilizers. The following table shows the share of the Port of Bogojevo in the overall trade (in all ports) for these three cargo types in 2021.

Cargo and trade direction	Total Serbia 2021	Share of Bogojevo
Grains - export	2,114,083.67	10.63%
Grains - import	29,451.80	8.12%
Fertilizers - import	429,684.53	5.78%
Oilseeds - import	26,169.61	3.92%
Oilseeds - export	75,765.70	19.82%

Table 4.9. Share of the Port of Bogojevo top three cargo types in the overall throughput in Serbian ports

Taking into account the overall volumes (all cargoes), the share of the Port of Bogojevo in the overall cargo volumes handled in Serbian ports was 1.68% in 2021.

4.5 Capacity analysis

Currently, the operator of the Port of Bogojevo, company “Luka Dunav Bogojevo” a.d., operates a portal crane and a grain loader connected to a silo via belt conveyors. Technical capacities of this transshipment equipment are as follows:

Portal crane: 100 t/hour

Grain loading equipment: 270 t/hour[28]

[25] Source: Port Governance Agency

[26] Since no exact quantities for corn, wheat and barley (three most exported cereals) were available, it was estimated that approximately 80% of the exported grain quantity in 2021 was corn, 12% was wheat and 8% was barley.

[27] Since no exact quantities for two mostly exported oilseeds (soy and soybean meal and rapeseed) were available, it was estimated that approximately 70% of the total quantity of exported oilseeds was soy and soybean meal, while 30% was rapeseed.

Capacity of the port us typically calculated in function of the capacity of the ship-berth link, that is, of the capacity of the transshipment equipment located at the berth or multiple berths. In addition to that, the working times, or the operating patterns of a port operator largely determine the annual capacity of the port. In this view, the capacity of the port will be calculated for four different cases, that is, for four different operating patterns (working times) of the port operator. These cases are the following:

Mark	Capacity case description	Working hours/week	Working days	Working time
Q1	Minimal capacity	75	Mon-Fri	07:00-22:00
Q2	Normal capacity	90	Mon-Sat	07:00-22:00
Q3	Intensive capacity	144	Mon-Sat	00:00-24:00
Q4	Maximal capacity	168	Mon-Sun	00:00-24:00

Table 4.10. Port capacity cases

In addition to the internal factors determining the actual (or operational) port capacity, there are external factors affecting the annual operational capacity of a port. Most important external factor in this case is the fairway availability, or the number of days when navigation is possible. According to the report[29] of the Directorate for Waterways "Plovput" of the Ministry of Transport, Construction and Infrastructure the average number of the navigable days is 300. For the purposes of this calculation, the number of navigable days on the Danube is taken to be 301 days, or 43 weeks. The remaining days of the year are not possible for navigation due to:

- extremely high water levels,
- extremely low water levels,
- ice occurrence,
- strong winds,
- dense fog.

Finally, the simplest way to calculate the average annual (operational) capacity of the port is given in the following formula:

$$Q = W_h \times N_w \times P_h$$

Where:

Q – average annual capacity of a port (tons/year),

W_h – number of working hours in a week, in function of the adopted capacity case,

P_h – hourly productivity of a transshipment equipment or a berth (tons/hour).

Therefore, the capacity of the port (having currently only one berth) for the non-grain cargo, when using the portal crane for loading/unloading is:

[28] According to the questionnaire filled by the "Luka Dunav Bogojevo" a.d. port operator. The data given was 4000 tons/day for grains as an overall daily capacity. Based on this, we have assumed that this figure is based on 15 hours operations pattern (regular working time from 07 to 22 hours) and calculated approximately 270 tons/hour as an hourly capacity of grain loading equipment.

[29] http://www.plovput.rs/file/danube-stream/common-danube-report-2018.pdf - last accessed 27 April 2022.

Annual capacity with portal crane	Tons/year
Capacity case Q1	322,500
Capacity case Q2	387,000
Capacity case Q3	619,200
Capacity case Q4	722,400

Table 4.11. Port capacity for non-grain cargo (with portal crane)

On the other hand, port of Bogojevo capacity for loading of grains (cereals and oilseeds) is:

Annual capacity with grain loaders	Tons/year
Capacity case Q1	870,750
Capacity case Q2	1,044,900
Capacity case Q3	1,671,840
Capacity case Q4	1,950,480

Table 4.12. Port capacity for loading of grains

From the point of view of capacity utilization on the basis of volumes handled in the last seven years, in the following figure it can be seen that the portal crane is underused, meaning that it has a large capacity reserve in all analysed capacity cases. This, in turn, means that the port has no reason to work overtime when handling non-grains cargo, taking into account the current and past volumes of handled non-grains cargo.

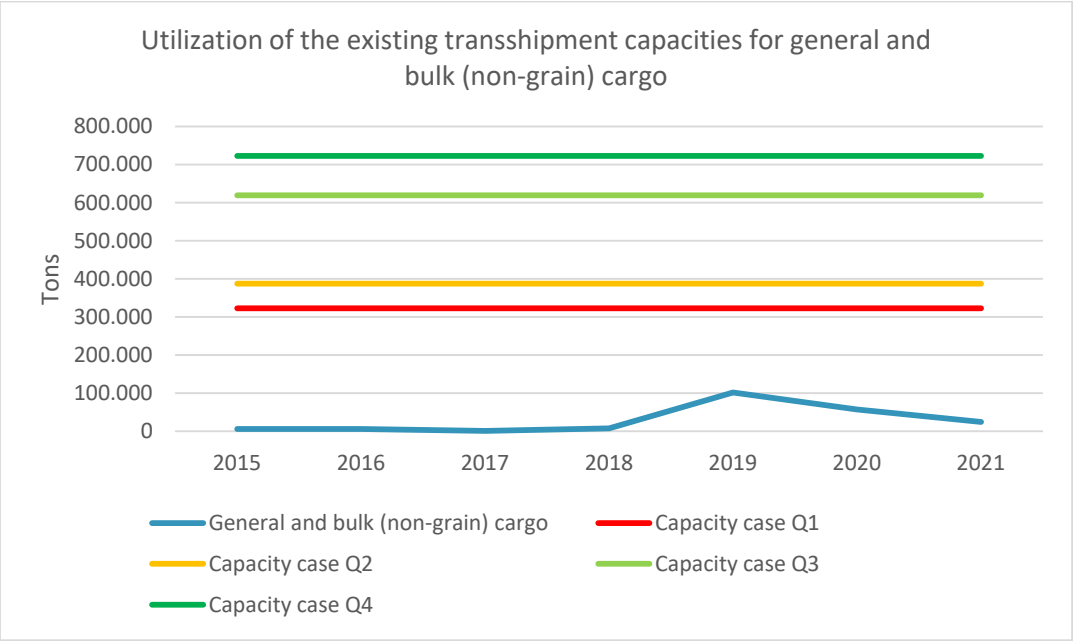

Figure 4.9. Capacity utilization of a port for non-grain cargo

Furthermore, the capacity utilization of the facilities for grains loading in the last seven years also demonstrated the average capacity utilization over the years. This means that the port does not need to work any overtimes in order to manage to handle the current volumes, unless specifically requested by the ship operator or cargo owner.

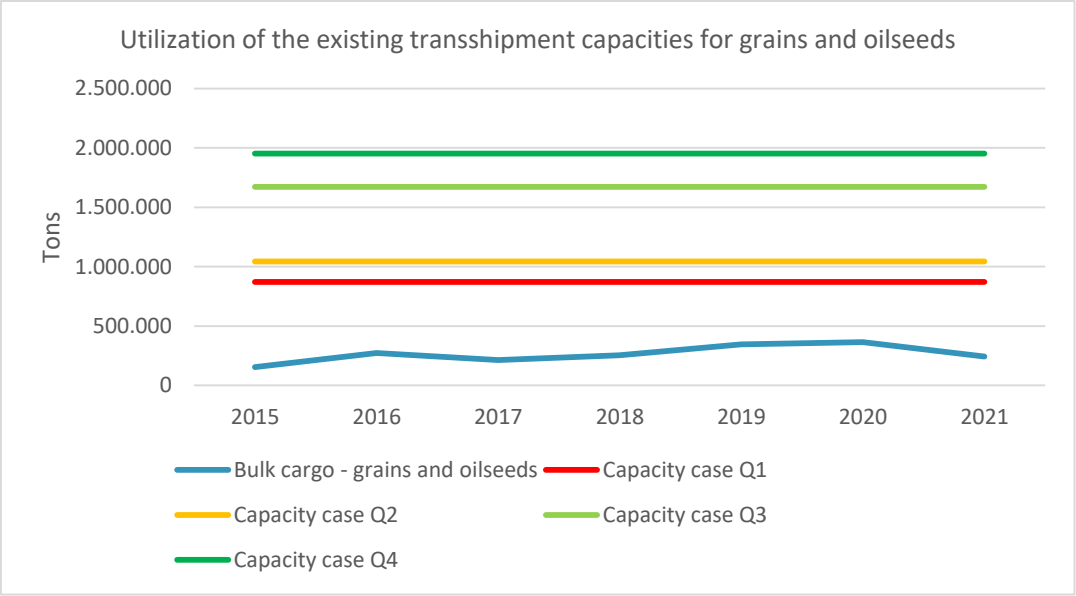

Figure 4.10. Port capacity utilization for grains

4.6 Potential users

Most direct port users for Bogojevo are **exporters of grains**. According to the report[30] of "Žita Srbije" (2021), the following companies are the top 25 exporters of grains:

Nr.	COMPANY	Tons
1	AGROGLOBE, NOVI SAD	452,592
2	CHS SERBIA, NOVI SAD	442,039
3	DELTA AGRAR, BELGRADE	315,817
4	CONSUL, NOVI SAD	284,038
5	TRADING TEAM, NOVI SAD	179,848
6	VIMEXIM, NOVI SAD	145,525
7	ĆIRIĆ AND SON, SAKULE	141,582
8	MAT AGRO, FUTOG	138,166
9	BCM TRADE, BELGRADE	120,691
10	RWA SERBIA, BELGRADE	105,330
11	AGRICOM COMP. GROUP, SOMBOR	80,283
12	VITERRA-GRANOLIS, NOVI SAD	64,329
13	BIMAL TRADING, BELGRADE	64,207
14	AGRO DOM TIM, CRVENKA	61,146
15	ANOVA NNL, SREMSKA KAMENICA	52,487
16	AS AGRO 99, BANATSKO NOVO SELO	52,278
17	AXEREAL SERBIA, NOVI SAD	51,273
18	AL DAHRA SERBIA, SLOPE SCAFFOLDING	50,268
19	ALCOR DLV, NOVI SAD	47,498
20	SOCIETY BALKANS, NOVI SAD	44,994
21	AGROFINANCE, BELGRADE	42,241
22	ALMEX, PANČEVO	41,935
23	SOLE KOMERC, BELGRADE	41,533
24	ŽITOPROMET MLINPEK, SREMSKA MITROVICA	37,254
25	DUMICO, BELGRADE	36,652

Table 4.13. Top 25 grain exporters in Serbia for 2021

[30] Žita Srbije (2021), Annual Report on Grains Exports in 2021, Belgrade (*in Serbian*)

Unfortunately, no detailed data on each port were available at the time of elaboration of this report. In addition to that, the port operator of the Port of Bogojevo did not want to disclose the exact quantities exported by their clients, but they did indicate that the above listed companies are their potential clients.

Serbia's total area wheat crop is estimated at 600,000 ha, 5% higher than in the previous year mostly due to high wheat prices during marketing year (MY)2019/20[31]. Corn production for MY2020/21 is estimated to be 8 million MT, almost 10 percent higher than the previous year. Serbia's corn exports of 3.2 million MT in MY2019/20 was a record. As of October 2020, Serbia had exported almost 460,000 MT of corn, 87 percent higher than in October 2019.

The constraints with exporting wheat (and other crops) from Serbia are limited by the transhipment capacities of the Serbian ports and reduced number of vessels in the river fleet. Serbian shipping was challenged in December 2020 - March 2021 by the low level of the Danube River and limited possibility to transport wheat by river barges to the Black Sea. On the average, over 60% of wheat exports from Serbia are transported to the huge silos at the Port of Constanta in Romania, which has direct inland waterway links to all Serbian river ports. The remaining 40% (on the average) of the wheat is transported over land to the neighbouring countries.

Most important export products of Serbia, forming a considerable bulk of goods transported by inland waterway transportation, are maize, wheat and barley. Below table[32] shows an overview of the grains exported and imported from/to Serbia in the last four years.

	Export (t)				**Import (t)**			
Year	2018	2019	2020	2021	2018	2019	2020	2021
Maize	1,311,400	3,117,958	3,637,973	2,332,224	18,983	7,112	6,193	8,464
Wheat	1,202,317	318,868	589,817	1,153,972	1,547	1,724	3,013	1,671
Barley	70,991	47,451	85,423	125,71	573	5,375	741	1,799
Oats	1,03	1,246	738	2,208	542	2,983	5,805	884
Buckwheat	23	1,149	116	1,471	1,002	2,573	1,014	2,174
Rye	810	491	50	1,944	75	428	2,078	345
Sunflower	145,317	134,606	144,272	90	22,161	29,227	20,001	11,474
Soy	70,078	182,331	249,828	70,036	19,791	4,235	192	49,964
Rapeseed	132,383	50,067	91,872	71,886	1,275	333	122	153
Total	**2,933,319**	**3,854,167**	**4,800,089**	**3,633,831**	**65,949**	**53,990**	**39,159**	**76,928**

Table 4.14. Exports and imports of grains from/to Serbia

Just as an example, the total of 173 exporters participated in corn (largest share of grain exports exports in 2021, of which 151 with quantities from 25 t to 270,344 t (206 exporters in 2020 and 204 in 2019).

Out of 2,332,224 tons exported, 1,571,779 tons were shipped by the Danube, i.e. 67.4% of total exports (75.7% of total exports in 2020, 58.33% in 2019), 584,763 tons, or 17.95% of corn were bought by buyers from Italy, and all others 175,682 tons, or 14.65%.

In addition to this, the next large group of potential users of the Port of Bogojevo are the **importers offertilizers**. Currently, there are only two fertilizers producer in Serbia: Elixir Group, whereas Elixir uses

[31] Maslać, Tatjana (2020), *Grain and Feed Update – Report on Serbia*, United States Department of Agriculture, Foreign Agriculture Service, Report Number: RB2020-0013
[32] Žita Srbije (2021), *Annual report on exports in 2021*, (in Serbian), Belgrade, 24 February 2022.

ports of Šabac and Prahovo for their imports of fertilizer components and export of fertilizers, because Elixir Group is a port operator (through their daughter companies) in the ports of Šabac and Prahovo.

In the absence of any newer data, the authors of this study used the Report on the Analysis of the State of Competition on the Market of Wholesale of Artificial Fertilizers in the Territory of the Republic of Serbia in the Period 2017-2019[33] in order to determine the potential users in the domain of fertilizers.

According to this report, production of artificial fertilizers in the period 2017-2019 had a growing trend, and since mid-2018, only one producer operates in the Republic of Serbia - the company "Elixir Group" (Elixir Group). When it comes to imports, according to the data of the Customs Administration, in 2017 and 2018, the leading importer was also "Elixir", but in 2019, the company "Promist" replaced “Elixir” in that position.

In 2019, the import of fertilizers achieved a growth of over 60% compared to the previous year. Fertilizers are mostly imported from Russia, while far smaller quantities are imported from Croatia, Austria, Hungary and Romania. Nitrogen and complex fertilizers predominate in the total import of mineral fertilizers, and these two types of fertilizers together make up 85-90% of the total import of fertilizers in the observed period. In 2019, the increase in exported quantities by 29% and the realized value of exports by 51% compared to 2017.

Another large group of potential users can be found in the **construction industry**. During the last six years, between 2015 and 2021, the Serbian construction industry rolled out into one of the strongest growth cycles in recent history[34]. The powerful surge in construction outputs surpassed all initial expectations, and there are a number of converging factors behind its formidable result. The recovery after the recession gradually transformed itself into a fully-fledged construction boom, which more than doubled Serbia’s construction output, from €2 billion in 2015 to €4 billion in 2019. Even the pandemic in 2020 didn’t change the very positive outlook, although it did cause a slowdown and negative consolidation of construction outputs by some 5% at constant prices.

According to the data collected in the fourth quarter of 2021[35], value of construction works done on the territory of the Republic of Serbia increased by 27.1% at current prices, while, at constant prices, the increase amounted to 10.4% relative to the fourth quarter of 2020. Observed by types of constructions, value of performed works on buildings increased by 9.0%, and on civil engineering by 11.2%, at constant prices.

In the fourth quarter 2021, the value of construction works done, at constant price, noted the greatest increase in Šumadija and Zapadna Srbija Region, by 42.5%, followed by Vojvodina Region, by 8.3%, Beogradski Region, by 3.2%, while in Južna and Istočna Srbija Region, it decreased by 9.6%, relative to the same quarter 2020.

Of the total value of works done, on the territory of the Republic of Serbia 98.8% were performed, while the rest of 1.2% was performed on building sites abroad.

[33] Republic of Serbia, Competition Protection Commission, Report on the Analysis of the State of Competition on the Market of Wholesale of Artificial Fertilizers in the Territory of the Republic of Serbia in the Period 2017-2019, Belgrade, November 2020, available at: http://www.kzk.gov.rs/kzk/wp-content/uploads/2020/12/Izveštaj-o-sektorskoj-analizi-na-tržištu-mineralnog-đubriva.pdf - last accessed 27 April 2022.

[34] https://www.property-forum.eu/news/serbias-construction-industry-to-return-to-growth-in-2021/8668

[35] https://www.stat.gov.rs/en-us/vesti/statisticalrelease/?p=8570&a=05&s=0503?s=0503

Value of works done by the contractors in the Republic of Serbia in the fourth quarter 2021, regarding works performed on the territory of the Republic of Serbia and abroad, increased by 25.7% relative to the fourth quarter 2020, at current prices, while at constant prices, the increase amounted to 9.2%.

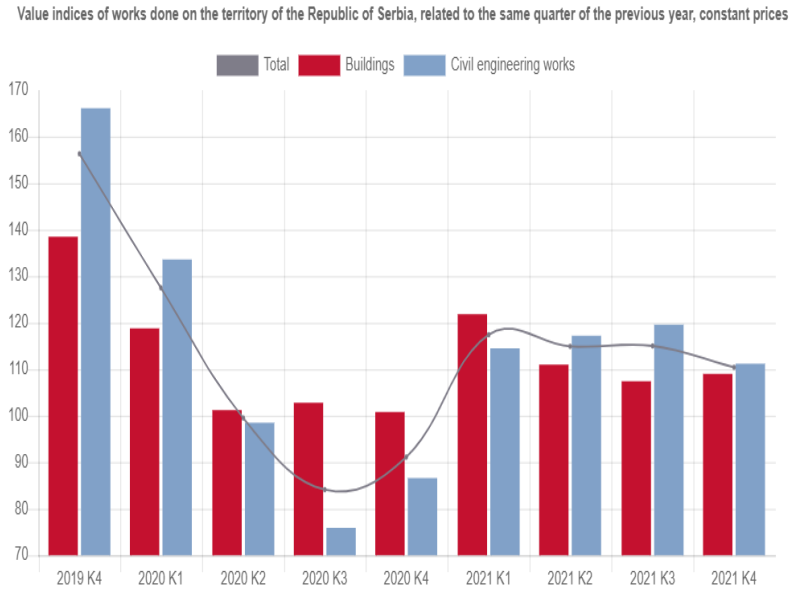

Figure 4.11. Comparison of indices of works done in Serbia 2021 with the same quarter of 2020

This can only confirm that the demand for construction materials will remain high in the years to come.

Last, but not least, potential users can be looked in the **oil industry**. According to the data from the Statistical Office of the Republic of Serbia, imports of oil and oil derivatives are constantly on the rise, with a steady growing trend. Viewed over the last 9 years, exports of oil and oil derivatives is also on the rise, but with a very mild growing trend. Below figure[36] demonstrates the change of exports and imports of oil and its derivatives in Serbia over the previous nine years.

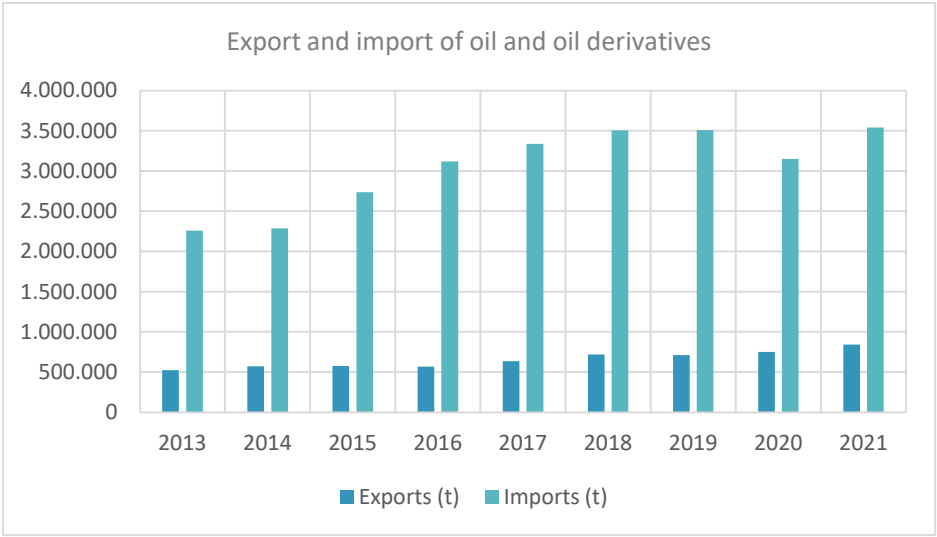

Figure 4.12. Exports and imports of oil and oil derivatives in Serbia

[36] Prepared on the basis of the data from the Statistical Office of the Republic of Serbia

Figure below[37] shows the quantities of exports and imports of oil and oil derivatives with the countries where most of exports/imports are destined to or originate from and which are suitable for transport by inland waterways due to a direct waterway links between Serbian and foreign ports.

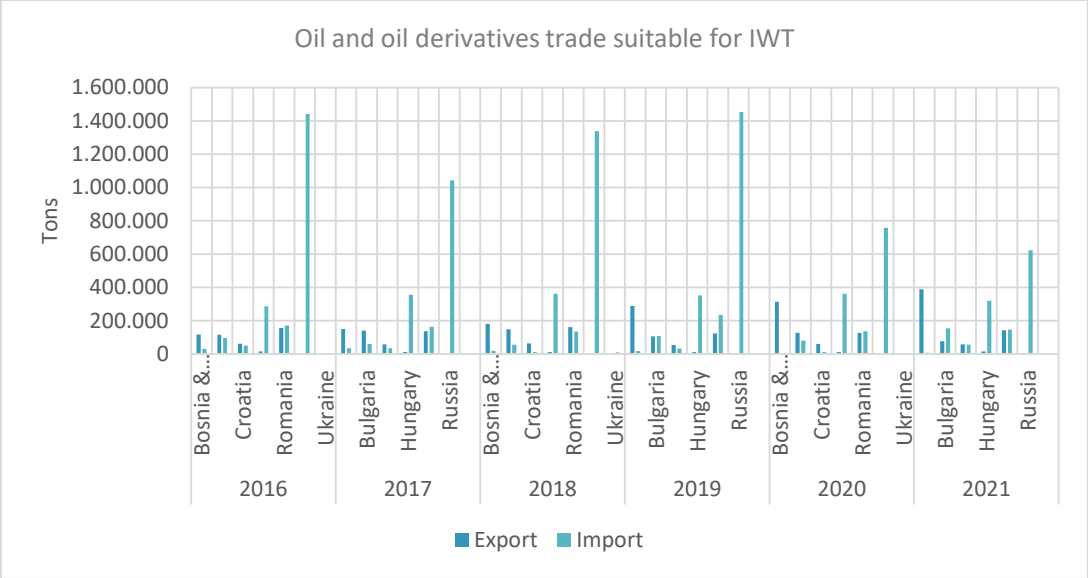

Figure 4.13. Oil and oil derivatives trade with countries suitable for transport by inland waterways

Considering the strategic plans of NIS (Oil Industry of Serbia – largest oil company in Serbia) development and preservation of the stability of the energy industry of the Republic of Serbia, it can be expected to have **oil and oil products** to be unloaded at the port of Bogojevo from domestic sources, while it is expected to be competitive in terms of purchase and transport price in relation to foreign sources. This, of course, can be done only if facilities for handling and storage of oil products are planned in the new, extended port.

Considering the pronounced agricultural production and the growth of the volume of production of the processing industry, it can be stated that there are needs of economic entities for oil and oil derivatives in the immediate hinterland of Bogojevo. In this view, the hinterland of Bogojevo is seen as a receptive area, that is, the final destination of the flows of this type of cargo.

Currently, the transport of these cargoes to the hinterland of the Port of Bogojevo is performed by road transport.

One of the possibilities for supplying the port's hinterland with petroleum products is the construction of an oil terminal for transshipment and storage of petroleum products transported primarily by barges. One of the reasons for considering the possibility of constructing an oil terminal is the advantage of inland waterway transport in terms of specific fuel consumption per ton of transported goods.

The statistical data of the Port Governance Agency, demonstrated that transshipment of oil and oil derivatives was recorded at 6 terminals on the Danube and 1 terminal on the Tisza River.

When assessing the size of the flows of petroleum products and transshipment of these cargoes in the port of Bogojevo, it is necessary to take into account the locations of oil industry plants in the Republic of Serbia and the region and the existing way of supplying the market.

[37] Ibid.

In the Republic of Serbia, oil refineries are located in Novi Sad, Belgrade and Pancevo, while in Šid there is a refinery "Victoria Oil" for the production of biodiesel. The starting points for the flow of oil and petroleum products in domestic transport on inland waterways can be refineries that have river terminals and storage capacities for this type of cargo, and these are currently the Oil Refinery in Novi Sad (NIS a.d.) and the Oil Refinery in Pančevo (NIS a.d.). 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 oil terminals in the region will become the starting points of international flows of this type of cargo to Bogojevo. For example, Hungarian oil company MOL, with its oil refinery and the capacity of the Danube oil terminal in Százhalombatta near Budapest, is present on the regional markets including Serbia.

4.7 Development Perspectives (Forecast scenarios)

The 25 years forecast (2022-2047) of the total volume of ship-to-shore (and vice-versa) transshipment in the Port of Bogojevo was made on the basis of partial estimates and forecasts using the analytical method of different growth rates, taking into account the following infrastructure and suprastructure additions to the port:

- new oil terminal completion in 2025, first cargo (oil derivatives) appearing in 2026,
- additional grain storage capacities planned by the current operator completion by the end of 2024, first quantities of additional cargoes appearing in 2025,
- new terminal for sand and gravel completion in 2025, although cargo operations for this cargo can be continued from the shore even at this moment,
- new quay for general cargo and containers completed by the end of 2025, first cargo flows appearing as of 2026.

As a general guidance, the forecasts for the Serbian GDP and export/import growth, prepared by the International Monetary Fund[38] were relied on.

Subject Descriptor	2019	2020	2021	2022	2023	2024	2025	2026
GDP	4.25%	-0.98%	6.54%	4.50%	4.50%	4.00%	4.05%	4.04%
Imports	9.81%	-0.25%	17.57%	6.57%	6.07%	5.57%	5.87%	5.87%
Exports	8.45%	-3.11%	24.04%	6.54%	5.54%	5.54%	5.54%	6.04%

Table 4.15. IMF analysis and forecast for the Serbian GDP and export/import growth

In order to engulf the widest possible scope of opportunities, the forecast will be done in two scenarios: Scenario 1 (minimalistic) and Scenario 2 (maximalist). For both scenarios, statistical data from 2021 have been used as a forecast basis.

In **Scenario 1**, the following assumptions and growth rates were adopted:

- **Fertilizers (import)**: in 2022, a drop of -20% is assumed, due to quotas[39] of grain exports introduced by the Government of the Republic of Serbia due to the Ukrainian crisis – these quotas

[38] International Monetary Fund, World Economic Outlook Database, October 2021, available at: https://www.imf.org/en/Countries/SRB#ataglance – last accessed 26 April 2022.

[39] https://www.politika.rs/scc/clanak/505406/Vlada-odobrila-kvote-za-izvoz-zitarica-brasna-i-ulja- last accessed 23 April 2022. The Serbian government approved quotas for the export of wheat, corn, flour and refined sunflower oil. This decision allows the export of 150,000 tons of wheat, 150,000 tons of corn and 20,000 tons of flour per month, while the monthly export quota for refined sunflower oil is 8,000,000 litres. Upon request, it will be possible to ask for permission to export a maximum of 20 percent of the approved quantities per group of products on a monthly basis.

(120,000 tons monthly as a maximum) are expected to cause less sowing in 2022 and therefore lower consumption of fertilizers; in 2023, assuming that the export quotas are abolished, the use of fertilizers is expected to rise immediately at a rate of 30% in 2023; in 2024, it is assumed that the import of fertilizers will have the same growth as IMF import forecast for Serbia, thereafter, in 2025 and 2026, a rise of 30% in each year is expected, due to the construction of additional storage facilities for fertilizers; in 2027 and 2028, it is expected that the growth goes back to approximately same estimate as for the import growth, that is, 6% annually. In 2030-2035, it is expected that the growth does not surpass 2% annually due to the gradual market saturation. Finally, in the period of 2036-2047, it is expected that the growth rate will be limited to 0.5% annually, as the maximum absorption rate of the agricultural producers will be more than 60% (estimated maximum absorption (demand) of the market in the port's hinterland is 90,000 tons per year).

- **Grains (import)**: since Serbia is largely an export country for grains, import of grains is mostly limited to special kinds of grains that are not sowed (in an observed year) in Serbia, such as rye, barley, buckwheat and similar. It is expected that the annual growth rate of import grains remains at 2% annually until 2025 (the year of construction of additional storage facilities) when a rise to 5% is expected. After that, a return to steady growth of 2% annually is expected until 2030, when a drop to 0.5% of growth is expected due to market saturation. It is estimated that the market in the hinterland could absorb up to 35,000 tons of imported grains.
- **Corn exports**: in 2022, it is expected that the export quotas cause a drop of -40% in corn exports compared to 2021. In 2023, it is expected that the quotas are abolished and that the growth will recover at a pace of 30% in 2023 and 20% in 2024. In 2025, when the new storage capacities are added, a growth of 40% in 2025 and 30% in 2026 is expected. In 2027, it is estimated that after the large growth, the annual change will be as low as 2%, while in 2028 and 2029 it is expected that the growth will be steady at 4%. As the throughput is closing to the maximum production capacities (estimated at 750,000 tons/year), the growth is expected to slow down to 3% in the period from 2030 to 2035 and, finally, to 2% annually in the period of 2036-2047.
- **Wheat exports**: in 2022, it is expected that the export quotas cause a drop of -40% in wheat exports compared to 2021. In 2023, it is expected that the quotas are abolished and that the growth will recover at a pace of 15% in 2023 and 10% in 2024. In 2025, when the new storage capacities are added, a growth of 40% in 2025, 30% in 2026 and 10% in 2027 is expected. In 2028 and 2029, it is estimated that after the large growth, the annual change will be as low as 2%. As the throughput is closing to the maximum production capacities (estimated at 75,000 tons/year), the growth is expected to slow down to 1.5% in the period from 2030 to 2035 and, finally, to 1% annually in the period of 2036-2047.
- **Barley exports**: Since the export of barley, at the moment, is not limited by governmental export quotas, it is estimated that the export of barley will be at the level of estimated general exports by IMF (6.54% in 2022 and 5.54% in 2023 and 2024 each). After that, the construction of new storage capacities is expected to trigger a growth of 40% in 2025 and 10% in 2026. After that, it is expected that the growth remains at 4% until 2030, when it is expected to drop down to 2% as of 2030 to 2035. Finally, the market saturation (maximum production estimated at 50,000 tons) will limit the annual growth to 0.5% from 2036 to 2047.
- **Oilseeds export (soy and soybean meal)**: Since the export of oilseeds, at the moment, is not limited by governmental export quotas, it is estimated that the export of barley will be at the level

In case exporters do not export or exceed the quantities approved, they will not be able to apply for the export permission the following month.

of 2% annually, until 2024. In 2025, the construction of new storage capacities is expected to trigger a growth of 20% in 2025 and 2026 each. The growth is estimated to drop down to 4% annually in the period 2027 to 2029, while in 2030-2035 it is expected to drop again to 1.5% and 1% in the period 2036-2047 due to market saturation and production limits (estimated at 75,000 for soy and soybean meal).

- **Oilseeds export (rapeseed)**: Since the export of oilseeds, at the moment, is not limited by governmental export quotas, it is estimated that the export of rapeseed will be at the level of 2% annually, until 2024. In 2025, the construction of new storage capacities is expected to trigger a growth of 20% in 2025 and 2026 each. From 2027, all the way to 2047, it is expected that the growth rate of rapeseed exports remains at 4%, matching the forecasted GDP. Maximum production capacities are estimated at 35,000 tons.
- **Oilseeds imports (all sorts)**: It is estimated that the growth of imports of oilseeds will remain around the forecasted GDP growth for Serbia from 2022 to 2024. In 2025 the construction of new storage capacities is expected to trigger a growth of 20%, as well as in 2026. From 2027 to 2035, it is expected that the growth is stabilized at 4% annually. Finally, from 2036 to 2047, the growth will be reduced to 1.5% annually, due to the approximation to the maximum absorption capacity of 25,000 tons, as estimated.
- **Liquid cargo (oil derivatives):** it is estimated that the two vessels per week will call the oil terminal in the extended Port of Bogojevo, during the 43 weeks of navigation. Each vessel is estimated to carry 1200 tons of oil derivatives. This gives 43 x 2 x 1200 = 103,800 tons per year in the starting year of 2026. After that, the growth will remain at 4% (following the GDP forecast) until 2036, when it is expected to drop down to 2% due to market saturation.
- **Natural aggregates (sand and gravel):** in this scenario, it is assumed that no sand and gravel will appear in the port until the sand and gravel terminal is constructed in 2024, when an estimated amount of 51,600 tons is expected. This quantity matches an estimated 2 calls per week of vessels of 600 tons, in 43 weeks of navigable period. Thereafter, it is estimated that the volumes will grow by 4% in 2025, dropping down to 2% from 2026 to 2030. After that, the growth will be 1% in the period 2030-2035, and 0.5% from 2036 to 2047.
- **General cargo (both import and export):** The completion of the infrastructure and suprastructure for general cargo and containers is expected in 2025, while the first amounts of cargo, estimated at 51,600 tons (25,800 tons in import and 25,800 tons in export) will appear from 2026. Thereafter, it is estimated that both import and export growth will be steady at 4% annually, largely matching the forecasted GDP growth.

Summary of the above analytics for **Scenario 1** is presented in the following table.

Cargo and trade	2022	2023	2024	2025	2026	2027	2028	2029	2030-2035	2036-2047
Fertilizers (import)	-20.00%	30%	5.57%	30.00%	30.00%	6.00%	6.00%	4.00%	2.00%	0.50%
Grains (import)	2.00%	2.00%	2.00%	5.00%	2.00%	2.00%	2.00%	2.00%	0.50%	0.50%
Export – Grains (corn)	-40.00%	30.00%	20.00%	40.00%	30.00%	2.00%	4.00%	4.00%	3.00%	2.00%
Export – Grains (wheat)	-40.00%	15.00%	10.00%	40.00%	30.00%	10.00%	2.00%	2.00%	1.50%	1.00%
Export – Grains (barley)	6.54%	5.54%	5.54%	40.00%	10.00%	4.00%	4.00%	4.00%	2.00%	0.50%
Export – Oilseeds (soy and soybean meal)	2.00%	2.00%	2.00%	20.00%	20.00%	2.00%	2.00%	2.00%	1.50%	1.00%
Export – Oilseeds (rapeseed)	4.00%	4.00%	4.00%	20.00%	20.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Oilseeds (import)	4.00%	4.00%	4.00%	40.00%	30.00%	4.00%	4.00%	4.00%	4.00%	1.50%
Liquid cargo (oil derivatives)						4.00%	4.00%	4.00%	4.00%	2.00%
Natural aggregates (sand and gravel) (unl.)				4.00%	2.00%	2.00%	2.00%	2.00%	1.00%	0.50%
General cargo (import)						4.00%	4.00%	4.00%	4.00%	4%
General cargo export						4.00%	4.00%	4.00%	4.00%	4.00%

Table 4.16. Assumptions and estimates of growth rates for different types of cargo in Scenario 1

Based on the above assumptions and estimates, the forecasts for the transshipment volumes in the Port of Bogojevo, for the period 2022-2047, **Scenario 1**, are given in continuation.

Cargo and trade	2022	2023	2024	2025	2026	2027	2028	2029
Fertilizers (import)	19,877	25,840	27,280	35,463	46,103	48,869	51,801	53,873
Grains (import)	2,440	2,489	2,538	2,665	2,719	2,773	2,828	2,885
Grains - corn (export)	107,852	140,207	168,249	235,548	306,213	312,337	324,831	337,824
Grains - wheat (export)	16,178	18,604	20,465	28,651	37,246	40,971	41,790	42,626
Grains - barley (export)	19,151	20,212	21,332	29,864	32,851	34,165	35,531	36,953
Oilseeds - soy and soybean meal (export)	10,721	10,935	11,154	13,385	16,062	16,383	16,710	17,045
Oilseeds - rapeseed (export)	4,685	4,872	5,067	6,080	7,296	7,588	7,892	8,207
Oilseeds (import)	1,068	1,111	1,155	1,617	2,103	2,187	2,274	2,365
Liquid bulk - oil derivatives (domestic)	0	0	0	0	103,200	107,328	111,621	116,086
Natural aggregates (domestic)	0	0	51,600	53,664	54,737	55,832	56,949	58,088
General cargo (import)	0	0	0	0	25,800	26,832	27,905	29,021
General cargo (export)	0	0	0	0	25,800	26,832	27,905	29,021
Total	**181,971**	**224,271**	**308,839**	**406,939**	**660,129**	**682,096**	**708,038**	**733,994**

Table 4.17. Forecasts of transport volumes in Scenario 1 (part 1/4)

Cargo and trade	2030	2031	2032	2033	2034	2035	2036	2037
Fertilizers (import)	54,950	56,049	57,170	58,314	59,480	60,670	60,973	61,278
Grains (import)	2,899	2,914	2,929	2,943	2,958	2,973	2,988	3,002
Grains - corn (export)	347,959	358,398	369,149	380,224	391,631	403,380	411,447	419,676
Grains - wheat (export)	43,265	43,914	44,573	45,242	45,920	46,609	47,075	47,546
Grains - barley (export)	37,692	38,445	39,214	39,999	40,799	41,615	41,823	42,032
Oilseeds - soy and soybean meal (export)	17,300	17,560	17,823	18,091	18,362	18,637	18,824	19,012
Oilseeds - rapeseed (export)	8,536	8,877	9,232	9,602	9,986	10,385	10,800	11,232
Oilseeds (import)	2,460	2,558	2,660	2,767	2,877	2,993	3,037	3,083
Liquid bulk - oil derivatives (domestic)	120,729	125,559	130,581	135,804	141,236	146,886	149,823	152,820
Natural aggregates (domestic)	58,669	59,255	59,848	60,446	61,051	61,661	61,970	62,279
General cargo (import)	30,182	31,390	32,645	33,951	35,309	36,721	38,190	39,718
General cargo (export)	30,182	31,390	32,645	33,951	35,309	36,721	38,190	39,718
Total	**754,824**	**776,309**	**798,471**	**821,332**	**844,917**	**869,250**	**885,141**	**901,397**

Table 4.18. Forecasts of transport volumes in Scenario 1 (part 2/4)

Cargo and trade	2038	2039	2040	2041	2042	2043	2044	2045
Fertilizers (import)	61,584	61,892	62,202	62,513	62,825	63,139	63,455	63,772
Grains (import)	3,017	3,033	3,048	3,063	3,078	3,094	3,109	3,125
Grains - corn (export)	428,070	436,631	445,364	454,271	463,356	472,623	482,076	491,717
Grains - wheat (export)	48,021	48,502	48,987	49,476	49,971	50,471	50,976	51,485
Grains - barley (export)	42,242	42,453	42,665	42,879	43,093	43,309	43,525	43,743
Oilseeds - soy and soybean meal (export)	19,202	19,394	19,588	19,784	19,982	20,182	20,383	20,587
Oilseeds - rapeseed (export)	11,682	12,149	12,635	13,140	13,666	14,213	14,781	15,372
Oilseeds (import)	3,129	3,176	3,224	3,272	3,321	3,371	3,422	3,473
Liquid bulk - oil derivatives (domestic)	155,876	158,994	162,174	165,417	168,726	172,100	175,542	179,053
Natural aggregates (domestic)	62,591	62,904	63,218	63,534	63,852	64,171	64,492	64,815
General cargo (import)	41,307	42,959	44,677	46,464	48,323	50,256	52,266	54,357
General cargo (export)	41,307	42,959	44,677	46,464	48,323	50,256	52,266	54,357
Total	**918,028**	**935,045**	**952,458**	**970,278**	**988,516**	**1,007,184**	**1,026,293**	**1,045,856**

Table 4.19. Forecasts of transport volumes in Scenario 1 (part 3/4)

Cargo and trade	2046	2047
Fertilizers (import)	64,091	64,412
Grains (import)	3,140	3,156
Grains - corn (export)	501,552	511,583
Grains - wheat (export)	52,000	52,520
Grains - barley (export)	43,961	44,181
Oilseeds - soy and soybean meal (export)	20,793	21,001
Oilseeds - rapeseed (export)	15,987	16,627
Oilseeds (import)	3,525	3,578
Liquid bulk - oil derivatives (domestic)	182,634	186,287
Natural aggregates (domestic)	65,139	65,464
General cargo (import)	56,531	58,792
General cargo (export)	56,531	58,792
Total	**1,065,885**	**1,086,393**

Table 4.20. Forecasts of transport volumes in Scenario 1 (part 4/4)

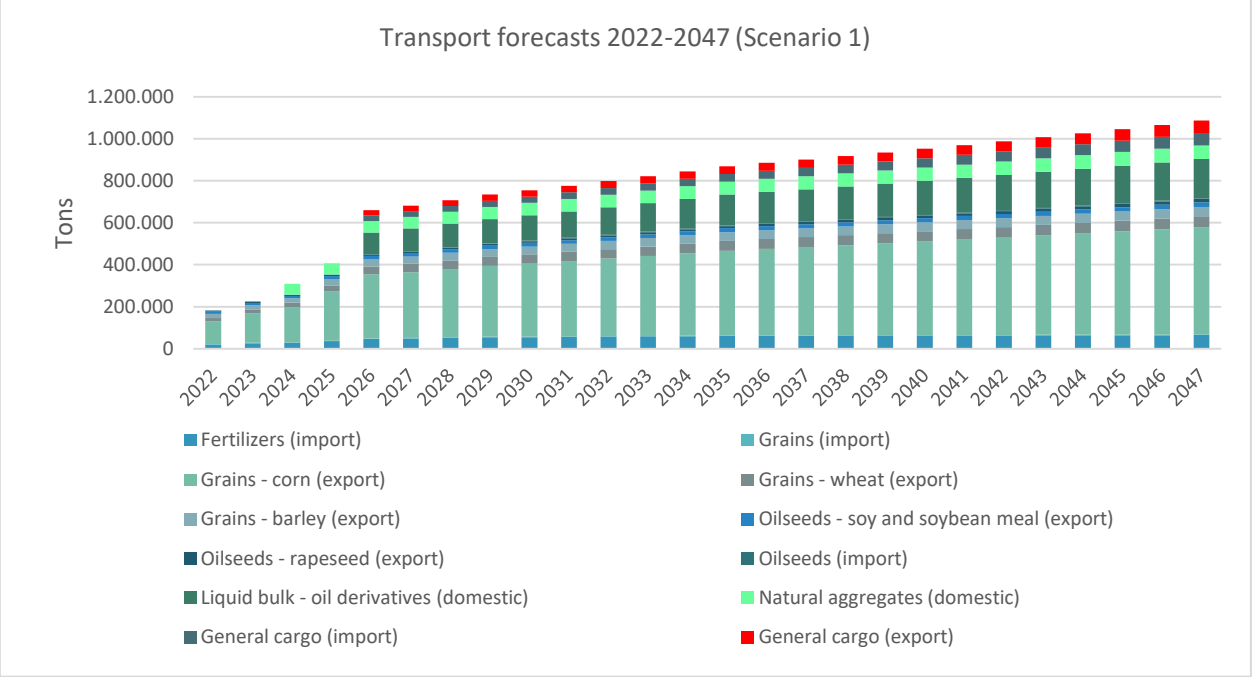

Figure 4.14. Forecasts of transport volumes in Scenario 1

The forecasted volumes are given in a different format in the summary table and figure below.

Cargo group and trade direction	Dry bulk (import)	Dry bulk (export)	Dry bulk (domestic)	General cargo (export)	General cargo (import)	Liquid bulk (domestic)	Total
2022	23,385	158,586	0	0	0	0	**181,971**
2023	29,440	194,831	0	0	0	0	**224,271**
2024	30,973	226,266	51,600	0	0	0	**308,839**
2025	39,746	313,529	53,664	0	0	0	**406,939**
2026	50,924	399,668	54,737	25,800	25,800	103,200	**660,129**
2027	53,828	411,444	55,832	26,832	26,832	107,328	**682,096**
2028	56,903	426,754	56,949	27,905	27,905	111,621	**708,038**
2029	59,123	442,655	58,088	29,021	29,021	116,086	**733,994**
2030	60,309	454,752	58,669	30,182	30,182	120,729	**754,824**
2031	61,521	467,194	59,255	31,390	31,390	125,559	**776,309**
2032	62,759	479,992	59,848	32,645	32,645	130,581	**798,471**
2033	64,024	493,156	60,446	33,951	33,951	135,804	**821,332**
2034	65,315	506,697	61,051	35,309	35,309	141,236	**844,917**
2035	66,635	520,626	61,661	36,721	36,721	146,886	**869,250**
2036	66,998	529,969	61,970	38,190	38,190	149,823	**885,141**
2037	67,363	539,498	62,279	39,718	39,718	152,820	**901,397**
2038	67,731	549,217	62,591	41,307	41,307	155,876	**918,028**
2039	68,101	559,129	62,904	42,959	42,959	158,994	**935,045**
2040	68,473	569,239	63,218	44,677	44,677	162,174	**952,458**
2041	68,848	579,550	63,534	46,464	46,464	165,417	**970,278**
2042	69,225	590,068	63,852	48,323	48,323	168,726	**988,516**
2043	69,604	600,797	64,171	50,256	50,256	172,100	**1,007,184**
2044	69,986	611,741	64,492	52,266	52,266	175,542	**1,026,293**
2045	70,370	622,905	64,815	54,357	54,357	179,053	**1,045,856**
2046	70,756	634,294	65,139	56,531	56,531	182,634	**1,065,885**
2047	71,146	645,912	65,464	58,792	58,792	186,287	**1,086,393**

Table 4.21. Forecasted transport volumes per cargo group and trade direction – Scenario 1

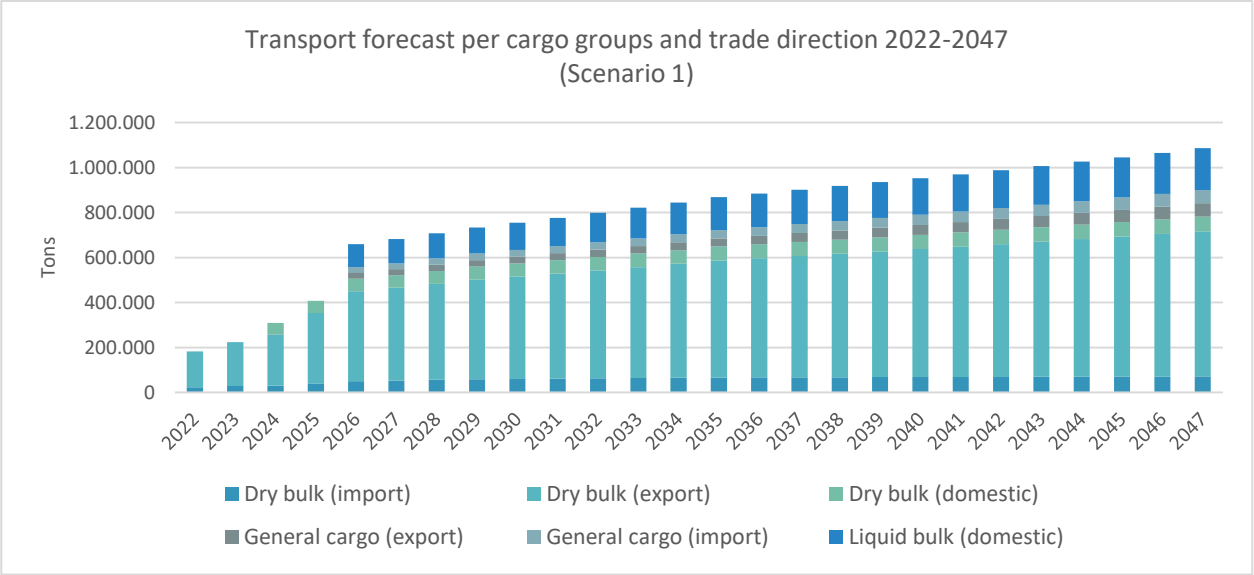

Figure 4.15. Forecasted transport volumes per cargo groups and trade direction – Scenario 1

In **Scenario 2**, the following assumptions and growth rates were adopted:

- **Fertilizers (import)**: in 2022, a drop of -10% is assumed, due to quotas[40] of grain exports introduced by the Government of the Republic of Serbia due to the Ukrainian crisis – these quotas (120,000 tons monthly as a maximum) are expected to cause less sowing in 2022 and therefore lower consumption of fertilizers; in 2023, assuming that the export quotas are abolished, the use of fertilizers is expected to rise immediately at a rate of 6.07% in 2023, matching import growth forecasts of the IMF for Serbia; in 2024, it is assumed that the import of fertilizers will have the same growth as IMF import forecast for Serbia, thereafter, in 2025 and 2026, a rise of 40% and 30%, respectively, is expected, due to the construction of additional storage facilities for fertilizers; in 2027 and 2028, it is expected that the growth reaches 10% in each year, dropping down to 4% in 2029. In 2030-2035, it is expected that the growth does not surpass 2% annually due to the gradual market saturation. Finally, in the period of 2036-2047, it is expected that the growth rate will be limited to 1% annually, as the maximum absorption rate of the agricultural producers will be more than 60% (estimated maximum absorption (demand) of the market in the port's hinterland is 90,000 tons per year).
- **Grains (import)**: since Serbia is largely an export country for grains, import of grains is mostly limited to special kinds of grains that are not sowed (in an observed year) in Serbia, such as rye, barley, buckwheat and similar. It is expected that the annual growth rate of import grains remains at 2% annually until 2025 (the year of construction of additional storage facilities) when a rise to 6% is expected. After that, a return to steady growth of 2% annually is expected until 2029. In 2030 a

[40] https://www.politika.rs/scc/clanak/505406/Vlada-odobrila-kvote-za-izvoz-zitarica-brasna-i-ulja - last accessed 23 April 2022. The Serbian government approved quotas for the export of wheat, corn, flour and refined sunflower oil. This decision allows the export of 150,000 tons of wheat, 150,000 tons of corn and 20,000 tons of flour per month, while the monthly export quota for refined sunflower oil is 8,000,000 litres. Upon request, it will be possible to ask for permission to export a maximum of 20 percent of the approved quantities per group of products on a monthly basis. In case exporters do not export or exceed the quantities approved, they will not be able to apply for the export permission the following month.

drop to 1% of growth is expected due to market saturation. It is estimated that the market in the hinterland could absorb up to 35,000 tons of imported grains.

- **Corn exports**: in 2022, it is expected that the export quotas cause a less significant drop of -20% in corn exports compared to 2021. In 2023, it is expected that the quotas are abolished and that the growth will recover at a pace of 20% in 2023 and 15% in 2024. In 2025, when the new storage capacities are added, a growth of 40% in 2025 and 30% in 2026 is expected. In 2027-2029, it is estimated that after the large growth, the annual change will stabilize at 4%. As the throughput is closing to the maximum production capacities (estimated at 750,000 tons/year), the growth is expected to slow down to 4% in the period from 2030 to 2035 and, finally, to 2% annually in the period of 2036-2047.
- **Wheat exports**: in 2022, it is expected that the export quotas cause a drop of -20% in wheat exports compared to 2021. In 2023, it is expected that the quotas are abolished and that the growth will recover at a pace of 15% in 2023 and 10% in 2024. In 2025, when the new storage capacities are added, a growth of 40% in 2025, 30% in 2026 and 20% in 2027 is expected. In 2028 and 2029, it is estimated that after the large growth, the annual change will be at 4%. As the throughput is closing to the maximum production capacities (estimated at 75,000 tons/year), the growth is expected to slow down to 0.5% in the period from 2030 to 2047.
- **Barley exports**: Since the export of barley, at the moment, is not limited by governmental export quotas, it is estimated that the export of barley will be at the level of estimated general exports by IMF (6.54% in 2022 and 5.54% in 2023 and 2024 each). After that, the construction of new storage capacities is expected to trigger a growth of 50% in 2025 and 50% in 2026. After that, it is expected that the growth remains at 4% from 2027 to 2029, when it is expected to drop down to 3% as of 2030 to 2035. Finally, the market saturation (maximum production estimated at 50,000 tons) will limit the annual growth to 0.5% from 2036 to 2047.
- **Oilseeds export (soy and soybean meal)**: Since the export of oilseeds, at the moment, is not limited by governmental export quotas, it is estimated that the export of barley will be 3% in 2022, 4% in 2023 and 2% in 2024. In 2025, the construction of new storage capacities is expected to trigger a growth of 30% in 2025 and 20% in 2026. The growth is estimated to drop down to 2% annually in the period 2027 to 2029, while in 2030-2035 it is expected to drop again to 1.5% and 1% in the period 2036-2047 due to market saturation and production limits (estimated at 75,000 for soy and soybean meal).
- **Oilseeds export (rapeseed)**: Since the export of oilseeds, at the moment, is not limited by governmental export quotas, it is estimated that the export of rapeseed will be 4% in 2022, rising to 8% in 2023 and going back to 4% in 2024. In 2025, the construction of new storage capacities is expected to trigger a growth of 20% in 2025 and 2026 each. From 2027, all the way to 2047, it is expected that the growth rate of rapeseed exports remains at 4% as in Scenario 1, matching the forecasted GDP. Maximum production capacities are estimated at 35,000 tons.
- **Oilseeds imports (all sorts)**: It is estimated that the growth of imports of oilseeds will remain at 4% from 2022 to 2024. In 2025 the construction of new storage capacities is expected to trigger a growth of 40%, and 30% in 2026. From 2027 to 2035, it is expected that the growth is stabilized at 4% annually. Finally, from 2036 to 2047, the growth will be reduced to 1.5% annually, due to the approximation to the maximum absorption capacity of 25,000 tons, as estimated.
- **Liquid cargo (oil derivatives):** it is estimated that the two vessels per week will call the oil terminal in the extended Port of Bogojevo, during the 43 weeks of navigation. Each vessel is estimated to carry 1200 tons of oil derivatives. This gives 43 x 2 x 1200 = 103,800 tons per year in the starting year of 2026. After that, the growth will remain at 4% (following the GDP forecast) until 2036, when

it is expected to drop down to 2% due to market saturation. In this case, Scenario 1 and 2 are the same.

- **Natural aggregates (sand and gravel):** in this scenario, it is assumed that sand and gravel will appear in the port already in 2022, with an estimated amount of 51,600 tons. This quantity matches an estimated 2 calls per week of vessels of 600 tons, in 43 weeks of navigable period. Thereafter, it is estimated that the volumes will grow by 4% until 2025, dropping down to 2% from 2026 to 2030 since the demand will be lower due to the completion of infrastructure works in the port. After that, the growth will be 1% in the period 2030-2035, and 0.5% from 2036 to 2047.
- **General cargo (import):** The completion of the infrastructure and suprastructure for general cargo (that can appear in containers) is expected in 2025, while the first amounts of cargo, estimated at 25,800 tons will appear from 2026. This quantity is estimated assuming that one vessel of 1200 tons of general cargo will call every two weeks during the 43 weeks of navigational period. Thereafter, it is estimated that both import growth will be steady at 4% annually, largely matching the forecasted GDP growth. This general cargo encompasses mostly various break-bulk cargo, packaged and unpackaged goods, cargo suitable for containerization, and, above all, products of the food processing industry.
- **General cargo (export):** similar to the above, with the difference of annual growths, which reaches 6% until 2029, and 5% from 2030 to 2047. Cargo types and packaging are the same as for the general cargo in import.
- **Grains (transit from HR):** it is expected that this cargo share remains at maximum 5% of the total grain exports, throughout the entire forecast period.
- **Oilseeds (transit from HR):** it is expected that this cargo reaches 5% of the total oilseed exports, throughout the entire forecast period.
- **General cargo (transit from HR):** it is expected that cargo from this direction starts appearing as of 2025 (completion of general and container terminal facilities) and remains at the level of 10% of general cargo in export throughout the entire forecast period.
- **Fertilizers (transit to HR):** it is expected that these volumes to Croatia reach 20% of import fertilizers for the entire period to 2047.
- **General cargo (transit to HR):** it is expected that the volumes of this cargo remain at 10% of all general cargo in import.

Summary of the above analytics in **Scenario 2** is presented in the following table.

Cargo	2022	2023	2024	2025	2026	2027	2028	2029	2030-2035	2036-2047
Fertilizers (import)	-10.00%	6.07%	5.57%	40.00%	30.00%	10.00%	10.00%	4.00%	2.00%	1.00%
Grains (import)	2.00%	2.00%	2.00%	6.00%	2.00%	2.00%	2.00%	2.00%	1.00%	1.00%
Export – Grains (corn)	-20.00%	20.00%	15.00%	40.00%	30.00%	6.00%	6.00%	6.00%	4.00%	2.00%
Export – Grains (wheat)	-20.00%	15.00%	10.00%	40.00%	30.00%	20.00%	4.00%	4.00%	0.50%	0.50%
Export – Grains (barley)	6.54%	5.54%	5.54%	50.00%	50.00%	4.00%	4.00%	4.00%	3.00%	0.50%
Export – Oilseeds (soy and soybean meal)	3.00%	4.00%	2.00%	30.00%	20.00%	2.00%	2.00%	2.00%	1.50%	1.00%
Export – Oilseeds (rapeseed)	4.00%	8.00%	4.00%	20.00%	20.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Oilseeds (import)	4.00%	4.00%	4.00%	40.00%	30.00%	4.00%	4.00%	4.00%	4.00%	1.50%
Liquid cargo (oil derivatives)						4.00%	4.00%	4.00%	4.00%	2.00%
Natural aggregates (sand and gravel) (unl.)		4.00%	4.00%	4.00%	2.00%	2.00%	2.00%	2.00%	1.00%	0.50%
General cargo (import)						4.00%	4.00%	4.00%	4.00%	4.00%
General cargo (export)[41]						6.00%	6.00%	6.00%	5.00%	5.00%
Grains (transit from HR)										
Oilseeds (transit from HR)										
General cargo (transit from HR)										
Fertilizers (transit to HR)										
General cargo (transit to HR)										

Table 4.22. Assumptions and estimates of growth rates for different types of cargo in Scenario 2

Based on the above assumptions and estimates, the forecast for the transshipment volumes in the Port of Bogojevo, for the period 2022-2047, **Scenario 2**, are given in continuation.

Cargo and trade direction	2022	2023	2024	2025	2026	2027	2028	2029
Fertilizers (import)	22,362	23,719	25,040	35,056	45,573	50,131	55,144	57,350
Grains (import)	2,440	2,489	2,538	2,691	2,745	2,799	2,855	2,913
Grains - corn (export)	143,803	172,563	198,447	277,826	361,174	382,845	405,816	430,164
Grains - wheat (export)	21,570	24,806	27,287	38,201	49,661	59,594	61,978	64,457
Grains - barley (export)	19,151	20,212	21,332	31,997	47,996	49,916	50,000	50,000
Oilseeds - soy and soybean meal (export)	10,826	11,259	11,484	14,929	17,915	18,273	18,639	19,012
Oilseeds - rapeseed (export)	4,685	5,059	5,262	6,314	7,577	7,880	8,195	8,523
Oilseeds (import)	1,068	1,111	1,155	1,617	2,103	2,187	2,274	2,365
Liquid bulk - oil derivatives (domestic)	0	0	0	0	103,200	107,328	111,621	116,086
Natural aggregates (domestic)	51,600	53,664	55,811	58,043	59,204	60,388	61,596	62,828
General cargo (import)	0	0	0	0	25,800	26,832	27,905	29,021
General cargo (export)	0	0	0	0	25,800	27,348	28,989	30,728
Grains (transit from HR)	0	0	0	17,401	22,942	24,618	25,890	27,231
Oilseeds (transit from HR)	0	0	0	1,062	1,275	1,308	1,342	1,377
General cargo (transit from HR)	0	0	0	0	2,580	2,735	2,899	3,073
Fertilizers (transit to HR)	0	0	0	7,011	9,115	10,026	11,029	11,470
General cargo (transit to HR)	0	0	0	0	2,580	2,683	2,791	2,902
Total	277,504	314,882	348,356	492,151	787,239	836,890	878,961	919,499

Table 4.23. Forecasts of transport volumes in Scenario 2 (part 1/4)

[41] For all empty cells, please see the explanations above the table.

Cargo and trade direction	2030	2031	2032	2033	2034	2035	2036	2037
Fertilizers (import)	58,497	59,666	60,860	62,077	63,319	64,585	65,231	65,883
Grains (import)	2,942	2,971	3,001	3,031	3,061	3,092	3,123	3,154
Grains - corn (export)	447,371	465,266	483,877	503,232	523,361	544,295	555,181	566,285
Grains - wheat (export)	64,779	65,103	65,428	65,755	66,084	66,415	66,747	67,080
Grains - barley (export)	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Oilseeds - soy and soybean meal (export)	19,297	19,586	19,880	20,178	20,481	20,788	20,996	21,206
Oilseeds - rapeseed (export)	8,864	9,219	9,587	9,971	10,370	10,784	11,216	11,665
Oilseeds (import)	2,460	2,558	2,660	2,767	2,877	2,993	3,037	3,083
Liquid bulk - oil derivatives (domestic)	120,729	125,559	130,581	135,804	141,236	146,886	149,823	152,820
Natural aggregates (domestic)	63,456	64,090	64,731	65,379	66,032	66,693	67,026	67,361
General cargo (import)	30,182	31,390	32,645	33,951	35,309	36,721	38,190	39,718
General cargo (export)	32,265	33,878	35,572	37,350	39,218	41,179	43,238	45,400
Grains (transit from HR)	28,107	29,018	29,965	30,949	31,972	33,035	33,596	34,168
Oilseeds (transit from HR)	1,408	1,440	1,473	1,507	1,543	1,579	1,611	1,644
General cargo (transit from HR)	3,226	3,388	3,557	3,735	3,922	4,118	4,324	4,540
Fertilizers (transit to HR)	11,699	11,933	12,172	12,415	12,664	12,917	13,046	13,177
General cargo (transit to HR)	3,018	3,139	3,265	3,395	3,531	3,672	3,819	3,972
Total	948,300	978,204	1,009,255	1,041,497	1,074,980	1,109,752	1,130,204	1,151,155

Table 4.24. Forecasts of transport volumes in Scenario 2 (part 2/4)

Cargo and trade direction	2038	2039	2040	2041	2042	2043	2044	2045
Fertilizers (import)	66,542	67,207	67,879	68,558	69,244	69,936	70,636	71,342
Grains (import)	3,185	3,217	3,249	3,282	3,315	3,348	3,381	3,415
Grains - corn (export)	577,610	589,163	600,946	612,965	625,224	637,729	650,483	663,493
Grains - wheat (export)	67,416	67,753	68,092	68,432	68,774	69,118	69,464	69,811
Grains - barley (export)	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Oilseeds - soy and soybean meal (export)	21,418	21,632	21,849	22,067	22,288	22,511	22,736	22,963
Oilseeds - rapeseed (export)	12,131	12,616	13,121	13,646	14,192	14,759	15,350	15,964
Oilseeds (import)	3,129	3,176	3,224	3,272	3,321	3,371	3,422	3,473
Liquid bulk - oil derivatives (domestic)	155,876	158,994	162,174	165,417	168,726	172,100	175,542	179,053
Natural aggregates (domestic)	67,698	68,037	68,377	68,719	69,062	69,408	69,755	70,103
General cargo (import)	41,307	42,959	44,677	46,464	48,323	50,256	52,266	54,357
General cargo (export)	47,670	50,053	52,556	55,183	57,943	60,840	63,882	67,076
Grains (transit from HR)	34,751	35,346	35,952	36,570	37,200	37,842	38,497	39,165
Oilseeds (transit from HR)	1,677	1,712	1,748	1,786	1,824	1,863	1,904	1,946
General cargo (transit from HR)	4,767	5,005	5,256	5,518	5,794	6,084	6,388	6,708
Fertilizers (transit to HR)	13,308	13,441	13,576	13,712	13,849	13,987	14,127	14,268
General cargo (transit to HR)	4,131	4,296	4,468	4,646	4,832	5,026	5,227	5,436
Total	1,172,617	1,194,608	1,217,143	1,240,238	1,263,910	1,288,178	1,313,059	1,338,573

Table 4.25. Forecasts of transport volumes in Scenario 2 (part 3/4)

Cargo and trade direction	2046	2047
Fertilizers (import)	72,055	72,776
Grains (import)	3,449	3,484
Grains - corn (export)	676,763	690,298
Grains - wheat (export)	70,160	70,511
Grains - barley (export)	50,000	50,000
Oilseeds - soy and soybean meal (export)	23,193	23,425
Oilseeds - rapeseed (export)	16,602	17,266
Oilseeds (import)	3,525	3,578
Liquid bulk - oil derivatives (domestic)	182,634	186,287
Natural aggregates (domestic)	70,454	70,806
General cargo (import)	56,531	58,792
General cargo (export)	70,430	73,951
Grains (transit from HR)	39,846	40,540
Oilseeds (transit from HR)	1,990	2,035
General cargo (transit from HR)	7,043	7,395
Fertilizers (transit to HR)	14,411	14,555
General cargo (transit to HR)	5,653	5,879
Total	1,364,739	1,391,578

Table 4.26. Forecasts of transport volumes in Scenario 2 (part 4/4)

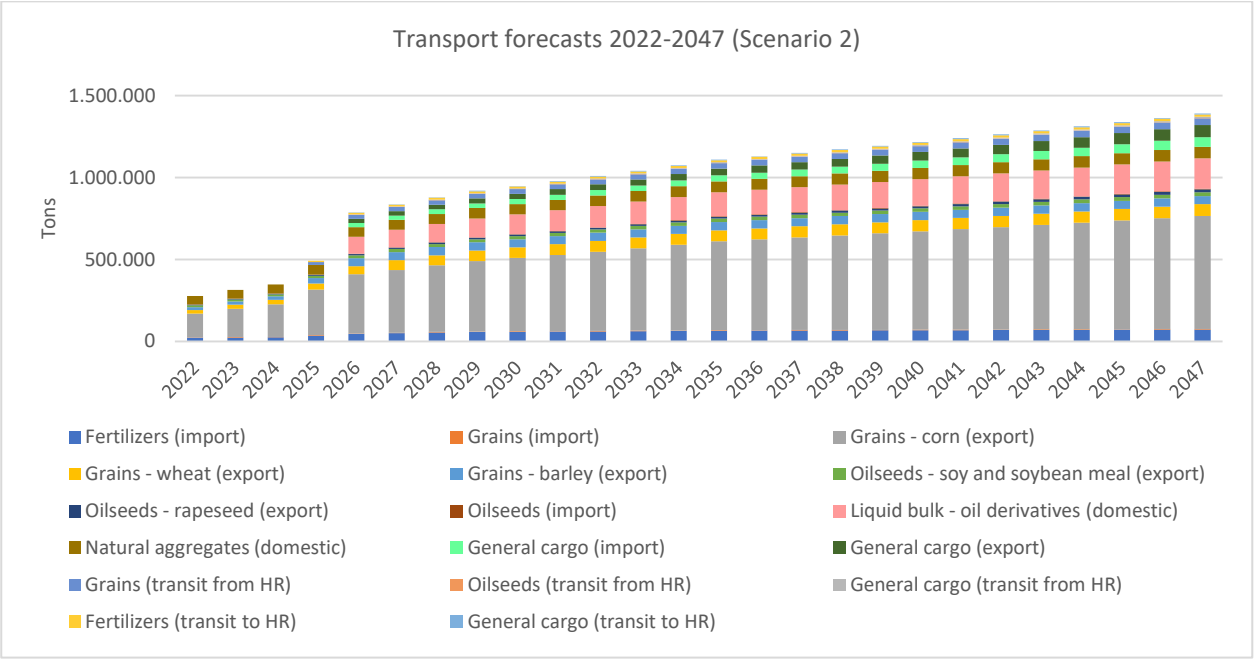

Figure 4.16. Forecasts of transport volumes in Scenario 2

The forecasted volumes are given in a different format in the summary table and figure below.

Cargo group and trade direction	Dry bulk (import)	Dry bulk (export)	Dry bulk (domestic)	General cargo (export)	General cargo (import)	Liquid bulk (domestic)	Dry bulk (transit)	General cargo (transit)	Total
2022	25,870	200,034	51,600	0	0	0	0	0	277,504
2023	27,319	233,899	53,664	0	0	0	0	0	314,882
2024	28,734	263,811	55,811	0	0	0	0	0	348,356
2025	39,364	369,268	58,043	0	0	0	25,475	0	492,151
2026	50,420	484,324	59,204	25,800	25,800	103,200	33,331	5,160	787,239
2027	55,117	518,508	60,388	27,348	26,832	107,328	35,952	5,418	836,890
2028	60,273	544,627	61,596	28,989	27,905	111,621	38,260	5,689	878,961
2029	62,627	572,156	62,828	30,728	29,021	116,086	40,078	5,975	919,499
2030	63,898	590,311	63,456	32,265	30,182	120,729	41,215	6,245	948,300
2031	65,196	609,174	64,090	33,878	31,390	125,559	42,392	6,527	978,204
2032	66,521	628,772	64,731	35,572	32,645	130,581	43,611	6,822	1,009,255
2033	67,875	649,136	65,379	37,350	33,951	135,804	44,872	7,130	1,041,497
2034	69,257	670,296	66,032	39,218	35,309	141,236	46,178	7,453	1,074,980
2035	70,669	692,283	66,693	41,179	36,721	146,886	47,531	7,790	1,109,752
2036	71,391	704,140	67,026	43,238	38,190	149,823	48,253	8,143	1,130,204
2037	72,120	716,236	67,361	45,400	39,718	152,820	48,988	8,512	1,151,155
2038	72,856	728,575	67,698	47,670	41,307	155,876	49,737	8,898	1,172,617
2039	73,601	741,164	68,037	50,053	42,959	158,994	50,500	9,301	1,194,608
2040	74,353	754,007	68,377	52,556	44,677	162,174	51,276	9,723	1,217,143
2041	75,112	767,110	68,719	55,183	46,464	165,417	52,067	10,165	1,240,238
2042	75,880	780,478	69,062	57,943	48,323	168,726	52,873	10,627	1,263,910
2043	76,655	794,117	69,408	60,840	50,256	172,100	53,693	11,110	1,288,178
2044	77,439	808,032	69,755	63,882	52,266	175,542	54,529	11,615	1,313,059
2045	78,230	822,231	70,103	67,076	54,357	179,053	55,380	12,143	1,338,573
2046	79,030	836,718	70,454	70,430	56,531	182,634	56,247	12,696	1,364,739
2047	79,838	851,500	70,806	73,951	58,792	186,287	57,130	13,274	1,391,578

Table 4.27. Forecasted transport volumes per cargo group and trade direction – Scenario 2

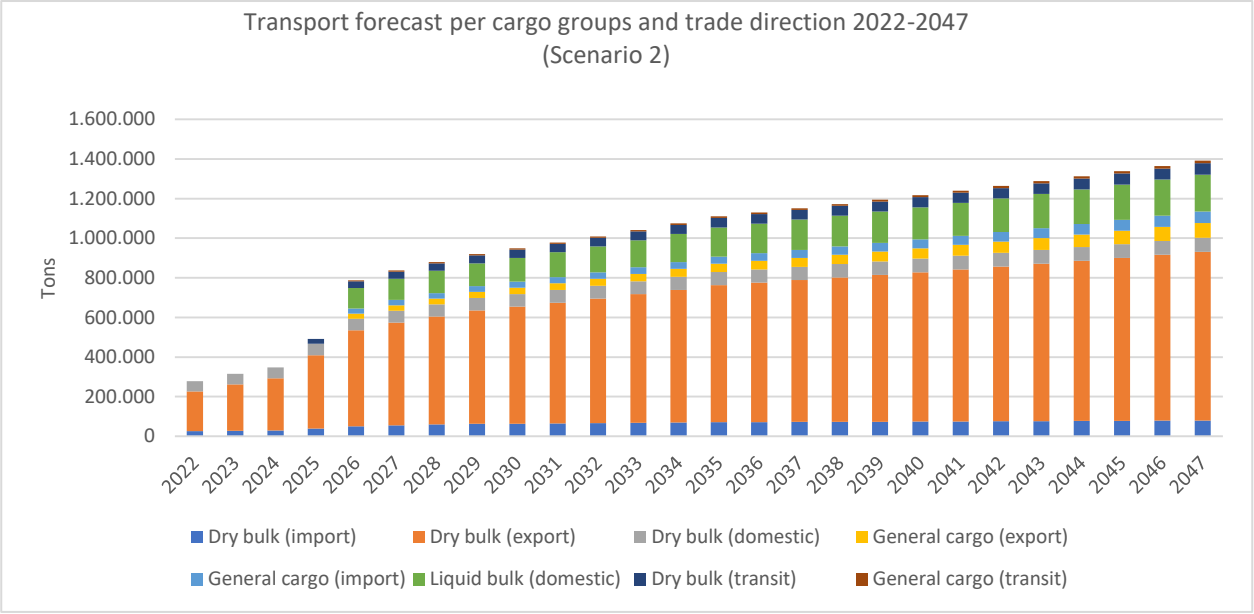

Figure 4.17. Forecasted transport volumes per cargo groups and trade direction – Scenario 2

Summarizing, the maximum cargo volume, at the end of the forecast period in 2047, reaches 1,086,393 tons in Scenario 1 and 1,391,578 tons in Scenario 2.

5 THE ASSESSMENT OF THE RELEVANT SPATIAL DEVELOPMENT PLANS

5.1 The Detailed regulation plan of the Bogojevo port

The expansion of the existing port by construction of a new port capacities is determined by the Detailed regulation plan of the Bogojevo port („Official gazette of Odžaci municipality“ no.4/21).

The planning basis for completion of the above mentioned Detailed regulation plan of the Bogojevo port are contained in the following higher ranged documents:

The Spatial plan of special purpose areas for international inland water way E-80 Danube (Paneuropean corridor VII) („Official gazette of the Republic of Serbia“, no. 14/15),

The Spatial plan of the Odžaci municipality („Official gazette of Odžaci municipality“ no.11/11 and 12/11) and

The General regulation plan for the Cargo-transport center in Bogojevo („Official gazette of Odžaci municipality. No. 18/10).

The existing Detailed regulation plan of the Bogojevo port (further on: „Plan“) is treated as relevant for this study.

Figure 5.1.Determination of port area in Bogojevo[42]

The existing port area defined by the Decree on Determination the port area of the Port of Bogojevo („Official gazette of the Republic of Serbia“ no. 1/20) covers cadastral parcels no. 2047,2048 and 3115 in cadastral municipality Bogojevo, 9,05 ha surface area, whereas „Plan“ foresee the port area extension for additional 9,52 ha, coming to the total of 18,57 ha.

[42](„Official gazette of the Republic of Serbia“ no. 1/20)

Except for the port aquatorium and the coastal basin port, it is planned to form the operational coast with vertical and slantindicular quay walls together with industrial rail tracks and other facilities needed for port infrastructure and suprastructure.

Within the port capacity extension in Bogojevo, it is planned to construct new grain and oil plants silos, mineral fertilizer warehouse and outdoor and indoor storage facilities for bulk cargo (gravel and sand) and general purpose cargo.

The growing trend of the increase of the container transport on international level (especially grain) caused the need for a construction of a lower capacity container terminal. The recognized need of shipping companies and overall economy for crude oil and oil products also influenced planning of the liquid cargo terminal.

Within the scope of the traffic infrastructure it is planned to construct industrial rail tracks and their connection with national rail infrastructure. The internal traffic lines, manipulative area and parking lot for trucks, tank trucks and automobiles are planned as well.

The special advantage of this port will be its tendency to specialize in reloading and storage of grains, oil plants and other agricultural products and mineral fertilizers.

The facilities of the Bogojevo port planned at port area are as follows:

The Territory:

- Port terminals;
- Operational coast with vertical and slantindicular quay walls and industrial rail tracks;
- Internal traffic network, traffic and manipulative areas and plateau.

The Aquatorium:

- Basin;
- Access waterway;
- Pier – pontoon.

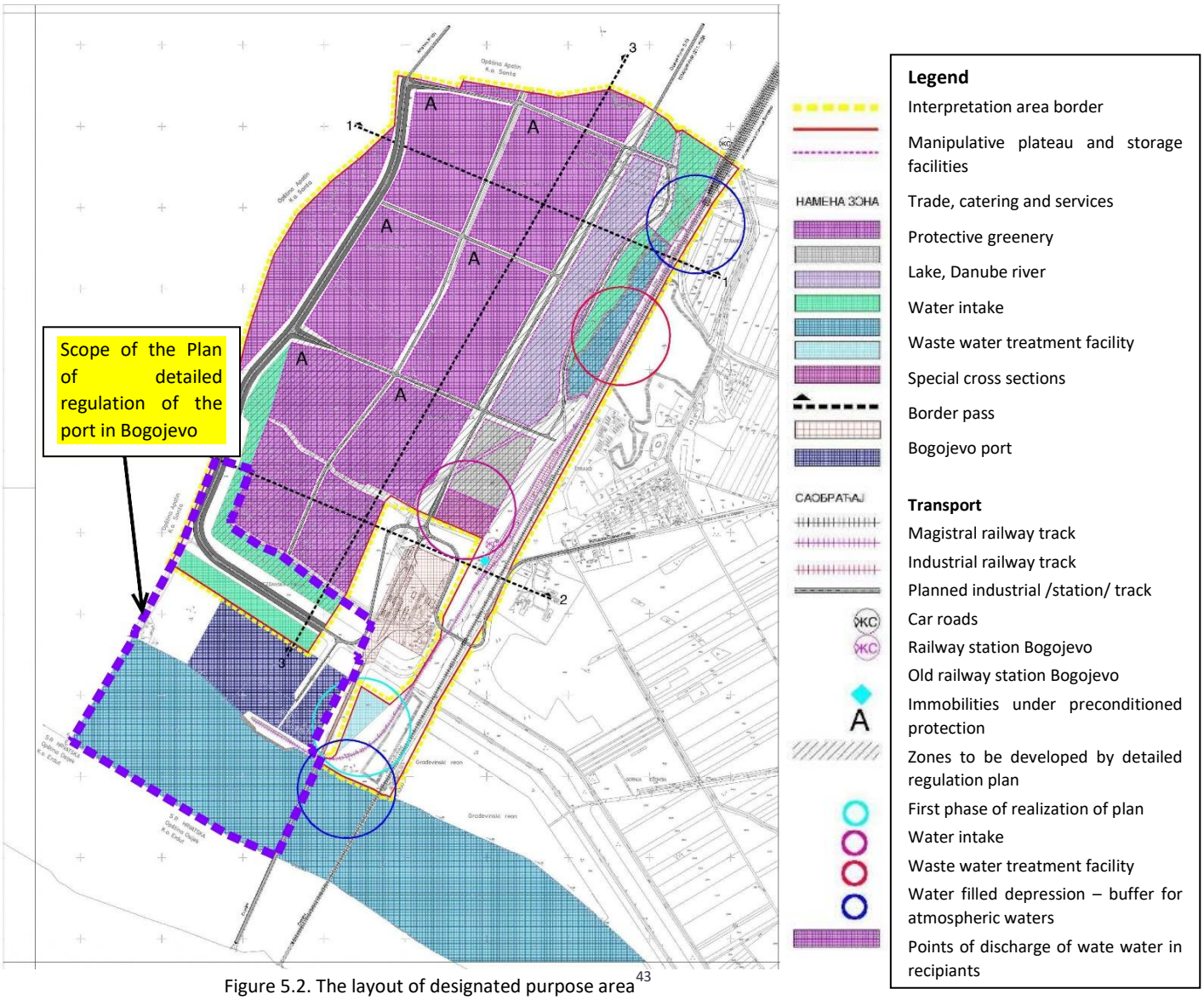

Figure 5.2. The layout of designated purpose area[43]

5.2 The zone of port area

Only a small portion of the designated port area in Bogojevo has been constructed. The existing facilities within the port (management building, silos, warehouses as well as auxiliary and infrastructure facilities) will keep functioning, with possible reconstruction, upgrading, remediation and adaptation.

In the unbuilt part of the port area, within planned expansion, the construction of new facilities is foreseen for an increased port functioning. The new management building is planned near the main port entrance, which will contain management and administrative space and business area designated for the port operators, but also office space needed for custom services, border police and competent inspection agencies. In the vicinity of this building, the two big multipurpose warehouses are planned to be

[43]The Detailed regulation plan of the Bogojevo port („Official gazette of Odžaci municipality“ no.4/21).

constructed. In addition to the existing indoor warehouses, „Plan“ foresee the construction of a new mineral fertilizers and agriculture products storage facilities.

The new silo for oil plants with auxiliary facilities and necessary equipment is planned to be constructed near existing grain silo. Within the terminal for liquid cargo, close to the commanding building, a four (4) liquid cargo tanks with capacity of 4 x 4000 m3 are planned.

The port functioning provides a whole set of auxiliary and infrastructure facilities, in addition top afore mentioned business and storage facilities, are planned: guardhouses, weighbridge, garages, fuel and energy source tanks, electric current substation, measurement and regulation stations, pumping-generation facilities, wells, hydrants, separators and waste water treatment facilities and so on.

Within the scope of port area, aside from basic activities and suprastructure and infrastructure facilities, it will be possible to add facilities for compatible activities which are not related directly to the port operations, such as business operations, logistics, services, maintenance facilities, workshops etc.)

The following terminal are planned with the zone of port area:

- Container terminal;
- General purpose cargo and bulk cargo terminal;
- Liquid cargo terminal.

A big outdoor storage facility is added to planned indoor warehouse for mineral fertilizers and agricultural products.

Figure 5.3. The detailed layout of facilities in designated area[44]

5.2.1 The container terminal

The port container terminal is specially planned to be constructed and equipped for loading/unloading/reloading of ISO6 containers by direct or indirect manipulation between ships and inland transportation means (road, railway).

For the purpose of constructing the container terminal within the port area in Bogojevo, the corresponding infrastructure and suprastructure at the area of app. 0,7 ha is planned. This terminal leans on the operational coast – vertical quay app. 120 m long.

[44]The Detailed regulation plan of the Bogojevo port („Official gazette of Odžaci municipality“ no.4/21).

5.2.2 The general-purpose cargo and bulk cargo terminal

For the purpose of reloading and storage of general-purpose cargo and bulk cargo (mainly gravel and sand) needed for construction industry, as well as other bulk cargo which are not influenced by atmospheric conditions (the storage facilities being outdoor), the total area of around 1,3 ha is planned. This terminal leans on the operational coast 110 m long. It is possible to set the equipment for the separation of gravel and sand.

5.2.3 The liquid cargo terminal

All modern port complexes, in addition to other activities, enable the forming of capacities to load, storage and manipulation (reloading ship-storage tanks, storage tanks-truck tanks, storage tanks-railroad tanks, and internal loading between the storage tanks) of liquid cargo (crude oil and oil derivates) providing maximum compliance with existing environmental regulations and standards. Within the basin part of the port and at the part of the operational coast, it is planned to construct infrastructure and suprastructure facilities related to the liquid cargo terminal (transfer point, operational coast, tanks, commanding building etc) within the area of app. 6,0 ha.

5.3 The operational shore

The operational coast is the most important part of the port terminal (length app. 630 m, width app. 15,5 m) and it is planned to consists of several segments which will in time enable an increase of cargo traffic volume to more than 600.00 t. By that increase, the Bogojevo port can be classified into the higher rank of EU Core TEN-T 8 network of the port terminals.

The operational coast will consist of five (5) interconnected segments**:**

The segment 1 (existing port berth) – vertical quay app. 90 m long with gantry crane, reloading transport equipment, railway tracks (coastal, manipulative and silo) and silos in the back. Main purpose: loading/unloading of grain and oil plants.

The segment 2 - (new port berth) - vertical quay 120 m long with planned container terminal containing necessary transport equipment (mobile auto crane, front and side forklifts for container manipulation), industrial rail tracks and storage facilities in the back. Option: this segment of operational coast can be used for reloading of mineral fertilizers as well grains – when the segment 1 is too busy.

The segment 3 – (new port berth) – in continuation with the segment 3, vertical quay 110 m, with necessary transport equipment (mobile auto crane, crane connection devices and tools) for reloading of general purpose and bulk cargo, with industrial rail track and storage facility in the back.

The segment 4 – (new port berth – in the basin part) – semi -sloped quay 110 m long, for reloading of bulk cargo (gravel, sand) with pumping system for loading from ships to shore storage facility, with mobile transport equipment and storage area in the back.

The segment 5 – (new port berth – in the basin part) – semi -sloped quay 110 m long, for reloading of liquid cargo (crude oil and oil derivates) with pipeline system, pump generator for unloading from ship to shore storage facility and rail tracks for unloading, liquid cargo tanks (4 x 4000m^3) in the back.

All segments of operational coast are connected to internal traffic network, between themselves and internally.

5.4 The internal traffic, manipulative and parking areas

The basic function of traffic network and traffic and manipulative areas within the frame of the existing and the planned activities in the international Bogojevo port is to prov ide adequate traffic connection of all port activities (related to the terminals) with interstate road II a category no. 107, that is Sombor – Apatin – Bogojevo and undisturbed functioning of internal traffic i9nside the port area for all vehicles expected to involve in the operations.

The construction of the traffic network and manipulative areas will enable adequate traffic access to the port terminal – subsystems /container, liquid cargo terminal, general purpose terminal, grain terminal and storage facilities subsystem/ as well as a potential construction and easy connection to all infrastructure facilities.

The traffic network and manipulative areas inside the scope of „Plan“ are foreseen areas in their total width serving for setting up traffic, hydrotechnical, energy and other lines planned for completion of communal infrastructure.

The traffic nd manipulative areas for parking of vehicles are planned in the part close to the management building with proposed number of parking places (30) for the employees and partners.

The parking lot for trucks is planned to be located by road no. 107 with dequate number of parking places for trucks (50) expected to be engaged within the port area and border crossing Bogojevo.

5.5 The traffic infrastructure

Within the scope of traffic infrastructure, the construction of the industrial rail tracks nd their connection with national railway infrastructure is planned, as well as the construction of internal traffic lines, manipulative areas and parking lots.

The international Bogojevo port is connected with international waterway, river Danube, by direct access to waterway across aquatorium – port basin, which is functioning as navigation and which must have the same navigational gauges and characteristics.

The existing manipulative rail track no. 403, Bogojevo – the Danube coast, will stay within existing corridor framed by the „Plan“ with obligatory rail reconstruction to enable increased load capacity and speed.

The railway infrastructure – track coming from the Bogojevo station, situated on the national railway no. 110, Subotica – Bogojevo – state border – (Erdut) and regional railway no. 207, Novi Sad – Odžaci – Bogojevo, across manipulative rail track no. 403, Bogojevo – the Danube coast, provide access by rail to the port terminal and all facilities on the waterway. There is a necessary need to reconstruct the manipulative rail from the Bogojevo station till the entrance into the port area and all segments of existing industrial rail tracks leading to the silos and the operational coast. In addition, the construction of a new rail tracks is necessary initiated by the disposition of the new terminals (rail track to the container terminal, the general purpose cargo terminal and the liquid cargo terminal).

The internal traffic network enables existing and planned activities and facilities within the port and the port area to connect with existing general purpose public area – state road no. 107/P-101, which present the main traffic line for territorial connection. The state road no. 107 aligned west-east, is in touch with the north side of the area covered by „Plan“ and there are two traffic connections (entrance 1 and entrance 2) related to the port area.

5.6 The further steps

To increase the capacity of Bogojevo port it is necessary to obtain corresponding technical documentation in accordance with the Law on planning and construction („The official gazette of the Republic of Serbia, no. 72/2009, 81/2009, 64/2010, 24/2011, 121/2012, 42/2013, 50/2013, 98/2013,132/2014 and 145/2014):

Draft disposition plan for obtaining location preconditions,

Feasibility study with conceptual design,

Technical documentation for obtaining construction permit,

All companying elaborates defined by the Law for the level of draft master plan (elaborate on fire protection, elaborate on geotechnical preconditions for construction).

The authority in charge of implementation and successful realization of the project for construction of the new Bogojevo port capacities is the Ministry of construction, transport and infrastructure of the Republic of Serbia, which, by the Serbian legislative, is the Investor.

6 SCENARIOS FOR PORT DEVELOPMENT

6.1 Institutional framework

In the Republic of Serbia, governance and exploitation of ports are regulated by the Law on Navigation and Ports on Inland Waters[45] (hereinafter: LNPIW). This Law stipulates that the port system in the Republic of Serbia is established according to a landlord port management model. This means that the public body, in this case Port Governance Agency acts as a port authority (in case of Serbia – national port authority), governing ports without any commercial exploitation of them, while private port operators operate ports under concession agreement or operating authorization.

6.1.1 Port concession as a recommended model for port development

In accordance with the basic goals of the European transport policy, as well as the Strategy on development of waterborne transport of the Republic of Serbia for the period 2015 – 2025[46], the volume of transport of goods on inland waterways is expected to increase to a total of 18 % compared to other modes of transport. In order to achieve this goal, it is necessary to improve the transport infrastructure on the network of inland waterways of the Republic of Serbia.

One of the options to develop transport infrastructure, and in this case port infrastructure, are port concessions. Apart from the LNPIW, port concessions are regulated also by the Law on Public-Private Partnership and Concessions[47] (hereinafter the PPP Law). Concessions are widely used in the port sector and subsequently represent a type of structure that is familiar to the established and diversified port operators.

Since investors and port operators around the world have a relatively good understanding of concession models, those interested in the development of the extended Port of Bogojevo are likely to be attracted to such a structure, ensuring that a sufficient number of potential investors participate in the process, thus contributing to competitive bidding (which will positively affect commercial terms offered by potential concessionaires).

A successfully implemented concession concept will also send a positive signal to the market, and ultimately increase interest for other port concessions in Serbia that are planned for implementation in the coming period allowing for the further development of both international as well as domestic waterborne transport.

Selection of a reliable port concessionaire will ensure that the extended Port of Bogojevo becomes part of larger supply chains, which would ensure the potential for increased traffic development as well as creation of a modern logistic hub primarily intended to serve the needs of agriculture industry and then to serve as a potential multimodal hub for its hinterland. Increased traffic in the Port of Bogojevo will be an economic development driver with positive socio-economic impact for the region of Bogojevo and wider, allowing it to realize its economic potential.

[45] Official Gazette of the Republic of Serbia", nr. 73 from 12 October 2010, 121 from 24 December 2012, 18 from 13 February 2015, 96 from 26 November 2015 – other law, 92 from 14 November 2016, 104 from 23 December 2016 – other law, 113 from 17 December 2017 – other law, 41 from 31 May 2018, 95 from 8 December 2018 – other law, 37 from 29 May 2019 – other law, 9 from 4 February 2020.
[46] "Official Gazette of RS", no. 3/15
[47] "Official Gazette of RS", no. 88/2011

Financially speaking, the concession will allow the Republic of Serbia to collect annual payments from the Concessionaire for the duration of the concession contract in the manner and under the conditions as will be provided for in the contract. Fixed and variable concession fee payments could serve as additional funds that could be used for further development of the Serbian infrastructure.

Another key reason for the development of concession is that this structure would allow the Republic of Serbia to retain ownership of the new terminals in the port. Following the end of the concession term, the Republic of Serbia would obtain full control of the new terminals (within the extended port) with a new, modern suprastructure and management model set according to the highest market principles.

According to Law on Navigation and Ports on Inland Waters, a port concession represents one of the two legal bases for conducting port activities.

A port concession is defined as a right acquired by a contract governing the provision of:

a) a port concession for services with the right to commercially use a specific service, or
b) a port concession for public works with the right to commercially use the works performed, or
c) simultaneous performance of port services and the construction of port buildings and facilities, with the obligation to maintain port infrastructure,

which is assigned by the the Ministry of Construction, Transport and Infrastructure (Ministry) to a domestic or foreign legal entity for a definite period of time, under specially stipulated conditions, against payment of a concession fee by the concessionaire who assumes the risk related to the commercial use of the subject of concession. Commercial risk in the use of works or services includes demand risk or supply risk or both demand and supply risk.

Under the Law on Navigation and Port of Inland Waters, the Ministry is the entity having the authority to engage into the concession agreement for a port in question. The mechanism for awarding the port concession will be controlled by the Law on Navigation and Ports on Inland Waters as well as the PPP Law, with the private partner/concessionaire being selected through a tender procedure as required by the PPP Law.

The PPP Law defines concessions in a complementary way: as PPPs with elements of concession as a "contractual or institutional PPP" whereby a public contract regulates the commercial use of a natural asset, a resource in general use that is in public ownership or a resource owned by a public authority, i.e. performing activities of general interest, which the public partner transfers to the private partner, for a certain period of time, under special conditions, with payment of concession fee by the private or public partner, and the private partner assumes the risk related to commercial use of the concession subject".

The PPP Law also regulates two types of special concessions:

- concession for public works and
- concession for public services.

From the aforementioned, a classic concession will mean that the concession fee is paid by either a public / private partner, and the private partner will have the right to use its subject commercially.

If the subject of the concession is the simultaneous performance of port service and construction of port buildings and facilities, the provisions of the Law on Navigation and Inland Ports and the, the PPP Law and the Law on Public Procurement shall apply to the procedure of granting a port concession

In terms of the concession duration, if the subject of the concession is the simultaneous performance of port service and construction of port buildings and facilities, the Law on Navigation and Ports on Inland

Waters does not prescribe the term for which the port concession may be granted (unlike for other types of port concessions) refers to the period prescribed under the PPP Law. As the PPP Law prescribes a minimum of 5 to a maximum of 50 years of concession contract, 50 years period would be the maximum period for such type of concession.

In the concrete case of the Port of Bogojevo, it is recommended that the public partner, that is, the Government of the Republic of Serbia with its Ministry of Construction, Transport and Infrastructure invests in port infrastructure, while the construction of the suprastructure and equipping of the port for operations will be granted to a potential port operator as a concession.

The Ministry of Construction, Transport and Infrastructure of the Republic of Serbia prepared the Preliminary feasibility study with conceptual design, and a Project for a construction permit for the expansion of port capacities of the Port of Bogojevo. A construction permit was issued for the construction of the port infrastructure.

The estimated value of the investment is EUR 48 million. Source of financing: 50% from the RS budget and 50% from the framework loan for the development of port infrastructure of the European Investment Bank.

The next steps are the execution of infrastructure construction works, selection of a concessionaire and construction of the port superstructure.

Therefore, the form of concession recommended for the Port of Bogojevo extension encompasses the following (among others):

- provision of port services;
- construction of port superstructure, and
- maintenance of port infrastructure.

Such structure falls under the scope of a concession as defined under the Law on Navigation and Ports on Inland Waters.

Further details on concession procedures, scope and subject, selection of the concessionaire are subject of the special concession study which is a legal requirement for each concession of capital infrastructure.

6.2 Proposed new capacities in function of transport forecast

6.2.1 Infrastructure

Port of Bogojevo area is planned to be expanded by building a port basin with operational quay. In that way port will be partly a port with the open operational quay and partly a port of basin type for transshipment of various types of cereals, oilseeds, fertilizers, sand, gravel, various cargoes and a smaller number of containers which could develop container transport on the Danube. In addition, 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. Also, there will be a possibility of supplying vessels with a fuel.

The existing territory of the port occupies 2.40 ha, while according to the new Plan of detailed regulation it will expand to 21.00 ha, of which 19.20 ha will be intended for the surface of the port territory, and 1.80 ha for the new basin.

The planned facilities and areas are:

- vertical quay

- semi-vertical quay

- open storages and temporary storages for gravel and sand

- open storage for containers

- open storage for general cargo

- fuel storage terminal

- new silos with auxiliary equipment

- new closed storages

- new transformer stations

- parking lot for trucks

- administrative building

- new truck scales

- new water supply system

- wastewater treatment plant with shaft pumping station

- oil and gasoline separators for atmospheric sewage

In addition to these facilities, port roads with connection to the public road network and railway tracks within the port territory are necessary. Reconstruction of the existing railway section “Bogojevo station - Bogojevo port”is needed. Also, a new, special fire water supply system with a pumping station next to the port basin is missing, as well as new sewage and atmospheric water sewage systems with auxiliary devices.

Within the port area, the following infrastructure objects are planned: terminal for liquid cargo, terminal for bulk cargo, terminal for general cargo and containers.

Liquid cargo terminal - Infrastructure and suprastructure objects of the liquid cargo terminal (transfer station, operational shore, reservoirs, command building, etc.) in the area of 6.0 ha are planned within the basin of the port.

Terminal for bulk cargo - For the needs of transshipment and storage of general cargo and bulk cargo (primarily gravel and sand), an area of about 1.0 ha is planned. The length of the operational quay of this terminal is 110 m Gravel and sand separation equipment can be installed within the area of terminal.

Terminal for general cargo and containers - For the purpose of forming a container terminal, an area of 1.0 ha with appropriate infrastructure and superstructure is planned within the port. The length of the operational quay (vertical quay) of this terminal is 120 m.

Internal port manipulative area for transport and parking lots - The construction of roads and manipulative areas provides adequate traffic access of port terminals (container, liquid cargo terminal, general cargo terminal, grain terminal, as well as storage subsystem) to the categorized road network-state road IIa row no. 107, “Sombor - Apatin – Bogojevo”.

Port railway tracks - Existing manipulative railway no. 403, “Bogojevo - Danube bank”, remains within the existing railway corridor, but with the reconstruction of the railway tracks, in order to increase the carrying capacity and speed.

Operational quay – In the port area an operational quay with vertical and sloping quay walls, as well as industrial tracks and other facilities of the necessary port infrastructure and superstructure are planned.

The proposed layout of the port of Bogojevo is shown in the figureFigure 6.1.

Figure 6.1. Proposed layout of port of Bogojevo

6.2.2 Transshipment equipment

Based on the findings of the forecast, the new extended port should have adequate equipment with sufficient productivity in order to handle the forecasted volumes easily and to enable large capacity reserve.

In order to formulate adequate recommendations for the transportation equipment, a capacity analysis for the future cargo flows and new terminals needs to be done.

In this view, we will first assume the operational patterns and working times of the future port. The simplest way to do so is to adopt the same setup as for the capacity analysis of the existing port:

Mark	Capacity case description	Working hours/week	Working days	Working time
Q1	Minimal capacity	75	Mon-Fri	07:00-22:00
Q2	Normal capacity	90	Mon-Sat	07:00-22:00
Q3	Intensive capacity	144	Mon-Sat	00:00-24:00
Q4	Maximal capacity	168	Mon-Sun	00:00-24:00

Table 6.1. Future port capacity cases

6.2.2.1 *Liquid cargo terminal*

This terminal is dedicated for handling oil derivatives, primarily diesel and unleaded gasoline. Typical equipment for the transshipment of oil derivatives contains a berthing pontoon (where barges are berthed) which follows the water levels and thus enables easier unloading of derivatives from a vessel. Unloading equipment is located on a pontoon itself and consists of working pumps (one for diesel and one for unleaded gasoline), unloading arms, appropriate valves and manifolds. Thereafter, it is connected, via pipelines, to the tanks on shore. Tanks should have appropriate equipment for loading of liquid cargo into tank trucks.

The system for unloading, storage and distribution of oil derivatives should have the following elements:

- Berthing pontoon with pumps, measuring gauges, unloading arms, piping and valves
- Ground tanks
- Valve stations
- External piping
- Fuel pump station for supplying the transfer station
- Truck transfer station
- VRU (Vapor Recovery Unit) unit
- Pump fire station
- Fire station
- Automatic control and monitoring systems
- Command building in the function of transfer station
- Electricity part
- Roads
- Security of the complex
- Diesel generator
- Compressor station for instrument air
- Transformer station building
- Wagon transfer station

- Pump station for unloading fuel from tank wagons (with drain vessels)
- Measuring discharges for measuring the amount of fuel drained from tank wagons.

Details of each of the above elements are beyond the scope of this project and are to be specified in more detailed designs (conceptual design and construction design).

This study will limit itself to recommending the productivity of the unloading equipment. Typical equipment of this kind is of **180 m^3/h** (**or150 t/hour**, where 1 t of derivatives is roughly 1.2 m^3 of derivatives). With this capacity, the utilization of the transshipment equipment will be satisfactory and it will provide sufficient capacity reserve. On the basis of the forecasted quantities of liquid cargo and recommended productivity of the unloading equipment, the capacity utilization is illustrated in the following figure.

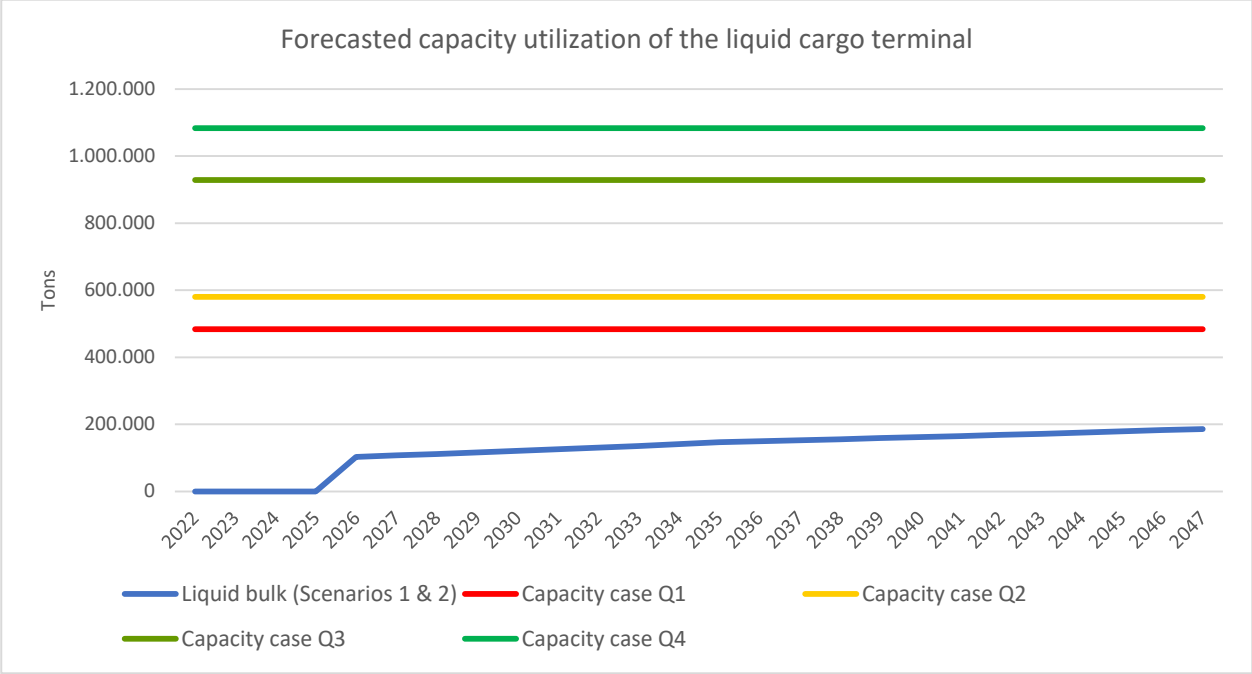

Figure 6.1: Forecasted capacity utilization at the liquid cargo terminal

From the above figure, it can be seen that no matter the operational pattern of the port, the recommended productivity of the transshipment equipment provides sufficient capacity reserve for the entire duration of the forecasted period and for all forecasted quantities. Capacity reserves are important for seasonal and peak loads which are either hard or impossible to forecast within one observed year.

6.2.2.2 *Bulk (sand and gravel) terminal*

Sand and gravel terminals can have their own equipment for unloading of sand and gravel, or they can use the equipment of the sand and gravel provider – that is of the vessel operator. Companies dedicated to the exploitation of sand and gravel from waterways usually have their own equipment for extraction, transport and unloading of sand and gravel on shore.

Taking into account that the port-based unloading equipment for sand and gravel is expensive and that the forecasted quantities of sand and gravel are not exceptionally large, it is recommended that in the case of the Port of Bogojevo the port operator uses the equipment of the company providing the sand and gravel.

Technological processes for unloading of sand and gravel are different. In case of gravel, the transport vessel is usually berthed alongside the unloading bucket dredger which collects the gravel from the barge,

lifts it up to the belt conveyor and the belt conveyor (or the system of belt conveyors and hoppers) transports the gravel to the designated place where the storage cone is formed. Depending on the type of separation process, further separation of gravel of different granulation is done either from the end of the conveyor line (where the unseparated gravel is poured from the conveyor directly into the separation hopper) or from the cone of unloaded gravel. Nevertheless, further processing of gravel is not the subject of port technology and it will not be further elaborated.

Figure 6.2. Bucket elevator (unloader) for gravel

Figure 6.3. Belt conveyor for the transport of gravel from the bucket elevator to shore

In the case of sand unloading, the typical way of unloading is through the suction dredger. Suction dredger is a vessel which sucks the mixture of water and sand from the bottom of the river, transports it through the ship pipes to the cargo area of the vessel, where the sand settles at the bottom of cargo space and the water freely spills over the sides of the vessel. When the vessel is full and drained from excess water, it travels to the berthing pontoon which usually carries the unloading equipment for sand, consisting of the piping, pumping systems, valves and manifolds. The suction dredger berths alongside the berthing pontoon, allowing for the vessel piping to be connected to the pipes on the pontoon. When firm connection is made, the vessel (suction dredger) pumps water into its cargo space making again the mixture of sand and water which is then pumped out of the vessel to the unloading piping on the berthing pontoon. The mixture of sand and water travels through the external piping to the specially prepared areas on shore (the so called “cassettes”) where the water from the mixture is drained back to the river through the soil and the sand settles in the “cassette”. Depending on the distance of the berthing pontoon from these “cassettes”, the external piping may be equipped with additional pumps, since the ship pump cannot always push the water-sand mixture very far.

It is recommended that the productivity of unloading equipment is **100 t/hour** (sand or gravel) as it is deemed sufficient, given the forecasted quantities during the entire forecast period of 25 years. The below figure illustrates the capacity utilization if such equipment is used.

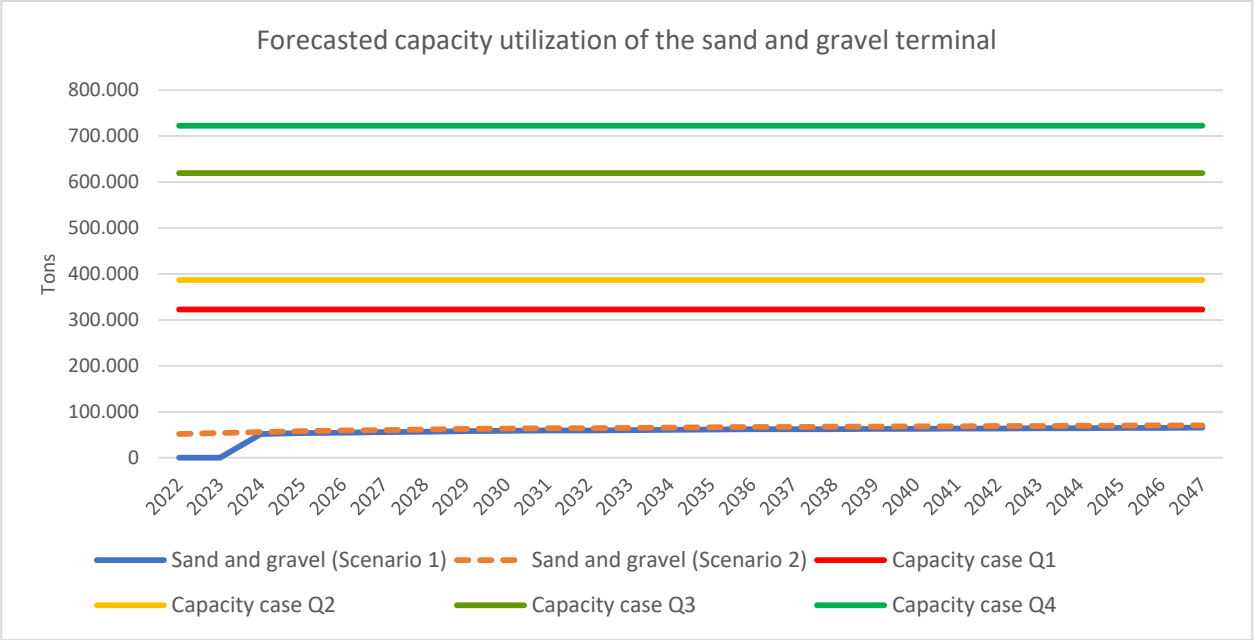

Figure 6.4. Forecasted capacity utilization of the future sand and gravel terminal

The above illustration demonstrates that the recommended productivity for and/gravel unloading provides sufficient capacity reserve for the entire duration of the forecasted period and for all forecasted quantities. Capacity reserves are important for seasonal and peak loads which are either difficult or impossible to forecast within one observed year.

6.2.2.3 *General cargo and container terminal*

Due to the relatively small number of containers forecasted, it is not recommended to equip this terminal with the equipment narrowly specialized for transshipment and handling of containers. Instead, a mobile crane with swappable handling equipment (bulk grab, coil grab, wire coil grab, forks, hook, sheet lifter, magnet lifter, equalizing spreader beam, container spreader, etc.) is recommended. Such mobile (auto) crane should have a lifting capacity of 80-100 tons, lifting height of at least 8 meters, capable of making **100 t/hour** of productivity when handling break-bulk cargo other than containers and **15 moves**[48]**/hour** when handling containers. If an average 23 tons of payload is calculated for each container, it means that such auto crane would reach the productivity of 345 tons/hour when handling containers only.

[48] One move means full crane cycle: from the moment it lowers the handling equipment into the ship hold, then travels to the loading/unloading position, then loads/unloads it on shore, then travels back to the ship and until it lowers the handling device into the ship hold again.

Figure 6.5. Mobile (auto) crane with the spreader for loading/unloading containers

Other equipment for handling general cargo (break-bulk) and containers in the yard behind the quay may include forklifts, reach stackers, etc.

Below figure illustrates the capacity utilization of the future general cargo and container terminal when recommended productivity is taken into account.

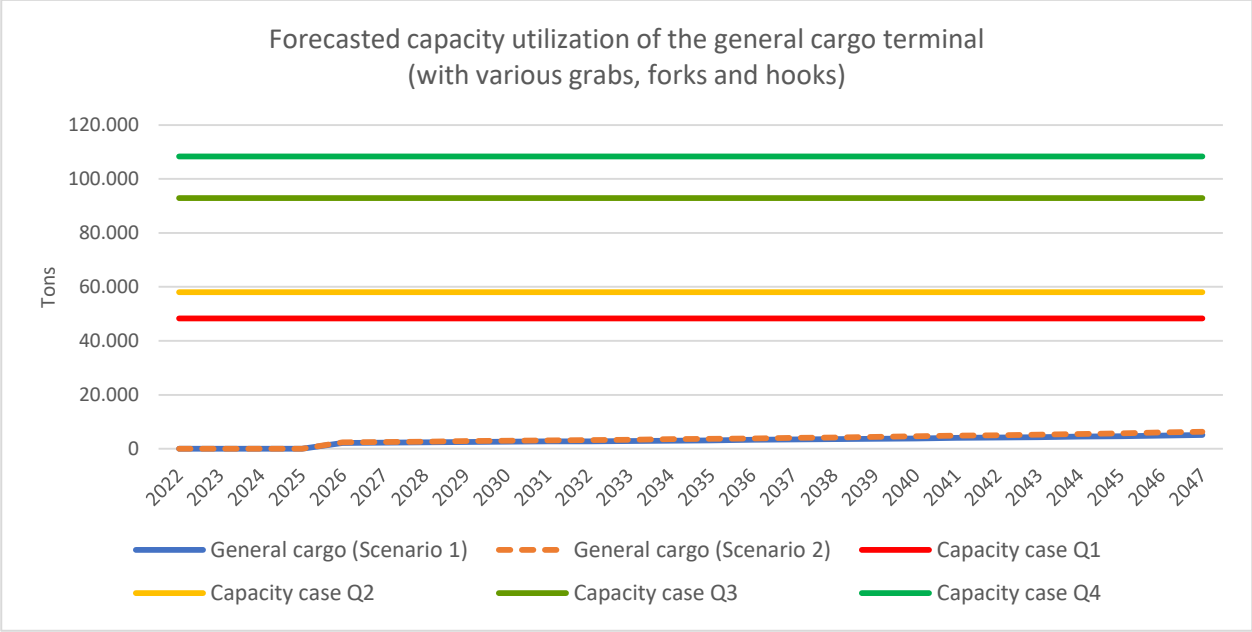

Figure 6.6. Forecasted capacity utilization for the general cargo terminal when using grabs, forks and hooks

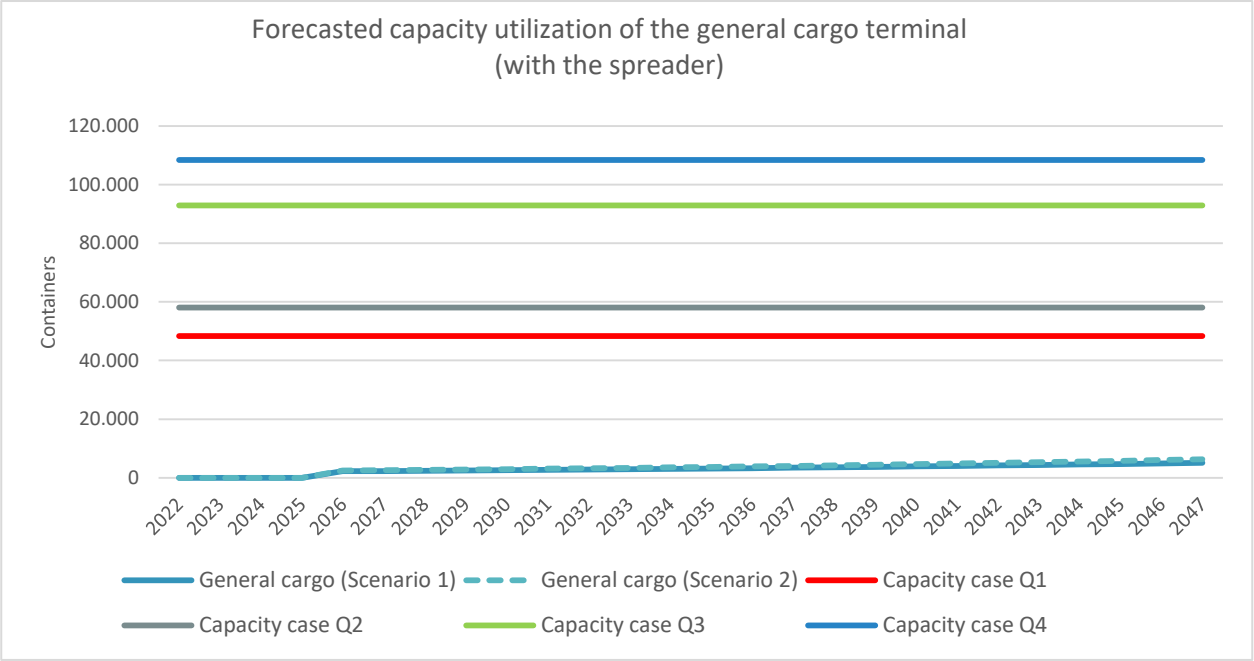

Figure 6.7. Forecasted capacity utilization for the general cargo terminal when using container spreader

The above illustrations show that the recommended productivity for and/gravel unloading provides sufficient capacity reserve for the entire duration of the forecasted period and for all forecasted quantities. Capacity reserves are important for seasonal and peak loads which are either difficult or impossible to forecast within one observed year.

6.2.2.4 *Existing grain terminal*

The existing grain terminal (currently the only existing terminal) in the Port of Bogojevo has two berths, one on vertical quay and another one on the sloped quay.

Figure 6.8. Port of Bogojevo existing grain terminal with two berths

Figure 6.9. Grain loading facility at the sloped quay

Their future capacity utilization was analysed taking into account the real productivity of their existing transshipment equipment, whereas the **productivity of the portal crane is 100 t/hour** and the **productivity for grains** (counting both loading devices – with the belt conveyor and pneumatic device) is **270 t/hour**.

Following figures illustrates the capacity utilization in such conditions.

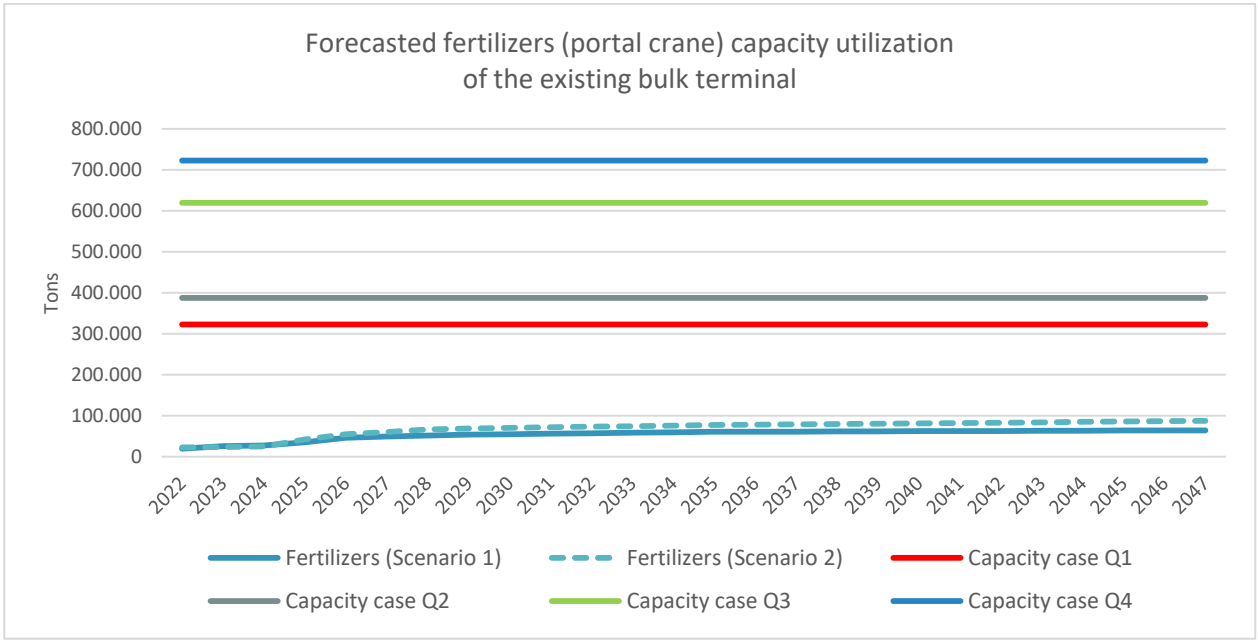

Figure 6.10. Forecasted capacity utilization of the existing equipment (portal crane) for fertilizers unloading

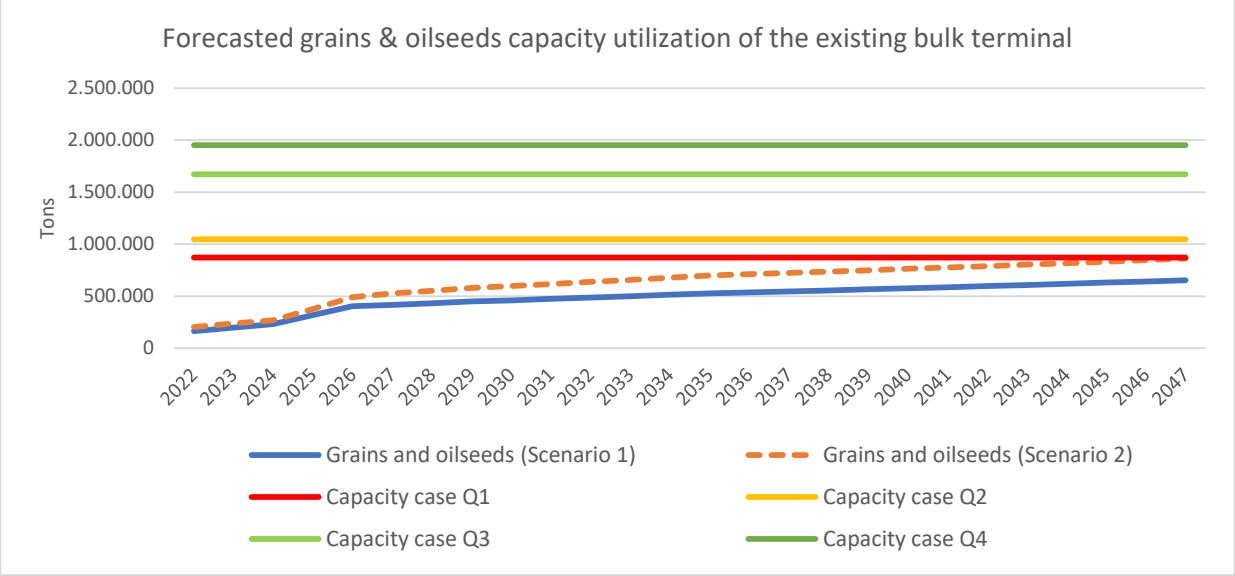

Figure 6.11. Forecasted capacity utilization of the existing equipment for grains and oilseeds

The above figure demonstrates an that in **Capacity case Q1** (working time 07:00 – 22:00, Monday to Friday) the terminal will have lack of capacity as of 2043 an on, in **Scenario 1**. However, congestion problems may appear even earlier, if recommendations on berth occupancy are taken into account.

According to UNCTAD Port Development Handbook[49], recommended berth occupancy (from the point of view of possible congestion effects) for ports/terminals with two berths is 50%. This means that, even though there is sufficient physical reserve of port capacity, congestion (with all its negative effects) can occur during peak loads when berth occupancy (or, in this case, simplified as capacity utilization) reaches values of more than 50%.

Number of berths in the same group	Recommended maximum berth occupancy (%)
1	40
2	50
3	55
4	60
5	65
6-10	70

Table 6.2. UNCTAD recommendation on berth occupancy

In Scenario 1, Capacity case Q1, such congestion effects may appear as early as 2029, while in Scenario 2, Capacity case Q1, such congestion may start already in 2026. In Scenario 1, Capacity case Q2 (working time 07:00-22:00, Monday to Saturday), congestion effects may take place already in 2035. In Scenario 2, Capacity cases Q1 and Q2, congestion may occur as early as in 2026 and 2027, respectively. This means that in the aforementioned cases the terminal will need to adjust the working times (switching to cases Q3 and Q4 when necessary) or to keep the existing working times as in Q1 and Q2, but to purchase equipment with higher loading productivity per hour.

For the unloading of fertilizers, the existing portal crane is deemed sufficient for both forecast scenarios and all four capacity cases.

[49]UNCTAD (1985), *Port Development: A handbook for planners in developing countries*, New York.

7 EXECUTIVE SUMMARY

With the transport network consisting of the Danube waterway in the length of 588 km with all its tributaries, along with the road and rail corridors, the Republic of Serbia holds a special importance within the overall European transport policy for the period 2014-2020. The new European policy opens up significant possibilities for better positioning and development of waterway transport in the Republic of Serbia foreseen by the Strategy on Development of Waterborne Transport of the Republic of Serbia, for the period 2015-2025. This Strategy lists the most important investments that are defined and initialised including: construction and reconstruction of Serbian ports, eliminating all critical sectors for navigation on the waterway network, further improvement of intelligent waterway transport systems.

According to the Strategy, the development plans for Port of Bogojevo towards a full port logistics centre should take advantage of the favourable geographic/traffic position of the port and make it a specialized handling and storage terminal for grains and mineral fertilizers, with an intermodal terminal. The plans are primarily concerned with the repair and re-design of the ruined part of the quay, 55 m long, with the construction of the 2.5 km operational railway tracks and their connection to the national railway network. The Bogojevo Municipality town plans and the regional spatial plan of AP Vojvodina include provisions for an intermodal terminal development, which is to be within the port area and treated as a port terminal. A need for new storage facilities and the pertaining port infrastructure has also been recognized (construction of operational railway tracks, connection to the national railway network in a length of 2.5 km, building one more vertical quay, storage facilities up to 100,000 t – the current capacity is 50,000 t). The required investment in the port infrastructure is estimated at 3.2 million euros, and for the port superstructure at 2.4 mill. euros.

The precise level of investment in the expansion of Port of Bogojevo area will be defined after the relevant documentation has been made and adopted. The projection of costs, together with the proposals for financing building designs and port development, will make an integral part of this documentation.

Annex 5 of Strategy on Development of Waterborne Transport of the Republic of Serbia (The Official Gazette of RS, No. 66/2020-10) assessed the construction of new port capacities of the Port of Bogojevo as a priority project.

The port of Bogojevo is located on the left bank of the Danube River from km 1366.73 to km 1367.42. The port covers surface of approximately 9 ha. Port of Bogojevo is an open-type port with maximum available draft maintained at 4 m. Total quay length is 276 m, out of which vertical quay is approximately 98 m. Two vessels can be simultaneously accommodated and serviced. Anchorage has the capacity for 17 vessels. The port has silo of 30,000 tons for cereals and 15,000 tons for fertilizer; closed space place of 14,200 m^2 and open space place of 10,200 m^2 available for port users. The operator of the Port of Bogojevo, company "Luka Dunav Bogojevo" a.d., operates a portal crane and a grain loader connected to a silo via belt conveyors. Technical capacities of this transshipment equipment are as follows:

- Portal crane: 100 t/hour
- Grain loading equipment: 270 t/hour

The port's superstructure includes two roads and one railroad filling hoppers with a total capacity of 700 t/h, a drying plant with a capacity of 40 t/h, a portal crane with a capacity of 20 t, a belt conveyor with an operating capacity of 400 t/h and the required handling and internal transport machinery.

Annual capacity of the Port of Bogojevo varies from 322,500 tons to 722,400 tons with the portal crane and from 870,750 tons to almost 2 million tons with the grain loader, depending on the number of shifts in a day and a number of working days in a week.

As a typical agricultural port, the Port of Bogojevo handled mostly grains and fertilizers, and, to a much smaller extent, determined quantities of natural aggregates (sand and gravel) and metallurgical products. Top three products handled in the Port of Bogojevo are grains, oilseeds and fertilizers. The port of Bogojevo is among the Serbian ports with the largest throughputs of grain. Throughput of other cargoes is being registered every year in the port, among which imported artificial fertilizers make up the largest share. Although a biggest throughput was 536,407 t of various cargoes in 2020, the estimated requests for transportation from the hinterland area of the Port of Bogojevo are much higher and more diverse than the current throughput possibility of this port.

As observed area of the Danube River is natural border with the Republic of Croatia, the planned activities in the Bogojevo port will benefit the business entities in the region of East Slavonia in Croatia, along the right coast of the Danube River. Typical port users are from the agricultural industry, namely grain trading companies and importers of fertilizers. Future potential users will largely remain within this group, while new additions will be the oil trading companies and companies from the construction sector.

Port of Bogojevo has a connection to the national railway network but railway tracks are not in function. The port is 300 m away from the main railway, and 2520 m from the railway yard. Railway section from Bogojevo to state border Erdut connects Port of Bogojevo directly with Croatia and indirectly with Hungary over other railway sections. It is a local railway section and is not electrified. The importance of this section is reflected in possibility to connect Port of Bogojevo with Port of Vukovar and further with Port of Budapest over the following railway sections which are part of the Mediterranean TEN-T corridor: Osijek – Beli Manastir, Beli Manastir (border) / Magyarboly - Pecs, Pecs – Dombovar, Dombovar – Pusztaszabolcs, Pusztaszabolcs - Budapest Kelenfold (part 1) and Pusztaszabolcs - Budapest Kelenfold (part 2).

On the northeast side, the micro location of the port is limited by the existing state road IIa no. 107, Sombor - Apatin - Bogojevo, while on the southeast side there is a road and next to it a railway bridge over the Danube, towards the Republic of Croatia. The port is 40 km away from the E75 highway, in the direction Belgrade-Budapest.

The expansion of the existing port by construction of a new port capacities is determined by the Detailed regulation plan of the Bogojevo port („Official gazette of Odžaci municipality“ no.4/21). Only a small portion of the designated port area in Bogojevo has been constructed. The existing facilities within the port (management building, silos, warehouses as well as auxiliary and infrastructure facilities) will keep functioning, with possible reconstruction, upgrading, remediation and adaptation. In the unbuilt part of the port area, within planned expansion, the construction of new facilities is foreseen for an increased port functioning.

Port of Bogojevo area is planned to be expanded by building a port basin with apron area. In that way port will be partly a port with the open operational quay and partly a port of basin type for transshipment of various types of cereals, oilseeds, fertilizers, sand, gravel, various cargoes and a smaller number of containers which could develop container transport on the Danube. In addition, 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. Also, there will be a possibility of supplying vessels with a fuel.

In addition to these facilities, port roads with connection to the public road network and railway tracks within the port territory are necessary. Reconstruction of the existing railway section “Bogojevo station -

Bogojevo port" is needed. Also, a new, special fire water supply system with a pumping station next to the port basin is missing, as well as new sewage and atmospheric water sewage systems with auxiliary devices.

The apron area is the most important part of the port terminal (length app. 630 m, width app. 15,5 m) and it is planned to consists of several segments which will in time enable an increase of cargo traffic volume to more than 600.00 t. By that increase, the Bogojevo port can be classified into the higher rank of EU Core TEN-T network of the port terminals.

In terms of future development, two scenarios (lower and higher), developed within this study, were assumed for the 25 years horizon cargo forecast, both of them being focused around the forecasted GDP growth and import/export forecasts of the International Monetary Fund. Besides the forecasts of typical existing cargoes handled in the port, determined quantities of new cargoes are forecasted, according to the strategic port development plans. In Scenario 1, the total forecasted quantity of all cargoes reached 1.08 million tons, while Scenario 2 forecast revealed a total forecasted quantity of 1.39 million tons of different cargo.

Within the port area, the following infrastructure objects are planned: terminal for liquid cargo, terminal for bulk cargo, terminal for general cargo and containers. Most important characteristics of these, as well as existing grains terminal are the following:

- Liquid cargo terminal
  - This terminal is dedicated for handling oil derivatives, primarily diesel and unleaded gasoline.
  - Typical equipment for the transshipment of oil derivatives contains a berthing pontoon (where barges are berthed) which follows the water levels and thus enables easier unloading of derivatives from a vessel.
  - Unloading equipment is located on a pontoon itself and consists of working pumps (one for diesel and one for unleaded gasoline), unloading arms, appropriate valves and manifolds. Thereafter, it is connected, via pipelines, to the tanks on shore.
  - Tanks should have appropriate equipment for loading of liquid cargo into tank trucks.
  - Productivity of the unloading equipment of this kind is of 180 m3/h (or 150 t/hour, where 1 t of derivatives is roughly 1.2 m3 of derivatives). With this capacity, the utilization of the transshipment equipment will be satisfactory and it will provide sufficient capacity reserve.

- Bulk (sand and gravel) terminal
  - it is recommended that the port operator uses the equipment of the company providing the sand and gravel
  - unloading of gravel
    - the transport vessel is usually berthed alongside the unloading bucket dredger which collects the gravel from the barge, lifts it up to the belt conveyor and the belt conveyor (or the system of belt conveyors and hoppers) transports the gravel to the designated place where the storage cone is formed;
    - further separation of gravel of different granulation is done either from the end of the conveyor line (where the unseparated gravel is poured from the conveyor directly into the separation hopper) or from the cone of unloaded gravel;
  - unloading of sand
    - the typical way of unloading is through the suction dredger;
    - the dredger sucks the mixture of water and sand from the bottom of the river, transports it through the ship pipes to the cargo area of the vessel, where the sand settles at the bottom of cargo space and the water freely spills over the sides of the vessel;

  - when it is full and drained from excess water, it travels to the berthing pontoon which usually carries the unloading equipment for sand, consisting of the piping, pumping systems, valves and manifolds;
  - the suction dredger berths alongside the berthing pontoon, allowing for the vessel (suction dredger) piping to be connected to the pipes on the pontoon;
  - when firm connection is made, the vessel pumps water into its cargo space making again the mixture of sand and water which is then pumped out of the vessel to the unloading piping on the berthing pontoon;
  - the mixture of sand and water travels through the external piping to the specially prepared areas on shore (the so called "cassettes") where the water from the mixture is drained back to the river through the soil and the sand settles in the "cassette";
  - depending on the distance of the berthing pontoon from these "cassettes", the external piping may be equipped with additional pumps, since the ship pump cannot always push the water-sand mixture very far;
- recommended productivity of unloading equipment is 100 t/hour (sand or gravel) – recommended productivity for sand/gravel unloading provides sufficient capacity reserve for the entire duration of the forecasted period (25 years) and for all forecasted quantities;

- General cargo and container terminal
  - due to the relatively small number of containers forecasted, it is not recommended to equip this terminal with the equipment narrowly specialized for transshipment and handling of containers;
  - a mobile crane with swappable handling equipment (bulk grab, coil grab, wire coil grab, forks, hook, sheet lifter, magnet lifter, equalizing spreader beam, container spreader, etc.) is recommended;
  - Such mobile (auto) crane should have a lifting capacity of 80-100 tons, lifting height of at least 8 meters, capable of making 100 t/hour of productivity when handling break-bulk cargo other than containers and 15 moves/hour when handling containers;
  - if an average 23 tons of payload is calculated for each container, it means that such auto crane would reach the productivity of 345 tons/hour when handling containers only;
  - other equipment for handling general cargo (break-bulk) and containers in the yard behind the quay may include forklifts, reach stackers, etc;
- Existing grain terminal
- the existing grain terminal (currently the only existing terminal) in the Port of Bogojevo has two berths, one on vertical quay and another one on the sloped quay;
- productivity of the portal crane is 100 t/hour and the productivity for grains (counting both loading devices – with the belt conveyor and pneumatic device) is 270 t/hour.

As for the transshipment equipment, this study demonstrated the need for transshipment equipment with sufficient productivity in order to handle the forecasted volumes easily and to enable sufficiently large capacity reserve. In addition, new cargo types will require specialized transshipment equipment, such as pumping systems for liquid bulk cargoes, or mobile crane with swappable handling equipment (bulk grab, coil grab, wire coil grab, forks, hook, sheet lifter, magnet lifter, equalizing spreader beam, container spreader, etc.) for the terminal for general cargo and containers.

In the case of the Port of Bogojevo, it is recommended that the public partner, that is, the Government of the Republic of Serbia with its Ministry of Construction, Transport and Infrastructure invests in port infrastructure, while the construction of the suprastructure and equipping of the port for operations will be granted to a potential port operator as a concession.

The Ministry of Construction, Transport and Infrastructure of the Republic of Serbia prepared the Preliminary feasibility study with conceptual design, and a Project for a construction permit for the expansion of port capacities of the Port of Bogojevo. A construction permit was issued for the construction of the port infrastructure.

The estimated value of the investment is EUR 48 million. Source of financing: 50% from the RS budget and 50% from the framework loan for the development of port infrastructure of the European Investment Bank.

The next steps are the execution of infrastructure construction works, selection of a concessionaire and construction of the port superstructure.

Therefore, the form of concession recommended for the Port of Bogojevo extension encompasses the following (among others):

- provision of port services;
- construction of port superstructure, and
- maintenance of port infrastructure.

By extension and construction of the new port capacities, connected with the railway infrastructure and by upgrading access road infrastructure, the port itself will enable efficient network connection of waterway, road and railway transport. Thus, it will promote better conditions for combined and intermodal transport, which is one of the preconditions for further service development in the sphere of waterway transport as the cheapest mean of mass loading transport both in internal and international transport, and, by that, the increased turnover in the ports on the internal waterways.

Further development and construction of new capacities in the Port of Bogojevo enables the port to become qualified for inclusion in the core of the TEN-T river port network.

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1 INTRODUCTION

1.1 European strategies

1.1.1 The Trans-European Transport Network

The Trans-European Transport Network [TEN-T][1]policy addresses the implementation and development of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. The ultimate objective is to close gaps, remove bottlenecks and technical barriers, as well as to strengthen social, economic and territorial cohesion in the EU.

Besides the construction of new physical infrastructure, the TEN-T policy supports the application of innovation, new technologies and digital solutions to all modes of transport. The objective is improved use of infrastructure, reduced environmental impact of transport, enhanced energy efficiency and increased safety.

TEN-T policy also sets requirements that the transport infrastructure must comply with, including on safety, quality for highly performing transport and alignment with environmental objectives.

The policy is a key instrument for the development of coherent, connected and high-quality transport infrastructure across the EU. It incentivizes the sustainable and more efficient transportation of people and goods, ensures access to jobs and services, and enables trade and economic growth. It also strengthens the EU's economic, social and territorial cohesion by creating seamless transport systems across borders, without missing links and bottlenecks.

Revision[2] of the TEN-T Regulation offers a real opportunity to make our Trans-European Transport Network fit for the future, and to align the development ofthe TEN-T network to the European Green Deal[3] objectives and the climate targets of the EU Climate Law. Cutting greenhouse gas emissions from the transport sector by 90%, compared with 1990 levels, by 2050, is key to achieving climate-neutrality by the same date.

To make such significant emission cuts, the society and industry need a modern, fully-fledged European transport network (1) that makes all transport modes more sustainable by setting firm incentives and requirements for transport infrastructure development and by better integrating the different modes in a multimodal transport system, (2) that ensures that new infrastructure projects on the network are climate-proof and consistent with environmental objectives and (3) that delivers the infrastructure basis for alternative fuel deployment.

At the same time, the TEN-T revision will reinforce the governance and monitoring instruments in place to ensure on-time network completion and exploit synergies between infrastructure planning and transport operations. This includes binding work plans to remove further obstacles for quicker and more efficient rail freight and passenger services.

[1] Source: https://ec.europa.eu/transport/themes/infrastructure/ten-t_en

[2] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2021%3A812%3AFIN

[3] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en#documents

The TEN-T Regulation supports the development of a reliable and seamless trans-European transport network that offers sustainable connectivity throughout the European Union, without physical gaps, bottlenecks or missing links.

This high-quality network shall be gradually completed in three steps: 2030 for the core network, 2040 for the extended core network and 2050 for the comprehensive network. The core and extended core network together form the European Transport Corridors which are the most strategic part of the network with highest EU added value.

The main novelties[4] compared to the 2013 Regulation:

- High infrastructure standards for all modes applied throughout the entire network.
- Nine "European Transport Corridors", representing the main arteries of EU transport, that integrate the former Core Network Corridors with the Rail Freight Corridors.
- Stronger synergies between infrastructure planning and the operation of transport services. Examples include higher speeds for train services across the TEN-T network (160 kilometers per hour for passenger services and 100 kilometers per hour for freight), maximum waiting times at borders of 15 minutes for rail freight. Another example is guaranteed good navigation status per river basin on the inland waterways on the TEN-T network.
- Requirements for the deployment, across the TEN-T network, of the charging and refueling infrastructure needed for alternative transport fuels in line with the Alternative Fuels Infrastructure Regulation. This would mean sufficient charging capacity for cars, vans and trucks at 60 kilometers distance in each direction by 2025 on the core network and by 2030 for the extended core and comprehensive networks.
- Providing safe and secure parking areas for commercial drivers, equipped with alternative fuels infrastructure.
- Use of innovative technologies like 5G to further advance the digitalization of transport infrastructure, further increasing efficiency, and improving the safety, security and resilience of the network.
- Increased resilience of the TEN-T network to natural and human-made disasters via climate-proofing requirements and environmental impact assessments for new projects, and to the implications of an accident or breakdown (e.g. by enabling alternative route alignments to the main network).
- The requirement for 424 major cities ("cities") on the TEN-T network to have sustainable urban mobility plans by 2025, in order to align their mobility developments on the TEN-T network. The SUMPs will contain measures such as the promotion of zero-emission mobility and the greening of the urban fleet.
- More transshipment hubs and multimodal passenger terminals in cities to facilitate multimodality, in particular for the last mile of a passenger or freight journey.
- Connect large airports to rail, where possible high-speed rail.
- Making it possible network-wide for lorries to be transported by trains.

[4] https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_6725

Cities are important points of transfer and last-mile connection within or between different transport modes on the TEN-T. It is important to ensure that neither capacity bottlenecks nor insufficient network connectivity within urban nodes can hamper multimodality along the trans-European transport network.

For this reason, the new provisions introduced through the revised TEN-T Regulation require that by 2040, at least one multimodal passenger hub and one multimodal freight terminal allowing for sufficient transshipment capacity within or in the vicinity of the urban node is in place.

In addition, by 2025, the 424 cities identified in the new TEN-T regulation must develop a Sustainable Urban Mobility Plan (SUMP) that includes measures to integrate the different modes of transport, and to promote zero-emission mobility.

For ports, the new extended version of the definition of a "cross-border" project could be of great importance as higher priorities are given to cross-border projects. Currently, "cross-border" section is defined as the section which ensures the continuity of a project of common interest on both sides of the border, between the closest urban nodes to the border of two Member States or between a Member State and a neighboring country. This definition leaves room for various interpretations, and it is not as clear as it could be. Inland ports, as well as seaports, are true examples of cross-border projects as they spread added value way beyond the borders of the port area and facilitate connectivity not just between mode but also between countries and various destinations in the foreland and hinterland of each port.

In addition, the proposal for the TEN-T revision foresees significant improvement for seaports in terms of their treatment as important nodes of the entire transport network. The proposal states that, being the entry and exit points for the land infrastructure of the trans-European transport network, maritime ports play an important role as cross-border multimodal nodes which serve not only as transport hubs, but also as gateways for trade, industrial clusters and energy hubs, for example with regard to the deployment of off-shore wind installations. Unfortunately, not even close recognition is given to inland ports, which is deemed fully unjustified.

Furthermore, the proposal states that the short sea shipping can make a substantial contribution to the decarbonization of transport by carrying more freight and passengers. The European Maritime Space should be promoted by creating or upgrading short-sea shipping routes and by developing maritime ports and their hinterland connections as to provide an efficient and sustainable integration with other modes of transport. The proposal unfortunately misses to include inland ports here, in spite of the fact that a huge number or short-sea shipping routes are actually sea-river routes where many origin or destination ports (without transshipment) are located on European inland waterways.

1.1.2 Sustainable and Smart Mobility Strategy

On 9 December 2020 the European Commission published the EU Sustainable and Smart Mobility Strategy.

The new Sustainable and Smart Mobility Strategy[5] sets out the EU vision for the transport system of the future and the action plan that will make it happen. It is structured around three key objectives: making the European transport system sustainable, smart and resilient.

[5] https://eur-lex.europa.eu/resource.html?uri=cellar:5e601657-3b06-11eb-b27b-01aa75ed71a1.0001.02/DOC_1&format=PDF

Sustainable mobility: involving an irreversible shift to zero-emission mobility by making all transport modes more sustainable, ensuring wide availability of the most sustainable options and giving users incentives to make sustainable choices;

Smart mobility: supporting sustainable choices by taking advantage of digitalization and automation to achieve seamless, safe and efficient connectivity;

Resilient mobility: bouncing back from the COVID-19 pandemic by creating a Single European Transport Area that is affordable and accessible for all citizens and businesses and resilient against future crises and safety and security challenges.

A clear path is needed to achieve a 90% reduction in transport-related greenhouse gas emissions by 2050. This is the effort required from transport to ensure the EU becomes the first climate-neutral continent by 2050, as outlined in the European Green Deal. Digitalization will become an indispensable driver for the modernization of the entire system, making it seamless and more efficient, while further reducing emissions. In addition, the coronavirus pandemic has shed light on the vulnerabilities of the single market and the need to strengthen its resilience.

The strategy sets out an action plan of concrete policy measures, structured around 10 key areas for action ("flagships") areas that will guide the Commission's work in the years to come. It also sets out milestones that show where we want to be in 10 and 30 years from now.

Various milestones show the path to achieving our objectives of sustainable, smart and resilient mobility (in the road transport environment), such as:

By 2030:

- at least 30 million zero-emission cars will be in operation on European roads
- 100 European cities will be climate neutral.
- scheduled collective travel for journeys under 500 km should be carbon neutral
- automated mobility will be deployed at large scale

By 2050:

- nearly all cars, vans, buses as well as new heavy-duty vehicles will be zero-emission.
- a fully operational, multimodal Trans-European Transport Network (TEN-T) for sustainable and smart transport with high-speed connectivity.

Major highlights of importance for inland ports are the following actions of this Strategy:

- Canals and rivers must ensure good navigation conditions, unhindered for example by water levels, for a minimum number of days per year.
- Calls for more transshipment terminals, improved handling capacity at freight terminals.
- Requires all 424 major cities along the TEN-T network to develop Sustainable Urban Mobility Plans to promote zero-emission mobility and to increase and improve public transport and infrastructure for walking and cycling.
- Decisive action to shift more activity towards more sustainable transport modes.
- Internalization of external costs (by implementing the "polluter pays" and "user pays" principles, in particular through carbon pricing and infrastructure charging mechanisms).

- In addressing its "Flagship 2 - Creation of zero-emission ports and airports", the Strategy states that inland and sea ports have a great potential to become new clean energy hubs for integrated electricity systems, hydrogen and other low-carbon fuels, and testbeds for waste reuse and the circular economy. For backing up this objective, the Commission will incentivize the deployment of renewable and low-carbon fuels and feeding stationed vessels and aircraft with renewable power instead of fossil energy, incentivizing the development and use of new, cleaner and quieter aircraft and vessels, revising airport charges, greening ground movements at airports as well as port services and operations and optimization of port calls.
- In addressing its "Flagship 4 – Greening freight transport", the Strategy states that the support for the the greening of cargo operations in Europe will require substantial revision of the existing framework for intermodal transport Options to revise the regulatory framework such as the Combined Transport Directive as well as introducing economic incentives for both operations and infrastructure should be considered. Incentive mechanisms should be based on impartial performance monitoring, according to a European framework to measure transport and logistics emissions.
- Moreover, the Strategy rightly claims that the scarcity of transshipment infrastructure, and of inland multimodal terminals in particular, is pronounced in certain parts of Europe, and should be given the highest priority. Missing links in multimodal infrastructure should be closed.

1.1.3 NAIADES III Action plan

The European Commission's new programme the NAIADES III Action Plan[6], is a programme aimed at boosting the role of inland waterway transport in mobility and logistics systems, in line with the European Green Deal and the Sustainable and Smart Mobility Strategy, which set the goal of increasing transport by inland waterways and short sea shipping by 25% by 2030, and by 50% by 2050.

The programme intends to assist the inland waterway managers to ensure a high level of service (Good Navigation Status[7]) along EU inland waterway corridors by 31 December 2030.

The NAIADES III Action plan delivers actions in the following areas:

- shifting more freight to inland waterways;
- transition to zero-emission inland waterway transport;
- smart inland waterway transport;
- more attractive and sustainable jobs in inland waterway transport.

Shifting more freight to inland waterways

This type of actions intends to help inland waterway managers to ensure a high level of service (Good Navigation Status) along EU inland waterway corridors by 31 December 2030. The long-awaited revision of the Combined Transport Directive[8]will have to fully integrate inland waterways as an essential component of intermodal transport. The Commission will also establish an EU framework for measuring and report

[6] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2021:324:FIN
[7] European Commission, Directorate-General for Mobility and Transport, Liere, R., Armbrecht, H., Turf, S., et al., Good Navigation Status: guidelines towards achieving a Good Navigation Status, Publications Office, 2018
[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01992L0106-20130701

emissions from logistics and transport. This could increase demand for more sustainable options, including inland waterways where feasible.

Transition to zero-emission inland waterway transport

Compared to other land-based modes of transport, inland waterway transport is energy-efficient, safe, almost congestion-free and silent. The Commission will propose measures to encourage investment in zero-emission and zero-waste technologies for inland vessels and inland ports and will also support research and innovation.

Smart inland waterway transport

The programme encompasses new measures to help the inland waterway transport sector to keep up with digital developments and improve competitiveness. Both will help the sector become an active part of broader multimodal chains. Further digitalization can play a significant role in improving the efficiency and reliability of navigation and traffic management, better integrating inland waterway transport in logistics processes and multimodal chains, and reducing the administrative burden and costs of complying with and enforcing legislation.

More attractive and sustainable jobs in inland waterway transport

The inland waterways sector relies on a skilled workforce. Included actions will ensure smart and flexible EU crewing rules and provide inland vessel crews with the right skills to deal with the green and digital transitions, cyber-security, synchro modality and the automation of vessels and infrastructure.

1.2 Regional strategies

1.2.1 Strategy for the Danube Region (EUSDR)

The EU Strategy for the Danube Region (EUSDR) is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011. The EU Strategy for the Danube Region, endorsed in June 2011 by the European Council, is the second EU macro-regional strategy after the EU Strategy for the Baltic Sea Region.

The Strategy was jointly developed by the Commission, together with the Danube Region countries and stakeholders, in order to address common challenges together. The Strategy seeks to create synergies and coordination between existing policies and initiatives taking place across the Danube Region.

The Danube Region Strategy addresses a wide range of issues; these are divided among 4 pillars and 12 priority areas. Each priority area is managed by two countries as Priority Area Coordinators (PACs).

Figure 1.1. Priority areas EU Strategy for the Danube Region (EUSDR)[9]

Priority Area 1A — To improve mobility and multimodality: inland waterways of the EU Strategy for the Danube Region. This Priority Area is coordinated by Austria and Romania, with the involvement of a wide network of key players and stakeholders from the 14 countries of the Danube region. Here you can find out about main activities, projects and actions in the field of inland waterways in the Danube region, latest news and upcoming events on the topic. During the period from 01 January 2020 until 31 December 2022 the activities of the Technical Secretariats of Austria and Romania are being co-financed by the Danube Transnational Programme (DTP).[10]

The goals of the Priority Area 1a of the EU Strategy for the Danube Region – "To improve mobility and multimodality: Inland waterways" are to increase the cargo transport on rivers by 20% by 2020 compared to 2010, remove obstacles to navigability taking into account the specific characteristics of each section of the Danube and its navigable tributaries, and to establish efficient inland waterway infrastructure management. For the coordination and discussion on existing and proposed projects which are in line with the objectives set for the Danube Region Strategy's Priority Area 1a and on the realisation of the Priority Area's targets and actions, the Priority Area Coordinators together with the Steering Group established six thematic Working Groups.[11]

[9] Priority Areas - EUSDR - Danube Strategy Point (danube-region.eu)
[10] https://navigation.danube-region.eu
[11] https://navigation.danube-region.eu/working-groups/

Of the six above Working Groups for ports is the most important WG Waterway and port infrastructure & management.

Action 1: Contribute to improve waterway and port infrastructure & management

Although enacted within the framework of the TEN-T Regulation (1315/2013), the "European Agreement on Main Inland Waterways of International Importance" (AGN) (which is ratified by all Danube riparian countries except for Germany) and the "Recommendations on minimum requirements for standard fairway parameters, hydrotechnical and other improvements on the Danube" of the Danube Commission, waterway management as well as upgrading and maintenance of the waterway and related infrastructure are under national responsibility.

Consequently, as the Danube is a linear transport axis, transnational coordination is essential for successful development. PA1a has brought up important milestones in this respect, such as the setting up of the Fairway Rehabilitation and Maintenance Masterplan for the Danube and its navigable tributaries, which continues to be a main element in the coordinated development of Danube navigation.

This working group supports this process by linking stakeholders from all user groups and regions and offering an open, but structured discussion basis on selected topics. Thematic coverage includes improvement of the fairway conditions, shore side and ports infrastructure along the Danube and its navigable tributaries as well as taking actions in a sustainable and environmentally sound way. Innovative fairway maintenance, service-oriented optimisation of lock operations and up-to-date shore side infrastructure, improved mooring places and bridge clearances as well as better multimodal accessibility of inland ports and transhipment sites to other transport modes and their hinterland are discussed and their implementation supported.[12]

1.3 National strategy

1.3.1 Strategy on Development of Waterborne Transport of the Republic of Serbia for the period from 2015 to 2025

All activities related to water transportation in the republic of Serbia have been prescribed by the Law on Navigation and Ports on Inland Waters (The Official Gazette of RS, No. 73/10, 121/12…52/21).

According toLaw on Navigation and Ports on Inland Waters, in 2015, a Strategy on waterborne transport development of the Republic of Serbia, 2015-2025 was adopted (The Official Gazette of RS, No. 3/2015-34, 66/2020-10)[13].

The Strategy dealing with broad issues ranging from renewing and modernising the national fleet to developing the economic potential of Serbian ports and harbours, and developing the navigational standard of international and national inland waterways. Action plan for the Strategy has been elaborated and priority projects and activities are set in order to reach targeted values.

Strategy on Development of Waterborne Transport of the Republic of Serbia for the period from 2015 to 2025 lists the most important investments that are defined and initialised including: construction and reconstruction of Serbian ports, eliminating all critical sectors for navigation on the waterway network, further improvement of intelligent waterway transport systems.

[12] WG 1 - WATERWAY AND PORT INFRASTRUCTURE & MANAGEMENT - PA 1A (danube-region.eu)
[13] Strategija vodnog saobracaja - osnovni tekst (aul.gov.rs)

The Development Strategy on Waterborne Transport for the Republic of Serbia 2015-2025 is based on the principles of safety, inter-modality, application of new technologies, complementary use of different transport modes and rational use of available capacities and resources in Serbia. Serbia is currently investing efforts to modernise transport infrastructure and to introduce contemporary standards in all the segments of the transport system. The strategy aims at having the Serbian fluvial infrastructure comply with the overall EU transport policy.

The transport sector naturally includes the inland waterways (IWW), of which Serbia has more than 1600 km split among several categories. The Serbian Government has defined priorities to improve the functioning of the transport system as a generator for the economic and social development. The system's needs are underlined from the national strategic and planning documents as well as from EU accession requirements.

Annex 5 of Strategy on Development of Waterborne Transport of the Republic of Serbia (The Official Gazette of RS, No. 66/2020-10) are defined list of priority projects for the development of inland water traffic for the period from 2015 to 2025 in the field of:

1) Port and port projects

2) Projects in the field of transport infrastructure of inland water transport

3) Projects for the development of intelligent transport systems in inland water transport.

1.3.1.1 *Development plans for Port of Prahovo*

According to the Strategy the development plans for Port of Prahovo give attention to building and expansion of the quay, purchase of additional portal cranes and enlargement of storage facilities. Bearing in mind the volume of the commodities gravitating towards the Prahovo port hinterland, the need for expanding the port area was also recognized together with the need for construction of a dangerous goods terminal and a container terminal, and putting in operation of the existing or building a new grains silo.

The estimated investment for the port infrastructure is 3 million euros, and for the port superstructure 9.8 million euros. The precise funds for investment in the port area expansion will be known after the relevant documentation for Port of Prahovo has been made and adopted.

The projection of costs, together with the proposals for financing building designs and port development, will make an integral part of this documentation.

Annex 5 of Strategy on Development of Waterborne Transport of the Republic of Serbia (The Official Gazette of RS, No. 66/2020-10) the construction of new port capacities of the Port of Prahovo was assessed as a priority project.

1.4 Conclusion

Rhine-Danube Corridor is one of the nine European corridors of the TEN-T network, which is passing through the Republic of Serbia. In the European policy so far, the Danube was a priority corridor on its own, but limited as the waterway. Now the Rhine-Danube corridor is a unique system of waterways, connecting important railways and roads of Central and Southeast Europe to the industrial centers of Germany and France. With this approach it will be possible to connect and integrate transport infrastructure, including

ports, and to remove technical and administrative barriers in the multimodal transport and ensure free flow of information in navigation.

The analyzed strategies of the EU indicate that Transport is fundamental for an efficient European economy. Freight traffic is expected to increase by 80% and passenger traffic by 50% by 2050. Areas of Europe cannot thrive without good connections, while the existing network contains infrastructure barriers and bottlenecks.

In this sense, with the transport network consisting of the Danube waterway in the length of 588 km with all its tributaries, along with the road and rail corridors, the Republic of Serbia holds a special importance within the overall European transport policy for the period 2014-2020. The new European policy opens up significant possibilities for better positioning and development of waterway transport in the Republic of Serbia foreseen by the Strategy on Development of Waterborne Transport of the Republic of Serbia, for the period 2015-2025.

Also, further development and construction of new capacities in the Port of Prahovo enables the port to become qualified for inclusion in the core of the TEN-T river port network.

2 PRESENT SITUATION IN THE PORT OF PRAHOVO

2.1 Description of the port area

Prahovo is a place in the municipality of Negotin, which is located near the borders of Serbia, Romania and Bulgaria. One of the most important industrial facility in the municipality of Negotin is the Port of Prahovo, which was established for the purpose of providing transport services to the industrial complex IHP Prahovo. The port of Prahovo is located on the 861st km of the right bank of the Danube. The port is open, and the operational shore is 560 m long. The 971 m long industrial railway track is connected to the national railway network. The port is about 150 km away from the E75 highway, while the "Vožd Karađorđe" highway from Belgrade to Bor is being underway according to the Investment Plan of the Republic of Serbia until 2025. After construction of the highway the distance of this port from the nearest highway will be less than 40 km.

The area covered by the Detailed Regulation Plan "Port of Prahovo" (PDR) is located within the cadastral municipality of Prahovo, on the right bank of the Danube, approximately from km 859+ 800 m to km 858 + 800 m, including water area and part of the area on the right bank of the Danube. Location of the Port of Prahovo is presented in the Figure 2.1.

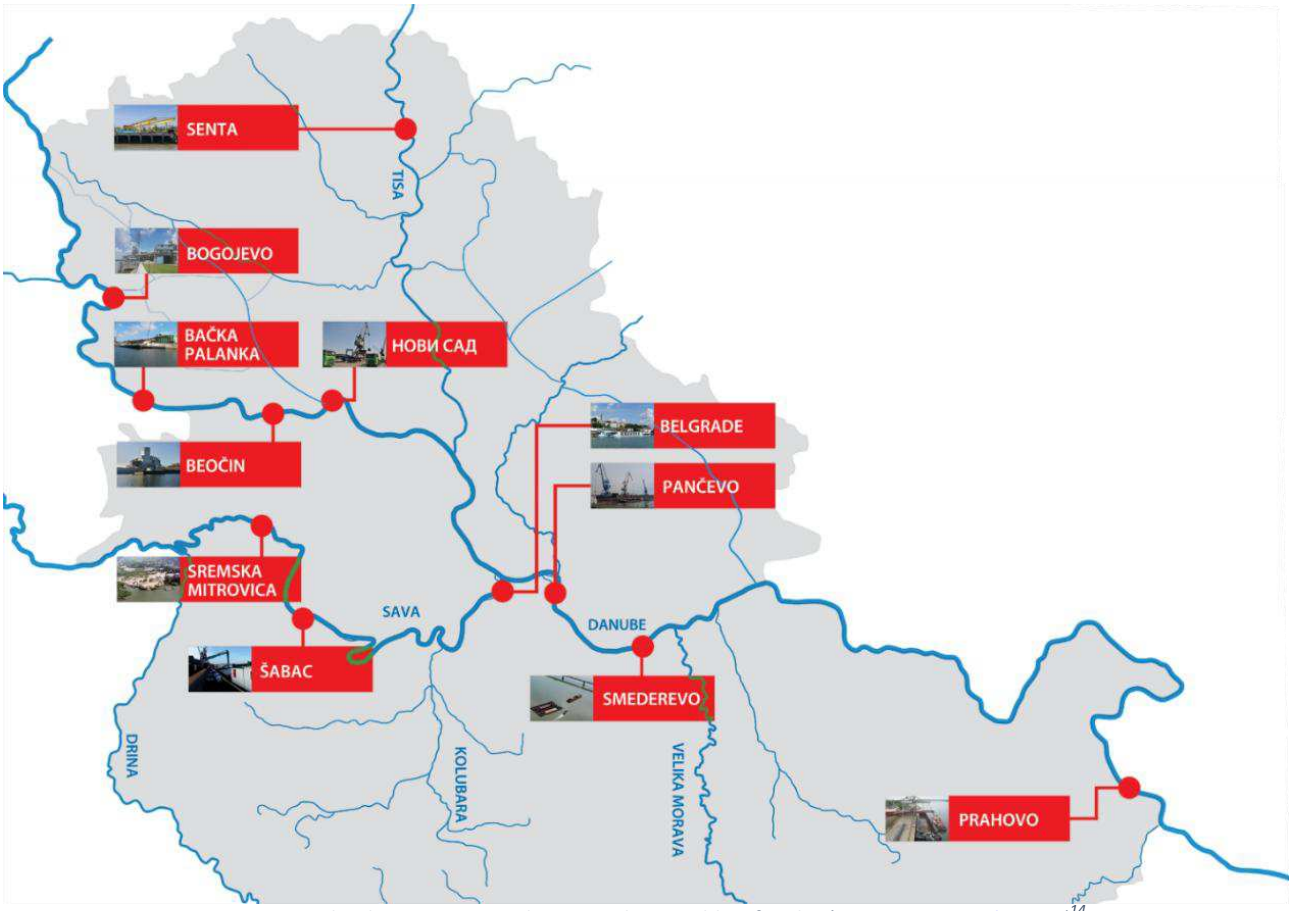


Figure 2.1. Inland Waterways and ports in the Republic of Serbia(Source: www.aul.gov.rs)[14]

[14]PGA - www.aul.gov.rs

The port of Prahovo is located 4 km downstream from the Djerdap II Hydroelectric Power Plant and the Kusjak International Border Crossing which put it as the last exit port in the territory of Serbia on the Danube.

Figure 2.2. Port of Prahovo

2.2 Organization and operations

Republic of Serbia is the owner of the port land and infrastructure. In 2013 Government of the Republic of Serbia established the Port Governance Agency that is in charge of management and development of all ports and harbours in the Republic of Serbia. Some of regulatory, professional and development tasks which the Agency performs are: issues and revokes the license for performing port activities; concludes a contract on performing port activities on the basis of the obtained approval; concludes the contract of port activities on the basis of the obtained approvals; keep a register of port operators to whom the clearance was issued; charges port dues; adopts and publicly announces port tariffs, etc[15].Currently, there is two licensed port operators in the Port of Prahovo – PD Elixir Prahovo and NIS AD Novi Sad.

2.3 History of development

In 1957, initial works related to the construction of the Port of Prahovo begun. RTB Bor and the new chemical industry in the hinterland had the main requirements and economic interests for the construction of berth.

In 1960, berth became an industrial port of Prahovo, when HIP Prahovo commenced its business activities. From 1960-1970, port of Prahovo was organized as enterprise for berthing and stocking of cargo with the name “Pretovar”. It is integrated into RBK Krajina - Prahovo from 1970. The port of Prahovo was built 200

[15]"Official Gazette of the Republic of Serbia ", n. 73/2010, 121/2012, 18/2015, 96/2015, 92/2016, 104/2016, 113/2017, 41/2018, 95/2018, 37/2019, 9/2020 and 52/2021

m downstream from the old berth (whose remains still exist), just below today's Customs House on the banks of the Danube.

Activities in the port of Prahovo were being done in order to follow the development of the chemical industry. They can be divided into three phases:

The first phase lasted from 1960 to 1968, and it was a time when phosphate was unloaded for the needs of "Superphosphate" – a factory in Prahovo. Unloading was done by using a system of three redlers on one berth. The first redler was vertical, and the other two were horizontal. Vessels with phosphate were being unloaded by one vertical redler (a chain conveyor), while two horizontal redlers were served for transport phosphate to a belt conveyor system, which was connected to the factory and warehouses in the area of factory.

The second phase refers to the period from 1968 to 1978 and brings an increased amount of phosphate which is used as a raw material in additional factory machines for the production. The port of Prahovo then had an operational quay (apron area) of 637.5 m long with two berths intended for unloading phosphate from vessels.

There were three quay walls on the operational quay from the downstream view: one sloping quay wall, one vertical quay wall and one sloping quay wall. The first sloping quay wall was 60 m long, the vertical quay was 150.5 m long, and the second sloping quay wall was 427 m long. One portal crane of type Cranbau was on the first sloping quay and was used for unloading phosphate from vessels to a bunker with a dozer placed about 35 m away from the vessel (which depended on the variation of the Danube navigation level). Phosphate was moved from the dozer to the collection conveyor by the 133 m long conveyor which capacity was 120 t/h. The dozer swayed from side to side covering the length of 40 m. The collection conveyor had the capacity of 180 t/h.

Over the first 75 m of the vertical quay (150.5 m long) there was a Ganz portal crane. 87.5 m from the beginning of the vertical quay there was a loading point with a hose which was used for loading phosphoric acid to the vessel tanks. On the remaining 63 m of the vertical quay there was a portal crane for bulk cargo.

The second sloping quay had two parts: one built which was 278 m long and one unbuilt with 149 m long (427 m in total). There were two cranes on the built part second sloping quay, which were used for other bulk and general cargo. At high water levels, one of these two cranes was used as an aid for the phosphate unloading.

In the third phase in 1984 of construction of port of Prahovo, the "Kranb" crane was relocated to the pyrite warehouse, and the Ganz crane was placed to its current location No. 6.

The port of Prahovo, as contemporaries know it, has been in operation since 1978.

2.4 Main features of the port and port infrastructure, superstructure and equipment

The port covers area of approximately 5.5 ha. Port of Prahovo is an open type port with minimum available depth of 1.8 m and maximum available depth of 4 m. Berths 3,4 and 5 have minimum available depths of 1.8 m, while berths 1 and 2 have minimum available depths of 2.5 m. Total quay length is 577m, out of which vertical quay is approximately 322m. Berths 1, 2, 3 and 4 are placed on vertical quay, while berths 5, 6 and 7 are on sloped quay. Consequently, there are 7 berths in total and seven vessels can be served in quay at once. Anchorage has the capacity to accept75 vessels.

Overview of basic port's features are given in the below table.

Parameters	Explanation / Value
Port land owner (State, Region, Municipality, Private, Other)	State owned
Port authority name	Port Governance Agency
Number of operators (concessionaires, lessors)	2
Total port area (ha)	5.5
Maximum draught (m) - natural or dredged	4
Total number of terminals	3
Heavy lift and out-of-gauge handling capacity (Yes/No)	NO
Ability to handle full block train along the quay (Yes/No)	YES
Ability to handle full block train in the port area (Yes/No)	YES
Transhipment equipment for intermodal transport (Yes/No)	YES
Total quay length (vertical + sloped) (m)	560
Vertical quay length (m)	322
Semi- vertical quay length (m)	355
Undeveloped quay length (m)	0
Max number of vessels handled at the same time	7
Max capacity of anchorage or waiting area for barges (number)	75
Storage capacity	6500 m^2 open space, customs storage 2000 m^2 and silo storages 7200 m^3
Storage capacity for liquid cargos (m^3)	N/A
Storage capacity (TEU)	N/A
Storage capacity (CEU - car equivalent unit, for Ro-Ro terminals)	N/A
Bunkering facilities within the port area (Yes/No)	YES
Shore-side power supply for vessels (Yes/No)	YES
Road conneection (Yes/No)	YES
Rail connection (Yes/No)	YES
Number of quay cranes of lifting capacity Q < 6 tons	1
Number of quay cranes of lifting capacity 6 < Q < 40tons	6
Number of quay cranes of lifting capacity Q > 40 tons	0
Total number of quay cranes	7

Table 2.1. Basic features of the Port of Prahovo

Storage facilities consist of 6500 $m^2$of open spaces. Port of Prahovo has the following facilities and devices: conveyor belt, pneumatic equipment, one crane of 5 t lifting capacity and 6 gantry cranes of 40 tons lifting capacity per each. Of storage facilities there are open storage area, silo storage and customs warehouse. The loading equipment of the port consists of 2 fork lifters with the maximum lifting capacity of 3 t, 3 fork lifters with the lifting capacity of 3 to 5 t and 4 wheel loaders. There is also one port tugboat for pilotage services. Maintenance and disposal facilities comprises bunkering facilities, fresh water supply and onshore power supply.

Port area encompasses: loading/unloading equipment and devices (crane tracks, conveyor belts, etc.), warehouses (silos, covered and open warehouses), roads, railway tracks, power transformer stations, installations such as water supply, sewerage, electrical network, etc., other port facilities and free areas.

Quay area in the port of Prahovo varies over different berths. Berth widths are the following: 18 m for 1 and 2, 12 m for 3 and 4, 13 m for 5, 6 and 7. Total quay area is about 10,000 to 11,000 m^2.

Port internal roads consist of the main port road and several internal roads that are interconnected into one road network. The main port road starts from the entrance to the port, ie the port gate and the registration office, and it serves as a lane for road traffic distribution inside the port.

Internal port railway tracks are connected to the public railway outside of the port area. Railway track which enters the port splits in two directions: one direction is towards the operational quay and other is towards the interior of the port. Railway track from the first direction splits into next two railway tracks upstream from the berth 4 and one of them splits again into two railway tracks. Railway tracks on the operational quay make an obstacle for the movement of road vehicles (trucks, dump trucks, etc.) and other port equipment (forklifts, loaders, mobile cranes, etc.).

There are no railway tracks on the quay area, along Berths 1, 2 and 3.The other railway track which is placed inside the port and out of operational quay passes behind the silo and the covered warehouse. Along this railway track there is a rail scale for train weighing. This railway track serves for maneuvering of train compositions which are coming and leaving from the port.

There is no specially designed parking lot for any visitors or employers that arrive at the port. Concrete floor grounds in front of the silos and on the plateau behind Berths 4, 5 and 6 can serve as parking lots for trucks waiting for loading or unloading of cargo and for other road vehicles.

The Port of Prahovo is connected to the public water supply network, the electricity network from the IHP Prahovo complex with two built transformer stations in the port, fire water supply with connection to the distributive water supply network of IHP Prahovo, while fecal and rain sewerage installations are only partially installed and do not cover the entire port.

Access to and docking of vessels along the sloping quay is difficult, especially at medium and lower navigation water levels. The port area is not separated by a fence, except a part of the port which is the closest to the state railway.

On the vertical quay the following handling equipment is installed:

Berth 1: Portal crane PD 055 "MIN", with a load capacity of 10 t, was used for unloading bulk materials for IHP PRAHOVO. Now it is out of operation.

Berth 2: Portal crane PD 056 "MIN", with a load capacity of 10 t, is used for unloading bulk materials for IHP PRAHOVO. Port crane and belt conveyor are coupled for unloading cargo.

Berth 3: Portal loading crane Comentri Oisel, with a productivity of 100 t/h, is used for loading bulk materials for IHP PRAHOVO. For transport of cargo on the route IHP PRAHOVO - Port "KRAJINA" Prahovo, special belt conveyors that are connected to the port conveyor belts are used.

Berth 4: Overhead crane PD 080 „MIN“, with a capacity of 40 t. Cargo for loading is delivered by trucks and left in an open storage area behind the quay area. The same operation is performed for cargo from vessels.

On the slope quay the following handling equipment is installed:

Berth 5: Portal crane "VEB KRANBAU", with a capacity of 10 t, is used for reloading bulk cargo and general cargo of lower weight.

Berth 6: Portal crane "GANZ", with a capacity of 5 to 6 t, is used for reloading bulk cargo.

Behind berths 5 and 6 there is an open temporary storage of reloaded cargo.Depending on the type of cargo a loader or a forklift is engaged for loading.For loading/unloading of bulk cargo, mobile belt conveyor with a buffer is used, so that these cargoes can be reloaded directly into road vehicles.

Berth 7: This berth is in the action field of the portal crane "GANZ", with a capacity of 5 t.The crane is out of operation.

2.5 Cargo types and volumes

The throughput cargo data used in the study were obtained from the port questionnaire.

The Port of Prahovo is intended for loading/unloading operations and storage of various types of goods such as cereals, oilseeds, fertilizers, gravel, sand, general cargo and cargo containers. Loading/unloading operations are performed both from vessels to the port quay and from the port quay to vessels, as well as stored cargo to trucks or railways and vice versa.

The terminals provide processing of cargo such as phosphate (bulk), copper concentrate (bulk), coal (bulk), KCl potassium chloride (bulk), road salt (bulk), equipment and parts (general), wire rods (general), fertilizers (bulk), fertilizers big bags (general), monocalcium phosphate MCP (general), monocalcium phosphate MCP (bulk), grains (bulk), scrap metal (bulk), hot rolled sheets (general), limestone (bulk) and gypsum (bulk). Table 2.2. shows cargo types and volumes for the period 2017–2021.

Cargo and trade direction	2017	2018	2019	2020	2021
Import - Phosphate (bulk)	479,450	505,825	609,320	568,930	479,300
Import - Copper concentrate (bulk)	84,260	76,950	141,670	20,290	0
Import - Coal (bulk)	27,300	14,734	9,460	30,950	32,240
Import - KCl potassium chloride (bulk)	12,500	16,840	28,900	25,300	45,560
Import - Road salt (bulk)	19,800	7,970	19,475	13,110	9,100
Import - Equipment and parts (general)	1,650	0	10,890	71	2,335
Import - Wire rods (general)	0	0	0	0	2,140
Export - Fertilizers (bulk)	45,000	77,410	42,346	31,300	44,240
Export - Fertilizers big bags (general)	81,750	120,160	230,720	208,600	232,440
Export - Monocalcium phosphate MCP (general)	13,640	9,750	7,598	4,850	3,030
Export - Monocalcium phosphate MCP (bulk)	10,020	27,832	31,045	50,990	35,710
Export - Grains (bulk)	5,900	8,090	1,020	17,070	19,320
Export - Scrap metal (bulk)	2,700	6,315		0	1,760
Transit - Hot rolled sheets (general)	67,000	150,220	54,130	88,640	47,400
Domestic - Limestone (bulk)	38,300	29,340	37,910	50,985	36,480
Domestic - Gypsum (bulk)	11,800	17,515	15,265	35,960	7,230
Total	**901,070**	**1,068,951**	**1,239,749**	**1,147,046**	**998,285**

Table 2.2. Cargo types and volumes in Port of Prahovo for the period 2017–2021

Based on the data in Table 2.2, we conclude that the growth of the Port of Prahovo throughput was the highest in 2019, as much as 1.4 times compared to 2017. From 2019, the next two years saw a decline in throughput of the Port of Prahovo. An increase of throughput was recorded from 2017 to 2019 with 1.18 times from 2017 to 2018 and 1.16 times from 2018 to 2019. In 2020 there was a drop in throughput for about 8% compare to 2019, while 13% of decrease in throughput appeared from 2020 to 2021. Overall

there was one and it happened in 2019, but the data in the next two years include operation in covid-19 pandemic period.

2.6 Port access

Port of Prahovo has a single road entrance with two lanes road allowing vehicle access. The road entrance distance from the main road is 5 km. The area of 2000 m^2 is intended for parking vehicles. In port area there is no truck scales.

There is one operative rail entrance which connects port to the national railway network with a three loading/unloading rail tracks with overall length of 880 m (360+360+160) and axle load of 20 t. In the hinterland of the port of Prahovo there is a railway station "Prahovo Pristaniste" with the railway tracks of 1100 m length.

The port is a hub in which road, railway and waterway transports intersect.

2.7 Current and potential user requirements

On the basis of the data from the port questionnaire, current users and their cargo which is loading/unloading in the port of Prahovo are presented in Table 2.3.

Users	Cargo
Elixir Prahovo	Phosphate (bulk), fertilizers (bulk), coal (bulk), KCl potassium chloride (bulk), limestone (bulk), road salt (bulk)
RTB Bor-Zijin	Copper concentrate (bulk), coal (bulk), equipment and parts (general)
Feršped Skolje	Hot rolled sheets (general), wire rods (general)
Phosphea	Monocalcium phosphate (MCP) –general, bulk
Boom trade	Road salt (bulk)
Spajić	wire rods (general)
Toplana Bor	Coal (bulk)
Elixir Zorka Šabac	Gypsum (bulk), Ammonium sulphate (bulk), KCl potassium chloride (bulk), phosphate (bulk)

Table 2.3. Current users of the port of Prahovo and their cargo intended for the port

The majority of the enumerated cargo types in Table 2.3 are intended for export and import, while the small amount is cargo in transit and cargo for domestic purposes. For example, cargoes that are intended for import are phosphate, copper concentrate, coal, KCl potassium chloride, road salt, equipment and parts and wire rods, while cargoes that are intended for export are fertilizers, fertilizers big bags, monocalcium phosphate MCP, grains, scrap metal. The rest of cargo is for transit and domestic purposes.

3 HINTERLAND CONNECTIONS

The 971 m long industrial railway track is connecting the port with the national railway network. Port of Prahovo has a connection with two railway sections: “Crveni Krst-Zaječar-Prahovo pristanište” section and “Bor teretna-Prahovo pristanište” section. “Crveni Krst-Zaječar-Prahovo pristanište” section connects port with Bulgaria, while “Bor teretna-Prahovo pristanište” section connects port with Belgrade and further with Hungary. State road of class IIb No. 400 connects Port of Prahovo with the State road 35 - Dušanovac - Border with Romania near Kusjak.

3.1 Rail main corridors

Rail connections (construction or improvement) to hinterland are of crucial importance since the port needs efficient and reliable connection to their hinterland and the rest of the transport network feeding the port with their cargoes.

In this section“Crveni Krst-Zaječar-Prahovo pristanište” railway section will be considered.

“Crveni Krst-Zaječar-Prahovo pristanište” is a regional single-track non-electrified railway section connected to the main electrified railway section “Belgrade - Mladenovac - Lapovo - Niš – Preševo” - state border - “Tabanovce”) and a regional single-track railway section whose part from “Mala Krsna to Požarevac” is electrified while “Bor – Rasputnica 2 - (Vražogrnac)” is non-electrified single track. The main advantage of this connection is that cargo from the Port of Prahovo can be transported to Bulgaria.

Cargo transported by this section include: sulfuric acid with more than 51% acid, phosphoric acid, sodium hydroxide, solid, sodium hydroxide, fluorosilic acid, ammonia, anhydrous, ammonate-based fertilizers and petroleum and petroleum products. The parameters of “Crveni Krst-Zaječar-Prahovo pristanište” railway section are presented in Table3.1.

Section	Parameter	Value	Unit	Reference in Regulation 1315/2013
Crveni krst - Zajecar-Prahovo pristanište	Length	205	km	n/a
	Electrification	No	% of km	§12 except for isolated networks
	Track gauge 1435mm	yes	% of km	§13 as priority for RR infrastructure development
	Line speed >= 100km/h	no	% of km	§39 requirement for core network
	Axle load (>=22.5t)	n/a	% of km	
	Train length (740m)	n/a	% of km	

Table3.1. Crveni krst - Zaječar-Prahovo pristanište railway section parameters

3.2 Road main corridors

This section refers to the major and important road section passing close enough to port of Prahovo to have enough impact on it. State road of class IIb No. 400 connects Port of Prahovo with the State road 35 - Dušanovac - Border with Romania near Kusjak. Its total length is 25 km. Figure 3.1 shows Prahovo-/Romania section.

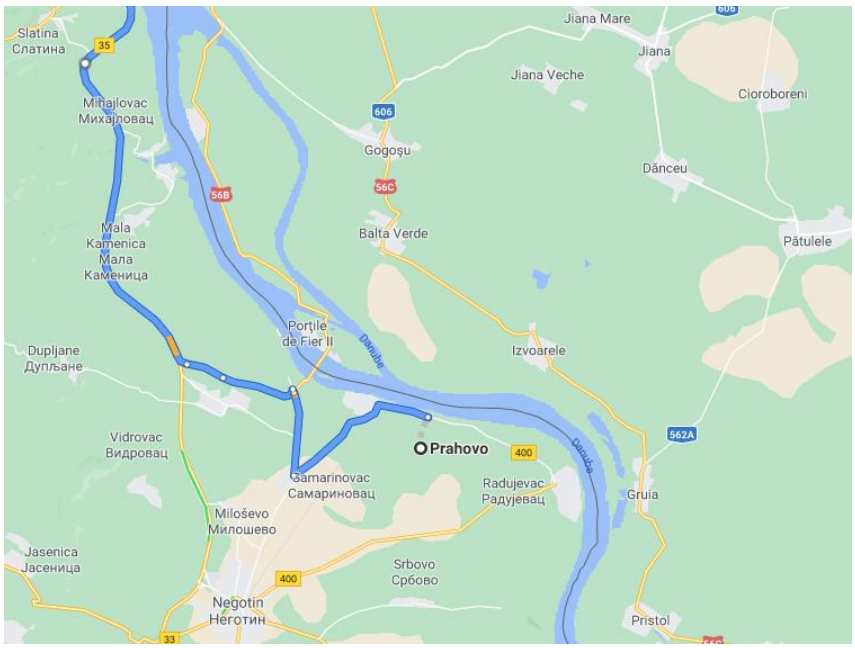


Figure 3.1. Prahovo-Romania road section

4 MARKET ANALYSIS, POTENTIAL USERS, AND DEVELOPMENT PERSPECTIVES

4.1 General economic outlook

COVID 19 and global slowdown, according to available data, had a less severe impact on Serbia compared to most European countries, due to achieved macroeconomic and financial stability, growth momentum, fiscal space created in previous years, large and timely monetary and fiscal package, and structure of the economy.

GDP recovery to pre-crisis level was accomplish

ed already in Q1 2021 while according to the SORS data real GDP growth in 2021 stood at 7.4% Such developments are the result of growing activity in industry, construction and the service sectors.

Having in mind new investment cycle, and planned infrastructure projects in following ten years, the NBS projection of real GDP growth for 2022 and the medium term is in the range from 4-5%.

According to the NBS projection, real GDP growth in Q 1 2022 should stand around 4.3% year-on-year (y/y), which includes the materialization of part of the risks related to the emerging crisis due to the Russia - Ukraine conflict.

The adopted economic policy measures (EUR 5.8 bn, about 13% of GDP in 2020) minimized the decline in GDP in 2020 while an additional package of EUR 2.2 bn (4.2% of GDP) in 2021 contributed to further GDP growth and its return to the path of sustainable growth in the medium term

According to NBS February 2022 projection, inflation will be on a declining path throughout 2022. The conflict in Ukraine creates significant upside risks in energy, commodities and food prices.

In 2021 current account deficit of EUR 2.34 bn (-4.4% of GDP) was recorded, with the record inflow of FDI (EUR 3.9 bn)

Owing to product and geographic diversification and export-oriented investments, goods exports in 2021 increased by as much as 29.1% y/y.

Moody's has upgraded Serbia's credit rating (March 2021 while S&P revised upwards the outlook for obtaining an investment rating from stable to positive (December 2021 and Fitch confirmed credit rating in conditions of intensified geopolitical tensions (February 2022) while acknowledging the maintained macroeconomic stability and favourable outlook, as well as adequate economic policy response before and during the pandemic.

4.1.1 Overview of Gross Domestic Product (GDP) growth

Serbia recorded a cumulative growth of real GDP of 6.4% in two pandemic years. According to the SORS[16] data, in 2021, Serbia achieved a real GDP growth of 7.4% driven by recovery in service sectors, as well as growth in construction and industrial production.

NBS projects growth in Q1 2022 of 4.3% y/y, whereby the projection includes the effects of the conflict between Russia and Ukraine, which led to disturbance in production and trade of goods and services worldwide.

[16] Statistical Office of the Republic of Serbia

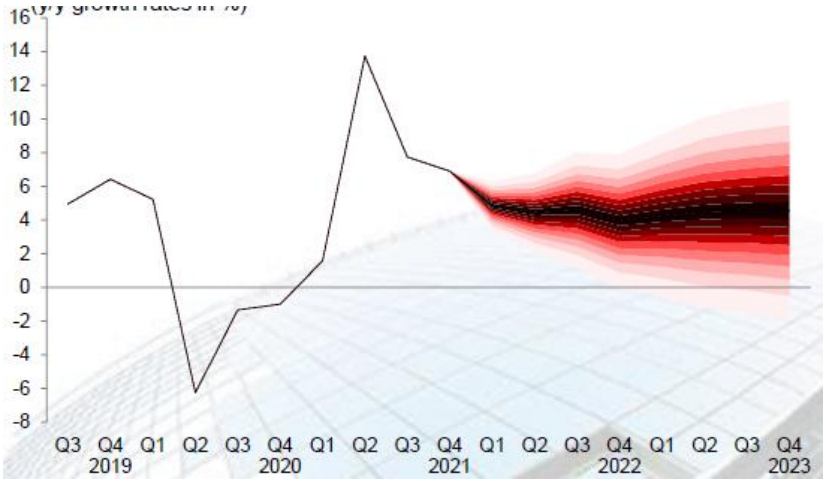


Figure 4.1. GDP forecasts of the National Bank of Serbia (NBS)

According to the International Monetary Fund data, the Serbian GDP variations of the years, since 1996, are given in the following figure.

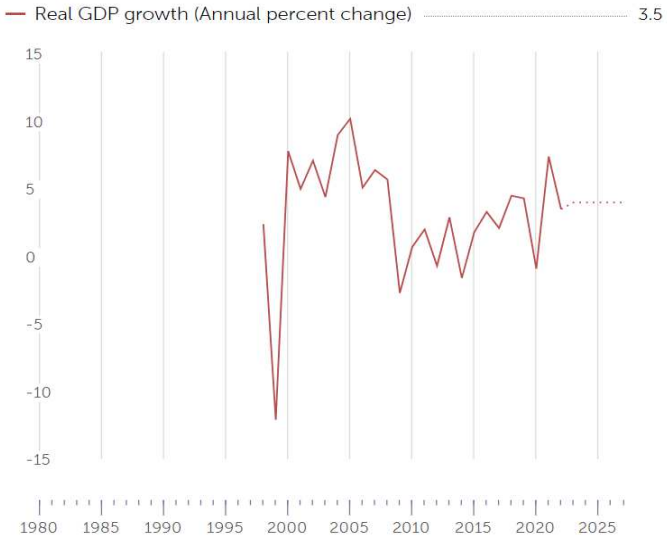


Figure 4.2. Serbian GDP growth since 1996 (IMF data)[17]

GDP reached the pre-crisis level in 2021 Q1, and, according to NBS estimate, in Q4 it is more than 5% above the pre-crisis level.

For 2022 and the medium term, the NBS expects growth to be in a range between 4%-5%, as a result of new investment cycle. This year, it is expected that the growth will be predominantly driven by further developments in service sectors, as well as construction and industrial production.

In light of the conflict between Russia and Ukraine, risks to the projection form international environment particularly those related to supply chain disruption, energy crisis and prices of primary products are asymmetrical to the downside. Since geopolitical situation is changing constantly, and new sanctions are being introduced, it is difficult to determine the economic effects of the conflict on Serbia.

[17] https://www.imf.org/en/Countries/SRB#ataglance , last accessed 5 May 2022.

4.1.2 Overview of investments

In 2015-2019, fixed investments grew at an average annual rate of about 10%, while their cumulative growth was about 64%. The share of fixed investment in GDP increased to 22.5% in 2019.

Despite pandemic, fixed investments cumulatively increased during 2020 and 2021 for around 12%. Thanks to the new investment cycle, the share of fixed investments in nominal GDP should reach the level of around 26% as early as 2024 and move around that level in the medium term.

Government investments reached level of over 7% of GDP and should remain around that level in the medium term.

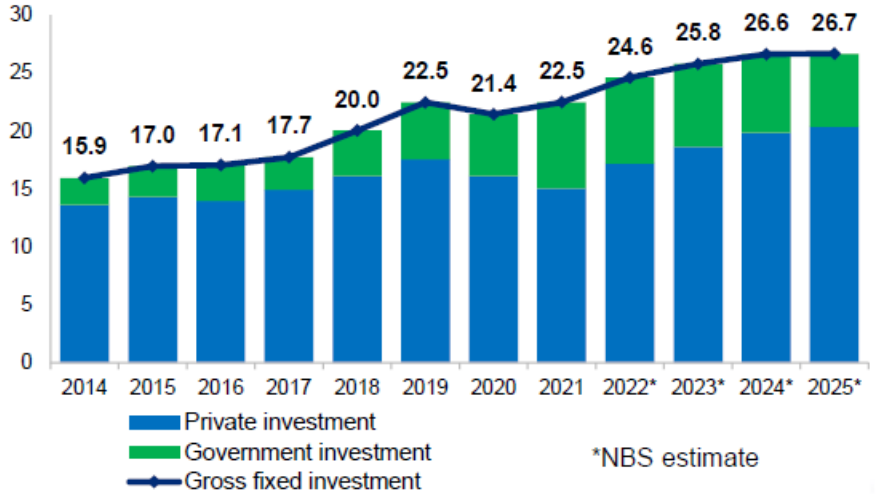


Figure 4.3. Overview of investments in Serbia for the period 2014-2025[18]

In earlier years, investments have largely relied on Foreign Direct Investments (FDI). Owing to maintained macroeconomic and financial stability, exchange rate stability, as well as fiscal consolidation. In recent years, three additional strong pillars for financing investments have been established: multiplied profitability of the economy, investment loans and doubled government investments. On top of that, FDI inflow reached record levels of around 8% of GDP.

[18] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 5 May 2022.

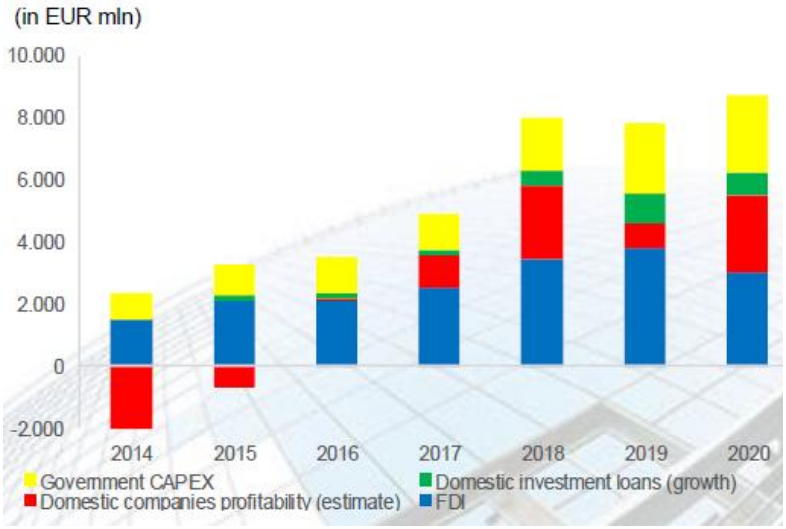


Figure 4.4. Key sources in investment financing[19]

4.1.3 Overview of trade parameters

In 2021, there was an intensive growth of **exports** of goods of 29.1%, driven by the recovery of exports of the manufacturing industry, which would have been even faster if there were no disruptions in global chains.

The growth of exports of services in 2021 amounted to 26% and was driven by exports of ICT services, as well as tourism services, which fully recovered in 2021. During the first two months of 2022, an increase in goods exports of 30.4% y/y was recorded, driven by growth in exports of manufacturing and mining.

Exports of services increased by 32.6% y/y.

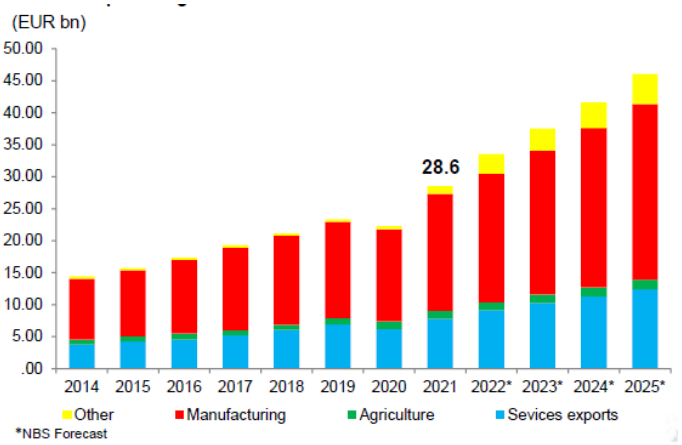


Figure 4.5. Growth and composition of exports[20]

Serbia's exports are largely directed towards EU and countries of the region, and reliant on demand in those countries which were recovering during 2021. In 2020, most of Serbian exports went to the EU, followed by CEFTA[21] countries and CIS[22] countries.

[19] Ibid.
[20] Ibid.

By country, the largest share of exports went to Germany (12.7%), followed by Italy (8.5%), Bosnia and Herzegovina (7.2%), Romania (5.5%), Hungary (5.0%) and Russia (3.9%). Exports to China in 2021 continued to grow compared to 2020, while recording growth even in 2020, so China is highly positioned on the list of Serbian export partners.

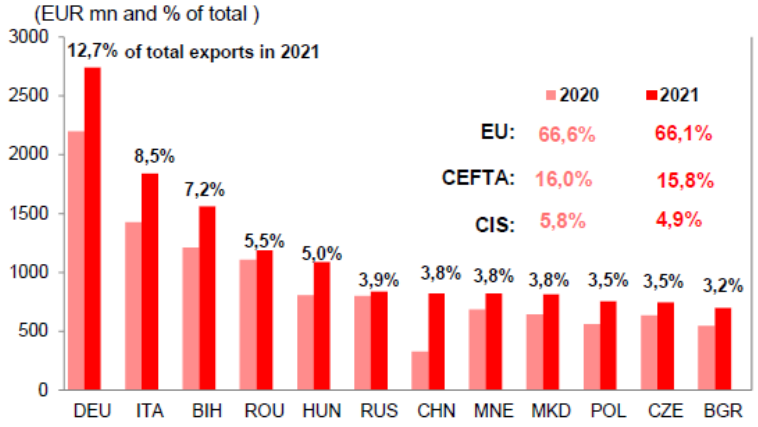


Figure 4.6. Destination countries of Serbian exports[23]

Goods **imports** increased by 25.4% in 2021, driven by intermediate products, of which a significant part relates to energy imports. Imports of equipment and consumer goods continued to grow.

Imports of goods increased by 52.0% y/y during January-February 2022. The biggest contribution came from intermediate goods, partly due to the growth of energy prices.

The agreement reached on a favourable import price of gas during the first half of 2022 is expected to have a positive effect on the balance of payments, as well as on macroeconomic developments as a whole.

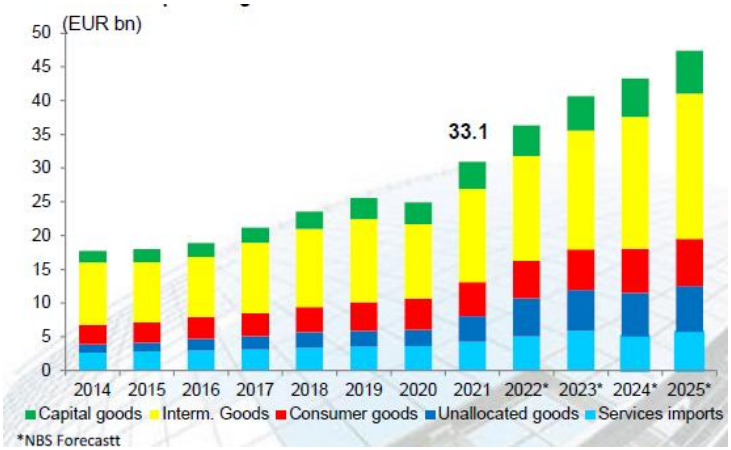


Figure 4.7. Growth and composition of imports[24]

[21] Central European Free Trade Agreement - https://cefta.int

[22] Commonwealth of Independent States - https://cis-legislation.com/index.fwx

[23] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 5 May 2022.

[24] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 5 May 2022.

Majority of imports (more than 58% in 2021) come from the EU, followed by CIS and CEFTA. In 2021, compared to 2020, imports (as well as exports) in absolute terms increased in most significant countries.

By country, the largest shares of imports are from Germany (13.2%), whereas the share of imports from China increased from 9.0% in 2019 to 12.5% in 2020 and sits at 12.8% in 2021.

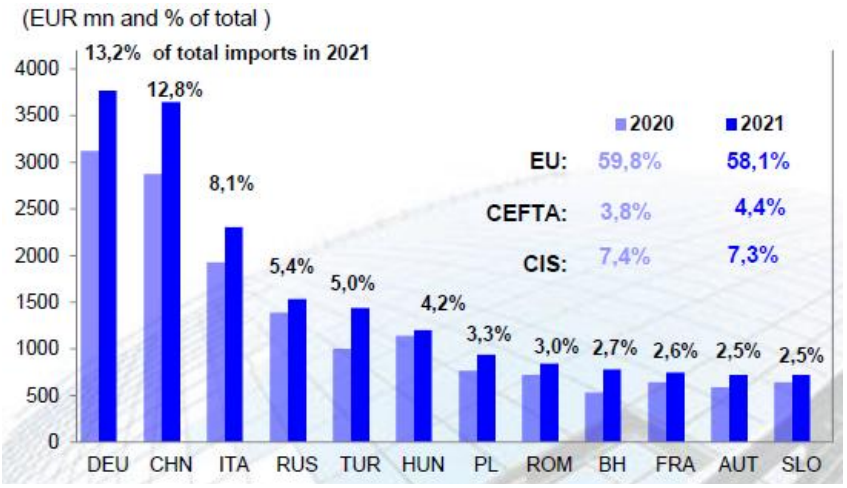


Figure 4.8. Origin countries of Serbian imports

4.2 Modal split of the overall transport volumes

Data about cargo flow in Serbia obtained from the Statistical Office of the Republic of Serbia cannot be considered as an appropriate source of information due to a lack of clear rules about which companies, registered for transport and production activities, are obliged to submit data about quantities of transported goods and transport routes. For that reason, data about volume of transport that are available on Statistical Office of the Republic of Serbia internet site cannot be considered overall or final, but only indicative.

The volume of transported cargo is presented according to basic quantitative indicators in tons (t) of cargo and tonne-kilometers (tkm), in accordance with the published methodology. The data presented under the term "traffic" refer to the total loading and unloading at terminals, regardless of whether they are realized by means of transport of domestic or foreign operators. In addition, the throughput of port terminals, besides to loading and unloading on/from vessels, includes the cargo throughput that has previously been stored in the port area.

The data presented in this section is taken from the documentation of the Statistical Office of the Republic of Serbia and is processed together with data from other sources like Customs Administration of the Republic of Serbia, Port governance agency, etc.

The total volume of cargo transport in the Republic of Serbia which is expressed in tons in the observed period (2015–2020) ranged from a minimum of 26.684million tons (in 2015) to a maximum of 34.78million tons (in 2019).

Volume of transported cargo by transport modes for the period from 2015 to 2020 is shown in Table 4.1.

Types of transport	Volume of transported cargo (10^3 t)					
	2015	2016	2017	2018	2019	2020
Land transport	25143	27415	28555	31667	33092	32061
Railway transport	11887	11896	12352	12317	11506	10499
Road transport	7964	9897	10120	13056	15858	15638
Pipelines transport	5292	5622	6083	6294	5728	5924
Inland waterway transport	1537	2014	1449	1559	1697	1692
Air transport	3.7	4.8	6.7	6.7	5.6	4.2
Total	26684	29434	30011	33233	34780	33663

Table 4.1. Volume of cargo in Republic of Serbia by types of transport from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data from Table 4.1 point out that railway transport had the largest share in the modal split till 2018, where from the road transport takes the lead in sharing. The share of railway transport ranged from a minimum of 31.19% (in 2020) to a maximum of 44.55% (in 2015). It is noticeable that in 2018, for the first time, the volume of cargo transported by road was higher (share of 39.29%) compared to rail (share of 37.06%).

The share of road transport in the modal split shows positive trend in the observed period, i.e. it goes from 29.85% in 2015 to 46.45% in 2020. The volume of cargo transported by road in 2020 was 1.56 times higher than in 2015.

The share of pipeline transport in the modal split showed minimum variation among all transport modes – 19.83% in 2015, 19.10% in 2016, 20.27% in 2017, 18.94% in 2018, 16.46% in 2019, 17.55% in 2020.

The share of inland waterway transport had a pick in 2016 with 6.84%. The quantity of transported cargo in 2016 had about 40% increase from the minimum year of 2017 and about 20% increase from the second best year of 2019. In general, variations in quantity of cargo transported by inland waterway transport are constant with occasional picks every 4 to 5 years. It can be clearly viewed in Table 4.1 that there was a downward trend in the volume of transport from 2015 to 2017 and a slight increase from 2018 onwards.

The share of air traffic during the entire period ranged between 0.01% and 0.02%

An overview of the growth index of freight transport volume (in percentages) by transport modes for the period from 2015 to 2020 is given in Table 4.2.

Types of transport	Growth index (%)				
	2016./ 2015.	**2017./ 2016.**	**2018./ 2017.**	**2019./ 2018.**	**2020./ 2019.**
Land transport	109.0	104.2	110.9	104.5	96.9
Railway transport	100.1	103.8	99.7	93.4	91.2
Road transport	124.3	102.3	129.0	121.5	98.6
Pipelines transport	106.2	108.2	103.5	91.0	103.4
Inland waterway transport	131.0	71.9	107.6	108.9	99.7
Air transport	129.7	139.6	100.0	83.6	75.0
Total	110.3	102.0	110.7	104.7	96.8

Table 4.2. Growth index of freight transport volume(in tons) by types of transport for the period 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data from Table 4.2 indicate that the growth indices of freight transport volume had the positive trend until 2020 where a slight flattening of the trend line happened. The average annual growth index in the observed period of 5 years for the total volume of transport was 4.76%despite decline of -3% that occurred in the last observed year. According to data from Statistical Office of the Republic of Serbia presented in Table 4.2, the average annual growth rate in land transport was 4.98%. Positive average growth rates were recorded in road (14.45%), air (2.57%), pipeline transport (2.28%) and inland waterway transport (1.94%) while negative average growth rates were recorded in rail transport (-2.45%).

The total volume of transport expressed in achieved tkm in the observed period ranged from a minimum of 8.02 billion tkm (in 2015) to a maximum of 12.8 billion tkm (in 2019).

A comparative overview of achieved tkm by types of transport for the period 2015 – 2020 is shown in Table 4.3.

Types of transport	**Achieved tkm (10^6)**					
	2015	**2016**	**2017**	**2018**	**2019**	**2020**
Land transport	7147	8340	9317	10696	12047	11306
Railway transport	3249	3087	3288	3187	2864	2746
Road transport	2974	4299	4980	6443	8175	7741
Pipelines transport	924	954	1.049	1.056	1.008	819
Inland waterway transport	865	927	725	580	727	558
Air transport	4.7	10.2	20.7	20.1	15.1	15.7
Total	8017	9277	10063	11286	12771	11862

Table 4.3. Achieved tkm by types of transport in the Republic of Serbia for the period 2015-2020 (source: Statistical Office of the Republic of Serbia)

The share of achieved tkm in railway transport ranged from a minimum of 22.39% (in 2019) to a maximum of 40.53% (in 2015).

The share of achieved tkm in road transport ranged from 37.10% in the first observed year to 65.16% in the last observed year. Achieved tkm in 2020 were about 2.6 times higher than in 2015.

The share of achieved tkm in pipeline transport ranged from a minimum of 6.9% (in 2020) to 11.53% (in 2015).

The share of achieved tkm in inland waterway transport was the highest at the beginning of the observed period with 10.79%, while the lowest share was recorded in 2020 and it was only 4.7%. Achieved tkm in 2020 were 2.29 times lower than in 2015.

The share of achieved air transport during the whole period was insignificant in terms of tkm and ranged between 0.01% and 0.02%.

In Table 4.4 an overview of growth index of achieved tkm is given by types of transport in the Republic of Serbia for the period 2015 to 2020.

Types of transport	Growth index of achieved tkm (%)				
	2016/ 2015	2017/ 2016	2018/ 2017	2019/ 2018	2020/ 2019
Land transport	116.7	111.7	114.8	112.6	93.8
Railway transport	95.0	106.6	96.9	89.6	95.9
Road transport	144.6	115.8	129.4	126.9	94.7
Pipelines transport	103.2	110.0	100.7	95.5	81.3
Inland waterway transport	107.2	78.2	80.0	125.3	76.8
Air transport	217.0	202.9	97.1	75.1	104.0
Total	115.7	108.5	112.2	113.1	92.9

Table 4.4. Growth index of achieved tkm by types of transport in the Republic of Serbia for the period 2015 to 2020

Data from Table 4.4 indicate that the growth indices of achieved tkm had the positive trend during period from 2015 to 2019, while there was slight negative trend from 2019 to 2020. The average annual growth rate in the observed period of 5 years for the achieved tkm was 8.15% despite decline of 7% that occurred in the last observed year. It suggests that there was a boost growth index from 2015 to 2019. According to Statistical Office of the Republic of Serbia presented in Table 4.4, the average annual growth rate in land transport was 9.61%. Positive average growth rates were recorded in road (21.09%) and air (27.28%) transport while pipeline transport (with –2.38%), inland waterway transport (with –8.39%) and rail transport (with –3.31%) experienced negative average growth indices. It is indicative that growth indices in inland waterway transport varied, recording positive trends in periods 2015–2016 (7.17%) and 2018–2019 (25.34%). The biggest growth index was noted in air transport for the period 2015–2016 and it is 117.02%. Other significant growth indices appear in road transport among which the biggest is achieved in the period 2015–2016 with 44.55% of growth.

Observed by types of traffic, in the period from 2015 to 2020, there was an increase in the volume of cargo transport in both domestic and foreign transport with small variations recorded by year in some modes of transport, especially in 2020 when there was a decline in the volume of transport due to the consequences of the global pandemic (see Table 4.5).

Types of transport	Volume of transported cargo (10^3 t)					
	2015.	2016.	2017.	2018.	2019.	2020.
Foreign transport: total	15307	16857	19044	19546	19385	18974
Land transport	14453	15980	18308	19024	18652	18458
Railway transport	7997	8261	9151	8610	8169	7437
Road transport	3138	4016	4890	5919	6331	6758
Pipeline transport	3318	3703	4267	4495	4152	4263
Inland waterway transport	850	872	729	515	727	512
Air transport	3.7	4.9	6.7	6.7	5.6	4.2
Domestic transport: total	11376	12577	10967	13687	15721	14689
Land transport	10689	11435	10247	12643	13721	13599
Railway transport	3890	3635	3201	3707	3337	3062
Road transport	4826	5881	5230	7137	8838	8876
Pipeline transport	1973	1919	1816	1799	1576	1661
Inland waterway transport	687	1142	720	1044	970	1090
Air transport	-	-	-	-	-	-
Total	26684	29434	30011	33233	34780	33663

Table 4.5. Volume of transport by types and modes of transport in the Republic of Serbia for the period from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

4.3 Transport volumes on inland waterways

The data on cargo transport by inland waterways refer to transport activities realized by companies and organizations registered for transport activities, regardless of whether the transport was performed inside or outside the national boundaries and for domestic or foreign users. The inland waterway transport operations are shown in ton-kilometres and reflect operations in transport carried out inside as well as outside the territory of the Republic of Serbia.

Domestic inland waterway cargo transport carried out by vessels under national or foreign flag covers the overall traffic at Serbian river ports, including other loading and unloading places out of ports.

Cargo loading or discharging at river ports and places out of ports refers only to realization of activities performed by companies responsible for cargo handling on the operational quays. It is mainly smaller than the overall throughput at river-ports by its volume. Total cargo transport and cargo loading and unloading from 2015. to 2020. in Republic of Serbia are given in Table 4.6.

Years			**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Ton-kilometers, million			865	927	725	580	727	558
Cargo transport (1000 tons)	National transport		687	1142	720	1045	970	1090
	Exports		126	121	133	151	195	221
	Imports		709	749	591	297	458	276
	Transit		15	2	4	60	64	15
	Traffic between foreign ports		–	–	–	–	10	–
Cargo loading or discharging (1000 tons)	Total cargo	Total	6486	8411	7112	8570	10821	9368
		Loading	2614	3594	2638	3432	4676	4957
		Unloading	3872	4817	4474	5138	6145	4411
	National cargo	Total	1354	2284	1440	2236	2170	2410
		Loading	677	1142	720	1118	1085	1205
		Unloading	677	1142	720	1118	1085	1205
	International cargo	Total	5132	6127	5672	6334	8651	6958
		Exports	1937	2452	1918	2314	3591	3752
		Imports	3195	3675	3754	4020	5060	3206
	Transit cargo	Total	4196	3812	3351	2844	3629	3436
		Upstream	1601	1827	1660	1739	2274	1927
		Downstream	2595	1985	1691	1105	1355	1509

Table 4.6. Transport volumes on inland waterways (source: Statistical Office of the Republic of Serbia)

The throughput of cargo in Serbian river ports from 2015 to 2020 is shown in Table 4.7. Data are gathered from the Statistical Office of the Republic of Serbiainternet site.

Year	**Cargo throughput in portsa (10^3 t)**									**Transit**
	Total cargo throughput			**Domestic throughput**			**Foreign throughput**			
	Total	***Load***	***Unload***	***Total***	***Load***	***Unload***	***Total***	***Export***	***Import***	
2015	6486	2614	3872	1354	677	677	5132	1937	3195	1595
2016	8411	3594	4817	2284	1142	1142	6127	2452	3675	3808
2017	7111	2637	4474	1439	719	720	5672	1918	3754	3351
2018	8570	3432	5138	2236	1118	1118	6334	2314	4020	2844
2019	10821	4676	6955	2170	1085	1085	8651	3591	5060	3629
2020	9368	4957	4411	2410	1205	1205	6958	3752	3206	3436

Table 4.7. Cargo throughput in Serbian river ports from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data in Table 4.7 indicate constant rise in cargo throughput from 2015 to 2019 and a slight decline in 2020 probably due to global pandemic. In 2019, there was an increase in the cargo throughput in compare with throughput in 2018 by about 26.3%. Growth in numbers was recorded in both domestic and foreign transport. In 2020, compared to 2019, there was a decline of about 13.4%, primarily in foreign throughput.

4.4 Statistical overview for the Port of Prahovo

As a typical multipurpose port, the Port of Prahovo handled mostly fertilizers (components and finished products), general cargo, and, to a lesser extent, determined quantities of grains in export and metallurgical products in transit from the North Macedonia.

During the elaboration of this study, statistical data were provided by both Port Governance Agency as a public port governing body and by the Elixir Prahovo a.d. – a company operating the Port of Prahovo. Due to the higher availability of details and completeness, the statistical data obtained from the port operator are taken as a basis for all analyses in this study and are therefore presented below[25].

Cargo and trade direction	2017	2018	2019	2020	2021
Import - Phosphate (bulk)	479,450	505,825	609,320	568,930	479,300
Import - Copper concentrate (bulk)	84,260	76,950	141,670	20,290	0
Import - Coal (bulk)	27,300	14,734	9,460	30,950	32,240
Import - KCl potassium chloride (bulk)	12,500	16,840	28,900	25,300	45,560
Import - Road salt (bulk)	19,800	7,970	19,475	13,110	9,100
Import - Equipment and parts (general)	1,650	0	10,890	71	2,335
Import - Wire rods (general)	0	0	0	0	2,140
Export - Fertilizers (bulk)	45,000	77,410	42,346	31,300	44,240
Export - Fertilizers big bags (general)	81,750	120,160	230,720	208,600	232,440
Export - Monocalcium phosphate MCP (general)	13,640	9,750	7,598	4,850	3,030
Export - Monocalcium phosphate MCP (bulk)	10,020	27,832	31,045	50,990	35,710
Export - Grains (bulk)	5,900	8,090	1,020	17,070	19,320
Export - Scrap metal (bulk)	2,700	6,315		0	1,760
Transit - Hot rolled sheets (general)	67,000	150,220	54,130	88,640	47,400
Domestic - Limestone (bulk)	38,300	29,340	37,910	50,985	36,480
Domestic - Gypsum (bulk)	11,800	17,515	15,265	35,960	7,230
Total	**901,070**	**1,068,951**	**1,239,749**	**1,147,046**	**998,285**

Table 4.8. Transshipment statistics in the Port of Prahovo 2017-2021

Top three products handled in the Port of Prahovo are fertilizers and their components, metallurgical products and grains. Unfortunately, due to the very different methodologies for recording and maintaining statistical data on transshipment between the port operator in Prahovo and the Port Governance Agency, it was not possible to determine the share of the Port of Prahovo in the overall transshipment of these top three cargoes in other Serbian ports.

[25]Source: Questionnaire with answers obtained from the management of Elixir Prahovo during an interview

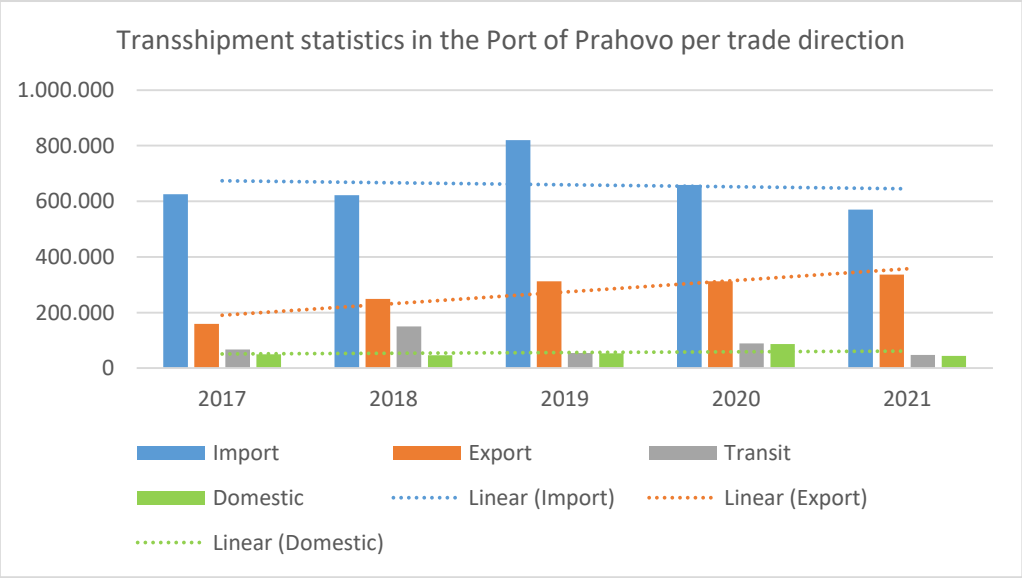


Figure 4.9. Transshipment statistics in the Port of Prahovo per trade direction 2017-2021

View from the point of view of trade direction, the data show that the export is on the constant steady growth and that the import is slightly declining over the last five years. Last but not least, domestic traffic has a very low growth, almost close to a full stagnation since 2017.

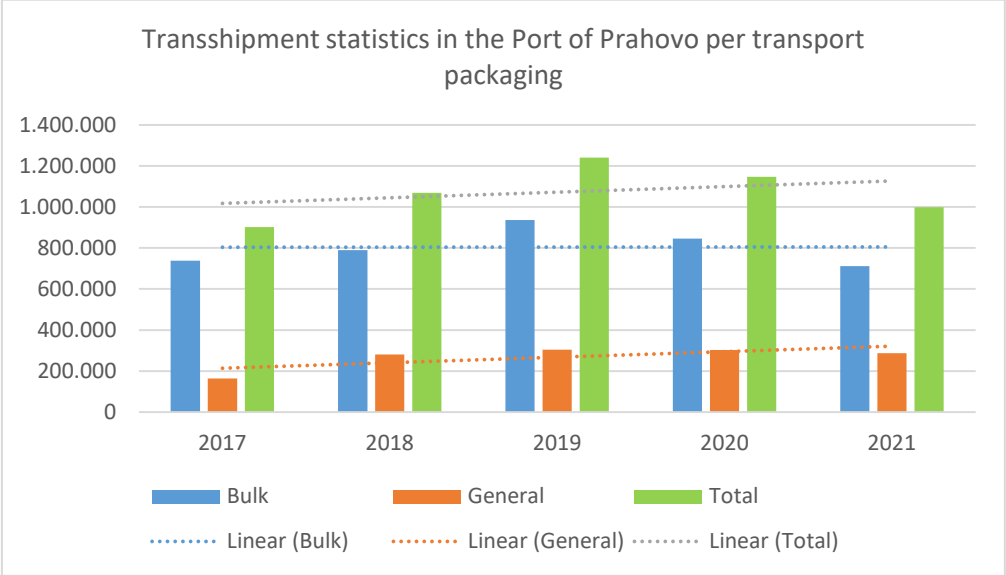


Figure 4.10. Transshipment statistics in the Port of Prahovo per transport packaging

From a different angle, available statistics demonstrate an average stagnation of the bulk cargo quantities on the one hand, and steady overall growth of general cargo and total volumes since 2017.

4.5 Capacity analysis

Currently, the operator of the Port of Prahovo, company “Elixir Prahovo” a.d., operates number of portal and slewing cranes on seven berths in the port. Productivities of this transshipment equipment are as follows:

Berth	Capacity (t/day)	Cargo packaging	Used for	Annual capacity in three shifts (t)
Berth 1	1500	Bulk	Unloading of bulk components for fertilizers, loading of bulk fertilizers and grains	451,500
Berth 2	1500	Bulk	Unloading of bulk components for fertilizers, loading of bulk fertilizers	451,500
Berth 3	1200	Bulk	Loading of bulk fertilizers (with loading crane) and unloading of components for fertilizers (with wheeled material handler)	361,200
Berth 4	1500	General	Loading and unloading of general (break-bulk) cargo: fertilizers in big bags, wire rods, hot rolled sheets	451,500
Berth 5	1500	Bulk	Unloading of components for fertilizers for stock (storage) and loading of gypsum	451,500
Berth 6	1000	Bulk and general	Rarely used, due to sloped quay making loading/unloading difficult, especially at lower water levels. Used for scrap metal loading, sometimes for lighter general cargo, up to 5 tons.	301,000
Berth 7	0	N/A	Not used. Scheduled for decommissioning and later reconstruction. Crane not functional.	0

Table 4.9. Productivity of existing cranes and their annual capacities

Capacity of the port us typically calculated in function of the capacity of the ship-berth link, that is, of the capacity of the transshipment equipment located at the berth or multiple berths. In addition to that, the working times, or the operating patterns of a port operator largely determine the annual capacity of the port. In case of the Port of Prahovo, the port operator works on a 24/7 basis, that is, from 00:00 hrs to 24:00 hrs, Monday to Sunday.

In addition to the internal factors determining the actual (or operational) port capacity, there are external factors affecting the annual operational capacity of a port. Most important external factor in this case is the fairway availability, or the number of days when navigation is possible. According to the report[26] of the Directorate for Waterways "Plovput" of the Ministry of Transport, Construction and Infrastructure the average number of the navigable days is 300. For the purposes of this calculation, the number of navigable days on the Danube is taken to be 301 days, or 43 weeks exactly. The remaining days of the year are not possible for navigation due to:

1. extremely high water levels,
2. extremely low water levels,
3. ice occurrence,
4. strong winds,
5. dense fog.

Finally, the simplest way to calculate the average annual (operational) capacity of the port is given in the following formula:

[26] http://www.plovput.rs/file/danube-stream/common-danube-report-2018.pdf - last accessed 6 May 2022.

$Q = W_d \times P_d$

Where:

Q – average annual capacity of a port (tons/year),

W_d – number of working days in a year,

P_d – daily productivity of a transshipment equipment or a berth (tons/day).

In case of the Port of Prahovo, W_d = 301, and P_d depends on the type of crane located at each berth.

In order to simplify the capacity analysis it has been decided not to analyse capacity of each berth, because various types of cargoes are handled at each berth. Instead, the cumulative capacities are determined for each type of transport packaging and, in certain cases, for determined types of cargo.

Capacities	Tons/day	Tons/year	Berths
Capacity for bulk cargo	5,700	1,717,500	B1+B2+B3+B5 (except scrap metal)
Capacity for grains	1,500	451,500	B1 (separate loading device at the same berth)
Capacity for general cargo	1,500	451,500	B4
Capacity for scrap metal in bulk	1,000	301,000	B6
Total capacity	9,700	2,919,700	Entire port

Table 4.10. Capacities for different types of cargo

It needs to be noted that grains are loaded at berth nr. 1, but not with the existing crane. Instead, a separate loading device is mounted for loading of grains, having the capacity of 1500 tons/day. However, the capacities are not combined together as the grain loading device cannot load cargoes other than grain.

Moreover, berth nr. 4 is occasionally equipped with a mobile (wheeled) material handler of the same capacity as the portal crane positioned at the berth nr. 4. It is not typical that this material handler and the portal crane operate in parallel, so their capacities are not summed together.

Finally, berth nr. 6 is equipped with a very old crane, capable of making 1000 tons/day. This berth and this crane are rarely used, because this berth is located on a sloped quay which makes operations very difficult, especially at lower water levels. It is, for example, used for loading of scrape metal.

From the point of view of capacity utilization on the basis of volumes handled in the last five years, figures in continuation demonstrate the utilization of capacities for each type of cargo packaging and, separately, for grains and scrap metal.

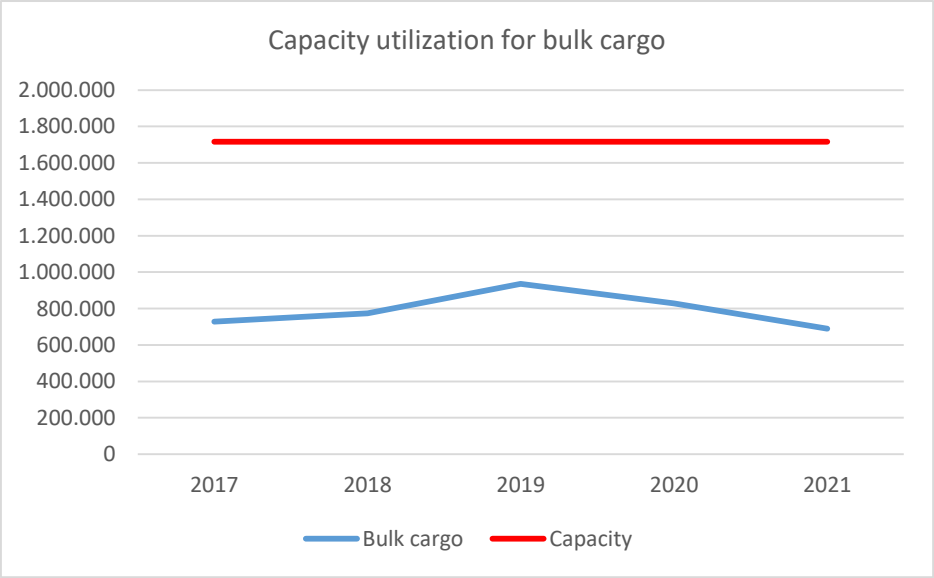


Table 4.11. Capacity utilization for bulk cargo

From the above figure, it can be seen that the bulk cargo transshipment equipment is used fairly well and that it has sufficient capacity reserves. In the last 5 years, the capacity utilization at the 4 berths where bulk cargo is mostly handled never surpassed 60%, which is the maximum recommended berth occupancy for four berths in the same group. According to UNCTAD Port Development Handbook[27], recommended berth occupancy (from the point of view of possible congestion effects) for ports/terminals with, for example, four berths of the same group (say, coal berths) is 60%. This means that, even though there is sufficient physical reserve of port capacity, congestion (with all its negative effects) can occur during peak loads when berth occupancy (or, in this case, simplified as capacity utilization) reaches values of more than 60%.

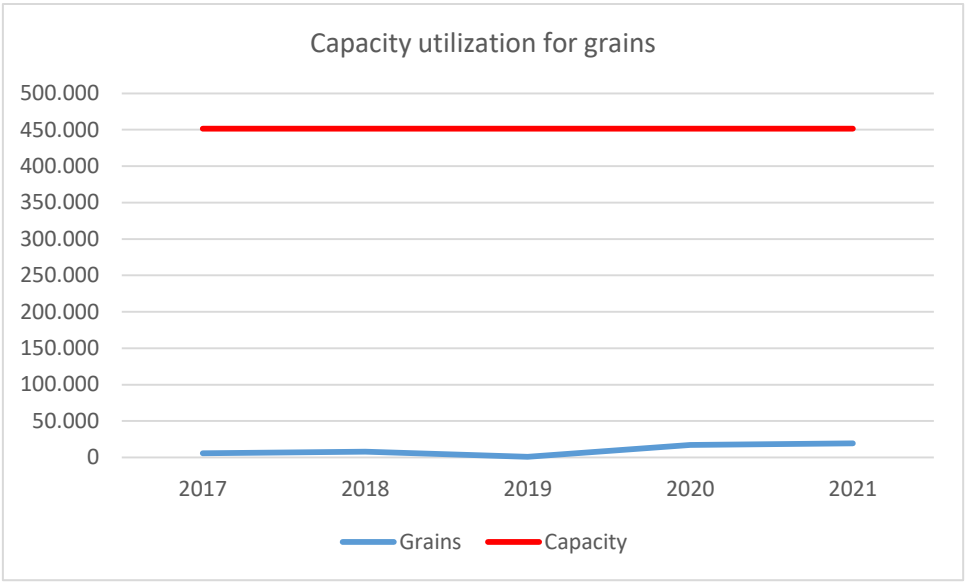


Figure 4.11. Capacity utilization for grains

This figure demonstrates that the utilization of the grain loading facility is very low and that it had sufficient capacity reserves in the last 5 years. This is not a surprise, given the fact that the grain loading device is

[27]UNCTAD (1985), *Port Development: A handbook for planners in developing countries*, New York.

intended solely for grains and that the volumes of grains loaded in the Port of Prahovo are not as high as in the ports of northern Serbia.

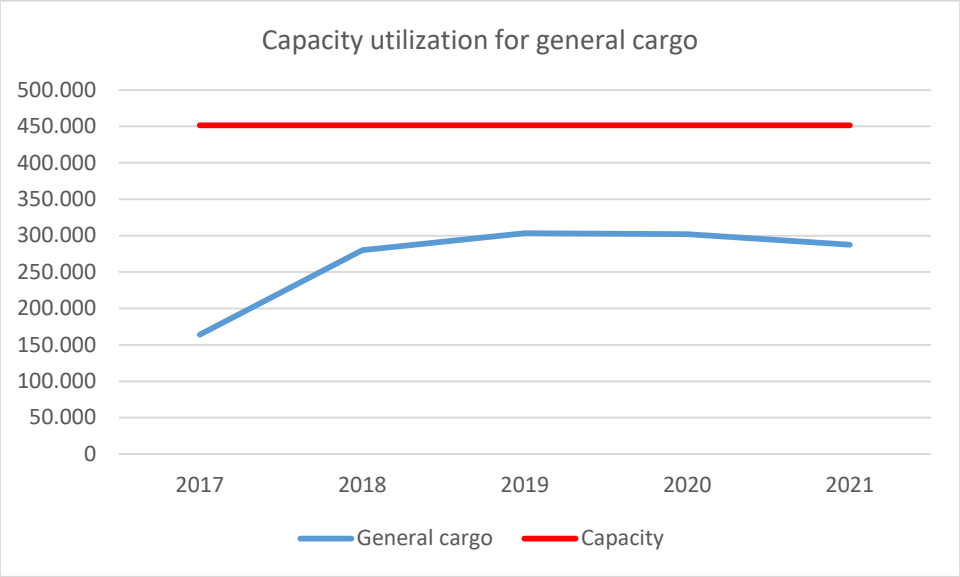


Figure 4.12. Capacity utilization for general cargo

Capacities for general cargo are utilized well above the average. Berth nr. 4 is where most of the capacities for general cargo are located, while berth 6 capacities are rarely used and, even then, only for the general cargo up to 5 tons of weight. It is noted that general cargo capacities are used well above 60% since 2018. UNCTAD recommendation for maximum occupancy of one berth is 40%, while for two berths in the same group is 50%. In both cases, even though there are reserves of physical capacity, capacities for general cargo are overused and the port is in danger of experiencing congestion effects, especially in peak periods.

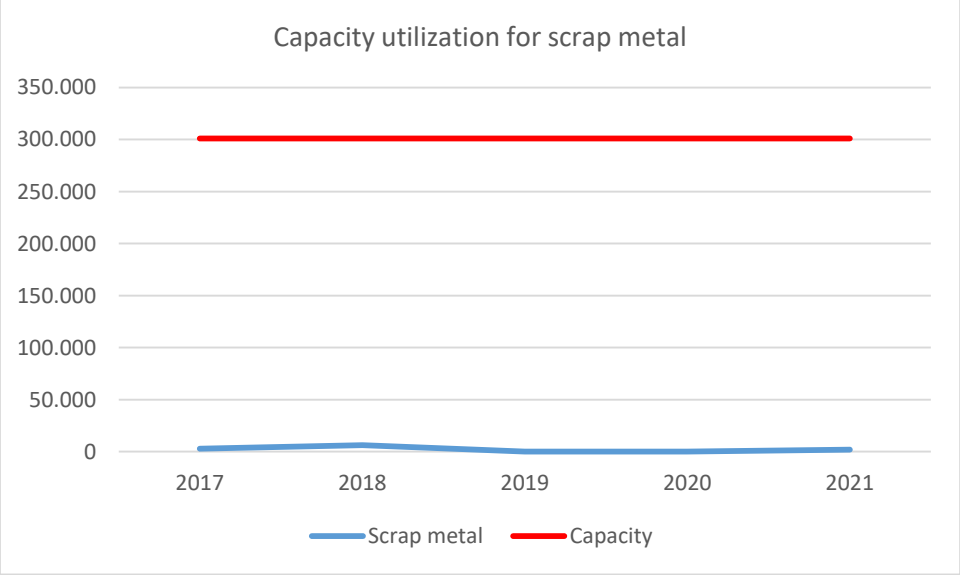


Figure 4.13. Capacity utilization for scrap metal

Capacities at berth nr. 6 are conveniently named capacities for scrap metal, since this type of cargo was loaded when this berth was last used. This capacity (berth itself and the old crane) can be used as a reserve capacity for either general (up to 5 tons) or bulk cargo, when water levels allow it.

4.6 Potential users

Most direct port users for are **exporters and producers of fertilizers**. Since the port is operated by the only fertilizer producer in Serbia, Elixir Prahovo d.o.o., components for fertilizers and complete fertilizers represent the largest group of cargoes handled in the Port of Prahovo. Companies belonging to Elixir Group use ports of Šabac and Prahovo for their imports of fertilizer components and export of fertilizers, because Elixir is a port operator (through their daughter companies) in the ports of Šabac and Prahovo.

In the absence of any newer data, the authors of this study used the Report on the Analysis of the State of Competition on the Market of Wholesale of Artificial Fertilizers in the Territory of the Republic of Serbia in the Period 2017-2019[28] in order to determine the potential users in the domain of fertilizers.

According to this report, production of artificial fertilizers in the period 2017-2019 had a growing trend, and since mid-2018, only one producer operates in the Republic of Serbia - the company "Elixir Group" (Elixir Group). When it comes to imports, according to the data of the Customs Administration, in 2017 and 2018, the leading importer was also "Elixir", but in 2019, the company "Promist" replaced “Elixir” in that position.

In 2019, the import of fertilizers achieved a growth of over 60% compared to the previous year. Fertilizers are mostly imported from Russia, while far smaller quantities are imported from Croatia, Austria, Hungary and Romania. Nitrogen and complex fertilizers predominate in the total import of mineral fertilizers, and these two types of fertilizers together make up 85-90% of the total import of fertilizers in the observed period. In 2019, the increase in exported quantities by 29% and the realized value of exports by 51% compared to 2017.

In terms of **grains**, only limited quantities are handled in Prahovo, mostly because of its unfavourable location away from the main agricultural centres. When the locations of the top 25 grain exporters are observed, it can be seen that none of them is even close to Prahovo. According to the report[29] of “Žita Srbije“ (2021), the following companies are the top 25 exporters of grains:

Nr.	COMPANY	Tons
1	AGROGLOBE, NOVI SAD	452,592
2	CHS SERBIA, NOVI SAD	442,039
3	DELTA AGRAR, BELGRADE	315,817
4	CONSUL, NOVI SAD	284,038
5	TRADING TEAM, NOVI SAD	179,848
6	VIMEXIM, NOVI SAD	145,525
7	ĆIRIĆ AND SON, SAKULE	141,582
8	MAT AGRO, FUTOG	138,166
9	BCM TRADE, BELGRADE	120,691
10	RWA SERBIA, BELGRADE	105,330
11	AGRICOM COMP. GROUP, SOMBOR	80,283
12	VITERRA-GRANOLIS, NOVI SAD	64,329
13	BIMAL TRADING, BELGRADE	64,207

[28] Republic of Serbia, Competition Protection Commission, Report on the Analysis of the State of Competition on the Market of Wholesale of Artificial Fertilizers in the Territory of the Republic of Serbia in the Period 2017-2019, Belgrade, November 2020, available at: http://www.kzk.gov.rs/kzk/wp-content/uploads/2020/12/Izveštaj-o-sektorskoj-analizi-na-tržištu-mineralnog-đubriva.pdf - last accessed 27 April 2022.

[29] Žita Srbije (2021), Annual Report on Grains Exports in 2021, Belgrade (*in Serbian*)

14	AGRO DOM TIM, CRVENKA	61,146
15	ANOVA NNL, SREMSKA KAMENICA	52,487
16	AS AGRO 99, BANATSKO NOVO SELO	52,278
17	AXEREAL SERBIA, NOVI SAD	51,273
18	AL DAHRA SERBIA, SLOPE SCAFFOLDING	50,268
19	ALCOR DLV, NOVI SAD	47,498
20	SOCIETY BALKANS, NOVI SAD	44,994
21	AGROFINANCE, BELGRADE	42,241
22	ALMEX, PANČEVO	41,935
23	SOLE KOMERC, BELGRADE	41,533
24	ŽITOPROMET MLINPEK, SREMSKA MITROVICA	37,254
25	DUMICO, BELGRADE	36,652

Table 4.12. Top 25 grain exporters in Serbia for 2021

One of the largest importers through the Port of Prahovo was the company **Serbia Zijin Copper** d.o.o., importing large amounts of copper concentrate requested for its production programme. As of 2022, this company expects to start its own programme of copper concentrate production, which will be then exported partly through the Port of Prahovo. In addition to that, the company is using coal for its smelters-related processes.

Another important current and potential user of the port is the company **Feršped Skopje**, from North Macedonia. This company imports hot rolled metal sheets and plates, as well as wires in rods, via the Port of Prahovo. In 2018, the company imported 150,000 tons of hot rolled metal sheets as general cargo. Thanks to its production programme, the company offers important potentials for cargo transshipment through the port.

Phosphea Danube d.o.o. is a Serbian company specialized in production, sales and distribution of monocalcium phosphate (MCP) for animal feed. It exports part of its products through the Port of Prahovo.

Company **Bom trade** imports road salt through the Port of Prahovo. Bom trade is a global manufacturing and trading company with a focus on the processing and distribution of salt as well as bitumen emulsions.

Wire rods are imported by company **Spajić d.o.o**. from Negotin, for their own production processes.

Company **Lafarge Srbija** from Beočin, receives gypsum and limestone for the needs of their cement factory. These cargoes are loaded in the Port of Prahovo and loaded at the company quay in the Port of Beočin.

Other potential users are to be companies that are expected to settle within the industrial-chemical park in Prahovo, which is founded by Elixir group. The aforementioned company Phosphea (with its headquarters in France) has already settled in this park and already started using the port services.

4.7 Development Perspectives (Forecast scenarios)

The 25 years forecast (2022-2047) of the total volume of ship-to-shore (and vice-versa) transshipment in the Port of Prahovo was made on the basis of partial estimates and forecasts using the analytical method of

different growth rates, taking into account detailed discussions with the port operator and the following recommended[30] infrastructure and suprastructure additions to the port:

6. silo reconstruction until 2025,
7. construction of the "green terminal" in 2025 or 2026, at the new berth nr. 8,
8. reconstruction of the entire berth infrastructure, from berth 1 to berth 7 to form a vertical quay wall along the entire berth line,
9. reconstruction of the so called "winter port" – an unused shallow port basin which used to be used a s a winter shelter for vessels in the past, through its land filling and construction of the additional storage areas and landside equipment for storage and treatment of waste oils and bilge waters,
10. additional storage capacities for general and bulk cargo planned by the current operator, with first quantities of additional cargoes appearing in 2025,
11. modernization of the transshipment equipment from 2024 and onwards,
12. necessary reconstruction of the internal roadways and railways and, especially the railway link from the Port of Prahovo to the main railway station Prahovo from 2025 to 2030.

As a general guidance, the forecasts for the Serbian GDP and export/import growth, prepared by the International Monetary Fund[31] were relied on.

Subject Descriptor	2019	2020	2021	2022	2023	2024	2025	2026
GDP	4.25%	-0.98%	6.54%	4.50%	4.50%	4.00%	4.05%	4.04%
Imports	9.81%	-0.25%	17.57%	6.57%	6.07%	5.57%	5.87%	5.87%
Exports	8.45%	-3.11%	24.04%	6.54%	5.54%	5.54%	5.54%	6.04%

Table 4.13. IMF analysis and forecast for the Serbian GDP and export/import growth

In order to engulf the widest possible scope of opportunities, the forecast will be done in two scenarios: Scenario 1 (minimalistic) and Scenario 2 (maximalist). For both scenarios, statistical data from 2021 have been used as a forecast basis.

Following baseline data, growth factors, major events, assumptions and facts were taken into account during the forecasting process[32]:

Scenario 1

Import cargoes

Phosphate in bulk: in Scenario 1, it is estimated that the incoming cargo flows for the production of fertilizers in the fertilizers factory of Elixir Prahovo (company which is, at the same time, a port operator of the Port of Prahovo) can grow at a rate of 5% annually, until 2026. Thereafter, as the quantities are approaching the maximum amount needed for the production (820,000 t/year), the growth becomes slower and remains at 2% annually.

[30] On the basis of discussions with the Port Governance Agency, port operator, several cargo owners and field visit during which a basic technical assessment of the port was performed, all in the period April-May 2022.
[31] International Monetary Fund, World Economic Outlook Database, October 2021, available at: https://www.imf.org/en/Countries/SRB#ataglance – last accessed 10 May 2022.
[32] For all the cargoes related to fertilizers, growth rates have been discussed and evaluated jointly with the fertilizers producer Elixir Prahovo, and estimated taking into account their production plans in the forthcoming years.

Coal in bulk: coal is, currently, needed for the production in the company Elixir Prahovo. It will remain so until the company transfers to an alternative fuel – old tyres. It will grow at a pace of 2% annually, but only until 2023, and in 2024 it is expected to drop down by 10% due to gradual transfer to alternative fuels, in order to be completely abandoned as of 2028.

KCl (potassium chloride) in bulk: needed for the production of fertilizers, the import of this cargo will grow 15% in 2022 due to the production demand, whereas it is expected that it will grow at the rate of 5% annually until it reaches the maximum production needs of 60,000 t/year.

Road salt in bulk: Import of this cargo will grow at a rate of 5% until 2025, and after that it is expected that the growth will remain at 2% until the end of the forecasting period.

Equipment and parts as general cargo: this cargo is needed mostly for the needs of the company Serbia Zijin Copper (copper mine operator) for the construction and overhaul of the equipment for processing of copper ore in the vicinity of the city of Bor. It will remain constant until 2025. As of 2025, it is expected that the growth of this cargo remains slow but steady, approximately 2% annually, due to the constant demand of the aforementioned user and other industrial users settling in the industrial-chemical park in Prahovo.

Wire rods (general cargo): due to increase of production of the company Spajić d.o.o., this cargo will grow significantly as of 2022, reaching 50% growth until 2025, thereafter slowing down to 10% until 2028 and 5% thereafter, until the maximum quantity of 20,000 t/year are reached.

Triple super phosphate (TSP) in bulk: this cargo is expected to start flowing in the port as of 2022, growing by 25% annually until 2025. Thereafter, the growth should remain slow and constant, until the maximum needs of 5,000 t/year is reached.

Waste oil (liquid bulk): import of this cargo will be limited with the capacity of the processing facility at the "green terminal". It is expected that the quantities of 2,000 t/year are imported as of 2026, when this facility becomes operational.

Bilge waters (liquid bulk): import of this cargo will be also limited with the capacity of the processing facility at the "green terminal". It is expected that the quantities of 10,000 t/year are imported as of 2026, when this facility becomes operational, growing at a pace of 20% in 2027 and by 10% after that, until the maximum capacity of the processing facility (15,000 t/year) is reached.

Waste tyres (general cargo): First quantities of this cargo are expected as of 2024, starting with 12,500 t/year, which is 50% of the annual needs of the processing facility. Remaining 50% are expected to be unloaded in domestic traffic.

Simple super phosphate in bulk: Cargo flows are planned to commence this year (12,000 t), growing by 15% until 2025. As of 2026, the growth will slow down to 2%, until the maximum needs are reached (30,000 t).

Export cargoes

Fertilizers in bulk: Annual growth is not expected to be higher than 3% until 2025. After that, it should stabilize at around 2% annually, until maximum production capacity of 77,000 t is reached.

Fertilizers in big bags (general cargo): due to the different production programme, these cargo flows are expected to grow 3% annually, until 2025, when it is expected that the maximum production output is reached (255,000 t).

Monocalcium phosphate (MCP) in bulk: Quantities of this cargo will grow 5% annually until 2025, and after that by 2% every year, until the maximum production output is reached at 50,000 t/year.

Monocalcium phosphate (MCP) in big bags (general cargo): quantities of this cargo will grow at high rates in the first 4 years (50% in 2022, 45% in 2023, 40% in 2024 and 2025), and will stabilize at 2% annually as of 2026, until the maximum production output is reached at 50,000 t/year.

Grains in bulk: it is expected that the growth of grains flows will be very low due to the fact that very low share of grains exports will be shipped out via the Port of Prahovo simply because the port is not located close to large agricultural centres which are, mostly, located in the northern Serbia. Quantities loaded in the Port of Prahovo are either quantities from the smaller producers of grains located in the hinterland, or are diverted from ports located in the large agricultural areas when these ports are not able to ship out the necessary quantities. Therefore, it is expected that the growth will be 2% in 2022 and 1% from 2023 to 2027, when the maximum estimated amount of 20,000 t/year is reached.

Scrap metal in bulk: This cargo is expected to be regular, but not so high in quantities. In 2022, a growth of 10% is expected, while a 5% annual growth is expected until 2026. Thereafter, a slow and steady growth of 2% annually is expected.

Copper concentrate in bulk: new product of Serbia Zijin Copper d.o.o. expected from 2025 with starting quantities of 50,000 t. Thereafter, it is expected to be doubled in 2026, followed by 50% in 2027, 20% in 2028 and 10% in 2029. After that, it is expected to stabilize at 2% until 20235 and at 1% from 2036 to 2047, until reaching the maximum production output of 255,000 t/year.

Copper slag in bulk: first quantities of 30,000 t in 2024 and 50,000 t are expected in 2024 and 2025. After these years, it is expected that the growth will be 50% in 2026, 30% in 2027, 20% in 2028, 10% in 2029. The growth will stabilize at 5% per year until a maximum production quantity of 200,000 t is reached.

Granular phosphate (GP) as general cargo: first quantities of 50,000 t expected as of 2025. Thereafter, the growth is expected to reach 20% in 2026, 10% in 2027 and 5% as of 2028 and until the maximum production output of 200,000 t/year is reached.

Granular phosphate (GP) in bulk: cargo flows and their growth are expected to be the same as for the GP in big bags (as general cargo.

Transit cargoes

Hot rolled metals as general cargo: this cargo is used by the ironworks in Skopje, North Macedonia. It is expected that it will grow by 5% every year until 2025. Until 2029 the growth is estimated to be 2% annually, and after that, since 2030 and until the end of the forecast period it is estimated to drop down to 1% every year.

Domestic cargoes

Limestone in bulk: this cargo is expected to have a constant growth of 3% every year, until maximum demand of 60,000 t/year from the cement factory in Beočin is reached.

Gypsum in bulk: it is expected that this cargo keeps growing 5% every year until 2026, when it is expected to drop down to 2% annually.

Calcium phosphate in bulk: first quantities of this cargo are expected in 2022 and will not be higher than 1000 t. Thereafter, it is expected to grow 15% annually until 2025, and 2% annually from 2026 until the end of the forecast period.

Waste tyres as general cargo: First quantities of this cargo are expected as of 2024, starting with 12,500 t/year, which is 50% of the annual needs of the processing facility. Remaining 50% are expected to be unloaded in import traffic.

Summary of the above analytics for **Scenario 1** is presented in the following table.

Cargo and trade direction	2022	2023	2024	2025	2026	2027	2028	2029	2030-2035	2036-2047
Import - Phosphate (bulk)	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Import - Coal (bulk)	2.00%	2.00%	-10.00%	-20.00%	-30.00%	-50.00%	-100.00%	0.00%	0.00%	0.00%
Import - KCl potassium chloride (bulk)	15.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Import - Road salt (bulk)	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Import - Equipment and parts (general)	1,500.00	1,500.00	1,500.00	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Import - Wire rods (general)	2,200.00	50.00%	50.00%	50.00%	10.00%	10.00%	10.00%	5.00%	5.00%	5.00%
Export - Fertilizers (bulk)	3.00%	3.00%	3.00%	3.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Fertilizers big bags (general)	3.00%	3.00%	3.00%	3.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Export - Monocalcium phosphate MCP (general)	50.00%	45.00%	40.00%	40.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Monocalcium phosphate MCP (bulk)	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Grains (bulk)	2.00%	1.00%	1.00%	1.00%	1.00%	1.00%	0.00%	0.00%	0.00%	0.00%
Export - Scrap metal (bulk)	10.00%	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Copper concentrate (bulk)	0.00	0.00	0.00	50,000.0	100.00%	50.00%	20.00%	10.00%	2.00%	1.00%
Export - Copper slag (bulk)	0.00	0.00	30,000.0	50,000.0	50.00%	30.00%	20.00%	10.00%	5.00%	5.00%
Transit - Hot rolled metals (general)	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	1.00%	1.00%	1.00%
Domestic - Limestone (bulk)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Domestic - Gypsum (bulk)	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Import - Triple super phosphate (bulk)	1,000.00	25.00%	25.00%	25.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Import - Waste oil (liquid bulk)	0.00	0.00	0.00	0.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Import - Bilge waters (liquid bulk)	0.00	0.00	0.00	0.00	10,000.0	20.00%	10.00%	10.00%	10.00%	10.00%
Import - Waste tyres (general)	0.00	0.00	12,500.0	12,500.0	12,500.0	12,500.0	12,500.0	12,500.0	12,500.0	12,500.0
Import - Simple super phosphate (bulk)	12,000.0	15.00%	15.00%	15.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Granular phosphate (general)	0.00	0.00	0.00	50,000.0	20.00%	10.00%	5.00%	5.00%	5.00%	5.00%
Export - Granular phosphate (bulk)	0.00	0.00	0.00	50,000.0	20.00%	10.00%	5.00%	5.00%	5.00%	5.00%
Domestic - Calcium phosphate (bulk)	1,000.00	15.00%	15.00%	15.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Domestic - Waste tyres (general)	0.00	0.00	12,500.0	12,500.0	12,500.0	12,500.0	12,500.0	12,500.0	12,500.0	12,500.0

Table 4.14. Assumptions and estimates of growth rates for different types of cargo in Scenario 1

Based on the above assumptions and estimates, the forecasts for the transshipment volumes in the Port of Prahovo (in tons), for the period 2022-2047, **Scenario 1**, are given in continuation.

Cargo and trade direction	2022	2023	2024	2025	2026	2027	2028	2029
Import - Phosphate (bulk)	503,265	528,428	554,850	582,592	594,244	606,129	618,251	630,616
Import - Coal (bulk)	32,885	33,542	30,188	24,151	16,905	8,453	0	0
Import - KCl potassium chloride (bulk)	52,394	55,014	57,764	60,653	60,653	60,653	60,653	60,653
Import - Road salt (bulk)	9,555	10,033	10,534	10,745	10,960	11,179	11,403	11,631
Import - Equipment and parts (general)	1,500	1,500	1,500	1,530	1,561	1,592	1,624	1,656
Import - Wire rods (general)	2,200	3,300	4,950	7,425	8,168	8,984	9,883	10,377
Export - Fertilizers (bulk)	45,567	46,934	48,342	49,793	50,788	51,804	52,840	53,897
Export - Fertilizers big bags (general)	239,413	246,596	253,993	261,613	261,613	261,613	261,613	261,613
Export - Monocalcium phosphate MCP (general)	4,545	6,590	9,226	12,917	13,175	13,439	13,708	13,982
Export - Monocalcium phosphate MCP (bulk)	37,496	39,370	41,339	43,406	44,274	45,159	46,063	46,984
Export - Grains (bulk)	19,706	19,903	20,102	20,304	20,507	20,712	20,712	20,712
Export - Scrap metal (bulk)	1,936	2,033	2,134	2,241	2,353	2,400	2,448	2,497
Export - Copper concentrate (bulk)	0	0	0	50,000	100,000	150,000	180,000	198,000
Export - Copper slag (bulk)	0	0	30,000	40,000	60,000	78,000	93,600	102,960
Transit - Hot rolled metals (general)	49,770	52,259	54,871	57,615	58,767	59,943	61,141	61,753
Domestic - Limestone (bulk)	37,574	38,702	39,863	41,059	42,290	43,559	44,866	46,212
Domestic - Gypsum (bulk)	7,592	7,971	8,370	8,788	8,964	9,143	9,326	9,513
Import - Triple super phosphate (bulk)	1,000	1,250	1,563	1,953	1,992	2,032	2,073	2,114
Import - Waste oil (liquid bulk)	0	0	0	0	2,000	2,000	2,000	2,000
Import - Bilge waters (liquid bulk)	0	0	0	0	10,000	12,000	13,200	14,520
Import - Waste tyres (general)	0	0	12,500	12,500	12,500	12,500	12,500	12,500
Import - Simple super phosphate (bulk)	12,000	13,800	15,870	18,251	18,616	18,988	19,368	19,755
Export - Granular phosphate (general)	0	0	0	50,000	60,000	66,000	69,300	72,765
Export - Granular phosphate (bulk)	0	0	0	50,000	60,000	66,000	69,300	72,765
Domestic - Calcium phosphate (bulk)	1,000	1,150	1,323	1,521	1,551	1,582	1,614	1,646
Domestic - Waste tyres (general)	0	0	12,500	12,500	12,500	12,500	12,500	12,500
Total	**1,059,398**	**1,108,375**	**1,211,783**	**1,421,555**	**1,534,381**	**1,626,364**	**1,689,984**	**1,743,620**

Table 4.15. Forecasts of transport volumes in Scenario 1 (part 1/4)

Cargo and trade direction	2030	2031	2032	2033	2034	2035	2036	2037
Import - Phosphate (bulk)	643,229	656,093	669,215	682,600	696,252	710,177	724,380	738,868
Import - Coal (bulk)	0	0	0	0	0	0	0	0
Import - KCl potassium chloride (bulk)	60,653	60,653	60,653	60,653	60,653	60,653	60,653	60,653
Import - Road salt (bulk)	11,863	12,101	12,343	12,590	12,841	13,098	13,360	13,627
Import - Equipment and parts (general)	1,689	1,723	1,757	1,793	1,828	1,865	1,902	1,940
Import - Wire rods (general)	10,896	11,440	12,012	12,613	13,244	13,906	14,601	15,331
Export - Fertilizers (bulk)	54,975	56,074	57,196	58,340	59,507	60,697	61,911	63,149
Export - Fertilizers big bags (general)	261,613	261,613	261,613	261,613	261,613	261,613	261,613	261,613
Export - Monocalcium phosphate MCP (general)	14,261	14,547	14,837	15,134	15,437	15,746	16,061	16,382
Export - Monocalcium phosphate MCP (bulk)	47,923	48,882	49,860	50,857	50,857	50,857	50,857	50,857
Export - Grains (bulk)	20,712	20,712	20,712	20,712	20,712	20,712	20,712	20,712
Export - Scrap metal (bulk)	2,547	2,598	2,650	2,703	2,757	2,812	2,869	2,926
Export - Copper concentrate (bulk)	201,960	205,999	210,119	214,322	218,608	222,980	225,210	227,462
Export - Copper slag (bulk)	108,108	113,513	119,189	125,149	131,406	137,976	144,875	152,119
Transit - Hot rolled metals (general)	62,370	62,994	63,624	64,260	64,903	65,552	66,207	66,870
Domestic - Limestone (bulk)	47,598	49,026	50,497	52,012	53,572	55,179	56,835	58,540
Domestic - Gypsum (bulk)	9,703	9,897	10,095	10,297	10,503	10,713	10,927	11,145
Import - Triple super phosphate (bulk)	2,156	2,200	2,244	2,288	2,334	2,381	2,428	2,477
Import - Waste oil (liquid bulk)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Import - Bilge waters (liquid bulk)	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Import - Waste tyres (general)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Import - Simple super phosphate (bulk)	20,150	20,553	20,964	21,383	21,811	22,247	22,692	23,146
Export - Granular phosphate (general)	76,403	80,223	84,235	88,446	92,869	97,512	102,388	107,507
Export - Granular phosphate (bulk)	76,403	80,223	84,235	88,446	92,869	97,512	102,388	107,507
Domestic - Calcium phosphate (bulk)	1,679	1,713	1,747	1,782	1,818	1,854	1,891	1,929
Domestic - Waste tyres (general)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Total	**1,778,893**	**1,814,778**	**1,851,796**	**1,889,991**	**1,928,392**	**1,968,041**	**2,006,759**	**2,046,759**

Table 4.16. Forecasts of transport volumes in Scenario 1 (part 2/4)

Cargo and trade direction	2038	2039	2040	2041	2042	2043	2044	2045
Import - Phosphate (bulk)	753,645	768,718	784,092	799,774	815,770	820,000	820,000	820,000
Import - Coal (bulk)	0	0	0	0	0	0	0	0
Import - KCl potassium chloride (bulk)	60,653	60,653	60,653	60,653	60,653	60,653	60,653	60,653
Import - Road salt (bulk)	13,900	14,178	14,461	14,751	15,046	15,347	15,654	15,967
Import - Equipment and parts (general)	1,979	2,019	2,059	2,100	2,142	2,185	2,229	2,273
Import - Wire rods (general)	16,098	16,903	17,748	18,635	19,567	20,000	20,000	20,000
Export - Fertilizers (bulk)	64,412	65,700	67,014	68,354	69,722	71,116	72,538	73,989
Export - Fertilizers big bags (general)	261,613	261,613	261,613	261,613	261,613	261,613	261,613	261,613
Export - Monocalcium phosphate MCP (general)	16,709	17,044	17,384	17,732	18,087	18,448	18,817	19,194
Export - Monocalcium phosphate MCP (bulk)	50,857	50,857	50,857	50,857	50,857	50,857	50,857	50,857
Export - Grains (bulk)	20,712	20,712	20,712	20,712	20,712	20,712	20,712	20,712
Export - Scrap metal (bulk)	2,984	3,044	3,105	3,167	3,230	3,295	3,361	3,428
Export - Copper concentrate (bulk)	229,737	232,034	234,354	236,698	239,065	241,456	243,870	246,309
Export - Copper slag (bulk)	159,725	167,711	176,097	184,901	194,146	200,000	200,000	200,000
Transit - Hot rolled metals (general)	67,538	68,214	68,896	69,585	70,281	70,983	71,693	72,410
Domestic - Limestone (bulk)	60,296	60,296	60,296	60,296	60,296	60,296	60,296	60,296
Domestic - Gypsum (bulk)	11,368	11,596	11,828	12,064	12,305	12,552	12,803	13,059
Import - Triple super phosphate (bulk)	2,527	2,577	2,629	2,681	2,735	2,790	2,845	2,902
Import - Waste oil (liquid bulk)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Import - Bilge waters (liquid bulk)	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Import - Waste tyres (general)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Import - Simple super phosphate (bulk)	23,609	24,081	24,563	25,054	25,555	26,066	26,588	27,119
Export - Granular phosphate (general)	112,882	118,527	124,453	130,675	137,209	144,070	151,273	158,837
Export - Granular phosphate (bulk)	112,882	118,527	124,453	130,675	137,209	144,070	151,273	158,837
Domestic - Calcium phosphate (bulk)	1,967	2,007	2,047	2,088	2,130	2,172	2,216	2,260
Domestic - Waste tyres (general)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Total	**2,088,094**	**2,129,008**	**2,171,313**	**2,215,067**	**2,260,329**	**2,290,679**	**2,311,290**	**2,332,714**

Table 4.17. Forecasts of transport volumes in Scenario 1 (part 3/4)

Cargo and trade direction	2046	2047
Import - Phosphate (bulk)	820,000	820,000
Import - Coal (bulk)	0	0
Import - KCl potassium chloride (bulk)	60,653	60,653
Import - Road salt (bulk)	16,286	16,612
Import - Equipment and parts (general)	2,319	2,365
Import - Wire rods (general)	20,000	20,000
Export - Fertilizers (bulk)	75,469	76,978
Export - Fertilizers big bags (general)	261,613	261,613
Export - Monocalcium phosphate MCP (general)	19,578	19,969
Export - Monocalcium phosphate MCP (bulk)	50,857	50,857
Export - Grains (bulk)	20,712	20,712
Export - Scrap metal (bulk)	3,497	3,567
Export - Copper concentrate (bulk)	248,772	251,260
Export - Copper slag (bulk)	200,000	200,000
Transit - Hot rolled metals (general)	73,134	73,866
Domestic - Limestone (bulk)	60,296	60,296
Domestic - Gypsum (bulk)	13,320	13,586
Import - Triple super phosphate (bulk)	2,960	3,019
Import - Waste oil (liquid bulk)	2,000	2,000
Import - Bilge waters (liquid bulk)	15,000	15,000
Import - Waste tyres (general)	12,500	12,500
Import - Simple super phosphate (bulk)	27,662	28,215
Export - Granular phosphate (general)	166,779	175,118
Export - Granular phosphate (bulk)	166,779	175,118
Domestic - Calcium phosphate (bulk)	2,305	2,351
Domestic - Waste tyres (general)	12,500	12,500
Total	**2,354,989**	**2,378,154**

Table 4.18. Forecasts of transport volumes in Scenario 1 (part 4/4)

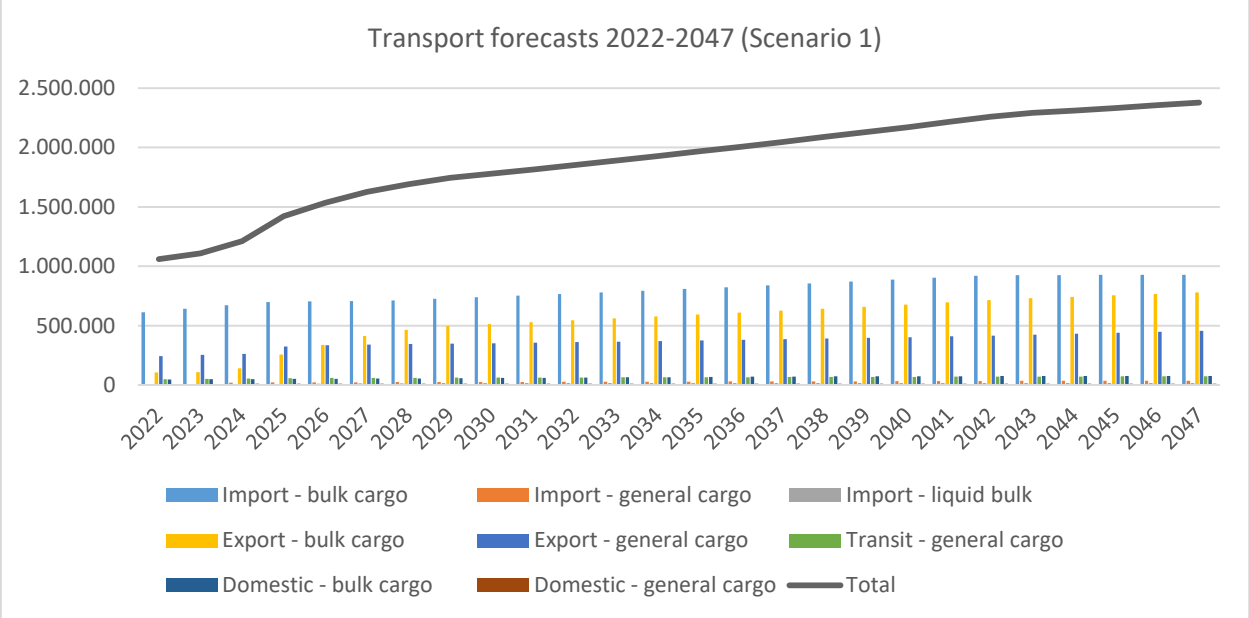


Figure 4.14. Forecast of transport volumes in Scenario 1

The forecasted volumes are given in a different format in the summary table and figure below.

Year	General cargo	Bulk cargo	Liquid bulk	Total
2022	297,428.20	761,969.80	0.00	1,059,398.00
2023	310,244.35	798,130.66	0.00	1,108,375.00
2024	349,541.24	862,241.96	0.00	1,211,783.20
2025	416,100.15	1,005,454.52	0.00	1,421,554.67
2026	428,283.89	1,094,097.15	12,000.00	1,534,381.04
2027	436,570.70	1,175,793.06	14,000.00	1,626,363.77
2028	442,268.59	1,232,515.46	15,200.00	1,689,984.06
2029	447,145.76	1,279,954.15	16,520.00	1,743,619.91
2030	452,233.14	1,309,659.81	17,000.00	1,778,892.95
2031	457,540.80	1,340,237.04	17,000.00	1,814,777.84
2032	463,079.32	1,371,716.87	17,000.00	1,851,796.19
2033	468,859.82	1,404,131.60	17,000.00	1,889,991.41
2034	474,893.93	1,436,497.77	17,000.00	1,928,391.70
2035	481,193.88	1,469,847.27	17,000.00	1,968,041.15
2036	487,772.51	1,501,986.43	17,000.00	2,006,758.94
2037	494,643.29	1,535,115.87	17,000.00	2,046,759.16
2038	501,820.34	1,569,273.32	17,000.00	2,088,093.66
2039	509,318.51	1,602,689.30	17,000.00	2,129,007.81
2040	517,153.35	1,637,159.53	17,000.00	2,171,312.89
2041	525,341.22	1,672,725.32	17,000.00	2,215,066.54
2042	533,899.25	1,709,429.82	17,000.00	2,260,329.07
2043	542,300.08	1,731,379.30	17,000.00	2,290,679.38
2044	550,626.08	1,743,664.08	17,000.00	2,311,290.16
2045	559,327.60	1,756,386.52	17,000.00	2,332,714.12
2046	568,422.89	1,769,565.93	17,000.00	2,354,988.83
2047	577,931.10	1,783,222.56	17,000.00	2,378,153.66

Table 4.19. Forecasted transport volumes per transport packaging – Scenario 1

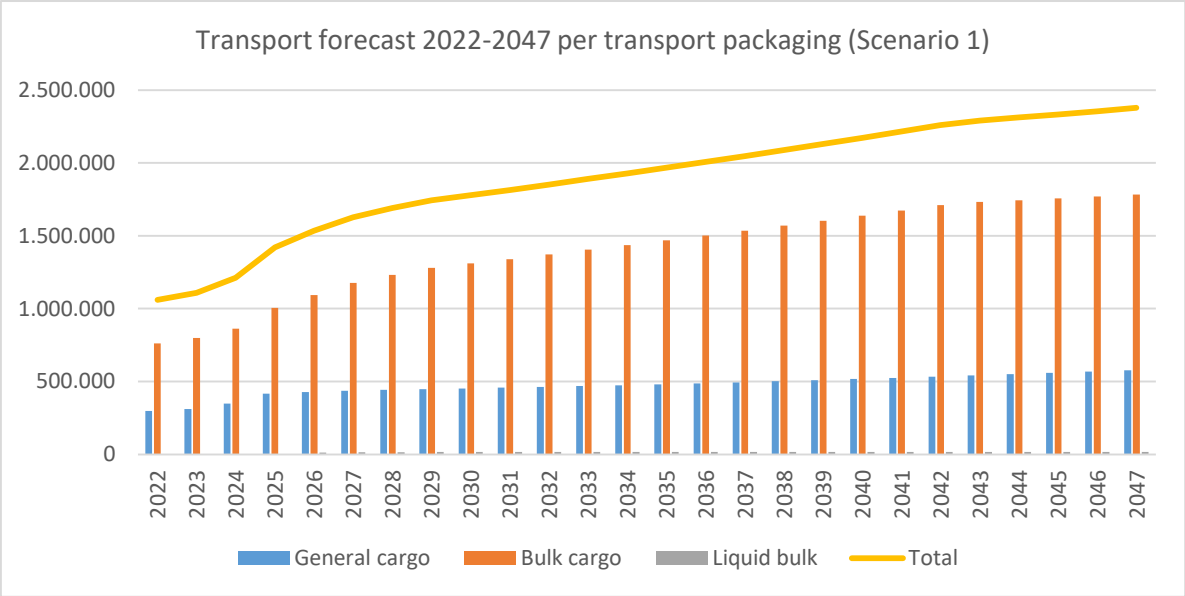


Figure 4.15. Forecasted transport volumes per transport packaging – Scenario 1

Scenario 2

Import cargoes

Phosphate in bulk: in Scenario 2, it is estimated that the incoming cargo flows for the production of fertilizers in the fertilizers factory of Elixir Prahovo (company which is, at the same time, a port operator of the Port of Prahovo) can grow at a rate of 10% annually, until 2025. Thereafter, as the quantities are approaching the maximum amount needed for the production (820,000 t/year), the growth becomes slower and remains at 2% annually.

Coal in bulk: coal is, currently, needed for the production in the company Elixir Prahovo. It will remain so until the company transfers to an alternative fuel – old tyres. It will grow at a pace of 2% annually, but only in 2022, and in 2023 it is expected to drop down by 5% and by 50% in 2024 due to gradual transfer to alternative fuels, in order to be completely abandoned as of 2025.

KCl (potassium chloride) in bulk: needed for the production of fertilizers, the import of this cargo will grow 15% annually until it reaches the maximum production needs of 60,000 t/year.

Road salt in bulk: Import of this cargo will grow at a rate of 10% until 2024, 5% until 2029 and after that it is expected that the growth will remain at 2% until the end of the forecasting period.

Equipment and parts as general cargo: this cargo is needed mostly for the needs of the company Serbia Zijin Copper (copper mine operator) for the construction and overhaul of the equipment for processing of copper ore in the vicinity of the city of Bor. It will remain constant at 2,200 t/year until 2024. In 2025 and 2026 it is expected to grow by 5% each year. As of 2027, it is expected that the growth of this cargo remains slow but steady, approximately 2% annually, due to the constant demand of the aforementioned user and other industrial users settling in the industrial-chemical park in Prahovo.

Wire rods (general cargo): due to increase of production of the company Spajić d.o.o., this cargo will start with 2,200 t in 2022 and grow by 100% in 2023 and 2024. After that, it is expected to grow 50% annually until 2028. Thereafter, it is expected to slow down the growth to 10% annually until 2035 and 5% after that until the maximum quantity of 20,000 t/year are reached.

Triple super phosphate (TSP) in bulk: this cargo is expected to start flowing in the port as of 2022 with 1,500 tons, growing by 25% annually until 2025. Thereafter, the growth should remain slow and constant, that is, 3% in 2026 and 2 % annually after that, until the maximum needs of 5,000 t/year is reached.

Waste oil (liquid bulk): import of this cargo will be limited with the capacity of the processing facility at the "green terminal". It is expected that the quantities of 2,000 t/year are imported as of 2025, when this facility becomes operational.

Bilge waters (liquid bulk): import of this cargo will be also limited with the capacity of the processing facility at the "green terminal". It is expected that the quantities of 10,000 t/year are imported as of 2025, when this facility becomes operational (earlier than in Scenario 1), growing by 50% in 2026, when the maximum capacity of the processing facility (15,000 t/year) is reached.

Waste tyres (general cargo): First quantities of this cargo are expected as of 2024, starting with 12,500 t/year, which is 50% of the annual needs of the processing facility. Remaining 50% are expected to be unloaded in domestic traffic.

Simple super phosphate in bulk: Cargo flows are planned to commence this year (10,000 t), growing by 15% until 2024. In 2025 it is expected to grow by 30% and in 2026 by 10%. After 2026 the growth will slow down to 2%, until the maximum needs are reached (30,000 t).

Export cargoes

Fertilizers in bulk: Annual growth is expected to be 5% until 2025. After that, it should stabilize at around 2% annually, until maximum production capacity of 77,000 t is reached.

Fertilizers in big bags (general cargo): due to the different production programme, these cargo flows are expected to grow 5% annually, until the maximum production output is reached (255,000 t).

Monocalcium phosphate (MCP) in bulk: Quantities of this cargo will grow 50% annually until 2025, and 100% in 2026 and after that by 5% every year, until the maximum production output is reached at 50,000 t/year.

Monocalcium phosphate (MCP) in big bags (general cargo): quantities of this cargo will grow 5% annually until 2025 and should stabilize at 2% annually as of 2026, until the maximum production output is reached at 50,000 t/year.

Grains in bulk: it is expected that the growth of grains flows will be very low due to the fact that very low share of grains exports will be shipped out via the Port of Prahovo simply because the port is not located close to large agricultural centres which are, mostly, located in the northern Serbia. Quantities loaded in the Port of Prahovo are either quantities from the smaller producers of grains located in the hinterland, or are diverted from ports located in the large agricultural areas when these ports are not able to ship out the necessary quantities. It is expected that the growth will be 2% in 2022 and 1% in 2023 and 2024. From 2025, when the silo is expected to be fully reconstructed an operational, the growth is expected to rise by 30% and 15% in 2025 and 2026. Thereafter, a slow and steady growth of 2% annually is expected.

Scrap metal in bulk: In 2022, a growth of 15% is expected, then 5% until 2025. In 2026% it is expected to rise to 10% is expected. Thereafter, a slow and steady growth of 2% annually is expected.

Copper concentrate in bulk: new product of Serbia Zijin Copper d.o.o. expected from 2024 with starting quantities of 70,000 t and 100,000 t in 2025. Thereafter, it is expected to grow by 70% in 2026, 40% in 2027, and 20% in 2028 when it is expected to reach the maximum production output of 255,000 t/year.

Copper slag in bulk: first quantities of 50,000 t in 2024 and 70,000 t are expected in 2024 and 2025. After these years, it is expected that the growth will be 50% in 2026, 30% in 2027, 20% in 2028, 10% in 2029. The growth will stabilize at 5% per year until a maximum production quantity of 200,000 t is reached.

Granular phosphate (GP) as general cargo: first quantities of 50,000 t expected as of 2025. Thereafter, the growth is expected to reach 20% in 2026, 15% in 2027 and 2028 and 5% as of 2028 and until the maximum production output of 200,000 t/year is reached.

Granular phosphate (GP) in bulk: cargo flows and their growth are expected to be the same as for the GP in big bags (as general cargo).

Transit cargoes

Hot rolled metals as general cargo: It is expected that it will grow by 40% in 2022, 10% annually until 2025, and 5% annually until the end of the forecasting period.

Domestic cargoes

Limestone in bulk: as in Scenario 1, this cargo is expected to have a constant growth of 3% every year, until maximum demand of 60,000 t/year from the cement factory in Beočin is reached.

Gypsum in bulk: it is expected that this cargo grows by 50% in 2022, 40% in 2023, 30% in 2024, 20% in 2025, 10% in 2026, 5% in 2027. Thereafter, it is expected that the growth will slow down and remain constant at 2% annually.

Calcium phosphate in bulk: first quantities of this cargo are expected in 2022 and will not be higher than 1,500 t. Thereafter, it is expected to grow 15% annually until 2025, and 2% annually from 2026 until the end of the forecast period.

Waste tyres as general cargo: First quantities of this cargo are expected as of 2024, starting with 12,500 t/year, which is 50% of the annual needs of the processing facility. Remaining 50% are expected to be unloaded in import traffic. Same quantity of cargo is expected every year until the end of the forecasting period.

Summary of the above analytics for **Scenario 2** is presented in the following table.

Cargo and trade direction	2022	2023	2024	2025	2026	2027	2028	2029	2030-2035	2036-2047
Import - Phosphate (bulk)	10.00%	10.00%	10.00%	10.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Import - Coal (bulk)	2.00%	-5.00%	-50.00%	-10.00%	-10.00%	-10.00%	-10.00%	-10.00%	-10.00%	-10.00%
Import - KCl potassium chloride (bulk)	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Import - Road salt (bulk)	10.00%	10.00%	10.00%	5.00%	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%
Import - Equipment and parts (general)	2,200	2,200	2,200	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Import - Wire rods (general)	2,200	100%	100%	50.00%	50.00%	50.00%	50.00%	10.00%	10.00%	5.00%
Export - Fertilizers (bulk)	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Fertilizers big bags (general)	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Export - Monocalcium phosphate MCP (general)	50.00%	50.00%	50.00%	50.00%	100%	5.00%	5.00%	5.00%	5.00%	5.00%
Export - Monocalcium phosphate MCP (bulk)	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Grains (bulk)	2.00%	1.00%	1.00%	30.00%	15.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Scrap metal (bulk)	15.00%	5.00%	5.00%	5.00%	10.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Copper concentrate	0.00	0.00	70,000	100,000	70.00%	40.00%	20.00%	0.00%	0.00%	0.00%
Export - Copper slag	0.00	0.00	50,000	70,000	50.00%	30.00%	20.00%	10.00%	5.00%	5.00%
Transit - Hot rolled metals (general)	40.00%	10.00%	10.00%	10.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Domestic - Limestone (bulk)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Domestic - Gypsum (bulk)	50.00%	40.00%	30.00%	20.00%	10.00%	5.00%	2.00%	2.00%	2.00%	2.00%
Import - Triple super phosphate (bulk)	1,500	25.00%	25.00%	25.00%	5.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Import - Waste oil (liquid bulk)	0.00	0.00	0.00	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Import - Bilge waters (liquid bulk)	0.00	0.00	0.00	10,000	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Import - Waste tyres (general)	0.00	0.00	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Import - Simple super phosphate (bulk)	10,000	15.00%	15.00%	30.00%	10.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Export - Granular phosphate (general)	0.00	0.00	0.00	50,000	20.00%	15.00%	15.00%	5.00%	5.00%	5.00%
Export - Granular phosphate (bulk)	0.00	0.00	0.00	50,000	20.00%	15.00%	15.00%	5.00%	5.00%	5.00%
Domestic - Calcium phosphate	1,500	15.00%	15.00%	15.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Domestic - Waste tyres (general)	0.00	0.00	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500

Table 4.20. Assumptions and estimates of growth rates for different types of cargo in Scenario 2

Based on the above assumptions and estimates, the forecasts for the transshipment volumes in the Port of Prahovo (in tons), for the period 2022-2047, **Scenario 2**, are given in continuation.

Cargo and trade direction	2022	2023	2024	2025	2026	2027	2028	2029
Import - Phosphate (bulk)	527,230	579,953	637,948	701,743	715,778	730,094	744,695	759,589
Import - Coal (bulk)	32,885	31,241	15,620	0	0	0	0	0
Import - KCl potassium chloride (bulk)	52,394	60,253	61,000	61,000	61,000	61,000	61,000	61,000
Import - Road salt (bulk)	10,010	11,011	12,112	12,718	13,354	14,021	14,722	15,458
Import - Equipment and parts (general)	2,200	2,200	2,200	2,310	2,426	2,474	2,523	2,574
Import - Wire rods (general)	2,200	4,400	8,800	13,200	19,800	20,000	20,000	20,000
Export - Fertilizers (bulk)	46,452	48,775	51,213	53,774	54,849	55,946	57,065	58,207
Export - Fertilizers big bags (general)	244,062	256,265	256,265	256,265	256,265	256,265	256,265	256,265
Export - Monocalcium phosphate MCP (general)	4,545	6,818	10,226	15,339	30,679	32,213	33,823	35,514
Export - Monocalcium phosphate MCP (bulk)	37,496	39,370	41,339	43,406	44,274	45,159	46,063	46,984
Export - Grains (bulk)	19,706	19,903	20,102	26,133	30,053	30,654	31,267	31,893
Export - Scrap metal (bulk)	2,024	2,125	2,231	2,343	2,577	2,629	2,681	2,735
Export - Copper concentrate (bulk)	0	0	70,000	100,000	170,000	238,000	250,000	250,000
Export - Copper slag (bulk)	0	0	50,000	70,000	105,000	136,500	163,800	180,180
Transit - Hot rolled metals (general)	66,360	72,996	80,296	88,325	92,741	97,378	102,247	107,360
Domestic - Limestone (bulk)	37,574	38,702	39,863	41,059	42,290	43,559	44,866	46,212
Domestic - Gypsum (bulk)	10,845	15,183	19,738	23,685	26,054	27,357	27,904	28,462
Import - Triple super phosphate (bulk)	1,500	1,875	2,344	2,930	3,076	3,168	3,264	3,361
Import - Waste oil (liquid bulk)	0	0	0	2,000	2,000	2,000	2,000	2,000
Import - Bilge waters (liquid bulk)	0	0	0	10,000	15,000	15,000	15,000	15,000
Import - Waste tyres (general)	0	0	12,500	12,500	12,500	12,500	12,500	12,500
Import - Simple super phosphate (bulk)	10,000	11,500	13,225	17,193	18,912	19,290	19,676	20,069
Export - Granular phosphate (general)	0	0	0	50,000	60,000	69,000	79,350	83,318
Export - Granular phosphate (bulk)	0	0	0	50,000	60,000	69,000	79,350	83,318
Domestic - Calcium phosphate (bulk)	1,500	1,725	1,984	2,281	2,327	2,373	2,421	2,469
Domestic - Waste tyres (general)	0	0	12,500	12,500	12,500	12,500	12,500	12,500
Total	**1,108,983**	**1,204,294**	**1,421,507**	**1,670,704**	**1,853,455**	**1,998,082**	**2,084,984**	**2,136,968**

Table 4.21.Forecast of transport volumes in Scenario 2 (part 1/4)

Cargo and trade direction	2030	2031	2032	2033	2034	2035	2036	2037
Import - Phosphate (bulk)	774,781	790,277	806,082	820,000	820,000	820,000	820,000	820,000
Import - Coal (bulk)	0	0	0	0	0	0	0	0
Import - KCl potassium chloride (bulk)	61,000	61,000	61,000	61,000	61,000	61,000	61,000	61,000
Import - Road salt (bulk)	15,768	16,083	16,405	16,733	17,067	17,409	17,757	18,112
Import - Equipment and parts (general)	2,625	2,678	2,732	2,786	2,842	2,899	2,957	3,016
Import - Wire rods (general)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Export - Fertilizers (bulk)	59,371	60,558	61,769	63,005	64,265	65,550	66,861	68,198
Export - Fertilizers big bags (general)	256,265	256,265	256,265	256,265	256,265	256,265	256,265	256,265
Export - Monocalcium phosphate MCP (general)	37,290	39,155	41,112	43,168	45,326	47,593	49,972	50,000
Export - Monocalcium phosphate MCP (bulk)	47,923	48,882	49,860	50,000	50,000	50,000	50,000	50,000
Export - Grains (bulk)	32,531	33,181	33,845	34,522	35,212	35,916	36,635	37,367
Export - Scrap metal (bulk)	2,790	2,846	2,902	2,961	3,020	3,080	3,142	3,205
Export - Copper concentrate (bulk)	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Export - Copper slag (bulk)	189,189	198,648	200,000	200,000	200,000	200,000	200,000	200,000
Transit - Hot rolled metals (general)	112,728	118,364	124,282	130,496	137,021	143,872	151,066	158,619
Domestic - Limestone (bulk)	47,598	49,026	50,497	52,012	53,572	55,179	56,835	58,540
Domestic - Gypsum (bulk)	29,031	29,612	30,204	30,808	31,424	32,053	32,694	33,348
Import - Triple super phosphate (bulk)	3,462	3,566	3,673	3,783	3,897	4,014	4,134	4,258
Import - Waste oil (liquid bulk)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Import - Bilge waters (liquid bulk)	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Import - Waste tyres (general)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Import - Simple super phosphate (bulk)	20,471	20,880	21,298	21,724	22,158	22,601	23,053	23,514
Export - Granular phosphate (general)	87,483	91,858	96,450	101,273	106,337	111,653	117,236	123,098
Export - Granular phosphate (bulk)	87,483	91,858	96,450	101,273	106,337	111,653	117,236	123,098
Domestic - Calcium phosphate (bulk)	2,519	2,569	2,621	2,673	2,726	2,781	2,837	2,893
Domestic - Waste tyres (general)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Total	**2,182,309**	**2,229,305**	**2,269,448**	**2,306,481**	**2,330,470**	**2,355,519**	**2,381,679**	**2,406,532**

Table 4.22. Forecast of transport volumes in Scenario 2 (part 2/4)

Cargo and trade direction	2038	2039	2040	2041	2042	2043	2044	2045
Import - Phosphate (bulk)	820,000	820,000	820,000	820,000	820,000	820,000	820,000	820,000
Import - Coal (bulk)	0	0	0	0	0	0	0	0
Import - KCl potassium chloride (bulk)	61,000	61,000	61,000	61,000	61,000	61,000	61,000	61,000
Import - Road salt (bulk)	18,474	18,844	19,221	19,605	19,997	20,397	20,805	21,221
Import - Equipment and parts (general)	3,076	3,138	3,200	3,264	3,330	3,396	3,464	3,533
Import - Wire rods (general)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Export - Fertilizers (bulk)	69,562	70,954	72,373	73,820	75,297	76,803	77,000	77,000
Export - Fertilizers big bags (general)	256,265	256,265	256,265	256,265	256,265	256,265	256,265	256,265
Export - Monocalcium phosphate MCP (general)	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Export - Monocalcium phosphate MCP (bulk)	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Export - Grains (bulk)	38,115	38,877	39,655	40,448	41,257	42,082	42,923	43,782
Export - Scrap metal (bulk)	3,269	3,334	3,401	3,469	3,538	3,609	3,681	3,755
Export - Copper concentrate (bulk)	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Export - Copper slag (bulk)	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
Transit - Hot rolled metals (general)	166,550	174,878	183,622	192,803	202,443	212,565	223,193	234,353
Domestic - Limestone (bulk)	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Domestic - Gypsum (bulk)	34,015	34,695	35,389	36,097	36,819	37,555	38,306	39,072
Import - Triple super phosphate (bulk)	4,386	4,517	4,653	4,793	4,936	5,000	5,000	5,000
Import - Waste oil (liquid bulk)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Import - Bilge waters (liquid bulk)	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Import - Waste tyres (general)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Import - Simple super phosphate (bulk)	23,985	24,464	24,954	25,453	25,962	26,481	27,011	27,551
Export - Granular phosphate (general)	129,253	135,715	142,501	149,626	157,108	164,963	173,211	181,872
Export - Granular phosphate (bulk)	129,253	135,715	142,501	149,626	157,108	164,963	173,211	181,872
Domestic - Calcium phosphate (bulk)	2,951	3,010	3,070	3,132	3,194	3,258	3,323	3,390
Domestic - Waste tyres (general)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Total	**2,432,154**	**2,457,407**	**2,483,804**	**2,511,400**	**2,540,252**	**2,570,337**	**2,600,394**	**2,631,665**

Table 4.23. Forecast of transport volumes in Scenario 2 (part 3/4)

Cargo and trade direction	2046	2047
Import - Phosphate (bulk)	820,000	820,000
Import - Coal (bulk)	0	0
Import - KCl potassium chloride (bulk)	61,000	61,000
Import - Road salt (bulk)	21,646	22,078
Import - Equipment and parts (general)	3,604	3,676
Import - Wire rods (general)	20,000	20,000
Export - Fertilizers (bulk)	77,000	77,000
Export - Fertilizers big bags (general)	256,265	256,265
Export - Monocalcium phosphate MCP (general)	50,000	50,000
Export - Monocalcium phosphate MCP (bulk)	50,000	50,000
Export - Grains (bulk)	44,658	45,551
Export - Scrap metal (bulk)	3,830	3,906
Export - Copper concentrate (bulk)	250,000	250,000
Export - Copper slag (bulk)	200,000	200,000
Transit - Hot rolled metals (general)	246,071	258,374
Domestic - Limestone (bulk)	60,000	60,000
Domestic - Gypsum (bulk)	39,854	40,651
Import - Triple super phosphate (bulk)	5,000	5,000
Import - Waste oil (liquid bulk)	2,000	2,000
Import - Bilge waters (liquid bulk)	15,000	15,000
Import - Waste tyres (general)	12,500	12,500
Import - Simple super phosphate (bulk)	28,102	30,000
Export - Granular phosphate (general)	190,965	200,513
Export - Granular phosphate (bulk)	190,965	200,513
Domestic - Calcium phosphate (bulk)	3,458	3,527
Domestic - Waste tyres (general)	12,500	12,500
Total	**2,664,416**	**2,700,056**

Table 4.24. Forecast of transport volumes in Scenario 2 (part 4/4)

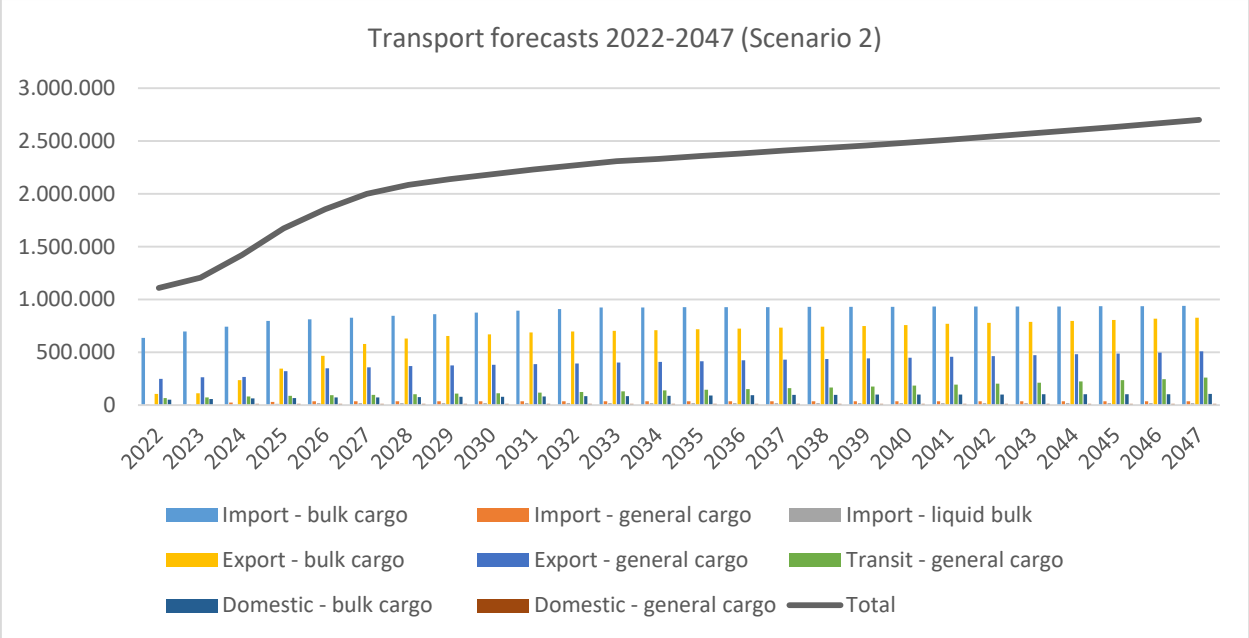


Figure 4.16. Forecast of transport volumes in Scenario 2

The forecasted volumes are given in a different format in the summary table and figure below.

Year	General cargo	Bulk cargo	Liquid bulk	Total
2022	319,367.00	789,616.10	0.00	1,108,983.10
2023	342,678.60	861,615.83	0.00	1,204,294.43
2024	382,786.95	1,038,719.84	0.00	1,421,506.79
2025	450,439.64	1,208,264.38	12,000.00	1,670,704.02
2026	486,910.77	1,349,544.68	17,000.00	1,853,455.45
2027	502,330.29	1,478,751.47	17,000.00	1,998,081.75
2028	519,209.33	1,548,774.41	17,000.00	2,084,983.74
2029	530,030.83	1,589,937.36	17,000.00	2,136,968.19
2030	541,391.90	1,623,916.77	17,000.00	2,182,308.67
2031	553,319.48	1,658,985.88	17,000.00	2,229,305.35
2032	565,841.86	1,686,605.82	17,000.00	2,269,447.68
2033	578,988.75	1,710,492.50	17,000.00	2,306,481.25
2034	592,791.35	1,720,678.49	17,000.00	2,330,469.84
2035	607,282.40	1,731,236.85	17,000.00	2,355,519.25
2036	622,496.31	1,742,183.12	17,000.00	2,381,679.43
2037	635,998.10	1,753,533.55	17,000.00	2,406,531.64
2038	650,144.27	1,765,009.25	17,000.00	2,432,153.52
2039	664,995.95	1,775,410.88	17,000.00	2,457,406.83
2040	680,588.36	1,786,215.74	17,000.00	2,483,804.10
2041	696,958.51	1,797,441.62	17,000.00	2,511,400.13
2042	714,145.25	1,809,107.16	17,000.00	2,540,252.41
2043	732,189.37	1,821,147.45	17,000.00	2,570,336.82
2044	751,133.69	1,832,260.73	17,000.00	2,600,394.42
2045	771,023.19	1,843,642.28	17,000.00	2,631,665.47
2046	791,905.09	1,855,511.27	17,000.00	2,664,416.37
2047	813,828.97	1,869,226.55	17,000.00	2,700,055.52

Table 4.25. Forecasted transport volumes per transport packaging – Scenario 2

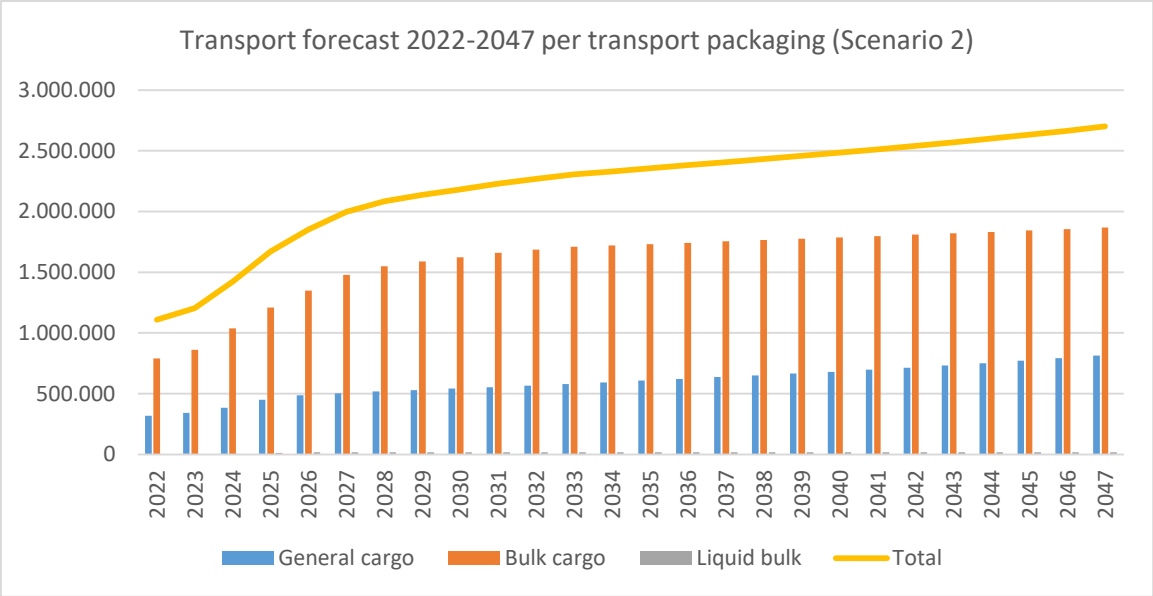


Figure 4.17. Forecasted transport volumes per transport packaging – Scenario 2

Summarizing, the maximum cargo volume, at the end of the forecast period in 2047, reaches 2,378,153 tons in Scenario 1 and 2,700,055tons in Scenario 2.

5 ASSESSMENT OF THE RELEVANT SPATIAL/URBAN DEVELOPMENT PLANS

5.1 The Detailed regulation plan of the port of Prahovo

The expansion of the existing port by construction of a new port capacities is determined by the Plan of detailed regulation of the "Port of Prahovo" (Official Gazette of the Municipality of Negotin, No. 7/20), ie Amendments to the Plan of detailed regulation of the „Port of Prahovo“ („Official Gazette of the Municipality of Negotin“, No. 20/220 and 1/221 - correction).

The planned construction of the new port capacity and reconstruction of the existing port of Prahovo are contained in the following higher ranged documents:

- The Spatial plan of special purpose areas for international inland water way E-80 Danube (Paneuropean corridor VII) („Official gazette of the Republic of Serbia“, no. 14/15),
- The Spatial Plan of the Republic of Serbia ("Official Gazette of RS", No.),
- The Spatial Plan of the Municipality of Negotin ("Official Gazette of the Municipality of Negotin" No. 16/11)
- The General regulation plan for the settlement of Prahovo ("Official Gazette of the Municipality of Negotin", No. 7/19)
- Detailed regulation plan for the chemical industry complex in Prahovo ("Official Gazette of the Municipality of Negotin" No. 21/14).
- Detailed Regulation plan of the Port of Prahovo (Official Gazette of the Municipality of Negotin, No. 7/20), and the Amendments to the Plan of Detailed Regulation of the Port of Prahovo (Official Gazette of the Municipality of Negotin, No. 1/2021, dated 14 January 2021)

The existingDetailed regulation plan of the Port of Prahovo and Amendments to the Detailed regulation plan of the Port of Prahovo is treated as relevant for this study.

The existing port area port of Prahovo defined by the Decree on Determination the port area of the Port of Prahovo („Official gazette of the Republic of Serbia“ no. 80/16) covers cadastral parcels no. 5852/2 and 5852/3 in the cadastral municipality Prahovo 5 ha 35 a 18 m² surface area, whereas „Plan“ foresee the port area extension for additional 6 ha 00 a 87m², coming to the total of 13 ha.

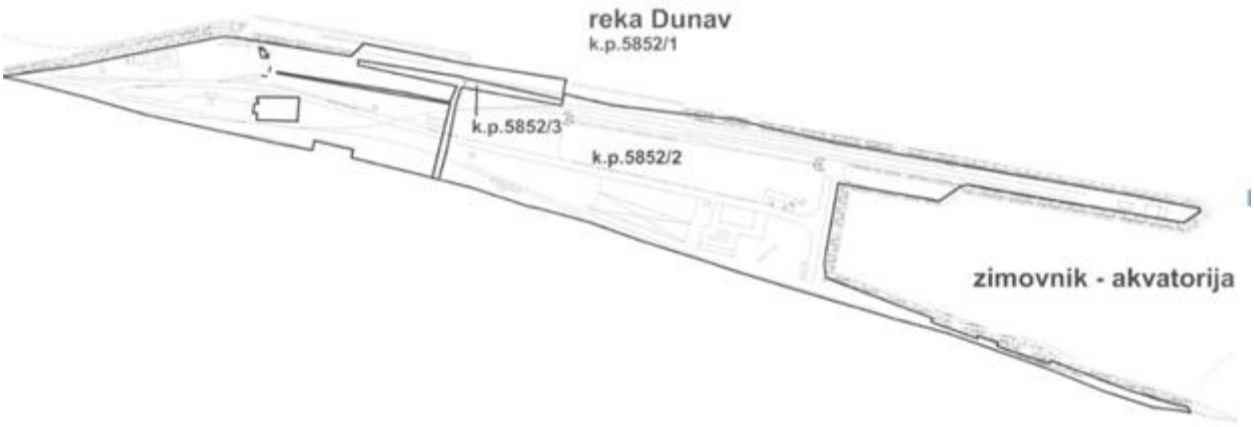


Figure 5.1. Determination of port area in Prahovo[33]

[33](„Official gazette of the Republic of Serbia“ no. 80/16)

The area covered by the Detailed regulation plan of the „Port of Prahovo“ is located within the cadastral municipality of Prahovo, on the right bank of the Danube, at approximate stations from km 859 + 800 to km 858 + 800, covering part of the waters and the entire part of the Danube coast. Within the defined boundaries of the planning document, there is a part of the port area declared by the Decree on Determining the Port Area of the Port of Prahovo („Official Gazette of RS“, No. 80/16), as well as the land directly connected with the port area.

In accordance with the conditions and guidelines from the planning documents of higher order - strategic planning documentation at the national and local level, and for the rational use of construction land, the basic settings of the concept of planning, arrangement and construction within the Plan are as follows:

- ordering, improvement and construction of the Port Area defined by the Decree on Determining the Port Area;
- determining the areas planned for the expansion of the Port Area;
- ordering, improvement and construction of areas in the hinterland of the Port Area necessary for its functioning;
- equipping the space with port infrastructure and port superstructure;
- connecting the port with the necessary traffic systems;
- planning the new access roads and improving the existing ones;
- planning of the railway tracks on the operational shore and their connection with the railway infrastructure;
- equipping the entire space with communal infrastructure;
- determination of areas for the public purpose and other purposes;

5.2 Functional units (zones)

Considering all potentials, limitations and spatial possibilities and the actual situation on the ground, the following units are defined within the planning area:

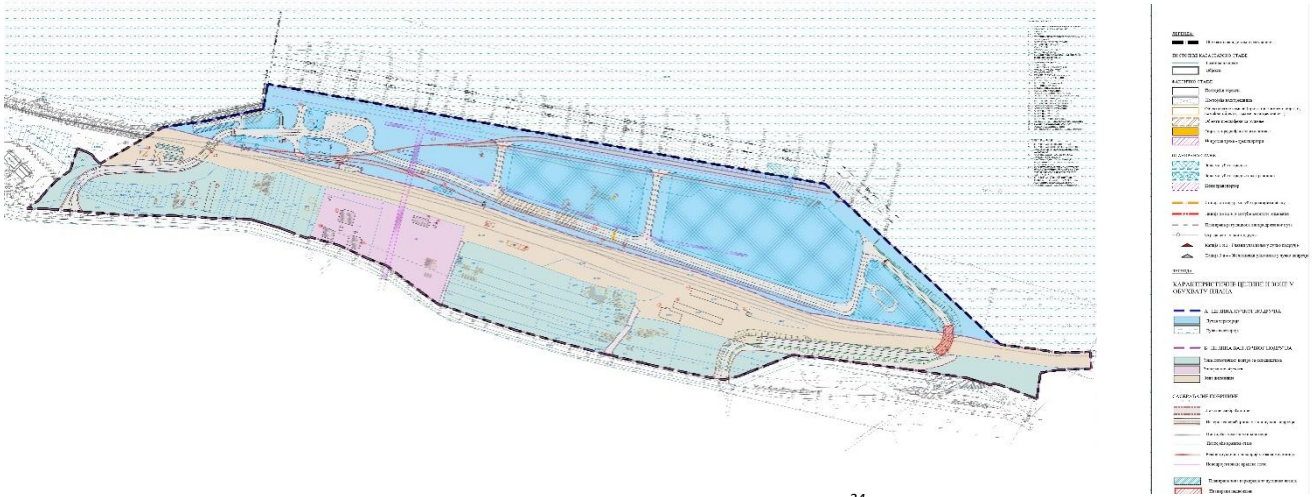


Figure 5.2. Functional units (zone)[34]

- [34]Amendments to the Plan of Detailed Regulation of the Port of Prahovo (Official Gazette of the Municipality of Negotin, No. 1/2021, dated 14 January 2021)

Port area (A):

- Water area (aquatorium);
- Territory.

• Unit outside the Port Area (B):

- Logistics center area with warehouses;
- Zone of public facilities;
- Raiway zone.

5.2.1 The Port area

According to the Detailed Regulation Plan, the port area will cover about 13 ha.
Within the port and storage capacities, the areas of the fortified port area were separated, the areas planned for the expansion of the port area (part of the coast and the wintering area planned for backfilling in order to create a working area of the port), and the logistics center with warehouses were separated.
„Plan" foresee the port area extension on cadastral parcels no. 5852/1 and 5852/5, and part of cadastral parcels no. 5852/6 in cadastral municipality Prahovo6 ha 00 a 87m², surface area. Taking into account the maximum allowed area of widening the coast and burying the winter quarters, it is possible to form a smaller area of the port territory, depending on the needs of the port operator and the actual situation.

Expansion of port capacities of the Port of Prahovo, includes:

- rehabilitation, reconstruction and extension of the operational shore, including one covered berth;
- enlarging the territory of Luka by filling in Zimovnik;
- construction of closed storage areas in the enlarged territory of the Port, with a packing space for bulk cargo, other bulk cargo in transport and delivery, piece goods and predominantly but not exclusively related to the chemical industry;
- reconstruction and construction of open floor warehouses for general cargo, containers and other packaged goods;
- rehabilitation and reconstruction of silos for grains and other granular goods;
- modernization of port machinery and other equipment and devices;
- reconstruction and construction of port roads, truck parking lots, car parking places;
- reconstruction of the existing and construction of a new access road to the Port;
- reconstruction and construction of industrial tracks of the port railway;
- reconstruction and construction of port infrastructure (installation of water supply, sewerage, electricity and signal network, outdoor lighting);
- construction of an administrative building, workshops with storage for tools and spare parts, control facilities for car entrances and weighbridge, fences, gates.

The planned expansion of the port area refers to the construction of a terminal for dangerous goods and the terminal for the reception of used oils and wastewater from ships (Green Terminal).

Downstream from the border of „Zimovnik", an embankment is planned, partly in the bed of the Danube and partly on the coastal part of the right bank, to the border defined in the PDR. It is planned that the area of „Zimovnik" and the downstream part of the right bank of the Danube, by embankment at the level of the territory of the Port, will be transferred from the water to the land surface and thus the new territory of the Port will be realized.

Within the scope of port area, aside from basic activities and superstructure and infrastructure facilities, it will be possible to add facilities for compatible activities which are not related directly to the port operations, such as business operations, logistics, services, maintenance facilities, workshops etc.)

Figure 5.3.The layout of designated purpose area

5.3 The Terminals

The terminals represent a spatially determined technical-technological and organizational unit, in which operations are performed for:

- transshipment process;
- storage process;
- transportation of freight.

The following types of ther terminals are planned in the Port Territory Zone:

- dry bulk goods terminal;
- liquid cargo terminal;
- container terminal;
- hazardous goods terminal;
- general cargo terminal.

5.3.1 The Terminal for hazardous goods - „Green Terminal“

The construction of a green terminal is planned as part of the expansion of the port area in Prahova. „Green terminal“, for the reception and temporary storage of non-hazardous and hazardous ship waste. I is defined within cadastral lot no. 5852/1 KO Prahovo, area ~ 0,5 ha. The creation of the „Green Terminal“ is planned by filling the „Zimovnik“ and part of the coast on the right bank of the Danube.

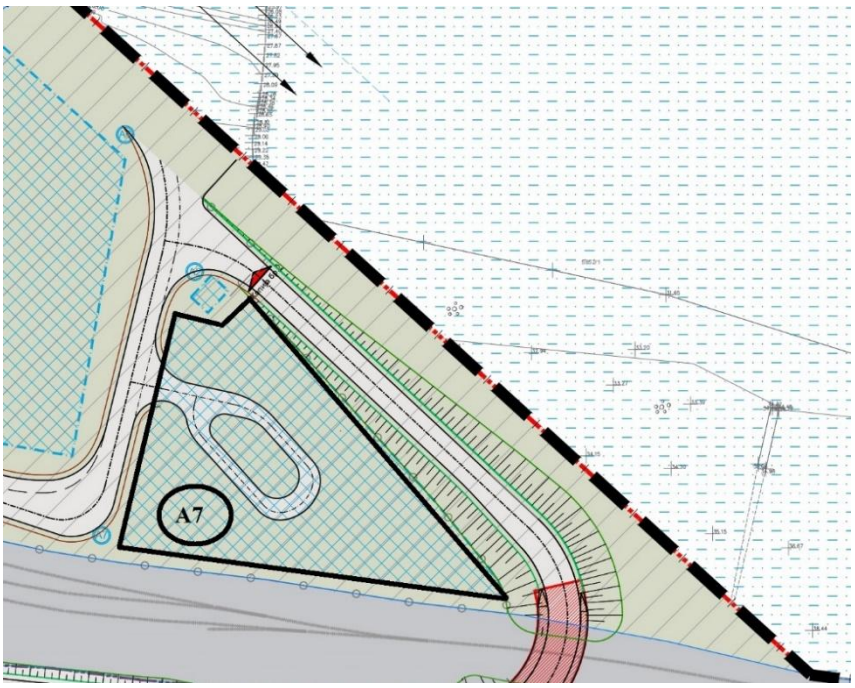


Figure 5.3. Zone "Green terminal"

The „green terminal" is planned on the part of the road that, with the existing internal roads, is connected to other functions within the complex of the Port of Prahovo and through the existing and planned internal roads, exits to the public road E-400, road Prahovo - Negotin.

The subject part of the plot is flat, triangular in shape (A7 figure 5.3.) and altitude follows the global leveling of the port area with an approximate altitude of +38.80 m above sea level, with the direction of the northwest-southeast.

Due to its purpose of the subject part of the plot, the location of the „Green Terminal" is surrounded by a transparent fence, with a gate for the entry of the transport vehicles and a gate for the pedestrian entrance (employees and others). In that way, it will be separated from other plots located within the Port of Prahovo.

'Green Terminal' Work Technology Management of ship waste, ie collection of waste, waste materials from ships (ship waste) in the Port of Prahovo is performed by the Ship Collector, in such a way that the Ship Collector approaches the anchored ships and takes over various waste materials.

At the location of the "Green Terminal", facilities for picking up waste from ships and temporary storage are planned.Also, within the Green Terminal, equipment for several types of waste oils, tanks and other accompanying necessary equipment is planned.

Liquid waste (bilge water, emulsion and oils from the bottom of ships) is pumped directly from the tank of the Collector's Ship into the tanks of the temporary waste storage within the „Green Terminal". The measurement of the entered amount of each individual type of liquid waste is performed via a flow meter.

Pieces of cargo (barrels and containers) are unloaded at the dock of the „Green Terminal" or directly into the truck using the crane of the Collector's Ship, from where they are taken by truck to the „Green Terminal". At the reception, their measurement is performed on the cargo scale in order to keep daily records of received waste, by types and categories.

Temporary storage of waste and waste materials in the "Green Terminal" is performed in phases that include:

- delivery of liquid waste from the Collector's Ship to the tank;
- shipment of liquid waste from the tank to the incineration plant;
- solid waste storage.

5.4 The Operational Shore

The port of Prahovo, in its current state, contains 7 berths which are placed on 322 m of vertical shore and 355 m of semi-vertical shore. The plan envisages the possibility of converting the semi-vertical coast into a vertical coast as well as extending the existing vertical coast.

At the downstream end of the Port, in the hinterland of berths 6 and 7, there is „Zimovnik“, largely filled with sediment, without function, and it prevents the full development of port activities on this part of the coast. The area of „Zimovnik“ belongs to the water plot of the river Danube (cp No. 5852/1).

An embankmnet is planned from the border of „Zimovnik“ downstream, partly in the bed of the Danube and partly on the coastal part of the right bank, to the border defined in the PDR. It is planned that the area of „Zimovnik“ and the downstream part of the right bank of the Danube, by embankment at the level of the territory of the Port, will be transferred from the water to the land surface and thus the new territory of the Port will be realized.

Water area – New berth 8, is planned as a berth of the "Green Terminal". With its lateral position in relation to the operational shore of the Port, on the outer border of the new territory of the port complex, the berth enters the shallow zone of the coastal and coastal terrain.

5.5 The Traffic infrastructure

The Expansion of the port of Prahovo will include the revitalization of existing and construction of new port infrastructure, as well as the construction of additional storage capacity and the improvement of railway and road infrastructure.

5.5.1 The Road traffic

The concept of traffic infrastructure of the Prahovo port complex is based on the connection with the State Road IIb-400 (Negotin - Radujevac - Prahovo - Samaritovac), to which a connection is made through the main access road and the three-lane intersection.

Two connections of the port road to the state road are planned. In accordance with the plans, the existing main access road will represent one connection, while the other connection is planned at the beginning of the second access road, at km 16 + 689.00 (on the right side in the direction of stationary growth) of the state road IIB order number 400.

The planned concept of road and network in the port area is based on the following principles:

- reconstruction along the existing routes of roads and street routes on the primary network, which will enable greater functionality of the primary network;

- fitting the traffic matrix into the spatial development of urban zones, i.e. the planned purpose of the areas;

- planning of leveled intersections of road and railway traffic.

The new access road to „Green Terminal“ is about L = 518 m long. At the beginning of the section is the connection of the road to the State Road through the surface intersection type 1.

The road was designed with a lane width of 3.50 m, noting that widenings were made in the curves for the passage of the relevant vehicle.

In terms of leveling, the access road to the "green terminal" will be harmonized with the elevation of the state road, the elevation of the track and the elevation of the main port road.

5.5.2 The Railway traffic

The railway traffic, the existing tracks of the port zone Prahovo are in the railway station „Prahovo Dock“ and are connected to the public railway infrastructure, via the regional single-track, non-electrified railway (Nis) - Crveni Krst-Zajecar – „Prahovo Pristaniste“. The development plans foresee the revitalization, modernization and electrification of the regional railway with capacity building to connect significant users of railway services.

Condition of the railway tracks within the Port Area is not satisfactory, overhaul and modernization are planned, which will significantly increase their capacity and transport capacity. The plan envisions the introduction of a new track which will serve warehouses in the hinterland of the port area.

If possible, the necessary safety distances between industrial tracks, plot boundaries and other infrastructure corridors must be observed. In addition to the tracks behind the silo, it is possible to envisage another track, so that the existing one would be used for loading and would not disrupt the transport of other cargo.

According to the development plans of "Serbian Railway Infrastructure" a.d. and in accordance with the Spatial Plan of the Republic of Serbia ("Official Gazette of RS", No. 88/10), revitalization, modernization and electrification of the existing single-track railway (Nis) - Red Cross - Zajecar - Prahovo port is planned This regional railway is very important for faster development of Prahovo as an industrial center.

At km 0 + 355.70, where the new road intersects with the railway tracks, the construction of a leveled intersection is planned, which will be done by the construction of a new AB bridge - overpass. A free profile which is 5.8 m high is provided under the bridge. The width of the free profile perpendicular to the tracks is 14.1m.

5.6 The Internal traffic infrastructure

The port must have internal and external road infrastructure, with the external infrastructure consisting of the access road from the state road to the port area border, with a full program of connections, and the internal infrastructure consisting of roads to the operational shore and other facilities in the port area.

Within the port area, it is planned to form internal roads within the port in the level of the plateau designed according to the conditions and regulations for the appropriate area and activity within which the road is designed.

The Internal port roads –Reconstruction and construction of internal port roads, the roads of the port complex make up the main port road and connecting roads that are interconnected and form a traffic network.

The main port road starts from the entrance to the complex, ie the gate and the registration office, and all traffic that will take place inside the complex is accepted and channeled with it. The port road has several intersections with industrial tracks within the port complex. The intersections will be solved by building level crossings.

From the port road, through the surface crossroads of type 1, a connecting road leads to the quay shore. On the part of the port road, which is parallel to the industrial track, an additional third lane is planned on the south side. Connecting road 2 is intended for one-way traffic and is in direct connection with the track and hopper next to the silo.

On the part of the main port road, on the left side, a connection is planned for subsequent expansions of the traffic areas of the Port. On the left side of the port road, in the silo zone, there is a parking lot for trucks with 4PM. Parking is provided through passing parking spaces, by parking the vehicle at an angle of 45°. On the port road, on the east side, there is a connection with the access and internal road of the „Green Terminal“.

On parts of roads and traffic surfaces, where the appearance of a transport vehicles can be expected (heavy cargo vehicle with a length of 16.50 m), it is planned to expand the edge geometry of roads.

The total length of all projected roads within the port complex is about L = 1230 m.

Within the entire Port area, spaces are planned for stationing road vehicles waiting to be loaded or unloaded. Roads within the port area must be arranged and lit.

The Railway traffic, within the entire Port area, overhaul and modernization of the railway tracks is planned, in order to increase their capacity and transport capacity. It is planned to introduce a new track that will serve warehouses in the hinterland of the Port area. The expansion of the operational shore is planned, so in accordance with that, the relocation of the railway tracks to the operational shore with the railway infrastructure is also planned.

It is planned that the Port area has at least two railway tracks, in the direction with the upper edge of the rail at the level of the plateau, in the total length not less than the allowed length of the railway composition in the class of standards applicable to combined traffic. Technological operations on railway vehicles can be performed on port tracks, which should be illuminated, equipped and marked.

5.7 The further steps

To increase the capacity of the port of Prahovo it is necessary to obtain corresponding technical documentation in accordance with the Law on planning and construction („The official gazette of the Republic of Serbia, no. 72/2009, 81/2009, 64/2010, 24/2011, 121/2012, 42/2013, 50/2013, 98/2013,132/2014 and 145/2014):

Draft disposition plan for obtaining location preconditions,

Feasibility study with conceptual design,

Technical documentation for obtaining construction permit,

All companying elaborates defined by the Law for the level of draft master plan (elaborate on fire protection, elaborate on geotechnical preconditions for construction).

The authority in charge of implementation and successful realization of the project for construction of the new Prahovo port capacities is the Ministry of construction, transport and infrastructure of the Republic of Serbia, which, by the Serbian legislative, is the Investor.

6 SCENARIOS FOR PORT DEVELOPMENT

6.1 Institutional framework

In the Republic of Serbia, governance and exploitation of ports are regulated by the Law on Navigation and Ports on Inland Waters[35] (hereinafter: LNPIW). This Law stipulates that the port system in the Republic of Serbia is established according to a landlord port management model. This means that the public body, in this case Port Governance Agency acts as a port authority (in case of Serbia – national port authority), governing ports without any commercial exploitation of them, while private port operators operate ports under concession agreement or operating authorization.

6.1.1 Port concession as a recommended model for port development

In accordance with the basic goals of the European transport policy, as well as the Strategy on development of waterborne transport of the Republic of Serbia for the period 2015 – 2025[36], the volume of transport of goods on inland waterways is expected to increase to a total of 18 % compared to other modes of transport. In order to achieve this goal, it is necessary to improve the transport infrastructure on the network of inland waterways of the Republic of Serbia.

One of the options to develop transport infrastructure, and in this case port infrastructure, are port concessions. Apart from the LNPIW, port concessions are regulated also by the Law on Public-Private Partnership and Concessions[37] (hereinafter the PPP Law). Concessions are widely used in the port sector and subsequently represent a type of structure that is familiar to the established and diversified port operators.

Since investors and port operators around the world have a relatively good understanding of concession models, those interested in the development of the reconstructed Port of Prahovo are likely to be attracted to such a structure, ensuring that a sufficient number of potential investors participate in the process, thus contributing to competitive bidding (which will positively affect commercial terms offered by potential concessionaires).

A successfully implemented concession concept will also send a positive signal to the market, and ultimately increase interest for other port concessions in Serbia that are planned for implementation in the coming period allowing for the further development of both international as well as domestic waterborne transport.

Selection of a reliable port concessionaire will ensure that the reconstructed and extended Port of Prahovo becomes part of larger supply chains, which would ensure the potential for increased traffic development as well as creation of a modern logistic hub primarily intended to serve the needs of agriculture industry and then to serve as a potential multimodal hub for its hinterland. Increased traffic in the Port of Prahovo will be an economic development driver with positive socio-economic impact for the region of Prahovo and wider, allowing it to realize its economic potential.

[35]Official Gazette of the Republic of Serbia", nr. 73 from 12 October 2010, 121 from 24 December 2012, 18 from 13 February 2015, 96 from 26 November 2015 – other law, 92 from 14 November 2016, 104 from 23 December 2016 – other law, 113 from 17 December 2017 – other law, 41 from 31 May 2018, 95 from 8 December 2018 – other law, 37 from 29 May 2019 – other law, 9 from 4 February 2020.
[36]"Official Gazette of RS", no. 3/15
[37] "Official Gazette of RS", no. 88/2011

Financially speaking, the concession will allow the Republic of Serbia to collect annual payments from the Concessionaire for the duration of the concession contract in the manner and under the conditions as will be provided for in the contract. Fixed and variable concession fee payments could serve as additional funds that could be used for further development of the Serbian infrastructure.

Another key reason for the development of concession is that this structure would allow the Republic of Serbia to retain ownership of the new terminals in the port. Following the end of the concession term, the Republic of Serbia would obtain full control of the new terminals (within the extended port) with a new, modern suprastructure and management model set according to the highest market principles.

According to Law on Navigation and Ports on Inland Waters, a port concession represents one of the two legal bases for conducting port activities.

A port concession is defined as a right acquired by a contract governing the provision of:

a) a port concession for services with the right to commercially use a specific service, or
b) a port concession for public works with the right to commercially use the works performed, or
c) simultaneous performance of port services and the construction of port buildings and facilities, with the obligation to maintain port infrastructure,

which is assigned by the Ministry of Construction, Transport and Infrastructure (Ministry) to a domestic or foreign legal entity for a definite period of time, under specially stipulated conditions, against payment of a concession fee by the concessionaire who assumes the risk related to the commercial use of the subject of concession. Commercial risk in the use of works or services includes demand risk or supply risk or both demand and supply risk.

Under the Law on Navigation and Port of Inland Waters, the Ministry is the entity having the authority to engage into the concession agreement for a port in question. The mechanism for awarding the port concession will be controlled by the Law on Navigation and Ports on Inland Waters as well as the PPP Law, with the private partner/concessionaire being selected through a tender procedure as required by the PPP Law.

The PPP Law defines concessions in a complementary way: as PPPs with elements of concession as a "contractual or institutional PPP" whereby a public contract regulates the commercial use of a natural asset, a resource in general use that is in public ownership or a resource owned by a public authority, i.e. performing activities of general interest, which the public partner transfers to the private partner, for a certain period of time, under special conditions, with payment of concession fee by the private or public partner, and the private partner assumes the risk related to commercial use of the concession subject".

The PPP Law also regulates two types of special concessions:

- concession for public works and
- concession for public services.

From the aforementioned, a classic concession will mean that the concession fee is paid by either a public / private partner, and the private partner will have the right to use its subject commercially.

If the subject of the concession is the simultaneous performance of port service and construction of port buildings and facilities, the provisions of the Law on Navigation and Inland Ports and the, the PPP Law and the Law on Public Procurement shall apply to the procedure of granting a port concession.

In terms of the concession duration, if the subject of the concession is the simultaneous performance of port service and construction of port buildings and facilities, the Law on Navigation and Ports on Inland Waters does not prescribe the term for which the port concession may be granted (unlike for other types of port concessions) refers to the period prescribed under the PPP Law. As the PPP Law prescribes a minimum of 5 to a maximum of 50 years of concession contract, 50 years period would be the maximum period for such type of concession.

In the concrete case of the Port of Prahovo, it is recommended that the public partner, that is, the Government of the Republic of Serbia with its Ministry of Construction, Transport and Infrastructure invests in the reconstruction and extension of the port infrastructure, while the construction of the suprastructure and equipping of the port for operations will be granted to a potential port operator as a concession.

The Ministry of Construction, Transport and Infrastructure of the Republic of Serbia prepared the Preliminary feasibility study with conceptual design, and a Project for a construction permit for the expansion of port capacities of the Port of Prahovo. A construction permit was issued for the construction of the port infrastructure.

The estimated value of the investment is EUR 58.8 million. Source of financing: 50% from the RS budget and 50% from the framework loan for the development of port infrastructure of the European Investment Bank.

The next steps are the execution of infrastructure construction works, selection of a concessionaire and construction of the port superstructure.

Therefore, the form of concession recommended for the Port of Prahovo reconstruction and extension encompasses the following (among others):

- provision of port services;
- construction of port superstructure, and
- maintenance of port infrastructure.

Such structure falls under the scope of a concession as defined under the Law on Navigation and Ports on Inland Waters.

Further details on concession procedures, scope and subject, selection of the concessionaire are subject of the special concession study which is a legal requirement for each concession of capital infrastructure.

6.2 Proposed new capacities in function of transport forecast

6.2.1 Infrastructure

The expansion of capacities of port of Prahovo covers 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.

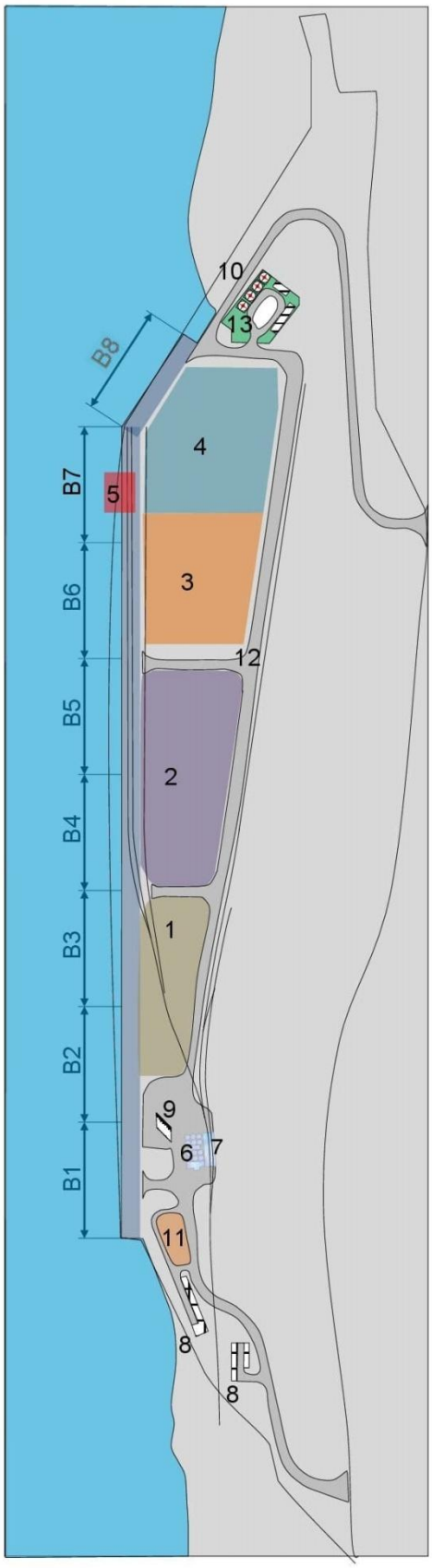
Due to the planned increase in transhipment, capacity expansion of the chemical industry and further modernization of the port, enabling smooth docking of ships at all navigation levels along the entire operational quay is the first and basic requirement. The operational quay will be aligned in the direction of berth 1 and will be extended all the way to the winter harbour. This will enable berthing of ships in all navigation levels throughout the whole year. In that case winter harbour will be replaced with the new port area. This will result in the reconstruction of the entire sloping quay into a vertical one and relocation of all crane and railway tracks in the operational quay area downstream from the existing berth 2. Two new railway tracks will be formed and they will occupy area of the rectangle which length extends from existing berth No. 4 to current entrance to winter harbour.

Suggested solution for the operational quay will be unified the berth lengths so that the total number of berths of the operational coast remains the same. Positions of the berths and navigation conditions will be changed by some margin compare to the present situation.

Proposed layout of port of Prahovo is shown on Figure 6.1.

The State Road IIb-400, Negotin - Radujevac - Prahovo – Samaritovac is the key factor for all road activities in port of Prahovo. It is necessary to connect port road lanes and areas for handling cargoes to the existing traffic network of state roads of the Republic of Serbia over hinterland access roads. Green terminal for the reception and treatment of oils and bilge water has to be connected to a state road.

Reconstruction of the sloping operational quay into a vertical quay brings repositioning of berths including relocation of associated crane and railway tracks and other port infrastructure installations.



1 – bulk cargo and grains terminal
2 – general cargo and container terminal
3 – general cargo terminal
4 – bulk cargo terminal
5 – covered berth
6 – silos
7 – loading hopper with awning
8 – parking lot for cars
9 – parking lot for trucks
10 – tanks on green terminal
11 – management building
12 – road lanes
13 – green terminal

Figure 6.1. Layout of Port of Prahovo

6.2.2 Transshipment capacities

Based on the findings of the forecast, the new reconstructed and extended port should have adequate equipment with sufficient productivity in order to handle the forecasted volumes easily and to enable large capacity reserve.

In order to formulate adequate recommendations for the transportation equipment, a capacity analysis for the future cargo flows and new berths needs to be done.

In this view, we will first assume the operational patterns and working times of the reconstructed and extended port. The simplest way to do so is to assume that the reconstructed and extended port will be working in the same operational pattern as applied by the current port operator, as summarized in continuation.

Number of daily shifts	Navigable days	Working hours/week	Working days	Working time
3 (24 hours/day)	301	168	Mon-Sun	00:00-24:00

Table 6.1. Applied operating patterns in the port

In continuation, the capacity analysis versus forecasted transport volumes will demonstrate how the existing capacities (in terms of existing quantitative capacity indicators, not necessarily the existing transshipment equipment) would serve the forecasted transport volumes. Where such capacity is not sufficient, new capacities will be recommended in terms of typical transshipment equipment with the required productivity. Current capacities were obtained from the interview with the port operator.

Berth	Capacity (t/day)	Cargo packaging	Used for	Annual capacity in three shifts (t)
Berth 1	1500	Bulk	Unloading of bulk components for fertilizers, loading of bulk fertilizers and grains	451,500
Berth 2	1500	Bulk	Unloading of bulk components for fertilizers, loading of bulk fertilizers	451,500
Berth 3	1200	Bulk	Loading of bulk fertilizers (with loading crane) and unloading of components for fertilizers (with wheeled material handler)	361,200
Berth 4	1500	General	Loading and unloading of general (break-bulk) cargo: fertilizers in big bags, wire rods, hot rolled sheets	451,500
Berth 5	1500	Bulk	Unloading of components for fertilizers for stock (storage) and loading of gypsum	451,500
Berth 6	1000	Bulk and general	Rarely used, due to sloped quay making loading/unloading difficult, especially at lower water levels. Used for scrap metal loading, sometimes for lighter general cargo, up to 5 tons.	301,000
Berth 7	0	N/A	Not used. Scheduled for decommissioning and later reconstruction. Crane not functional.	0

Table 6.2. Transshipment capacities at existing berths

In a simplified form, the existing capacities can be represented in the following way:

Capacities	Tons/day	Tons/year	Berths
Capacity for bulk cargo	5,700	1,717,500	B1+B2+B3+B5 (except scrap metal)
Capacity for grains	1,500	451,500	B1 (separate loading device at the same berth)
Capacity for general cargo	1,500	451,500	B4
Capacity for scrap metal in bulk	1,000	301,000	B6
Total capacity	9,700	2,919,700	Entire port

Table 6.3. Simplified existing capacities recapitulation

Moreover, in the determination of the optimum transshipment capacities, UNCTAD recommendations of the maximum berth occupancy will be used. According to UNCTAD Port Development Handbook[38], recommended berth occupancy (from the point of view of possible congestion effects) for ports/terminals with, for example, two berths is 50%. This means that, even though there is sufficient physical reserve of port capacity, congestion (with all its negative effects) can occur during peak loads when berth occupancy (or, in this case, simplified as capacity utilization) reaches values of more than 50%.

Number of berths in the same group	Recommended maximum berth occupancy (%)
1	40
2	50
3	55
4	60
5	65
6-10	70

Table 6.4. UNCTAD recommendation on berth occupancy

6.2.2.1 *Bulk cargo transshipment capacities*

Currently, out of 7 physically existing berths, 5 berths are regularly used, while berth 6 (B6) is rarely used, mostly for handling of general cargo up to 5 tons or for occasional loading of scrap metal. This is due to the presence of sloped quay which is partly damaged and which prevents or restricts operations during lower water levels. Berth 7 (B7) is decommissioned and out of use, as well as the crane located on that berth. Out of 5 regularly used berths, 4 of them are available for various types of bulk cargoes, while berth 4 (B4) is used primarily for general cargo.

Capacities for bulk cargo (again, in terms of existing quantitative capacity indicators, not necessarily the existing transshipment equipment) are analyzed versus forecasted bulk cargo volumes and the results are presented in continuation.

[38] UNCTAD (1985), *Port Development: A handbook for planners in developing countries*, New York.

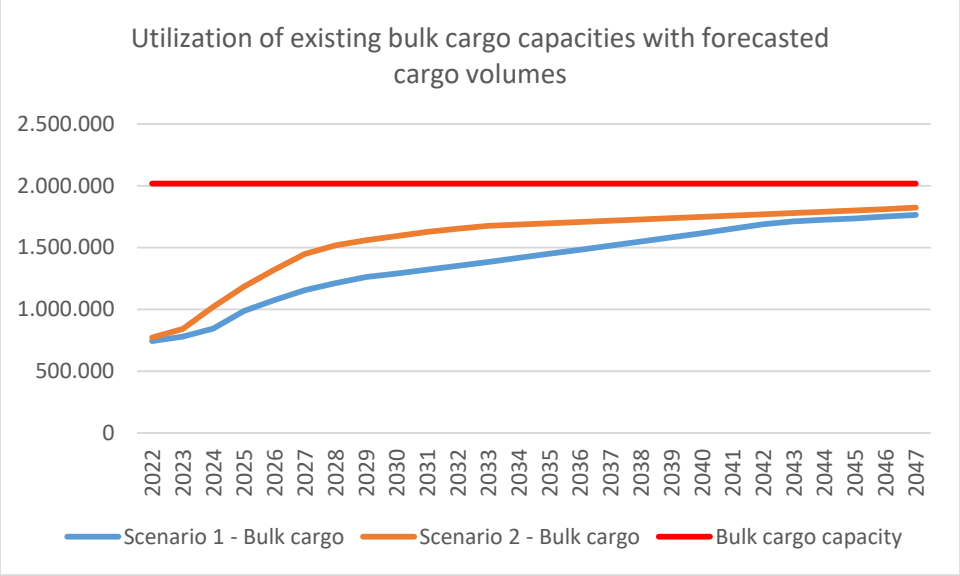


Figure 6.2. Utilization of existing bulk cargo handling capacity vs. forecasted cargo volumes

From the above figure it can be seen that the existing bulk cargo capacities, distributed over five berths where bulk cargo is handled, can cover the forecasted flows of bulk cargo in both scenarios. However, when UNCTAD recommendations are taken into account, maximum berth occupancy for five berths of the same group (where bulk cargo is handled) can be 65%. This means that this threshold is already breached as of 2031, when the utilization rate will be 65.43% in Scenario 1. In Scenario 2, this threshold is breached even earlier, in 2026, when the same rate of utilization is reached.

Finally, this means that the future transshipment capacities, in terms of appropriate transshipment devices, will have to have such productivity to enable at least **2.8 million tons a year** of cumulative bulk cargo handling capacity (calculated in such way so that utilization remains below the 65% threshold throughout the entire forecast period), if bulk cargo handling is distributed over the five berths as today. If bulk cargo is distributed over more berths, this cumulative bulk cargo handling capacity can be lower so as not to breach the threshold of 70% of capacity utilization, according to aforementioned UNCTAD recommendations.

6.2.2.2 *Grain transshipment capacities*

Although grains belong to the group of bulk cargo, they are handled separately, whenever that is possible, simply because they are intended for the human consumption and are therefore considered as the “clean” bulk cargo, for the difference of the “dirty” bulk cargo such as fertilizers, ores, coal, scrap metal, etc. Current operator of the Port of Prahovo has therefore assembled a separate loading mechanism for grains and the berth number 1 (B1), having the loading capacity of 1500 tons/day.

Brief analysis of the capacity utilization of such loading device, in the current operational pattern (3 shifts a day, 24/7 working time), is given in continuation.

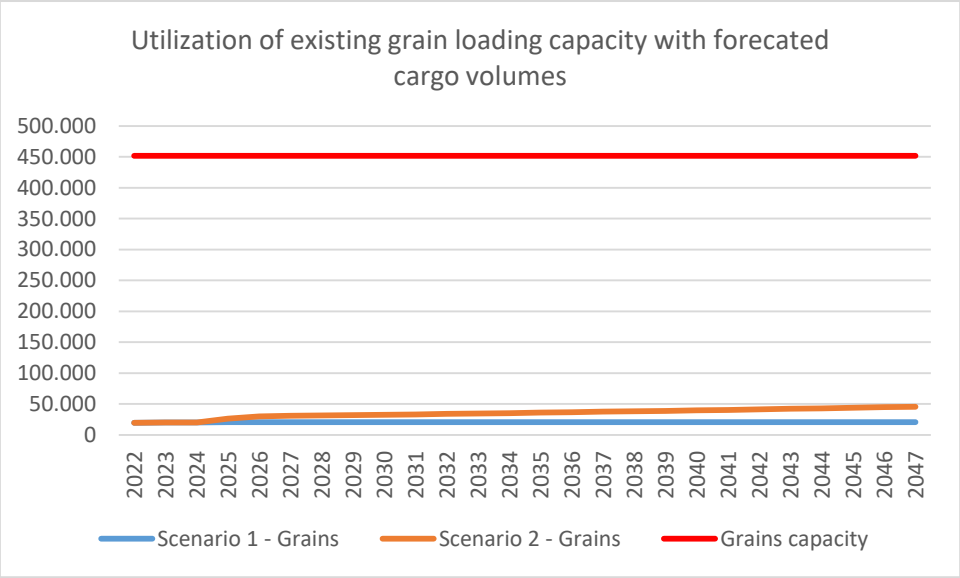


Figure 6.3. Utilization of existing grain handling capacity vs. forecasted cargo volumes

From the above figure it can be seen that the utilization rate of the existing capacities for grains is very low and that a large reserve of capacities exists. In fact, utilization rate barely passes 10% in the year with the highest forecasted volume in the (higher) Scenario 2. Therefore, there is no need for an increased productivity of the loading device, in terms of productivity only. Whether the future operator will want to modernize the facility in any way is beyond the scope of this study.

6.2.2.3 *General cargo transshipment capacities*

Currently, only berth nr. 4 (B4) is used for the transshipment of general cargo, where the existing crane allows for lifting of cargoes of up to 40 tons. Occasionally, berth number 6 is also used for general cargo loading/unloading, but only for the cargo oof up to 5 tons.

The available productivity at B4 allows for the capacity of 451,500 tons/year in 24/7 working pattern in three daily shifts. Analysis of this capacity versus forecasted volumes of general cargoes is elaborated in continuation.

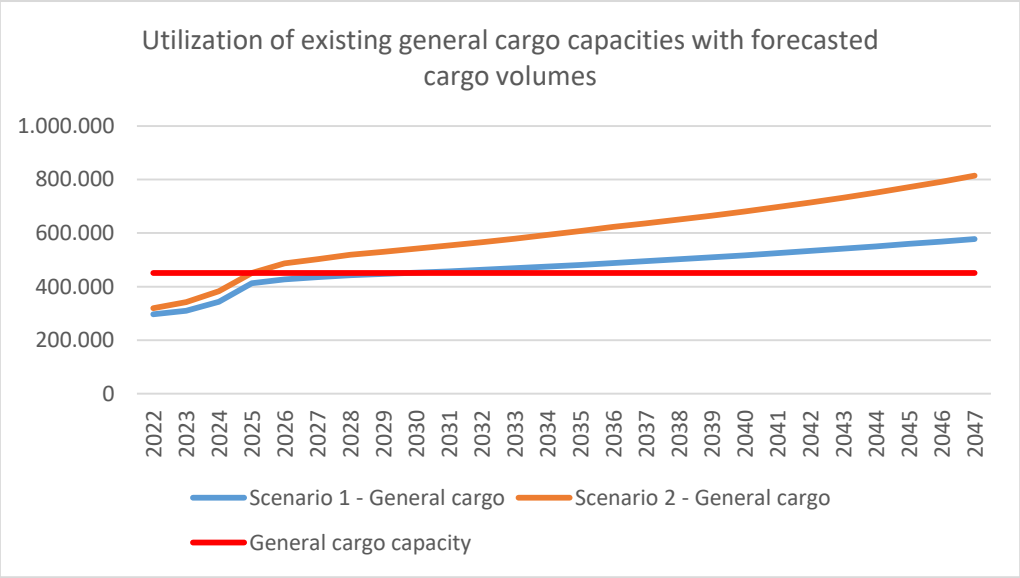


Figure 6.4. Utilization of existing general cargo transshipment capacity vs. forecasted cargo volumes

From the above figure, it can be seen that the situation with the currently available capacity at berth nr. 4 is critical in both scenarios. UNCTAD recommended threshold (for ports with one berth of the same group) of 40% occupancy is already breached. Moreover, it is expected that the port will completely run out of capacity after 2029 in Scenario 1 and already after 2025 in Scenario 2. Since there is no room for changes in operational patterns (the port already works 24 hours/day), the capacity will have to be significantly increased either at the berth 4, or, more likely, at another berth with the appropriate new transshipment device having the productivity at least 1.8 million tons if concentrated at one berth, or 1.7 million tons (cumulative) if distributed over two berths. These figures take into account the UNCTAD recommendations on maximum berth occupancies.

If, however, the port continues to uses both berth nr. 4 and berth nr. 6, with the existing productivities and capacities the situation with the capacity utilization becomes somewhat different.

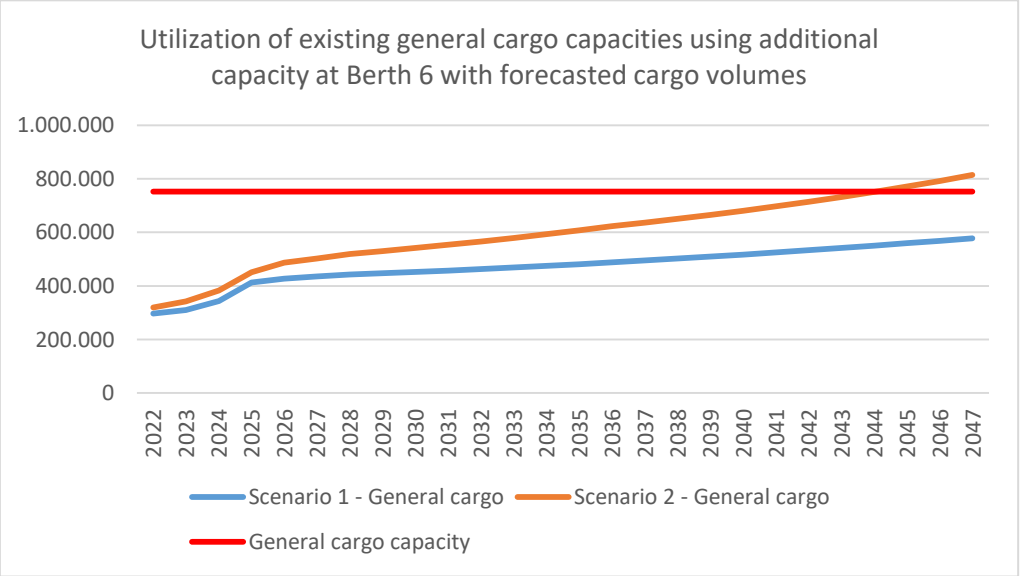


Figure 6.5. Utilization of existing general cargo transshipment capacity with additional capacity vs. forecasted cargo volumes

In case of using extra 1000 tons/day transshipment capacity at the berth nr. 6, such capacity remains sufficient throughout the entire forecast period in Scenario 1. However, in Scenario 2, the port would run out of all available capacities after 2044, for the forecasted quantity of general cargo. The situation becomes even more critical if UNCTAD recommendations are taken into account. In this case, the port would have two berths of the same group (berths for general cargo), whereas the maximum recommended occupancy rate would be 50%. Taking this into account, the potential congestion effects would appear as of 2025 when the utilization rate would be 54.83% in Scenario 1, or as of 2024 when this rate would pass the 50% threshold in Scenario 2.

Therefore, as mentioned earlier, it is recommended that the cumulative capacity, in case of two berths for general cargo, reaches the value of 1.7 million tons/year in order to avoid potential congestion effects which may be extremely serious during the peak periods which are either hard or impossible to forecast.

6.2.2.4 *Liquid bulk cargo transshipment capacities at the "Green terminal"*

The Law on Navigation and Ports on Inland Waters in its article 215 foresees that the "ports of international importance are equipped with reception stations for collecting various residues from ships". Such reception stations, also known as "green terminals", must be equipped, according to the Law, with flanges for receiving bilge and sanitary wastewater in accordance with the applicable European standards, as well as with tanks for receiving waste oil, waste lubricant and garbage. Due to difficulties with finding the ways on how to apply these requirements in practice, until now ports have not been required to construct this kind of terminal, or, strictly speaking in terms of the applicable Law, reception stations. In this view, given the overall throughput and the position of the Port of Prahovo, it is adopted that this port becomes the first port to host such reception stations. For this reason, it is suggested that this reception station, or the green terminal becomes foreseen in the reconstruction and extension project of the Port of Prahovo.

Transshipment capacities at the "Green terminal" need to be sufficient to handle the limited quantities of cargo (waste oil, bilge waters from ships). These quantities are limited due to the maximal processing capacity of processing facilities, which are estimated to 17,000 tons per year.

In a nutshell, the process of collecting waste oils and bilge waters is performed in such way that a special motorized barge (of typical cargo carrying capacity of 250 tons) visits vessels waiting at the anchorage or being berthed (but without interrupting any loading/unloading operations of berthed vessels) and collects waste oil and bilge waters through special piping connected to the adequate pipelines onboard the ship from which the residues are taken over. Once the collecting barge fills its own tanks, it berths alongside the quay (at the new berth nr. 8) and transfers the waste oil and or bilge waters to the reception tanks on shore. Typical capacity of the unloading pumps does not need to be very high as there is no particular need to unload the collector barge quickly. In general, such capacity can be as low as 15 m^3/hour, which for a navigable period of 301 day in a year gives the annual capacity of 108,360 m^3/year. Assuming that the average density[39] of waste oil and/or mixture of oils and fresh water is 990 kg/m^3, the total capacity in tons becomes 102,276 tons/year, which is more than enough to cover for the annual quantities of these specific cargoes.

[39] https://rules.dnv.com/docs/pdf/DNV/CP/2016-03/DNVGL-CP-0208.pdf - last accessed 4 May 2022.

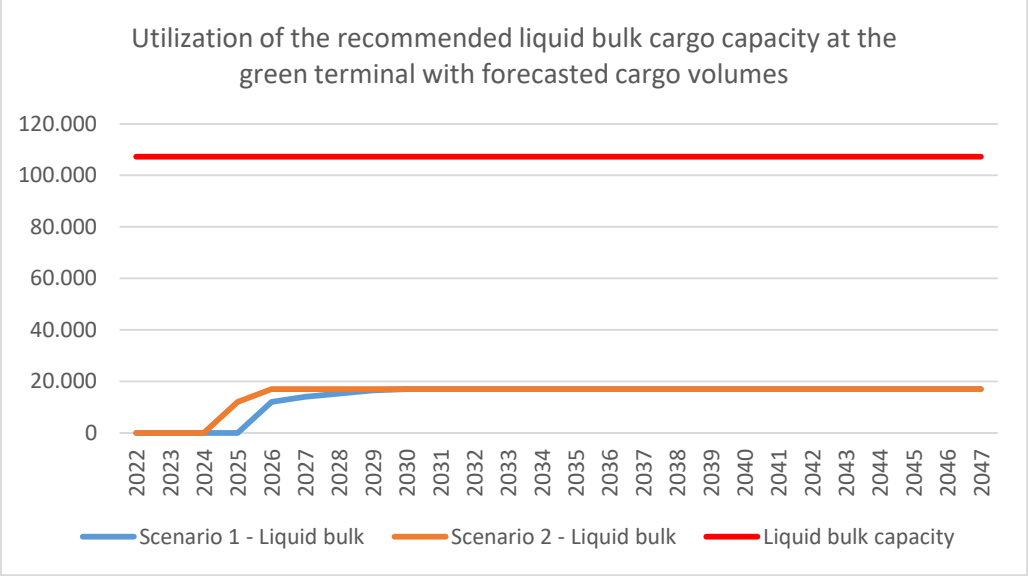


Figure 6.6. Utilization of the "green terminal" capacity vs. forecasted cargo volumes

Although such large capacity reserves are not really necessary, it is accepted that the capacity of unloading pumps should not be less than the aforementioned 15 m^3/hour since this capacity enables the unloading of collecting barge within the timeframe of approximately 16 hours. Any lower capacity of unloading pumps would unnecessarily prolong the unloading time of collector barge.

7 EXECUTIVE SUMMARY

With the transport network consisting of the Danube waterway in the length of 588 km with all its tributaries, along with the road and rail corridors, the Republic of Serbia holds a special importance within the overall European transport policy for the period 2014-2020. The new European policy opens up significant possibilities for better positioning and development of waterway transport in the Republic of Serbia foreseen by the Strategy on Development of Waterborne Transport of the Republic of Serbia, for the period 2015-2025. This Strategy lists the most important investments that are defined and initialised including: construction and reconstruction of Serbian ports, eliminating all critical sectors for navigation on the waterway network, further improvement of intelligent waterway transport systems.

According to the Strategy, the development plans for Port of Prahovo give attention to building and expansion of the quay, purchase of additional portal cranes and enlargement of storage facilities. Bearing in mind the volume of the commodities gravitating towards the Prahovo port hinterland, the need for expanding the port area was also recognized together with the need for construction of a dangerous goods terminal and a container terminal, and putting in operation of the existing or building a new grains silo.

According to the Strategy, the estimated investment for the port infrastructure is 3 million euros, and for the port superstructure 9.8 million euros. The precise funds for investment in the port area expansion will be known after the relevant documentation for Port of Prahovo has been made and adopted. Annex 5 of the Strategy assessed the construction of new port capacities of the Port of Prahovo as a priority project.

Port of Prahovo is located on rkm 861 of the right bank of the Danube. It is an open type port, with an apron area 560 m long. The Port of Prahovo was originally established for the purpose of providing transport services to the industrial complex IHP „Prahovo“.

Current annual capacity of the Port of Prahovo reaches almost 3 million tons of dry bulk and general cargo, in the current working setup of the operator who works on a 24/7 basis, that is, from 00:00 hrs to 24:00 hrs, Monday to Sunday. The port enables the reception and transshipment of various types of cargo and all important raw materials that are necessary for the production of mineral fertilizers, and which come from the Black Sea ports along the Danube. The activities at the location of the Port of Prahovo includes: berthing of vessels, loading and unloading of vessels, temporary storage of goods within storage area at terminals.

The port covers area of approximately 5.5 ha. Port of Prahovo is an open type port with minimum available depth of 1.8 m and maximum available depth of 4 m. Berths 3,4 and 5 have minimum available depths of 1.8 m, while berths 1 and 2 have minimum available depths of 2.5 m. Total quay length is 577 m, out of which vertical quay is approximately 322m. Berths 1, 2, 3 and 4 are placed on vertical quay, while berths 5, 6 and 7 are on sloped quay. Consequently, there are 7 berths in total and seven vessels can be served in quay at once. Anchorage has the capacity to accept 75 vessels.

Storage facilities consist of 6500 m^2 of open spaces. Port of Prahovo has the following facilities and devices: conveyor belt, pneumatic equipment, one crane of 5 t lifting capacity and 6 gantry cranes of 40 tons lifting capacity per each. Of storage facilities there are open storage area, silo storage and customs warehouse. The loading equipment of the port consists of 2 fork lifters with the maximum lifting capacity of 3 t, 3 fork lifters with the lifting capacity of 3 to 5 t and 4 wheel loaders. There is also one port tugboat for pilotage services. Maintenance and disposal facilities comprises bunkering facilities, fresh water supply and onshore power supply.

At the downstream end of the Port, in the hinterland of berths 6 and 7, there is „Zimovnik“, largely filled with sediment, without function, and it prevents the full development of port activities on this part of the coast. The area of „Zimovnik“ belongs to the water plot of the river Danube (cp no. 5852/1).

Currently, there is two licensed port operators in the Port of Prahovo – PD Elixir Prahovo and NIS AD Novi Sad.

The Port of Prahovo is intended for loading/unloading operations and storage of various types of goods such as cereals, oilseeds, fertilizers, gravel, sand, general cargo and cargo containers. Loading/unloading operations are performed both from vessels to the port quay and from the port quay to vessels, as well as stored cargo to trucks or railways and vice versa.

The terminals provide processing of cargo such as phosphate (bulk), copper concentrate (bulk), coal (bulk), KCl potassium chloride (bulk), road salt (bulk), equipment and parts (general), wire rods (general), fertilizers (bulk), fertilizers big bags (general), monocalcium phosphate MCP (general), monocalcium phosphate MCP (bulk), grains (bulk), scrap metal (bulk), hot rolled sheets (general), limestone (bulk) and gypsum (bulk).

As a typical multipurpose port, the Port of Prahovo handled mostly fertilizers (components and finished products), general cargo, and, to a lesser extent, determined quantities of grains in export and metallurgical products in transit from the North Macedonia. Top three products handled in the Port of Prahovo are fertilizers and their components, metallurgical products and grains.

Typical port users are from the fertilizers industry, as well as users from the metallurgical and mining industry. Future users will largely remain within this group, while new additions will be the industrial companies that are expected to settle within the industrial-chemical park in Prahovo, which is founded by Elixir group, a well-known fertilizer producer in Serbia and a current operator of the Port of Prahovo.

Port of Prahovo has a single road entrance with two lanes road allowing vehicle access. The road entrance distance from the main road is 5 km. The area of 2000 m^2 is intended for parking vehicles. In port area there is no truck scales.

There is one operative rail entrance which connects port to the national railway network with a three loading/unloading rail tracks with overall length of 880 m (360+360+160) and axle load of 20 t. In the hinterland of the port of Prahovo there is a railway station “Prahovo Pristaniste” with the railway tracks of 1100 m length.

The expansion of the existing port by construction of a new port capacities is determined by the Plan of detailed regulation of the "Port of Prahovo" (Official Gazette of the Municipality of Negotin, No. 7/20), ie Amendments to the Plan of detailed regulation of the „Port of Prahovo“ („Official Gazette of the Municipality of Negotin“, No. 20/220 and 1/221 - correction).

Expansion of port capacities of the Port of Prahovo, includes:

- rehabilitation, reconstruction and extension of the operational shore, including one covered berth;
- increasing the territory of Luka by filling in Zimovnik;
- construction of closed storage areas on the enlarged territory of the Port, with a packing room for bulk cargo, other bulk cargo in transport and delivery, general cargoes predominantly but not exclusively related to the chemical industry;
- reconstruction and construction of open floor warehouses for general cargo, containers
- and other packaged goods;

- rehabilitation and reconstruction of silos for cereals and other granular goods;
- modernization of port machinery and other equipment and devices;
- reconstruction and construction of port roads, truck parking lots, car parks;
- reconstruction of the existing and construction of a new access road to the Port;
- reconstruction and construction of industrial tracks of the port railway;
- reconstruction and construction of port infrastructure (installation of water supply, sewerage, electricity and signal network, outdoor lighting);
- construction of an administrative building, workshops with storage of tools and spare parts, control facilities for car entrances and car scales, fences, gates.

The planned expansion of the port area refers also to the construction of a terminal for dangerous goods and the terminal for the reception of used oils and wastewater from ships (Green Terminal).

Downstream from the border of „Zimovnik“, an embankment is planned, partly in the bed of the Danube and partly on the coastal part of the right bank, to the border defined in the PDR. It is planned that the area of „Zimovnik“ and the downstream part of the right bank of the Danube, by embankment at the level of the territory of the Port, will be transferred from the water to the land surface and thus the new territory of the Port will be realized.

In terms of future development, two scenarios (lower and higher), developed within this study, were assumed for the 25 years horizon cargo forecast, both of them being focused around the forecasted GDP growth and import/export forecasts of the International Monetary Fund. Besides the forecasts of typical existing cargoes handled in the port, determined quantities of new cargoes are forecasted, according to the strategic port development plans, such as ship-originated waste oil and bilge waters at the new “green” terminal. In Scenario 1, the total forecasted quantity of all cargoes reached 2.38 million tons, while Scenario 2 forecast revealed a total forecasted quantity of 2.7 million tons of different cargo.

Due to the planned increase in transhipment, capacity expansion of the chemical industry and further modernization of the port, enabling smooth docking of ships at all navigation levels along the entire operational quay is the first and basic requirement. The apron area will be aligned in the direction of berth 1 and will be extended all the way to the winter harbour. This will enable berthing of ships in all navigation levels throughout the whole year. In that case winter harbour will be replaced with the new port area. This will result in the reconstruction of the entire sloping quay into a vertical one and relocation of all crane and railway tracks in the operational quay area downstream from the existing berth 2. Two new railway tracks will be formed and they will occupy area of the rectangle which length extends from existing berth No. 4 to current entrance to winter harbour.

The following types of the terminals are planned in the Port Territory Zone:

- dry bulk goods terminal;
- liquid cargo terminal;
- container terminal;
- hazardous goods terminal;
- general cargo terminal.

The construction of a green terminal is planned as part of the expansion of the port area in Prahovo.
„Green terminal“ will be used for the reception and temporary storage of non-hazardous and hazardous ship waste. The development of the „Green Terminal“ is planned by filling the „Zimovnik“ and part of the coast on the right bank of the Danube.

At the location of the "Green Terminal", facilities for picking up waste from ships and temporary storage are planned. Also, within the Green Terminal, equipment for several types of waste oils, tanks and other accompanying necessary equipment is planned.

This study demonstrated the need for transshipment equipment with sufficient productivity in order to handle the forecasted volumes easily and to enable sufficiently large capacity reserve. In addition, the new "green" terminal will require specialized transshipment equipment, such as pumping systems for bilge waters and waste oils, as well as suitable transshipment device for waste tires handling.

Bulk cargo transshipment capacities

- The future bulk cargo (other than grain) transshipment capacities will have to have such productivity to enable at least 2.8 million tons a year of cumulative bulk cargo handling capacity.

Grain transshipment capacities

- Utilization rate of the existing cargo handling capacities for grains is very low and a large reserve of capacities exists.
- Current physical capacity is enough for the forecasted volumes. It is up to the operator to determine whether any modernization of grain handling equipment is needed.

General cargo transshipment capacities

- Currently, only berth nr. 4 (B4) is used for the transshipment of general cargo, where the existing crane allows for lifting of cargoes of up to 40 tons.
- Currently available capacity at berth nr. 4 is critical. So, the capacity will have to be significantly increased either at the berth 4, or, more likely, at another berth with the appropriate new transshipment device having the productivity at least 1.8 million tons if concentrated at one berth, or 1.7 million tons (cumulative) if distributed over two berths.
- In such a way, the Port of Prahovo will avoid potential congestion effects which may be extremely serious during the peak periods which are either hard or impossible to forecast.

Liquid bulk cargo transshipment capacities at the "Green terminal"

- Transshipment capacities at the "Green terminal" need to be sufficient to handle the limited quantities of cargo (waste oil, bilge waters from ships).
- These quantities are limited due to the maximal processing capacity of processing facilities, which are estimated to 17,000 tons per year.
- The process of collecting waste oils and bilge waters is performed in such way that a special motorized barge (of typical cargo carrying capacity of 250 tons) visits vessels waiting at the anchorage or being berthed (but without interrupting any loading/unloading operations of berthed vessels) and collects waste oil and bilge waters through special piping connected to the adequate pipelines onboard the ship from which the residues are taken over.
- Once the collecting barge fills its own tanks, it berths alongside the quay (at the new berth nr. 8) and transfers the waste oil and or bilge waters to the reception tanks on shore.
- Typical capacity of the unloading pumps does not need to be very high as there is no particular need to unload the collector barge quickly. In general, such capacity can be as low as 15 m^3/hour, which for a navigable period of 301 day in a year gives the annual capacity of 108,360 m^3/year.

- Assuming that the average density[40] of waste oil and/or mixture of oils and fresh water is 990 kg/m^3, the total capacity in tons becomes 102,276 tons/year, which is more than enough to cover for the annual quantities of these specific cargoes.

In the case of the Port of Prahovo, it is recommended that the public partner, that is, the Government of the Republic of Serbia with its Ministry of Construction, Transport and Infrastructure invests in the reconstruction and extension of the port infrastructure, while the construction of the suprastructure and equipping of the port for operations will be granted to a potential port operator as a concession.

The Ministry of Construction, Transport and Infrastructure of the Republic of Serbia prepared the Preliminary feasibility study with conceptual design, and a Project for a construction permit for the expansion of port capacities of the Port of Prahovo. A construction permit was issued for the construction of the port infrastructure.

The estimated value of the investment is EUR 58.8 million. Source of financing: 50% from the RS budget and 50% from the framework loan for the development of port infrastructure of the European Investment Bank.

The next steps are the execution of infrastructure construction works, selection of a concessionaire and construction of the port superstructure.

Therefore, the form of concession recommended for the Port of Prahovo reconstruction and extension encompasses the following (among others):

- provision of port services;
- construction of port superstructure, and
- maintenance of port infrastructure.

Reconstruction and construction of the missing primary infrastructure in the Port will significantly improve the operation of the port and its transhipment and operational performance. The construction of a new green terminal for the disposal of ship waste will significantly improve the level of environmental protection.

Capacity expansion of the Prahovo Port through construction of new storage capacities for bulk and general cargo (predominantly, but not exclusively related to the chemical industry) as well as modernization of port equipment, will create additional value for the economy operating in port's hinterland of the Bor district, but also for the companies that operate in eastern Bulgaria and iron industry of North Macedonia.

Further development and construction of new capacities in the Port of Prahovo is expected to enable the port to become qualified for inclusion in the core of the TEN-T river port network.

[40] https://rules.dnv.com/docs/pdf/DNV/CP/2016-03/DNVGL-CP-0208.pdf - last accessed 4 May 2022.

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Project name	**INTEGRATING DANUBE REGION INTO SMART & SUSTAINABLE MULTI-MODAL & INTERMODAL TRANSPORT CHAINS–DIONYSUS** - Programme co-funded by the European Union
Part A	Elaboration of the Port Development Plans for the Port of Bačka Palanka
Project contractor	**PTC – Public Transport Consult d.o.o.** Poenkareova 12/11, 11000, Beograd, Srbija

Version / Revision	Final version	
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Date	12/08/2022	
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Authorized by	SvjetlanaTICA	
No. of project	1-AL/22	

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1 INTRODUCTION

1.1 European strategies

1.1.1 The Trans-European Transport Network policy

The Trans-European Transport Network [TEN-T][1]policy addresses the implementation and development of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. The ultimate objective is to close gaps, remove bottlenecks and technical barriers, as well as to strengthen social, economic and territorial cohesion in the EU.

Besides the construction of new physical infrastructure, the TEN-T policy supports the application of innovation, new technologies and digital solutions to all modes of transport. The objective is improved use of infrastructure, reduced environmental impact of transport, enhanced energy efficiency and increased safety.

TEN-T policy also sets requirements that the transport infrastructure must comply with, including on safety, quality for highly performing transport and alignment with environmental objectives.

The policy is a key instrument for the development of coherent, connected and high-quality transport infrastructure across the EU. It incentivizes the sustainable and more efficient transportation of people and goods, ensures access to jobs and services, and enables trade and economic growth. It also strengthens the EU's economic, social and territorial cohesion by creating seamless transport systems across borders, without missing links and bottlenecks.

Revision[2] of the TEN-T Regulation, which is currently ongoing, offers a realistic opportunity to make the Trans-European Transport Network fit for the future, and to align the development ofthe TEN-T network to the European Green Deal[3] objectives and the climate targets of the EU Climate Law. Cutting greenhouse gas emissions from the transport sector by 90%, compared with 1990 levels, by 2050, is key to achieving climate-neutrality by the same date.

To make such significant emission cuts, the society and industry need a modern, fully-fledged European transport network (1) that makes all transport modes more sustainable by setting firm incentives and requirements for transport infrastructure development and by better integrating the different modes in a multimodal transport system, (2) that ensures that new infrastructure projects on the network are climate-proof and consistent with environmental objectives and (3) that delivers the infrastructure basis for alternative fuel deployment.

At the same time, the TEN-T revision will reinforce the governance and monitoring instruments in place to ensure on-time network completion and exploit synergies between infrastructure planning and transport operations. This includes binding work plans to remove further obstacles for quicker and more efficient rail freight and passenger services.

[1]Source: https://ec.europa.eu/transport/themes/infrastructure/ten-t_en

[2]https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2021%3A812%3AFIN

[3]https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en#documents

The TEN-T Regulation supports the development of a reliable and seamless trans-European transport network that offers sustainable connectivity throughout the European Union, without physical gaps, bottlenecks or missing links.

This high-quality network shall be gradually completed in three steps: 2030 for the core network, 2040 for the extended core network and 2050 for the comprehensive network. The core and extended core network together form the European Transport Corridors which are the most strategic part of the network with highest EU added value.

The main novelties[4] compared to the 2013 Regulation:

- High infrastructure standards for all modes applied throughout the entire network.
- Nine "European Transport Corridors", representing the main arteries of EU transport, that integrate the former Core Network Corridors with the Rail Freight Corridors.
- Stronger synergies between infrastructure planning and the operation of transport services. Examples include higher speeds for train services across the TEN-T network (160 kilometers per hour for passenger services and 100 kilometers per hour for freight), maximum waiting times at borders of 15 minutes for rail freight. Another example is guaranteed good navigation status per river basin on the inland waterways on the TEN-T network.
- Requirements for the deployment, across the TEN-T network, of the charging and refueling infrastructure needed for alternative transport fuels in line with the Alternative Fuels Infrastructure Regulation. This would mean sufficient charging capacity for cars, vans and trucks at 60 kilometers distance in each direction by 2025 on the core network and by 2030 for the extended core and comprehensive networks.
- Providing safe and secure parking areas for commercial drivers, equipped with alternative fuels infrastructure.
- Use of innovative technologies like 5G to further advance the digitalization of transport infrastructure, further increasing efficiency, and improving the safety, security and resilience of the network.
- Increased resilience of the TEN-T network to natural and human-made disasters via climate-proofing requirements and environmental impact assessments for new projects, and to the implications of an accident or breakdown (e.g. by enabling alternative route alignments to the main network).
- The requirement for 424 major cities ("cities") on the TEN-T network to have sustainable urban mobility plans by 2025, in order to align their mobility developments on the TEN-T network. The SUMPs will contain measures such as the promotion of zero-emission mobility and the greening of the urban fleet.
- More transshipment hubs and multimodal passenger terminals in cities to facilitate multimodality, in particular for the last mile of a passenger or freight journey.
- Connect large airports to rail, where possible high-speed rail.
- Making it possible network-wide for lorries to be transported by trains.

[4] https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_6725

Cities are important points of transfer and last-mile connection within or between different transport modes on the TEN-T. It is important to ensure that neither capacity bottlenecks nor insufficient network connectivity within urban nodes can hamper multimodality along the trans-European transport network.

For this reason, the new provisions introduced through the revised TEN-T Regulation require that by 2040, at least one multimodal passenger hub and one multimodal freight terminal allowing for sufficient transshipment capacity within or in the vicinity of the urban node is in place.

In addition, by 2025, the 424 cities identified in the new TEN-T regulation must develop a Sustainable Urban Mobility Plan (SUMP) that includes measures to integrate the different modes of transport, and to promote zero-emission mobility.

For ports, the new extended version of the definition of a "cross-border" project could be of great importance as higher priorities are given to cross-border projects. Currently, "cross-border" section is defined as the section which ensures the continuity of a project of common interest on both sides of the border, between the closest urban nodes to the border of two Member States or between a Member State and a neighboring country. This definition leaves room for various interpretations, and it is not as clear as it could be. Inland ports, as well as seaports, are true examples of cross-border projects as they spread added value way beyond the borders of the port area and facilitate connectivity not just between mode but also between countries and various destinations in the foreland and hinterland of each port.

In addition, the proposal for the TEN-T revision foresees significant improvement for seaports in terms of their treatment as important nodes of the entire transport network. The proposal states that, being the entry and exit points for the land infrastructure of the trans-European transport network, maritime ports play an important role as cross-border multimodal nodes which serve not only as transport hubs, but also as gateways for trade, industrial clusters and energy hubs, for example with regard to the deployment of off-shore wind installations. Unfortunately, not even close recognition is given to inland ports, which is deemed fully unjustified.

Furthermore, the proposal states that the short sea shipping can make a substantial contribution to the decarbonization of transport by carrying more freight and passengers. The European Maritime Space should be promoted by creating or upgrading short-sea shipping routes and by developing maritime ports and their hinterland connections as to provide an efficient and sustainable integration with other modes of transport. The proposal unfortunately misses to include inland ports here, in spite of the fact that a huge number or short-sea shipping routes are actually sea-river routes where many origin or destination ports (without transshipment) are located on European inland waterways.

1.1.2 Sustainable and Smart Mobility Strategy

On 9 December 2020 the European Commission published the EU Sustainable and Smart Mobility Strategy.

The new Sustainable and Smart Mobility Strategy[5] sets out the EU vision for the transport system of the future and the action plan that will make it happen. It is structured around three key objectives: making the European transport system sustainable, smart and resilient.

[5] https://eur-lex.europa.eu/resource.html?uri=cellar:5e601657-3b06-11eb-b27b-01aa75ed71a1.0001.02/DOC_1&format=PDF

Sustainable mobility: involving an irreversible shift to zero-emission mobility by making all transport modes more sustainable, ensuring wide availability of the most sustainable options and giving users incentives to make sustainable choices;

Smart mobility: supporting sustainable choices by taking advantage of digitalization and automation to achieve seamless, safe and efficient connectivity;

Resilient mobility: bouncing back from the COVID-19 pandemic by creating a Single European Transport Area that is affordable and accessible for all citizens and businesses and resilient against future crises and safety and security challenges.

A clear path is needed to achieve a 90% reduction in transport-related greenhouse gas emissions by 2050. This is the effort required from transport to ensure the EU becomes the first climate-neutral continent by 2050, as outlined in the European Green Deal. Digitalization will become an indispensable driver for the modernization of the entire system, making it seamless and more efficient, while further reducing emissions. In addition, the coronavirus pandemic has shed light on the vulnerabilities of the single market and the need to strengthen its resilience.

The strategy sets out an action plan of concrete policy measures, structured around 10 key areas for action ("flagships") areas that will guide the Commission's work in the years to come. It also sets out milestones that show where we want to be in 10 and 30 years from now.

Various milestones show the path to achieving our objectives of sustainable, smart and resilient mobility (in the road transport environment), such as:

By 2030:

- at least 30 million zero-emission cars will be in operation on European roads
- 100 European cities will be climate neutral.
- scheduled collective travel for journeys under 500 km should be carbon neutral
- automated mobility will be deployed at large scale

By 2050:

- nearly all cars, vans, buses as well as new heavy-duty vehicles will be zero-emission.
- a fully operational, multimodal Trans-European Transport Network (TEN-T) for sustainable and smart transport with high-speed connectivity.

Major highlights of importance for inland ports are the following actions of this Strategy:

- Canals and rivers must ensure good navigation conditions, unhindered for example by water levels, for a minimum number of days per year.
- Calls for more transshipment terminals, improved handling capacity at freight terminals.
- Requires all 424 major cities along the TEN-T network to develop Sustainable Urban Mobility Plans to promote zero-emission mobility and to increase and improve public transport and infrastructure for walking and cycling.
- Decisive action to shift more activity towards more sustainable transport modes.
- Internalization of external costs (by implementing the "polluter pays" and "user pays" principles, in particular through carbon pricing and infrastructure charging mechanisms).

- In addressing its "Flagship 2 - Creation of zero-emission ports and airports", the Strategy states that inland and sea ports have a great potential to become new clean energy hubs for integrated electricity systems, hydrogen and other low-carbon fuels, and testbeds for waste reuse and the circular economy. For backing up this objective, the Commission will incentivize the deployment of renewable and low-carbon fuels and feeding stationed vessels and aircraft with renewable power instead of fossil energy, incentivizing the development and use of new, cleaner and quieter aircraft and vessels, revising airport charges, greening ground movements at airports as well as port services and operations and optimization of port calls.
- In addressing its "Flagship 4 – Greening freight transport", the Strategy states that the support for the the greening of cargo operations in Europe will require substantial revision of the existing framework for intermodal transport Options to revise the regulatory framework such as the Combined Transport Directive as well as introducing economic incentives for both operations and infrastructure should be considered. Incentive mechanisms should be based on impartial performance monitoring, according to a European framework to measure transport and logistics emissions.
- Moreover, the Strategy rightly claims that the scarcity of transshipment infrastructure, and of inland multimodal terminals in particular, is pronounced in certain parts of Europe, and should be given the highest priority. Missing links in multimodal infrastructure should be closed.

1.1.3 NAIADES III Action plan

The European Commission's new programme the NAIADES III Action Plan[6], is a programme aimed at boosting the role of inland waterway transport in mobility and logistics systems, in line with the European Green Deal and the Sustainable and Smart Mobility Strategy, which set the goal of increasing transport by inland waterways and short sea shipping by 25% by 2030, and by 50% by 2050.

The programme intends to assist the inland waterway managers to ensure a high level of service (Good Navigation Status[7]) along EU inland waterway corridors by 31 December 2030.

The NAIADES III Action plan delivers actions in the following areas:

- shifting more freight to inland waterways;
- transition to zero-emission inland waterway transport;
- smart inland waterway transport;
- more attractive and sustainable jobs in inland waterway transport.

Shifting more freight to inland waterways

This type of actions intends to help inland waterway managers to ensure a high level of service (Good Navigation Status) along EU inland waterway corridors by 31 December 2030. The long-awaited revision of the Combined Transport Directive[8]will have to fully integrate inland waterways as an essential component of intermodal transport. The Commission will also establish an EU framework for measuring and report

[6] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2021:324:FIN
[7] European Commission, Directorate-General for Mobility and Transport, Liere, R., Armbrecht, H., Turf, S., et al., Good Navigation Status: guidelines towards achieving a Good Navigation Status, Publications Office, 2018
[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01992L0106-20130701

emissions from logistics and transport. This could increase demand for more sustainable options, including inland waterways where feasible.

Transition to zero-emission inland waterway transport

Compared to other land-based modes of transport, inland waterway transport is energy-efficient, safe, almost congestion-free and silent. The Commission will propose measures to encourage investment in zero-emission and zero-waste technologies for inland vessels and inland ports and will also support research and innovation.

Smart inland waterway transport

The programme encompasses new measures to help the inland waterway transport sector to keep up with digital developments and improve competitiveness. Both will help the sector become an active part of broader multimodal chains. Further digitalization can play a significant role in improving the efficiency and reliability of navigation and traffic management, better integrating inland waterway transport in logistics processes and multimodal chains, and reducing the administrative burden and costs of complying with and enforcing legislation.

More attractive and sustainable jobs in inland waterway transport

The inland waterways sector relies on a skilled workforce. Included actions will ensure smart and flexible EU crewing rules and provide inland vessel crews with the right skills to deal with the green and digital transitions, cyber-security, synchro modality and the automation of vessels and infrastructure.

1.2 Regional strategies

1.2.1 Strategy for the Danube Region (EUSDR)

The EU Strategy for the Danube Region (EUSDR) is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011. The EU Strategy for the Danube Region, endorsed in June 2011 by the European Council, is the second EU macro-regional strategy after the EU Strategy for the Baltic Sea Region.

The Strategy was jointly developed by the Commission, together with the Danube Region countries and stakeholders, in order to address common challenges together. The Strategy seeks to create synergies and coordination between existing policies and initiatives taking place across the Danube Region.

The Danube Region Strategy addresses a wide range of issues; these are divided among 4 pillars and 12 priority areas. Each priority area is managed by two countries as Priority Area Coordinators (PACs).

Figure 1.1. Priority areas EU Strategy for the Danube Region (EUSDR)[9]

Priority Area 1A — To improve mobility and multimodality: inland waterways of the EU Strategy for the Danube Region. This Priority Area is coordinated by Austria and Romania, with the involvement of a wide network of key players and stakeholders from the 14 countries of the Danube region. Here you can find out about main activities, projects and actions in the field of inland waterways in the Danube region, latest news and upcoming events on the topic. During the period from 01 January 2020 until 31 December 2022 the activities of the Technical Secretariats of Austria and Romania are being co-financed by the Danube Transnational Programme (DTP).[10]

The goals of the Priority Area 1a of the EU Strategy for the Danube Region – "To improve mobility and multimodality: Inland waterways" are to increase the cargo transport on rivers by 20% by 2020 compared to 2010, remove obstacles to navigability taking into account the specific characteristics of each section of the Danube and its navigable tributaries, and to establish efficient inland waterway infrastructure management. For the coordination and discussion on existing and proposed projects which are in line with the objectives set for the Danube Region Strategy's Priority Area 1a and on the realisation of the Priority Area's targets and actions, the Priority Area Coordinators together with the Steering Group established six thematic Working Groups.[11]

[9] Priority Areas - EUSDR - Danube Strategy Point (danube-region.eu)
[10] https://navigation.danube-region.eu
[11] https://navigation.danube-region.eu/working-groups/

Of the six above Working Groups for ports is the most important WG Waterway and port infrastructure & management.

Action 1: Contribute to improve waterway and port infrastructure & management

Although enacted within the framework of the TEN-T Regulation (1315/2013), the "European Agreement on Main Inland Waterways of International Importance" (AGN) (which is ratified by all Danube riparian countries except for Germany) and the "Recommendations on minimum requirements for standard fairway parameters, hydrotechnical and other improvements on the Danube" of the Danube Commission, waterway management as well as upgrading and maintenance of the waterway and related infrastructure are under national responsibility.

Consequently, as the Danube is a linear transport axis, transnational coordination is essential for successful development. PA1a has brought up important milestones in this respect, such as the setting up of the Fairway Rehabilitation and Maintenance Masterplan for the Danube and its navigable tributaries, which continues to be a main element in the coordinated development of Danube navigation.

This working group supports this process by linking stakeholders from all user groups and regions and offering an open, but structured discussion basis on selected topics. Thematic coverage includes improvement of the fairway conditions, shore side and ports infrastructure along the Danube and its navigable tributaries as well as taking actions in a sustainable and environmentally sound way. Innovative fairway maintenance, service-oriented optimisation of lock operations and up-to-date shore side infrastructure, improved mooring places and bridge clearances as well as better multimodal accessibility of inland ports and transhipment sites to other transport modes and their hinterland are discussed and their implementation supported.[12]

1.3 National strategy

1.3.1 Strategy on Development of Waterborne Transport of the Republic of Serbia for the period from 2015 to 2025

All activities related to water transportation in the republic of Serbia have been prescribed by the Law on Navigation and Ports on Inland Waters (The Official Gazette of RS, No. 73/10, 121/12…52/21).

According toLaw on Navigation and Ports on Inland Waters, in 2015, a Strategy on waterborne transport development of the Republic of Serbia, 2015-2025 was adopted(The Official Gazette of RS, No. 3/2015-34, 66/2020-10)[13].

The Strategy dealing with broad issues ranging from renewing and modernising the national fleet to developing the economic potential of Serbian ports and harbours, and developing the navigational standard of international and national inland waterways. Action plan for the Strategy has been elaborated and priority projects and activities are set in order to reach targeted values.

Strategy on Development of Waterborne Transport of the Republic of Serbia for the period from 2015 to 2025 lists the most important investments that are defined and initialised including: construction and reconstruction of Serbian ports, eliminating all critical sectors for navigation on the waterway network, further improvement of intelligent waterway transport systems.

[12] WG 1 - WATERWAY AND PORT INFRASTRUCTURE & MANAGEMENT - PA 1A (danube-region.eu)
[13] Strategija vodnog saobracaja - osnovni tekst (aul.gov.rs)

The Development Strategy on Waterborne Transport for the Republic of Serbia 2015-2025 is based on the principles of safety, inter-modality, application of new technologies, complementary use of different transport modes and rational use of available capacities and resources in Serbia. Serbia is currently investing efforts to modernise transport infrastructure and to introduce contemporary standards in all the segments of the transport system. The strategy aims at having the Serbian fluvial infrastructure comply with the overall EU transport policy.

The transport sector naturally includes the inland waterways (IWW), of which Serbia has more than 1600 km split among several categories. The Serbian Government has defined priorities to improve the functioning of the transport system as a generator for the economic and social development. The system's needs are underlined from the national strategic and planning documents as well as from EU accession requirements.

Annex 5 of Strategy on Development of Waterborne Transport of the Republic of Serbia (The Official Gazette of RS, No. 66/2020-10) are defined list of priority projects for the development of inland water traffic for the period from 2015 to 2025 in the field of:

1) Port and port projects

2) Projects in the field of transport infrastructure of inland water transport

3) Projects for the development of intelligent transport systems in inland water transport.

1.3.1.1 *Development plans for Port of Bačka Palanka*

According to the Strategy the development plans for Port of Bačka Palanka are strategically oriented towards building a container terminal, a liquid cargo terminal and a grains handling and storage terminal. To do this, it is essential to build an embankment and a vertical quay in the length of 480 m, as well as a grains silo with a capacity of 60,000 t.

New handling equipment that would increase the capacities and operational railway tracks connecting the port to the national railway network would also be an asset. The implementation of these plans depends primarily on the levels of economic activity in the region and on port area expansion in accordance with the Law. A prerequisite for the expansion is an agreement between the Bačka Palanka Municipality, the Port Governance Agency and the current port operator regarding the property status of the land which could be used to fan out the port area. The rights of use are currently vested in "Port Bačka Palanka" d.o.o. A larger port area is highly important for the growth of port industry in Bačka Palanka and the overall economy in this municipality.

The required investment in the port infrastructure is estimated at 5.1 mill. euros, and in the port superstructure at 5.6 mill. euros.

The precise amount to be invested in the expansion of Port of Bačka Palanka area will be known after the relevant documentation has been made and adopted. The projection of costs, together with the proposals for financing building designs and port development, will make an integral part of the mentioned documentation.

1.4 Conclusion

Rhine-Danube Corridor is one of the nine European corridors of the TEN-T network, which is passing through the Republic of Serbia. In the European policy so far, the Danube was a priority corridor on its own, but limited as the waterway. Now the Rhine-Danube corridor is a unique system of waterways, connecting important railways and roads of Central and Southeast Europe to the industrial centers of Germany and France. With this approach it will be possible to connect and integrate transport infrastructure, including ports, and to remove technical and administrative barriers in the multimodal transport and ensure free flow of information in navigation.

The analyzed strategies of the EU indicate that Transport is fundamental for an efficient European economy. Freight traffic is expected to increase by 80% and passenger traffic by 50% by 2050. Areas of Europe cannot thrive without good connections, while the existing network contains infrastructure barriers and bottlenecks.

In this sense, with the transport network consisting of the Danube waterway in the length of 588 km with all its tributaries, along with the road and rail corridors, the Republic of Serbia holds a special importance within the overall European transport policy for the period 2014-2020. The new European policy opens up significant possibilities for better positioning and development of waterway transport in the Republic of Serbia foreseen by the Strategy on Development of Waterborne Transport of the Republic of Serbia, for the period 2015-2025.

2 PRESENT SITUATION IN THE PORT OF BAČKA PALANKA

2.1 Description of the port area

The port of Bačka Palanka is located on the left bank of the Danube River, km 1295 in the agrarian area of South Bačka. It is basin type port, with a water area of 5.2 ha and a minimum depth of 3.5 m at a low navigation level.

It is characterized by an exceptional strategic position thanks to the connection with the corridor Rhine-Danube which makes it available for the cargo coming from the countries from North to the Black Sea.The proximity of the highways Novi Sad-Sombor-Osijek, Belgrade-Subotica and Belgrade-Zagreb, as well as the vicinity of railway track (only 5 km from the port) also contribute to the strategic position.

Location of Port of Bačka Palanka is shown in the Figure 2.1.

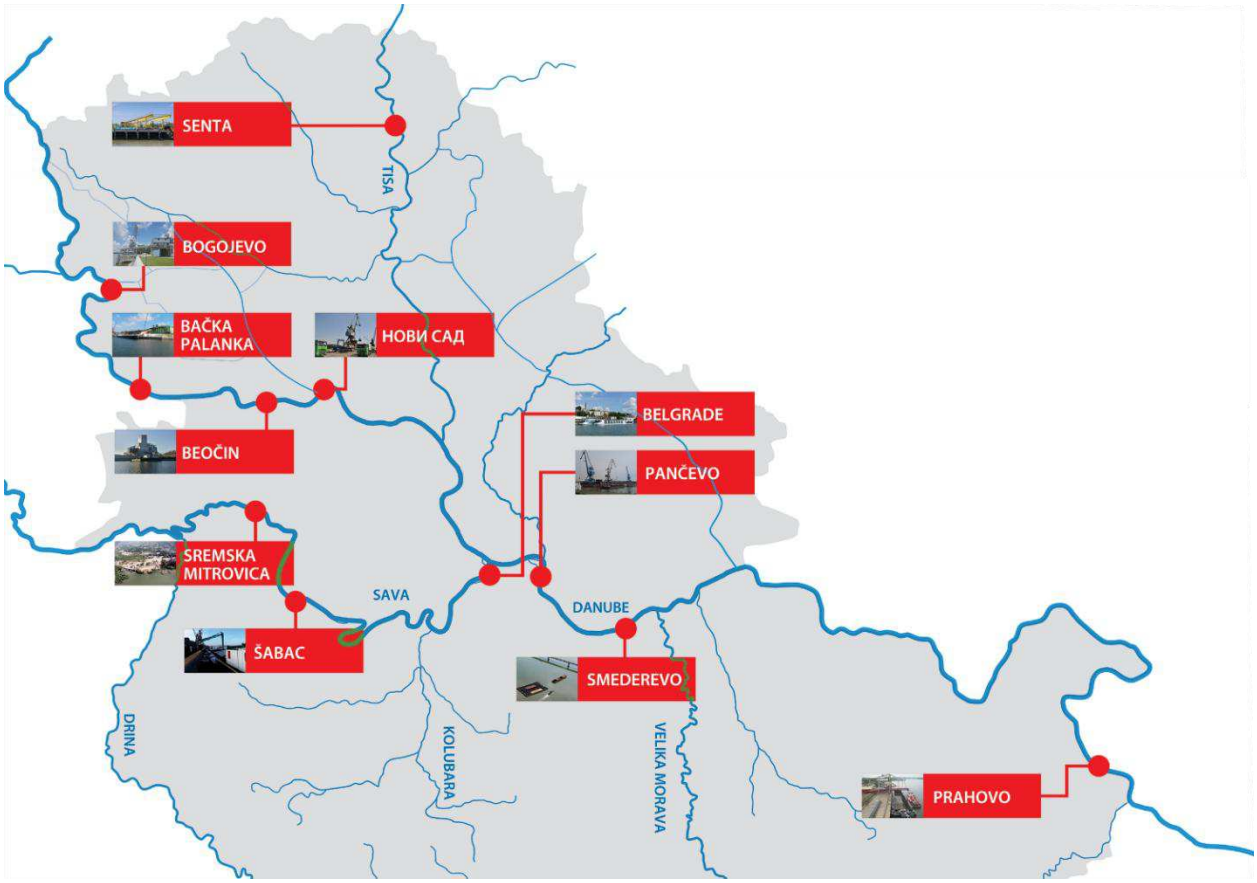

Figure 2.1. Inland Waterways and ports in the Republic of Serbia[14]

2.2 Organization and operations

Republic of Serbia is the owner of the port land, while the infrastructure is owned by the private company operating in the port. In 2013 Government of the Republic of Serbia established the Port Governance Agency that is in charge of management and development of all ports and harbors in the Republic of Serbia so it is the case with the Port of Bačka Palanka. Some of regulatory, professional and development tasks

[14]PGA - www.aul.gov.rs

which the Agency performs are: issues and revokes the license for performing port activities; concludes a contract on performing port activities on the basis of the obtained approval; concludes the contract of port activities on the basis of the obtained approvals; keep a register of port operators to whom the clearance was issued. charges port dues; adopts and publicly announces port tariffs, etc[15].Currently, there is one licensed port operator in the Bačka Palanka - Luka Bačka Palanka D.O.O.

2.3 History of development

Data no available.

2.4 Main features of the port and port infrastructure, superstructure and equipment

Overview of basic port's features is given in the table 2.1.

Parameters	Explanation / Value
Port land owner (State, Region, Municipality, Private, Other)	State owned
Port authority name	Port Governance Agency
Number of operators (concessionaires, lessors)	1
Total port area (ha)	74,17
Maximum draught (m) - natural or dredged	4
Total number of terminals	1
Heavy lift and out-of-gauge handling capacity (Yes/No)	NO
Ability to handle full block train along the quay (Yes/No)	NO
Ability to handle full block train in the port area (Yes/No)	NO
Transhipment equipment for intermodal transport (Yes/No)	N/A
Total quay length (vertical + sloped) (m)	400
Vertical quay length (m)	-
Sloped quay length (m)	0
Undeveloped quay length (m)	0
Max number of vessels handled at the same time	4
Max capacity of anchorage or waiting area for barges (number)	30
Storage capacity (m2)	658.8 covered and 14,138 open
Storage capacity for liquid cargos (m3)	N/A
Storage capacity (TEU)	N/A
Storage capacity (CEU - car equivalent unit, for Ro-Ro terminals)	N/A
Bunkering facilities within the port area (Yes/No)	NO
Shore-side power supply for vessels (Yes/No)	YES
Road conneection (Yes/No)	YES
Rail connection (Yes/No)	NO
Number of quay cranes of lifting capacity Q < 10 tons	2

[15]"Official Gazette of the Republic of Serbia ", n. 73/2010, 121/2012, 18/2015, 96/2015, 92/2016, 104/2016, 113/2017, 41/2018, 95/2018, 37/2019, 9/2020 and 52/2021

Parameters	Explanation / Value
Number of quay cranes of lifting capacity 10 < Q < 16 tons	1
Number of quay cranes of lifting capacity 16 < Q < 50 tons	
Number of quay cranes of lifting capacity Q > 50 tons	
Total number of quay cranes	

Table 2.1.Basic features of the Port of Bačka Palanka

The port covers surface area of approximately 74 ha. Port of Bačka Palankais a basin-type port with minimum available draft of 2 m. Total quay length is 400 m, out of which vertical quay is approximately 65 m and semi-vertical quay is 335 m. Four vessels can be simultaneously accommodated and serviced. Anchorage has the capacity for 30 vessels.

Figure 2.2. Port of Bačka Palanka

There is already a built infrastructure in the port, which ensures the functioning of port activities. The port uses a portal crane, a port mobile crane, a floating crane and a port tugboat to provide port transshipment services. The port provides transshipment services for all types of bulk and general cargo: cereals, mineral fertilizers, scrap iron, gravel, wood and other cargo, in bulk, in bags, jumbo bags, reels, crates, barrels, on pallets and more.

Storage facilities consist of open spaces that cover area of 14,138 m^2 and closed spaces of 658.8 m^2. The types of cargo handled in the port are bulk commodities including construction materials, metallurgy products, heavy loads and general cargo.

The port owns the tugboat Kapetan Vinarev, which provides maneuvering services to its clients. The Agroport Center which belongs to Port of Bačka Palanka also houses storage capacities for receiving and

storing 50,000 tons of mineral fertilizers and 30,000 tons for packaged goods, as well as 30,000 tons of storage capacity for mercantile goods. The center has a line for packing mineral fertilizers with a daily packing capacity of 450 tons and a line for packing in a "big bag" with a daily capacity of 500 tons. The daily shipping capacity of packaged mineral fertilizer is 2.000 tons.

2.5 Cargo types and volumes

The throughput cargo data used in the study were obtained from the Port Governance Agency.Data provided by the port of Bačka Palanka were also available, but the authors opted for the Port Governance Agency data due to its completeness.

The most common cargo in the port is grains which are expected due to location of the port. Grains make up the most of the port throughput while other types of cargo appear to a much lesser extent. Other types of cargo are fertilizers, coal, oilseeds, ores, general cargo and other bulk cargoes

Throughput of other cargoes is being registered every year in the port, among which fertilizers make up the largest share. Table 2.2 shows cargo types and volumes for the period 2015–2021.

Cargo and trade direction	2015	2016	2017	2018	2019	2020	2021
Fertilizers	0.00	0	0	0	89,065.70	141,083.08	85,760.33
Grains	10,108.00	2,152.00	46,054.00	3,815.00	0	2,245.00	2,953.00
Export - Fertilizers	0.00	0	0	0	0	0	4,998.91
Export - Grains	30,321.00	226,384.95	164,118.24	119,762.42	183,972.30	320,481.74	203,514.82
Export - Coal	0.00	0	0	0	0	0	1,062.00
Export - Oilseeds	0.00	0	0	1,997.00	60,103.30	73,771.50	15,130.06
Ores	0.00	0	0	0	0	0	1,080.00
Coal	0.00	0	0	0	0	0	22,556.00
Oilseeds	0.00	0	0	0	12,828.00	9,010.00	12,579.61
General cargo	0	462	3,994.00	3,170.00	1,373.12	1,756.34	0
Other bulk cargoes	0	0	66,213.00	51,335.82	9,365.00	9,360.00	0
Export – Other bulk cargoes	5,486.00	57,299.00	0	3,337.37	0	1,107.00	0
Export – Waste materials	5,487.49	0	0	0	0	0	0.00
Export – Natural aggregates	0.00	12,160.00	0	0	0	0	0.00
Natural aggregates	2,817.45	18,232.13	0	0	0	0	0.00
Metallurgical products	0.00	0	0	0	449.00	0	0.00
Total:	**54,219.94**	**316,690.08**	**280,379.24**	**183,417.61**	**357,156.42**	**558,814.66**	**349,634.73**

Table 2.2. Cargo types and volumes in Port of Bačka Palanka for the period 2015–2021

Based on the data in Table 2.2, we conclude that the growth of the Port of Bačka Palanka throughput was the highest in 2020, as much as 10.3 times compared to 2015. The next four years saw variations of throughput of the Port of Bačka Palanka. Increase of throughput was recorded in 2016 and 2019 besides 2020, while 2017, 2018 and 2021 saw decline of throughput which was expected for 2021 due to a covid-19 pandemic. Recorder variations of throughputs were pretty much high as they ranged from 1.13 times from 2016-2017 to 5.84 times from 2015 to 2016. Other variations were smaller due to disproportionate increase of throughput from 2015 to 2016 and from 2016 to 2020 when the port reached maximum throughput. Therefore, there is a noticeable lack of consistency in the flow of cargoes through the port of Bačka Palanka.

Top product handled in the Port of Bačka Palanka is grains. The share of grains in the port of Bačka Palanka throughput for the observed period is shown in the Table 2.3.

Year	2015	2016	2017	2018	2019	2020	2021
Share of grains (%)	74.56	72.16	74.96	67.37	51.51	57.75	59.05

Table 2.3. Grains volume shares in the Port of Bačka Palanka 2015-2021

2.6 Port access

Port of Bačka Palanka has a single road entrance with two lanes road allowing vehicle access. In port area there is two truck scales that work simultaneously. The port of Bačka Palanka is a hub in which road and waterway transport intersect.

2.7 Current and potential user requirements

The largest numbers of users of port services are companies that are primarily registered in the area of Bačka, other districts of AP Vojvodina, Belgrade and other cities in Serbia. The types of cargo handled in the port are grains, fertilizers, coal, oilseeds, ores[16], general cargo and other bulk cargoes. The list of current and potential users is made based on the cargo and trade direction from Table 2.2.

Some of the current users are:

- For grains – AGROLEK DOO, AL RAWAFED SRBIJA DOO Beograd, ANOVA NNL DOO, AXEREAL SERBIA DOO, BCM TRADE DOO, ELIXIR AGRAR DOO, GLENCORE SRB DOO, KONZUL D.O.O, MK COMMERCE DOO, RAIFFEISEN AGRO DOO, RWA SRBIJA DOO, SLADARA MALTINEX DOO, SOJAPROTEIN a.d., SYNTHESIS AGRO KONSALTING DOO, ULJARICE-BAČKA DOO, VICTORIA LOGISTIC DOO, VIMEKSIM SRB DOO, ŽITO BAČKA DOO,
- For bulk cargo – BOREALIS L.A.T. DOO, CHS SERBIA DOO, ELIXIR ZORKA - MINERALNA ĐUBRIVA, UTP FERTILISERS DOO,
- For general cargo – MASTER LINE DOO

Some of the potential users are:

- For grains and oilseeds – AGROGLOBE, NOVI SAD, CHS SERBIA, NOVI SAD, DELTA AGRAR, BELGRADE, CONSUL, NOVI SAD, TRADING TEAM, NOVI SAD , VIMEXIM, NOVI SAD, ĆIRIĆ AND SON, SAKULE, MAT AGRO, FUTOG, AGRICOM COMP. GROUP, SOMBOR, VITERRA-GRANOLIS, NOVI SAD, BIMAL TRADING, BELGRADE, AGRO DOM TIM, CRVENKA, AS AGRO 99, BANATSKO NOVO SELO, AL DAHRA SERBIA, SLOPE SCAFFOLDING, ALCOR DLV, NOVI SAD, SOCIETY BALKANS, NOVI SAD, AGROFINANCE, BELGRADE, ALMEX, PANČEVO, SOLE KOMERC, BELGRADE, ŽITOPROMET MLINPEK, SREMSKA MITROVICA, DUMICO, BELGRADE, "VICTORIA OIL". ŠID, VAIT DOO, NOVI SAD, GRANOLIA DOO, NOVI SAD
- For fertilizers – VICTORIA GROUP, BAČKA PALANKA, PETROKEMIJA, NOVI SAD, TEAM AGRO BALKANS, NOVI SAD
- For other cargo – METALOPROMET, KULA.

[16] Will not be considered due to a small amount of throughput in 2021.

3 HINTERLAND CONNECTIONS

The port of Bačka Palanka is 30 km away from the E70 highway, direction Belgrade-Zagreb, and 45 km from the E75 highway, direction Belgrade-Budapest. There are two state roads near the Port of Bačka Palanka of IB class which extend to the borders of Bosnia and Herzegovina and Romania: state road 19 connecting Port Bačka Palanka with Bosnia and Herzegovina at Sremska Rača (Neštin-Erdevik-Kuzmin-Sremska Rača) and state road 12 connecting Port Bačka Palanka with Romania (Subotica - Sombor - Odzaci - Bačka Palanka - Novi Sad - Zrenjanin - Zitiste - Nova Crnja - state border with Romania –border crossing Srpska Crnja).

Bačka Palanka with Croatia: - Bačka Topola - Kula - Despotovo - Silbas - Gajdobra - Bačka Palanka - state border with Croatia (border crossing Bačka Palanka).

3.1 Rail main corridors

The port of Bačka Palanka is not connected to the national railway network.

3.2 Road main corridors

Road section Bačka Palanka-Romania-border Srpska Crnja

The port of Bačka Palanka is connected to Romania (border Srpska Crnja) with road No 12. And belongs to IB.

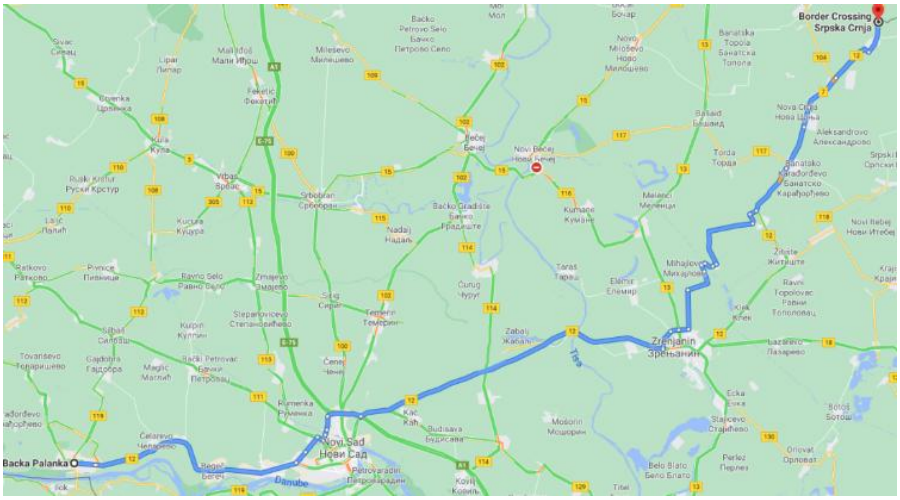

Figure 3.1. Bačka Palanka-Romania-border Srpska Crnja road section

Category / Section	Parameter	Value	Unit
IB / Bačka Palanka-Romania-border Srpska Crnja	Length	145	km
	Number of lanes (total, in both directions)	2	lanes
	Maximum speed allowed	80	km/h
	Axle load for trucks allowed	10	t/axle

Table 3.1. Bačka Palanka-Romania-border Srpska Crnja road section parameters

Road section Bačka Palanka-Croatia

Bačka Palanka-Croatia is connected with road No. 108. (Total length of road No. 108 is 74 km).

This road belongs to IIA State roads, class IIA, and is marked with three-digit numbers, the first digit being 1 or 2. The total length of these roads is 7781 km.

Allowed axle load for trucks does not changed based on road category but based on the number of axles on truck. For trucks with one axle the allowed load is 10 t, for trucks with 2 axles the allowed load is 9 t, due to that the allowed axle load is the same on roads IIA and IB.

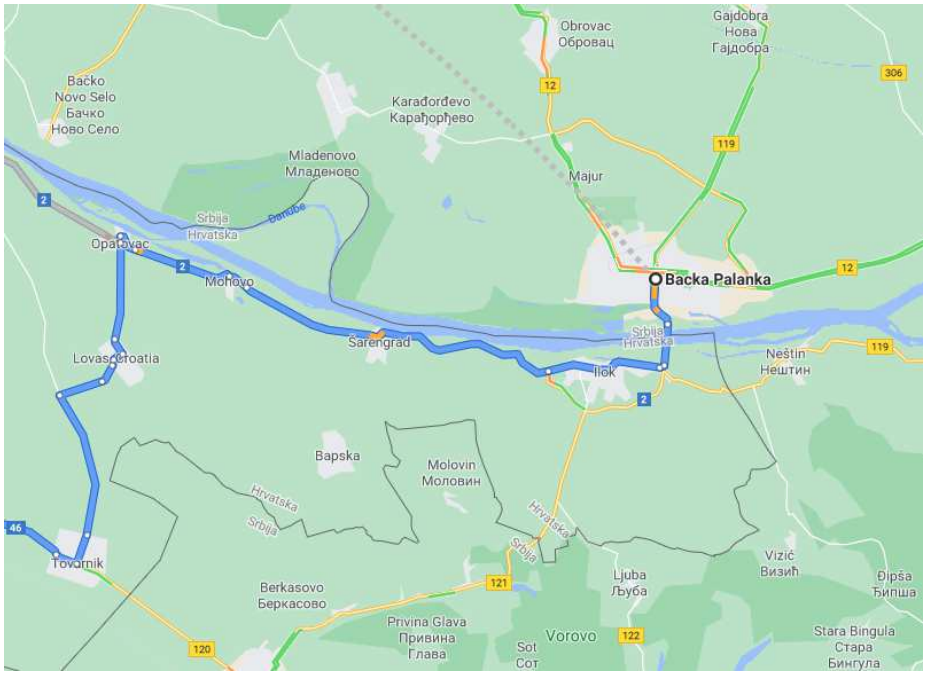

Figure 3.2. Bačka Palanka-Croatia road section

Category / Section	Parameter	Value	Unit
IIA / Bačka Palanka-Croatia	Length	3	km
	Number of lanes (total, in both directions)	2	lanes
	Maximum speed allowed	80	km/h
	Axle load for trucks allowed	10	t/axle

Table 3.2. Bačka Palanka-Croatia road section parameters

4 MARKET ANALYSIS, POTENTIAL USERS, AND DEVELOPMENT PERSPECTIVES

4.1 General economic outlook

COVID 19 and global slowdown, according to available data, had a less severe impact on Serbia compared to most European countries, due to achieved macroeconomic and financial stability, growth momentum, fiscal space created in previous years, large and timely monetary and fiscal package, and structure of the economy

GDP recovery to pre-crisis level was accomplished already in Q1 2021 while according to the SORS data real GDP growth in 2021 stood at 7.4% Such developments are the result of growing activity in industry, construction and the service sectors.

Having in mind new investment cycle, and planned infrastructure projects in following ten years, the NBS projection of real GDP growth for 2022 and the medium term is in the range from 4-5%.

According to the NBS projection, real GDP growth in Q 1 2022 should stand around 4.3% year-on-year (y/y), which includes the materialization of part of the risks related to the emerging crisis due to the Russia - Ukraine conflict.

The adopted economic policy measures (EUR 5.8 bn, about 13% of GDP in 2020) minimized the decline in GDP in

2020 while an additional package of EUR 2.2 bn (4.2% of GDP) in 2021 contributed to further GDP growth and its return to the path of sustainable growth in the medium term

According to NBS February 2022 projection, inflation will be on a declining path throughout 2022. The conflict in Ukraine creates significant upside risks in energy, commodities and food prices.

In 2021 current account deficit of EUR 2.34 bn (-4.4% of GDP) was recorded, with the record inflow of FDI (EUR 3.9 bn)

Owing to product and geographic diversification and export-oriented investments, goods exports in 2021 increased by as much as 29.1% y/y.

Moody's has upgraded Serbia's credit rating (March 2021 while S&P revised upwards the outlook for obtaining an investment rating from stable to positive (December 2021 and Fitch confirmed credit rating in conditions of intensified geopolitical tensions (February 2022) while acknowledging the maintained macroeconomic stability and favourable outlook, as well as adequate economic policy response before and during the pandemic.

4.1.1 Overview of Gross Domestic Product (GDP) growth

Serbia recorded a cumulative growth of real GDP of 6.4% in two pandemic years. According to the SORS[17] data, in 2021, Serbia achieved a real GDP growth of 7.4% driven by recovery in service sectors, as well as growth in construction and industrial production.

[17] Statistical Office of the Republic of Serbia

NBS projects growth in Q1 2022 of 4.3% y/y, whereby the projection includes the effects of the conflict between Russia and Ukraine, which led to disturbance in production and trade of goods and services worldwide.

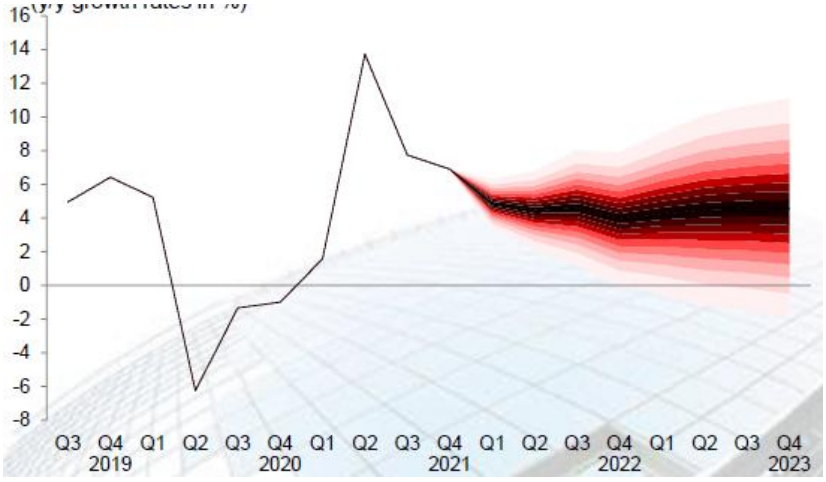

Figure 4.1: GDP forecasts of the National Bank of Serbia (NBS)

According to the International Monetary Fund data, the Serbian GDP variations of the years, since 1996, are given in the following figure.

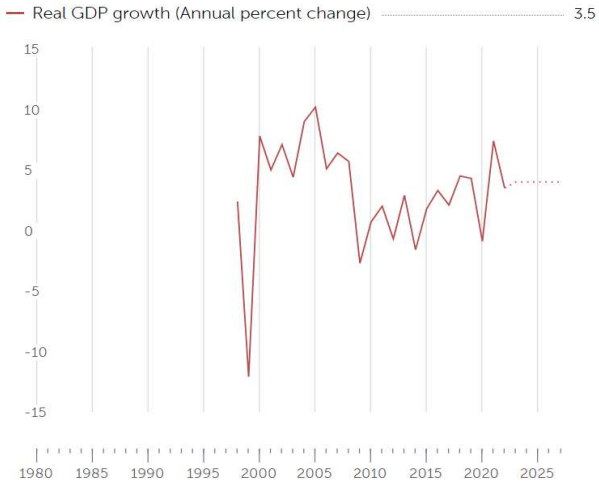

Figure 4.2: Serbian GDP growth since 1996 (IMF data)[18]

GDP reached the pre-crisis level in 2021 Q1, and, according to NBS estimate, in Q4 it is more than 5% above the pre-crisis level.

For 2022 and the medium term, the NBS expects growth to be in a range between 4%-5%, as a result of new investment cycle. This year, it is expected that the growth will be predominantly driven by further developments in service sectors, as well as construction and industrial production.

In light of the conflict between Russia and Ukraine, risks to the projection form international environment particularly those related to supply chain disruption, energy crisis and prices of primary products are

[18] https://www.imf.org/en/Countries/SRB#ataglance , last accessed 27 April 2022.

asymmetrical to the downside. Since geopolitical situation is changing constantly, and new sanctions are being introduced, it is difficult to determine the economic effects of the conflict on Serbia.

4.1.2 Overview of investments

In 2015-2019, fixed investments grew at an average annual rate of about 10%, while their cumulative growth was about 64%. The share of fixed investment in GDP increased to 22.5% in 2019.

Despite pandemic, fixed investments cumulatively increased during 2020 and 2021 for around 12%.Thanks to the new investment cycle, the share of fixed investments in nominal GDP should reach the level of around 26% as early as 2024 and move around that level in the medium term.

Government investments reached level of over 7% ofGDP and should remain around that level in the medium term.

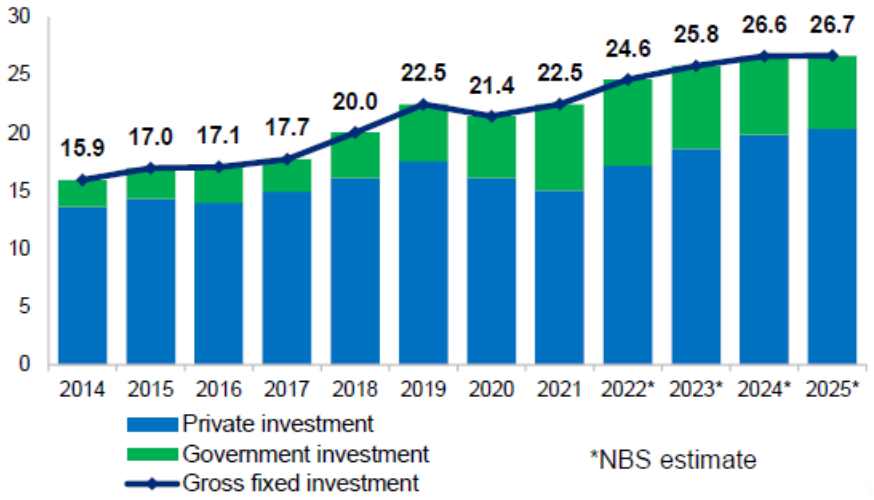

Figure 4.3: Overview of investments in Serbia for the period 2014-2025[19]

In earlier years, investments have largely relied on Foreign Direct Investments (FDI).Owing to maintained macroeconomic and financial stability, exchange rate stability, as well as fiscal consolidation. In recent years, three additional strong pillars for financing investments have been established: multiplied profitability of the economy, investment loans and doubled government investments. On top of that, FDI inflow reached record levels of around8% of GDP.

[19] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 27 April 2022.

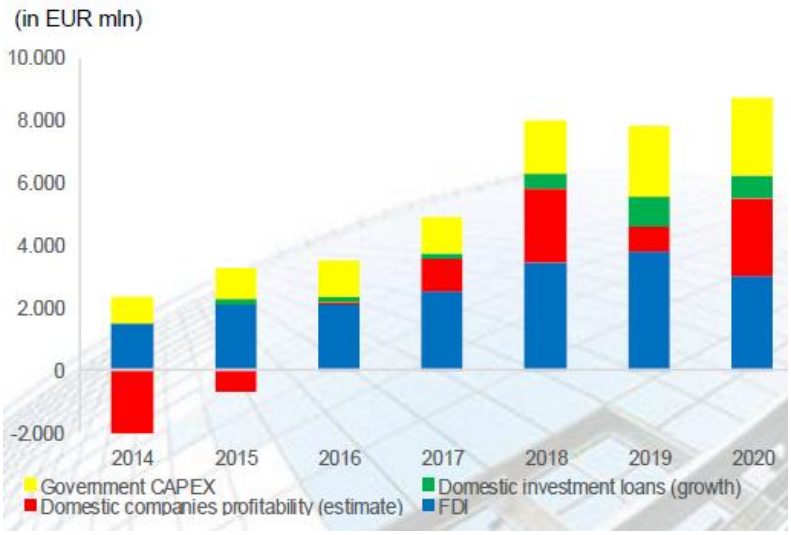

Figure 4.4: Key sources in investment financing[20]

4.1.3 Overview of trade parameters

In 2021, there was an intensive growth of **exports** of goods of 29.1%, driven by the recovery of exports of the manufacturing industry, which would have been even faster if there were no disruptions in global chains.

The growth of exports of services in 2021 amounted to26% and was driven by exports of ICT services, as well as tourism services, which fully recovered in 2021.During the first two months of 2022, an increase in goods exports of 30.4% y/y was recorded, driven by growth in exports of manufacturing and mining.

Exports of services increased by 32.6% y/y.

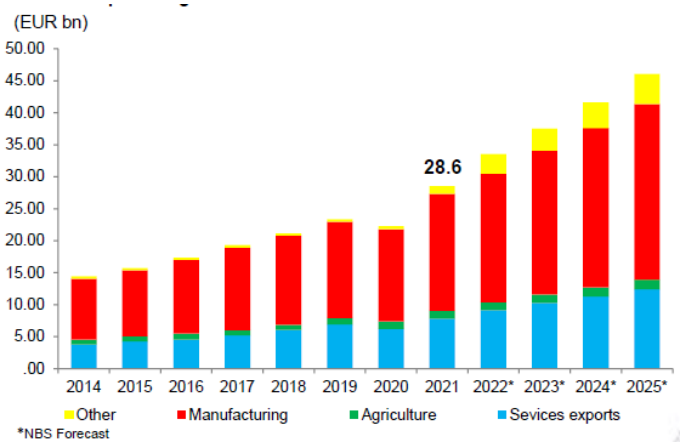

Figure 4.5: Growth and composition of exports[21]

Serbia's exports are largely directed towards EU and countries of the region, and reliant on demand in those countries which were recovering during 2021. In 2020, most of Serbian exports went to the EU, followed by CEFTA[22] countries and CIS[23] countries.

[20] Ibid.
[21] Ibid.

By country, the largest share of exports went to Germany (12.7%), followed by Italy (8.5%), Bosnia and Herzegovina (7.2%), Romania (5.5%), Hungary (5.0%) and Russia (3.9%). Exports to China in 2021 continued to grow compared to 2020, while recording growth even in 2020, so China is highly positioned on the list of Serbian export partners.

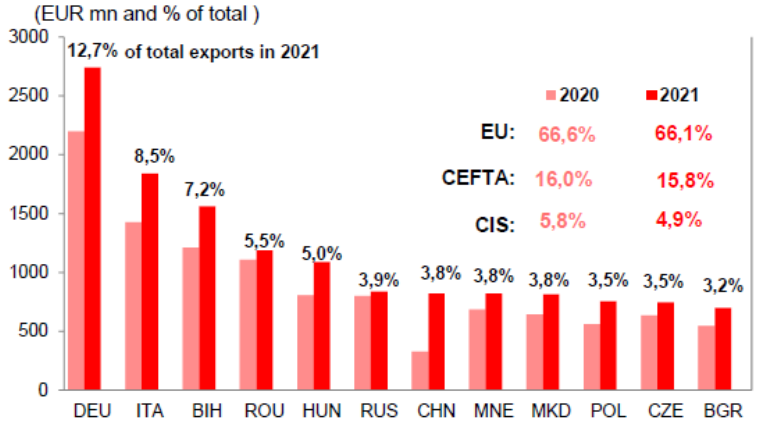

Figure 4.6: Destination countries of Serbian exports[24]

Goods **imports** increased by 25.4% in 2021, driven by intermediate products, of which a significant part relates to energy imports. Imports of equipment and consumer goods continued to grow.

Imports of goods increased by 52.0% y/y during January-February 2022. The biggest contribution came from intermediate goods, partly due to the growth of energy prices.

The agreement reached on a favourable import price of gas during the first half of 2022 is expected to have a positive effect on the balance of payments, as well as on macroeconomic developments as a whole.

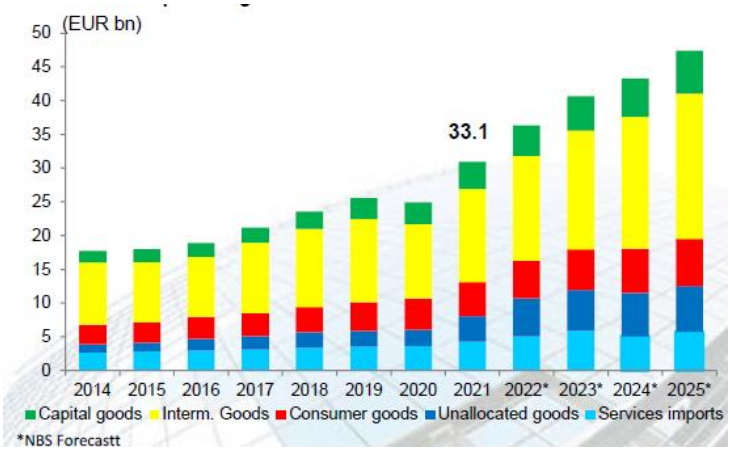

Figure 4.7: Growth and composition of imports[25]

[22] Central European Free Trade Agreement - https://cefta.int
[23] Commonwealth of Independent States - https://cis-legislation.com/index.fwx
[24] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 27 April 2022.
[25] https://nbs.rs/export/sites/NBS_site/documents-eng/finansijska-stabilnost/presentation_invest.pdf - last accessed 27 April 2022.

Majority of imports (more than 58% in 2021) come from the EU, followed by CIS and CEFTA. In 2021, compared to 2020, imports (as well as exports) in absolute terms increased in most significant countries.

By country, the largest shares of imports are from Germany(13.2%), whereas the share of imports from China increased from 9.0% in 2019 to 12.5% in 2020 and sits at 12.8% in2021.

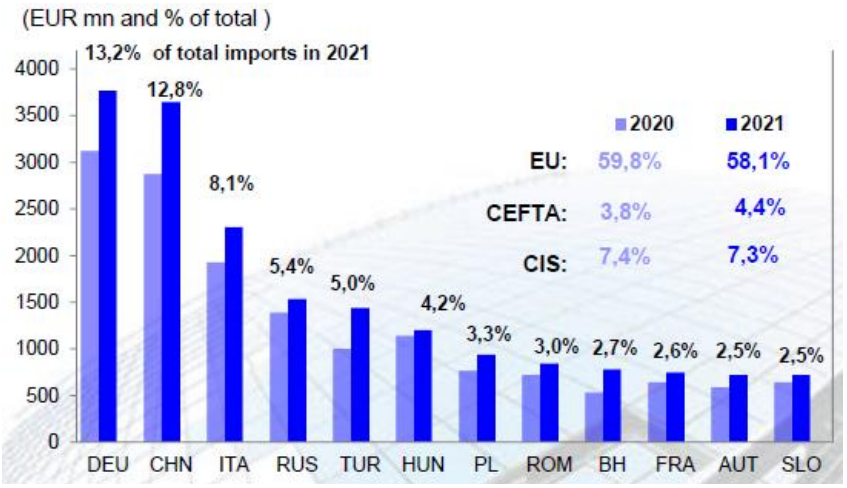

Figure 4.8: Origin countries of Serbian imports

4.2 Modal split of the overall transport volumes

Data about cargo flow in Serbia obtained from the Statistical Office of the Republic of Serbia cannot be considered as an appropriate source of information due to a lack of clear rules about which companies, registered for transport and production activities, are obliged to submit data about quantities of transported goods and transport routes. For that reason, data about volume of transport that are available on Statistical Office of the Republic of Serbia internet site cannot be considered overall or final, but only indicative.

The volume of transported cargo is presented according to basic quantitative indicators in tons (t) of cargo and tonne-kilometers (tkm), in accordance with the published methodology. The data presented under the term "traffic" refer to the total loading and unloading at terminals, regardless of whether they are realized by means of transport of domestic or foreign operators. In addition, the throughput of port terminals, besides to loading and unloading on/from vessels, includes the cargo throughput that has previously been stored in the port area.

The data presented in this section is taken from the documentation of the Statistical Office of the Republic of Serbia and is processed together with data from other sources like Customs Administration of the Republic of Serbia, Port governance agency, etc.

The total volume of cargo transport in the Republic of Serbia which is expressed in tons in the observed period (2015–2020) ranged from a minimum of 26.684million tons (in 2015) to a maximum of 34.78million tons (in 2019).

Volume of transported cargo by transport modes for the period from 2015 to 2020 is shown in Table 4.1.

Types of transport	Volume of transported cargo (10^3 t)					
	2015	2016	2017	2018	2019	2020
Land transport	25143	27415	28555	31667	33092	32061
Railway transport	11887	11896	12352	12317	11506	10499
Road transport	7964	9897	10120	13056	15858	15638
Pipelines transport	5292	5622	6083	6294	5728	5924
Inland waterway transport	1537	2014	1449	1559	1697	1692
Air transport	3.7	4.8	6.7	6.7	5.6	4.2
Total	26684	29434	30011	33233	34780	33663

Table 4.1Volume of cargo in Republic of Serbia by types of transport from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data from Table 4.1 point out that railway transport had the largest share in the modal split till 2018, where from the road transport takes the lead in sharing. The share of railway transport ranged from a minimum of 31.19% (in 2020) to a maximum of 44.55% (in 2015). It is noticeable that in 2018, for the first time, the volume of cargo transported by road was higher (share of 39.29%) compared to rail (share of 37.06%).

The share of road transport in the modal split shows positive trend in the observed period, i.e. it goes from 29.85% in 2015 to 46.45% in 2020. The volume of cargo transported by road in 2020 was 1.56 times higher than in 2015.

The share of pipeline transport in the modal split showed minimum variation among all transport modes – 19.83% in 2015, 19.10% in 2016, 20.27% in 2017, 18.94% in 2018, 16.46% in 2019, 17.55% in 2020.

The share of inland waterway transport had a pick in 2016 with 6.84%. The quantity of transported cargo in 2016 had about 40% increase from the minimum year of 2017 and about 20% increase from the second best year of 2019. In general, variations in quantity of cargo transported by inland waterway transport are constant with occasional picks every 4 to 5 years. It can be clearly viewed in Table 4.1 that there was a downward trend in the volume of transport from 2015 to 2017 and a slight increase from 2018 onwards.

The share of air traffic during the entire period ranged between 0.01% and 0.02%

An overview of the growth index of freight transport volume (in percentages) by transport modes for the period from 2015 to 2020 is given in Table 4.2.

Types of transport	Growth index (%)				
	2016./ 2015.	**2017./ 2016.**	**2018./ 2017.**	**2019./ 2018.**	**2020./ 2019.**
Land transport	109.0	104.2	110.9	104.5	96.9
Railway transport	100.1	103.8	99.7	93.4	91.2
Road transport	124.3	102.3	129.0	121.5	98.6
Pipelines transport	106.2	108.2	103.5	91.0	103.4
Inland waterway transport	131.0	71.9	107.6	108.9	99.7
Air transport	129.7	139.6	100.0	83.6	75.0
Total	110.3	102.0	110.7	104.7	96.8

Table 4.2. Growth index of freight transport volume(in tons) by types of transport for the period 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data from Table 4.2 indicate that the growth indices of freight transport volume had the positive trend until 2020 where a slight flattening of the trend line happened. The average annual growth index in the observed period of 5 years for the total volume of transport was 4.76%despite decline of -3% that occurred in the last observed year. According to data from Statistical Office of the Republic of Serbia presented in Table 4.2, the average annual growth rate in land transport was 4.98%. Positive average growth rates were recorded in road (14.45%), air (2.57%), pipeline transport (2.28%) and inland waterway transport (1.94%) while negative average growth rates were recorded in rail transport (-2.45%).

The total volume of transport expressed in achieved tkm in the observed period ranged from a minimum of 8.02 billion tkm (in 2015) to a maximum of 12.8 billion tkm (in 2019).

A comparative overview of achieved tkm by types of transport for the period 2015 – 2020 is shown in Table 4.3.

Types of transport	**Achieved tkm (10^6)**					
	2015	**2016**	**2017**	**2018**	**2019**	**2020**
Land transport	7147	8340	9317	10696	12047	11306
Railway transport	3249	3087	3288	3187	2864	2746
Road transport	2974	4299	4980	6443	8175	7741
Pipelines transport	924	954	1.049	1.056	1.008	819
Inland waterway transport	865	927	725	580	727	558
Air transport	4.7	10.2	20.7	20.1	15.1	15.7
Total	8017	9277	10063	11286	12771	11862

Table 4.3. Achieved tkm by types of transport in the Republic of Serbia for the period 2015-2020 (source: Statistical Office of the Republic of Serbia)

The share of achieved tkm in railway transport ranged from a minimum of 22.39% (in 2019) to a maximum of 40.53% (in 2015).

The share of achieved tkm in road transport ranged from 37.10% in the first observed year to 65.16% in the last observed year. Achieved tkm in 2020 were about 2.6 times higher than in 2015.

The share of achieved tkm in pipeline transport ranged from a minimum of 6.9% (in 2020) to 11.53% (in 2015).

The share of achieved tkm in inland waterway transport was the highest at the beginning of the observed period with 10.79%, while the lowest share was recorded in 2020 and it was only 4.7%. Achieved tkm in 2020 were 2.29 times lower than in 2015.

The share of achieved air transport during the whole period was insignificant in terms of tkm and ranged between 0.01% and 0.02%.

In Table 4.4 an overview of growth index of achieved tkm is given by types of transport in the Republic of Serbia for the period 2015 to 2020.

Types of transport	Growth index of achieved tkm (%)				
	2016/ 2015	2017/ 2016	2018/ 2017	2019/ 2018	2020/ 2019
Land transport	116.7	111.7	114.8	112.6	93.8
Railway transport	95.0	106.6	96.9	89.6	95.9
Road transport	144.6	115.8	129.4	126.9	94.7
Pipelines transport	103.2	110.0	100.7	95.5	81.3
Inland waterway transport	107.2	78.2	80.0	125.3	76.8
Air transport	217.0	202.9	97.1	75.1	104.0
Total	115.7	108.5	112.2	113.1	92.9

Table 4.4. Growth index of achieved tkm by types of transport in the Republic of Serbia for the period 2015 to 2020

Data from Table 4.4 indicate that the growth indices of achieved tkm had the positive trend during period from 2015 to 2019, while there was slight negative trend from 2019 to 2020. The average annual growth rate in the observed period of 5 years for the achieved tkm was 8.15% despite decline of 7% that occurred in the last observed year. It suggests that there was a boost growth index from 2015 to 2019. According to Statistical Office of the Republic of Serbia presented in Table 4.4, the average annual growth rate in land transport was 9.61%. Positive average growth rates were recorded in road (21.09%) and air (27.28%) transport while pipeline transport (with –2.38%), inland waterway transport (with –8.39%) and rail transport (with –3.31%) experienced negative average growth indices. It is indicative that growth indices in inland waterway transport varied, recording positive trends in periods 2015–2016 (7.17%) and 2018–2019 (25.34%). The biggest growth index was noted in air transport for the period 2015–2016 and it is 117.02%. Other significant growth indices appear in road transport among which the biggest is achieved in the period 2015–2016 with 44.55% of growth.

Observed by types of traffic, in the period from 2015 to 2020, there was an increase in the volume of cargo transport in both domestic and foreign transport with small variations recorded by year in some modes of transport, especially in 2020 when there was a decline in the volume of transport due to the consequences of the global pandemic (see Table 4.5).

Types of transport	Volume of transported cargo (10^3 t)					
	2015.	2016.	2017.	2018.	2019.	2020.
Foreign transport: total	15307	16857	19044	19546	19385	18974
Land transport	14453	15980	18308	19024	18652	18458
Railway transport	7997	8261	9151	8610	8169	7437
Road transport	3138	4016	4890	5919	6331	6758
Pipeline transport	3318	3703	4267	4495	4152	4263
Inland waterway transport	850	872	729	515	727	512
Air transport	3.7	4.9	6.7	6.7	5.6	4.2
Domestic transport: total	11376	12577	10967	13687	15721	14689
Land transport	10689	11435	10247	12643	13721	13599
Railway transport	3890	3635	3201	3707	3337	3062
Road transport	4826	5881	5230	7137	8838	8876
Pipeline transport	1973	1919	1816	1799	1576	1661
Inland waterway transport	687	1142	720	1044	970	1090
Air transport	-	-	-	-	-	-
Total	26684	29434	30011	33233	34780	33663

Table 4.5. Volume of transport by types and modes of transport in the Republic of Serbia for the period from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

4.3 Transport volumes on inland waterways

The data on cargo transport by inland waterways refer to transport activities realized by companies and organizations registered for transport activities, regardless of whether the transport was performed inside or outside the national boundaries and for domestic or foreign users. The inland waterway transport operations are shown in ton-kilometres and reflect operations in transport carried out inside as well as outside the territory of the Republic of Serbia.

Domestic inland waterway cargo transport carried out by vessels under national or foreign flag covers the overall traffic at Serbian river ports, including other loading and unloading places out of ports.

Cargo loading or discharging at river ports and places out of ports refers only to realization of activities performed by companies responsible for cargo handling on the operational quays (apron areas). It is mainly smaller than the overall throughput at river-ports by its volume. Total cargo transport and cargo loading and unloading from 2015. to 2020. in Republic of Serbia are given in Table 4.6.

Years			**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Ton-kilometers, million			865	927	725	580	727	558
Cargo transport (1000 tons)	National transport		687	1142	720	1045	970	1090
	Exports		126	121	133	151	195	221
	Imports		709	749	591	297	458	276
	Transit		15	2	4	60	64	15
	Traffic between foreign ports		–	–	–	–	10	–
Cargo loading or discharging (1000 tons)	Total cargo	Total	6486	8411	7112	8570	10821	9368
		Loading	2614	3594	2638	3432	4676	4957
		Unloading	3872	4817	4474	5138	6145	4411
	National cargo	Total	1354	2284	1440	2236	2170	2410
		Loading	677	1142	720	1118	1085	1205
		Unloading	677	1142	720	1118	1085	1205
	International cargo	Total	5132	6127	5672	6334	8651	6958
		Exports	1937	2452	1918	2314	3591	3752
		Imports	3195	3675	3754	4020	5060	3206
	Transit cargo	Total	4196	3812	3351	2844	3629	3436
		Upstream	1601	1827	1660	1739	2274	1927
		Downstream	2595	1985	1691	1105	1355	1509

Table 4.6. Transport volumes on inland waterways (source: Statistical Office of the Republic of Serbia)

The throughput of cargo in Serbian river ports from 2015 to 2020 is shown in Table 4.7. Data are gathered from the Statistical Office of the Republic of Serbiainternet site.

Year	**Cargo throughput in portsa (10^3 t)**									**Transit**
	Total cargo throughput			**Domestic throughput**			**Foreign throughput**			
	Total	***Load***	***Unload***	***Total***	***Load***	***Unload***	***Total***	***Export***	***Import***	
2015	6486	2614	3872	1354	677	677	5132	1937	3195	1595
2016	8411	3594	4817	2284	1142	1142	6127	2452	3675	3808
2017	7111	2637	4474	1439	719	720	5672	1918	3754	3351
2018	8570	3432	5138	2236	1118	1118	6334	2314	4020	2844
2019	10821	4676	6955	2170	1085	1085	8651	3591	5060	3629
2020	9368	4957	4411	2410	1205	1205	6958	3752	3206	3436

Table 4.7. Cargo throughput in Serbian river ports from 2015 to 2020 (source: Statistical Office of the Republic of Serbia)

Data in Table 4.7 indicate constant rise in cargo throughput from 2015 to 2019 and a slight decline in 2020 probably due to global pandemic. In 2019, there was an increase in the cargo throughput in compare with throughput in 2018 by about 26.3%. Growth in numbers was recorded in both domestic and foreign transport. In 2020, compared to 2019, there was a decline of about 13.4%, primarily in foreign throughput.

4.4 Statistical overview for the Port of Bačka Palanka

As a typical agricultural port, the Port of Bačka Palanka handled mostly grains and fertilizers, and, to a much smaller extent, determined quantities of natural aggregates (sand and gravel) and metallurgical products.

During the elaboration of this study, statistical data were provided by both Port Governance Agency as a public port governing body and by the Luka Bačka Palanka DOO – a company operating the Port of Bačka Palanka. Due to the higher availability of details and completeness, the statistical data obtained from the Port Governance Agency are taken as a basis for all analyses in this study and are therefore presented below[26].

Cargo and trade direction	2015	2016	2017	2018	2019	2020	2021
Fertilizers	0.00	0	0	0	89,065.70	141,083.08	85,760.33
Grains	10,108.00	2,152.00	46,054.00	3,815.00	0	2,245.00	2,953.00
Export - Fertilizers	0.00	0	0	0	0	0	4,998.91
Export - Grains	30,321.00	226,384.95	164,118.24	119,762.42	183,972.30	320,481.74	203,514.82
Export - Coal	0.00	0	0	0	0	0	1,062.00
Export - Oilseeds	0.00	0	0	1,997.00	60,103.30	73,771.50	15,130.06
Ores	0.00	0	0	0	0	0	1,080.00
Coal	0.00	0	0	0	0	0	22,556.00
Oilseeds	0.00	0	0	0	12,828.00	9,010.00	12,579.61
General cargo	0	462	3,994.00	3,170.00	1,373.12	1,756.34	0
Other bulk cargoes	0	0	66,213.00	51,335.82	9,365.00	9,360.00	0
Export – Other bulk cargoes	5,486.00	57,299.00	0	3,337.37	0	1,107.00	0
Export – Waste materials	5,487.49	0	0	0	0	0	0.00
Export – Natural aggregates	0.00	12,160.00	0	0	0	0	0.00
Natural aggregates	2,817.45	18,232.13	0	0	0	0	0.00
Metallurgical products	0.00	0	0	0	449.00	0	0.00
Total:	**54,219.94**	**316,690.08**	**280,379.24**	**183,417.61**	**357,156.42**	**558,814.66**	**349,634.73**

Table 4.8. Throughput of cargo in the Port of Bačka Palanka 2015-2021

Top three products handled in the Port of Bačka Palanka are grains, oilseeds and fertilizers. The following table shows the share of the Port of Bačka Palanka in the overall trade (in all ports) for these three cargo types in 2021.

[26] Source: Port Governance Agency

Cargo and trade direction	Total Serbia 2021	Share of Bačka Palanka
Grains - export	2,114,083.67	9.63%
Grains - import	29,451.80	10.03%
Fertilizers - import	429,684.53	19.96%
Oilseeds - import	26,169.61	48.07%
Oilseeds - export	75,765.70	19.97%

Table 4.9. Share of the Port of Bačka Palanka top three cargo types in the overall throughput in Serbian ports

Taking into account the overall volumes (all cargoes), the share of the Port of Bačka Palanka in the overall cargo volumes handled in Serbian ports was 2.19% in 2021.

4.5 Capacity analysis

Currently, the operator of the Port of Bačka Palanka, company "Luka Bačka Palanka" d.o.o.., operates a portal crane, a floating crane and a mobile crane grain loader connected to a silo via belt conveyors. Technical capacities[27] of this transshipment equipment are as follows:

Portal crane: 80 t/hour

Floating crane: 30 t/hour

Mobile crane: 50 t/hour

Capacity of the port us typically calculated in function of the capacity of the ship-berth link, that is, of the capacity of the transshipment equipment located at the berth or multiple berths. In addition to that, the working times, or the operating patterns of a port operator largely determine the annual capacity of the port. In this view, the capacity of the port will be calculated for two different cases, that is, for two different operating patterns (working times) of the port operator. These cases are the following:

Mark	Capacity case description	Working hours/day	Working days	Working time
Q1	Normal capacity	16	Mon-Sun	06:00-22:00
Q2	Intensive capacity	24	Mon-Sun	00:00-24:00

Table 4.10. Port capacity cases

In addition to the internal factors determining the actual (or operational) port capacity, there are external factors affecting the annual operational capacity of a port. Most important external factor in this case is the fairway availability, or the number of days when navigation is possible. According to the report[28] of the Directorate for Waterways "Plovput" of the Ministry of Transport, Construction and Infrastructure the average number of the navigable days is 300. For the purposes of this calculation, the number of navigable days on the Danube is taken to be 301 days, or 43 weeks. The remaining days of the year are not possible for navigation due to:

- extremely high water levels,
- extremely low water levels,
- ice occurrence,
- strong winds,
- dense fog.

[27] According to the questionnaire filled by the "Luka Bačka Palanka" d.o.o. port operator.
[28] http://www.plovput.rs/file/danube-stream/common-danube-report-2018.pdf - last accessed 07 June 2022.

Finally, the simplest way to calculate the average annual (operational) capacity of the port is given in the following formula:

$Q = W_d \times W_h \times P_h$

Where:

Q – average annual capacity of a port (tons/year),

W_d – number of working days in a year

W_h – number of working hours in a day, in function of the adopted capacity case,

P_h – hourly productivity of a transshipment equipment or a berth (tons/hour).

Therefore, the capacity of the port (having two berths) for all types of cargoes is:

Annual port capacity	Tons/year
Capacity case Q1	722,400
Capacity case Q2	1,083,600

Table 4.11. Port capacity for all types of cargo

From the point of view of capacity utilization on the basis of volumes handled in the last seven years, in the following figure it can be seen that the port has a determined capacity reserve in both analysed capacity cases. This, in turn, means that the port has no reason to work overtime from the point of view of potential congestion, taking into account the current and past volumes of handled cargo.

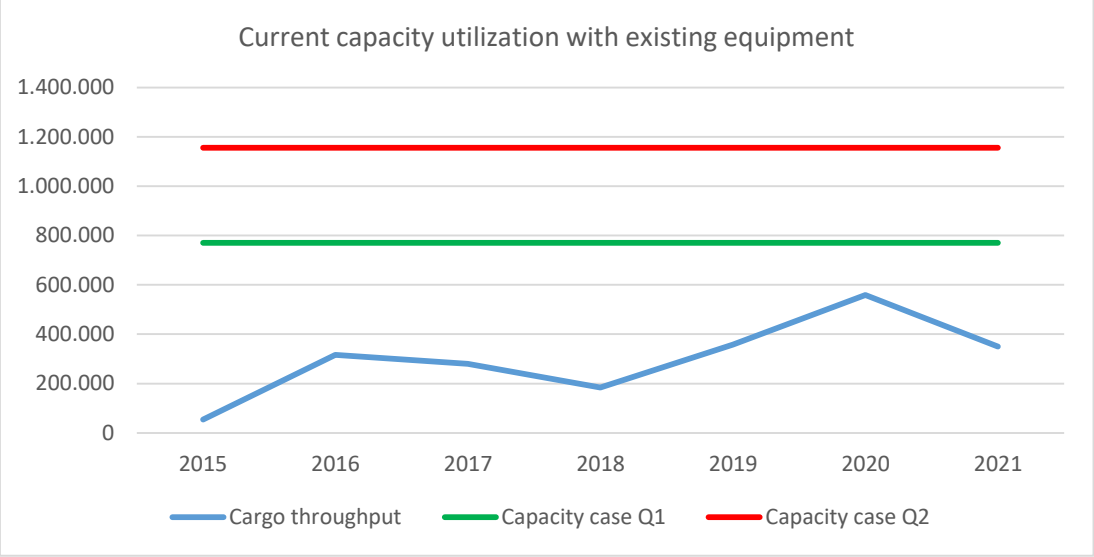

Figure 4.9. Capacity utilization of the Port of Bačka Palanka 2015-2021

Furthermore, the capacity utilization of the transshipment facilities in the last seven years also demonstrated the average capacity utilization over the years. This means that the port does not need to work any overtimes in order to manage to handle the current volumes, unless specifically requested by the ship operator or cargo owner.

According to UNCTAD Port Development Handbook[29], recommended berth occupancy (from the point of view of possible congestion effects) for ports/terminals with two berths is 50%. This means that, even though there is sufficient physical reserve of port capacity, congestion (with all its negative effects) can occur during peak loads when berth occupancy (or, in this case, simplified as capacity utilization) reaches values of more than 50%.

Number of berths in the same group	Recommended maximum berth occupancy (%)
1	40
2	50
3	55
4	60
5	65
6-10	70

Table 4.12. UNCTAD recommendation on berth occupancy

Utilization rate was surpassed only in 2020, when it reached 72.52%, if capacity case Q1 is observed.

4.6 Potential users

Most direct port users for Bačka Palanka are **exporters of grains**. According to the report[30] of "Žita Srbije" (2021), the following companies are the top 25 exporters of grains are given in Table 4.13.

Nr.	COMPANY	Tons
1	AGROGLOBE, NOVI SAD	452,592
2	CHS SERBIA, NOVI SAD	442,039
3	DELTA AGRAR, BELGRADE	315,817
4	CONSUL, NOVI SAD	284,038
5	TRADING TEAM, NOVI SAD	179,848
6	VIMEXIM, NOVI SAD	145,525
7	ĆIRIĆ AND SON, SAKULE	141,582
8	MAT AGRO, FUTOG	138,166
9	BCM TRADE, BELGRADE	120,691
10	RWA SERBIA, BELGRADE	105,330
11	AGRICOM COMP. GROUP, SOMBOR	80,283
12	VITERRA-GRANOLIS, NOVI SAD	64,329
13	BIMAL TRADING, BELGRADE	64,207
14	AGRO DOM TIM, CRVENKA	61,146
15	ANOVA NNL, SREMSKA KAMENICA	52,487
16	AS AGRO 99, BANATSKO NOVO SELO	52,278
17	AXEREAL SERBIA, NOVI SAD	51,273
18	AL DAHRA SERBIA, SLOPE SCAFFOLDING	50,268
19	ALCOR DLV, NOVI SAD	47,498
20	SOCIETY BALKANS, NOVI SAD	44,994
21	AGROFINANCE, BELGRADE	42,241
22	ALMEX, PANČEVO	41,935

[29] UNCTAD (1985), *Port Development: A handbook for planners in developing countries*, New York.
[30] Žita Srbije (2021), Annual Report on Grains Exports in 2021, Belgrade (*in Serbian*)

23	SOLE KOMERC, BELGRADE	41,533
24	ŽITOPROMET MLINPEK, SREMSKA MITROVICA	37,254
25	DUMICO, BELGRADE	36,652

Table 4.13. Top 25 grain exporters in Serbia for 2021

Unfortunately, no detailed data on each port were available at the time of elaboration of this report. In addition to that, the port operator of the Port of Bačka Palanka did not want to disclose the exact quantities exported by their clients, but they did indicate that the above listed companies are their potential clients.

Serbia's total area wheat crop is estimated at 600,000 ha, 5% higher than in the previous year mostly due to high wheat prices during marketing year (MY)2019/20[31]. Corn production for MY2020/21 is estimated to be 8 million MT, almost 10 percent higher than the previous year. Serbia's corn exports of 3.2 million MT in MY2019/20 was a record. As of October 2020, Serbia had exported almost 460,000 MT of corn, 87 % higher than in October 2019.

The constraints with exporting wheat (and other crops) from Serbia are limited by the transhipment capacities of the Serbian ports and reduced number of vessels in the river fleet. Serbian shipping was challenged in December 2020 - March 2021 by the low level of the Danube River and limited possibility to transport wheat by river barges to the Black Sea. On the average, over 60% of wheat exports from Serbia are transported to the huge silos at the Port of Constanta in Romania, which has direct inland waterway links to all Serbian river ports. The remaining 40% (on the average) of the wheat is transported over land to the neighbouring countries.

Most important export products of Serbia, forming a considerable bulk of goods transported by inland waterway transportation, are maize, wheat and barley. Below table[32] shows an overview of the grains exported and imported from/to Serbia in the last four years.

	Export (t)				**Import (t)**			
Year	2018	2019	2020	2021	2018	2019	2020	2021
Maize	1,311,400	3,117,958	3,637,973	2,332,224	18,983	7,112	6,193	8,464
Wheat	1,202,317	318,868	589,817	1,153,972	1,547	1,724	3,013	1,671
Barley	70,991	47,451	85,423	125,71	573	5,375	741	1,799
Oats	1,03	1,246	738	2,208	542	2,983	5,805	884
Buckwheat	23	1,149	116	1,471	1,002	2,573	1,014	2,174
Rye	810	491	50	1,944	75	428	2,078	345
Sunflower	145,317	134,606	144,272	90	22,161	29,227	20,001	11,474
Soy	70,078	182,331	249,828	70,036	19,791	4,235	192	49,964
Rapeseed	132,383	50,067	91,872	71,886	1,275	333	122	153
Total	**2,933,319**	**3,854,167**	**4,800,089**	**3,633,831**	**65,949**	**53,990**	**39,159**	**76,928**

Table 4.14. Exports and imports of grains from/to Serbia

Just as an example, the total of 173 exporters participated in corn (largest share of grain exports exports in 2021, of which 151 with quantities from 25 t to 270,344 t (206 exporters in 2020 and 204 in 2019).

[31] Maslać, Tatjana (2020), *Grain and Feed Update – Report on Serbia*, United States Department of Agriculture, Foreign Agriculture Service, Report Number: RB2020-0013

[32] Žita Srbije (2021), *Annual report on exports in 2021*, (in Serbian), Belgrade, 24 February 2022.

Out of 2,332,224 tons exported, 1,571,779 tons were shipped by the Danube, i.e., 67.4% of total exports (75.7% of total exports in 2020, 58.33% in 2019), 584,763 tons, or 17.95% of corn were bought by buyers from Italy, and all others 175,682 tons, or 14.65%.

In addition to this, the next large group of potential users of the Port of Bačka Palanka are the **importers of fertilizers**. Currently, there is only one fertilizers producer in Serbia: Elixir Group, whereas Elixir uses ports of Šabac and Prahovo for their imports of fertilizer components and export of fertilizers, because Elixir Group is a port operator (through their daughter companies) in the ports of Šabac and Prahovo.

This situation may change, as "Azotara Pančevo" plans to reinitiate the production of fertilizers in the second half of 2022, under the new ownership, according to the media reports[33].

In the absence of any newer data, the authors of this study used the Report on the Analysis of the State of Competition on the Market of Wholesale of Artificial Fertilizers in the Territory of the Republic of Serbia in the Period 2017-2019[34] in order to determine the potential users in the domain of fertilizers.

According to this report, production of artificial fertilizers in the period 2017-2019 had a growing trend, and since mid-2018, only one producer operates in the Republic of Serbia - the company "Elixir Group" (Elixir Group). When it comes to imports, according to the data of the Customs Administration, in 2017 and 2018, the leading importer was also "Elixir", but in 2019, the company "Promist" replaced "Elixir" in that position.

In 2019, the import of fertilizers achieved a growth of over 60% compared to the previous year. Fertilizers are mostly imported from Russia, while far smaller quantities are imported from Croatia, Austria, Hungary and Romania. Nitrogen and complex fertilizers predominate in the total import of mineral fertilizers, and these two types of fertilizers together make up 85-90% of the total import of fertilizers in the observed period. In 2019, the increase in exported quantities by 29% and the realized value of exports by 51% compared to 2017.

In the Port of Bačka Palanka, larger importers of fertilizers are Phosagro Balkans, Eurochem Agro, Elixir Zorka and Borealis.

Last, but not least, potential users can be looked in the **oil industry**. According to the data from the Statistical Office of the Republic of Serbia, imports of oil and oil derivatives are constantly on the rise, with a steady growing trend. Viewed over the last 9 years, exports of oil and oil derivatives is also on the rise, but with a very mild growing trend. Below figure[35] demonstrates the change of exports and imports of oil and its derivatives in Serbia over the previous nine years.

[33] https://www.boljazemlja.com/pocinje-proizvodnja-vestackog-djubriva-u-srbiji/

[34] Republic of Serbia, Competition Protection Commission, Report on the Analysis of the State of Competition on the Market of Wholesale of Artificial Fertilizers in the Territory of the Republic of Serbia in the Period 2017-2019, Belgrade, November 2020, available at: http://www.kzk.gov.rs/kzk/wp-content/uploads/2020/12/Izveštaj-o-sektorskoj-analizi-na-tržištu-mineralnog-đubriva.pdf - last accessed 27 April 2022.

[35] Prepared on the basis of the data from the Statistical Office of the Republic of Serbia

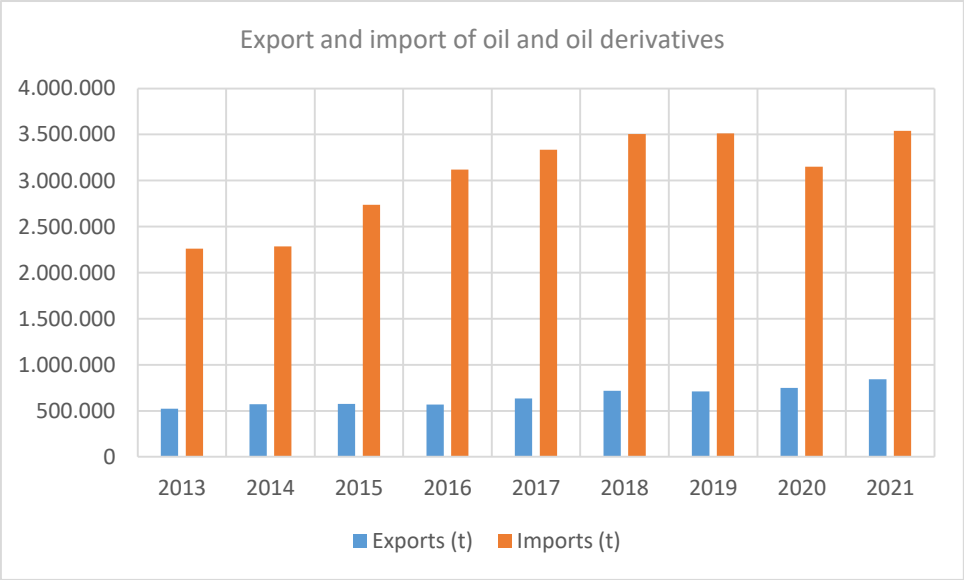

Figure 4.10. Exports and imports of oil and oil derivatives in Serbia

Figure below[36] shows the quantities of exports and imports of oil and oil derivatives with the countries where most of exports/imports are destined to or originate from and which are suitable for transport by inland waterways due to a direct waterway links between Serbian and foreign ports.

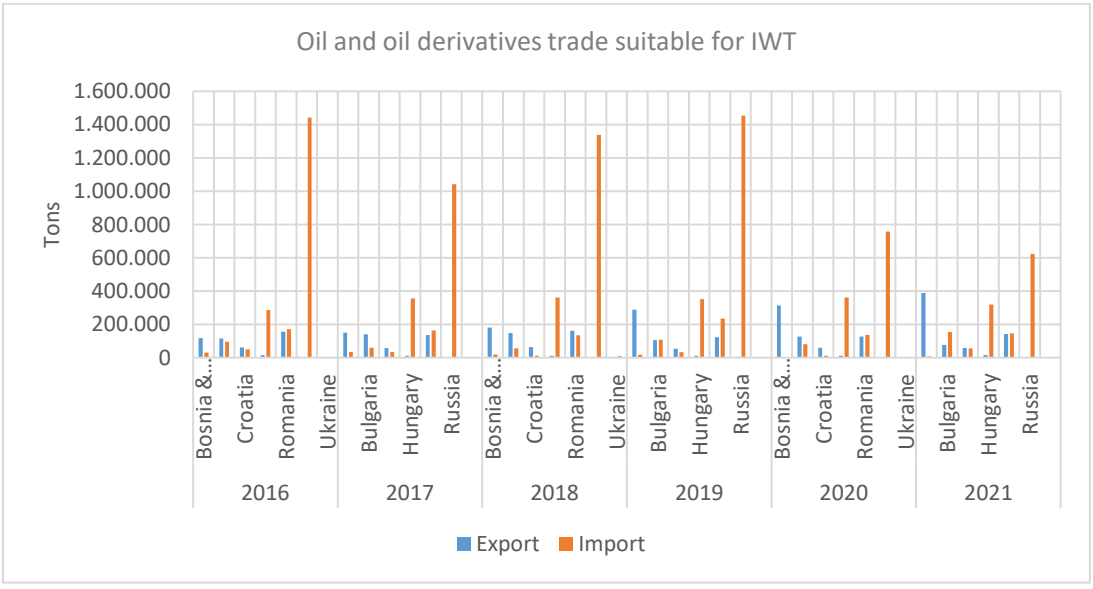

Figure 4.11. Oil and oil derivatives trade with countries suitable for transport by inland waterways

Considering the strategic plans of NIS (Oil Industry of Serbia – largest oil company in Serbia) development and preservation of the stability of the energy industry of the Republic of Serbia, it can be expected to have **oil and oil products** to be unloaded at the port of Bačka Palanka from domestic sources, while it is expected to be competitive in terms of purchase and transport price in relation to foreign sources. This, of course, can be done only if facilities for handling and storage of oil products are planned in the new, extended port.

[36] Ibid.

Considering the pronounced agricultural production and the growth of the volume of production of the processing industry, it can be stated that there are needs of economic entities for oil and oil derivatives in the immediate hinterland of Bačka Palanka. In this view, the hinterland of Bačka Palanka is seen as a receptive area, that is, the final destination of the flows of this type of cargo.

Currently, the transport of these cargoes to the hinterland of the Port of Bačka Palanka is performed by road transport.

One of the possibilities for supplying the port's hinterland with petroleum products is the construction of an oil terminal for transshipment and storage of petroleum products transported primarily by barges. One of the reasons for considering the possibility of constructing an oil terminal is the advantage of inland waterway transport in terms of specific fuel consumption per ton of transported goods.

The statistical data of the Port Governance Agency, demonstrated that transshipment of oil and oil derivatives was recorded at 6 terminals on the Danube and 1 terminal on the Tisza River.

When assessing the size of the flows of petroleum products and transshipment of these cargoes in the Port of Bačka Palanka, it is necessary to take into account the locations of oil industry plants in the Republic of Serbia and the region and the existing way of supplying the market.

In the Republic of Serbia, oil refineries are located in Novi Sad, Belgrade and Pančevo, while in Šid there is a refinery "Victoria Oil" for the production of biodiesel. The starting points for the flow of oil and petroleum products in domestic transport on inland waterways can be refineries that have river terminals and storage capacities for this type of cargo, and these are currently the Oil Refinery in Novi Sad (NIS a.d.) and the Oil Refinery in Pančevo (NIS a.d.). 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 oil terminals in the region will become the starting points of international flows of this type of cargo to Bačka Palanka. For example, Hungarian oil company MOL, with its oil refinery and the capacity of the Danube oil terminal in Százhalombatta near Budapest, is present on the regional markets including Serbia.

4.7 Development Perspectives (Forecast scenarios)

The 25 years forecast (2022-2047) of the total volume of ship-to-shore (and vice-versa) transshipment in the Port of Bačka Palanka was made on the basis of partial estimates and forecasts using the analytical method of different growth rates, taking into account the following infrastructure and suprastructure additions to the port:

- new oil terminal completion in 2025, first cargo (oil derivatives) appearing in 2026,
- additional grain storage capacities planned by the current operator completion by the end of 2024, first quantities of additional cargoes appearing in 2025,
- new terminal for sand and gravel completion in 2025, although cargo operations for this cargo can be continued from the shore even at this moment,
- new quay for general cargo and containers completed by the end of 2025, first cargo flows appearing as of 2026.

As a general guidance, the forecasts for the Serbian GDP and export/import growth, prepared by the International Monetary Fund[37] were relied on.

Subject Descriptor	2019	2020	2021	2022	2023	2024	2025	2026
GDP	4.25%	-0.98%	6.54%	4.50%	4.50%	4.00%	4.05%	4.04%
Imports	9.81%	-0.25%	17.57%	6.57%	6.07%	5.57%	5.87%	5.87%
Exports	8.45%	-3.11%	24.04%	6.54%	5.54%	5.54%	5.54%	6.04%

Table 4.15. IMF analysis and forecast for the Serbian GDP and export/import growth

In order to engulf the widest possible scope of opportunities, the forecast will be done in two scenarios: Scenario 1 (minimalistic) and Scenario 2 (maximalist). For both scenarios, statistical data from 2021 have been used as a forecast basis.

In **Scenario 1**, the following assumptions and growth rates were adopted:

- **Fertilizers (import)**: in 2022, a drop of -20% is assumed, due to quotas[38] of grain exports introduced by the Government of the Republic of Serbia due to the Ukrainian crisis – these quotas (120,000 tons monthly as a maximum) are expected to cause less sowing in 2022 and therefore lower consumption of fertilizers; in 2023, assuming that the export quotas are abolished, the use of fertilizers is expected to rise immediately at a rate of 30% in 2023; as of 2024 and until 2029, it is assumed that the import of fertilizers will have the same growth as GDP growth forecast (4%) for Serbia; thereafter, from 2030 to 2035 , a rise of 2% in each year is expected. Finally, in the period of 2036-2047, it is expected that the growth rate will be limited to 1% annually, as the maximum absorption rate of the agricultural producers will be near 100% (estimated maximum absorption (demand) of the market in the port's hinterland is 150,000 tons per year in this scenario).
- **Grains (import)**: since Serbia is largely an export country for grains, import of grains is mostly limited to special kinds of grains that are not sowed (in an observed year) in Serbia, such as rye, barley, buckwheat and similar. It is expected that the annual growth rate of import grains remains at 2% annually until 2029 when it will rise for about 20% due to the assumed construction of the grain terminal and additional storage capacities. After that, a return to steady growth of 1% annually is expected until the end of the forecasting period in 2047.
- **Fertilizers (export)**: Since there are no fertilizer producers in the immediate vicinity of Bačka Palanka, it is expected that this cargo flow will be limited and it will represent a "spill off" from other ports in case of navigational hindrances (e.g. Port of Šabac) or congestion (ports of Pančevo or Novi Sad). Therefore, the annual growth is expected to remain at 5% until 2030 when it will drop down to 2% and remain steady until the end of the forecasting period.
- **Grains (export)**: in 2022, it is expected that the export quotas cause a drop of -40% in corn and wheat exports compared to 2021. In 2023, it is expected that the quotas are abolished and that the growth will recover at a pace of 50% in 2023, 25% in 2024, 15% in 2025 and 10% in 2026. In 2027 and 2028 the growth will slow down to 4% due to the lack of storage and handling capacities, while

[37] International Monetary Fund, World Economic Outlook Database, October 2021, available at: https://www.imf.org/en/Countries/SRB#ataglance – last accessed 26 April 2022.

[38] https://www.politika.rs/scc/clanak/505406/Vlada-odobrila-kvote-za-izvoz-zitarica-brasna-i-ulja - last accessed 23 April 2022. The Serbian government approved quotas for the export of wheat, corn, flour and refined sunflower oil. This decision allows the export of 150,000 tons of wheat, 150,000 tons of corn and 20,000 tons of flour per month, while the monthly export quota for refined sunflower oil is 8,000,000 litres. Upon request, it will be possible to ask for permission to export a maximum of 20 percent of the approved quantities per group of products on a monthly basis. In case exporters do not export or exceed the quantities approved, they will not be able to apply for the export permission the following month.

in 2029 it is expected that the growth will jump to 30% due to the assumed construction of the grain terminal and additional storage capacities. After that, it is expected that the growth will be steady at 4% until 2035. Thereafter, it will assume a growth of 2% annually until the maximum production in the hinterland is reached (estimated at 600,000 tons annually).

- **Coal (export)**: this cargo is not a typical cargo for the port of Bačka Palanka, but it represents an occasional capture from other nearby ports. It is expected to double in 2022 and to grow for 100% every three to four years (due to the habitual formation of transport lots to match the typical barge load of 1000-1200 tons of coal). It is expected to remain below maximum 5,000 tons annually until the end of the forecasting period.
- **Oilseeds (export)**: Since the export of oilseeds, at the moment, is not limited by governmental export quotas, it is estimated that the export of oilseeds in general will be at the level of 4% annually, throughout the entire forecasting period. Estimated maximum production in the hinterland of the port is around 75,000 tons/year in this scenario.
- **Ores (import)**: this cargo is not a typical cargo for the port of Bačka Palanka, but it represents an occasional capture from other nearby ports. It is expected to double in 2025, remaining at that level until 2029 when it is expected to have another growth of 100% (due to the habitual formation of transport lots to match the typical barge load of 1000-1200 tons of coal) and remain at 2029 level until the end of the forecasting period.
- **Coal (import)**: this cargo is imported for the needs of sugar production plans and, to a much lesser extent, for municipal heating plants that are not using natural gas. It is expected that the growth of these cargo flows will be at 5% until 2025 and 2% until 2029. After that, it is expected to drop down to only 1% annually until the end of forecasting period in 2047, as it is expected that the users will switch to cleaner energy sources.
- **Oilseeds (imports)**: It is estimated that the growth of imports of oilseeds will remain around the forecasted GDP growth for Serbia from 2022 to 2029. In 2029, the construction of the new storage capacities and the grain terminal is expected to trigger a growth of 10% in this scenario. From 2030 to 2047, it is expected that the growth becomes stable at 3% annually.
- **General cargo (imports)**: this occasional cargo is expected to remain at lower levels, starting as low as 1,500 tons in 2022 (approximately a single barge load of various cargo such as machinery parts, plant parts and similar, for the newly established industrial facilities in the 56 ha large planned industrial zone). Thereafter, these cargo flows are expected to grow at a steady pace of 5% annually, until 2030, when this growth I expected to slow down to 2% annually, until the end of the forecasting period in 2047.
- **Other bulk cargoes (import)**: this cargo represents mostly the components for fertilizers being produced in Šabac (Elixir Zorka) which cannot be unloaded in Šabac due to the restricted navigational conditions on the Sava River. Elixir Zorka has established alternative supply chains through the Port of Bačka Palanka when the Sava River is not navigable. During the interview with the operators of the port, it has been estimated that such cargo could reach the quantity of 10,000 tons in 2022. Thereafter, the growth of this cargo is estimated at 5% until 2030, when it will slow down to 3% annually until the end of the forecasting period.
- **Other bulk cargoes (export)**: this cargo encompasses non-typical grains (other than corn and wheat), that is, rye, buckwheat, oat, barley and similar. During the interview with the operators of the port, it has been estimated that such cargo could reach the quantity of 1,200 tons in 2022. Thereafter, the growth of this cargo is estimated at 5% until 2030, when it will slow down to 3% annually until the end of the forecasting period.

- **Waste materials (export)**: mostly scrap metal, expected to reach 1,200 tons (single barge load) in 2022, thereafter growing steadily at the pace of 3% annually until 2030, when it will drop down slightly, to 2% until the end of the forecasting period.
- **Metallurgical products (import)**: various semi-finished products, mostly destined for the industrial companies being settled in the future industrial zone in Bačka Palanka. It is expected that this cargo flows starts in 2022 with a single barge load (ca. 1,200 t), being doubled every 2-3 years (due to the habitual formation of transport lots to match the typical barge load of 1000-1200 tons of general cargo) until 2030, when it will stabilize and reach 10% of annual growth until 2047.
- **Other occasional bulk and general cargo (export and import)**: uncategorized cargo flows of bulk and general cargo in both import and export are estimated to start with 2,000 tons for each type and each direction (2,000 t bulk cargo imports, 2,000 t general cargo imports, 2,000 t bulk cargo exports and 2,000 t general cargo exports). Thereafter, for all 4 given categories, the growth is estimated to be constant at 4% until 2030, when it is expected to drop to 2% until the end of the forecasting period in 2047.
- **Liquid cargo (oil derivatives):** it is estimated that the two vessels per week will call the oil terminal in the extended Port of Bačka Palanka, during the 43 weeks of navigation. Each vessel is estimated to carry 1200 tons of oil derivatives, which is a typical barge load for the liquid bulk cargo. This gives 43 x 2 x 1200 = 103,800 tons per year in the starting year of 2029 in this scenario. After that, the growth will remain at 4% (following the GDP forecast) until 2036, when it is expected to drop down to 2% due to market saturation.

Summary of the above analytics for **Scenario 1** is presented in the following table.

Cargo	2022	2023	2024	2025	2026	2027	2028	2029	2030-2035	2036-2047
Fertilizers	-20.00%	30.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	2.00%	1.00%
Grains	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	20.00%	1.00%	1.00%
Export - fertilizers (general cargo)	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%
Export - grains	-40.00%	50.00%	25.00%	15.00%	10.00%	4.00%	4.00%	30.00%	4.00%	2.00%
Export - coal	100%	0.00%	0.00%	100%	0.00%	0.00%	0.00%	100%	2.00%	2.00%
Export - oilseeds	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Ores	0.00%	0.00%	0.00%	100%	0.00%	0.00%	0.00%	100%	0.00%	0.00%
Coal	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	1.00%	1.00%
Oilseeds	6.57%	6.07%	5.57%	5.87%	5.87%	5.87%	5.87%	10.00%	3.00%	3.00%
General cargo	1,500	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	2.00%	2.00%
Other bulk cargo	10,000	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	3.00%	3.00%
Export - Other bulk cargo	1,200	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	3.00%	3.00%
Export - Waste materials	1,200	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	2.00%	2.00%
Metallurgical products	1,100	0.00%	100%	0.00%	0.00%	100%	0.00%	0.00%	10.00%	10.00%
Other occasional bulk cargo	2,000	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	2.00%	2.00%
Other occasional general cargo	2,000	4.00%	4.00%	4.00%	4.00%	4.00	4.00	4.00%	2.00%	2.00%

						%	%			
Export - Other occasional bulk cargo	2,000	4.00%	4.00%	4.00%	4.00%	4.00 %	4.00 %	4.00%	2.00%	2.00%
Export - Other occasional general cargo	2,000	4.00%	4.00%	4.00%	4.00%	4.00 %	4.00 %	4.00%	2.00%	2.00%
Liquid cargo (oil derivatives)	0	0	0	0	0	0	0	108,000	3.00%	2.00%

Table 4.16. Assumptions and estimates of growth rates for different types of cargo in Scenario 1

Based on the above assumptions and estimates, the forecasts for the transshipment volumes in the Port of Bačka Palanka, for the period 2022-2047, **Scenario 1**, are given in continuation.

Cargo and trade direction	2022	2023	2024	2025	2026	2027	2028	2029
Fertilizers (bulk)	68,608	89,191	92,758	96,469	100,327	104,341	108,514	112,855
Grains (bulk)	3,012	3,072	3,134	3,196	3,260	3,326	3,392	4,070
Export - fertilizers (general cargo)	5,249	5,511	5,787	6,076	6,380	6,699	7,034	7,386
Export - grains (bulk)	122,109	183,163	228,954	263,297	289,627	301,212	313,261	407,239
Export - coal (bulk)	2,124	2,124	2,124	4,248	4,248	4,248	4,248	5,000
Export - oilseeds (bulk)	15,735	16,365	17,019	17,700	18,408	19,144	19,910	20,707
Ores (bulk)	1,080	1,080	1,080	2,160	2,160	2,160	2,160	4,320
Coal (bulk)	23,684	24,868	26,111	27,417	27,965	28,525	29,095	29,677
Oilseeds (bulk)	13,406	14,220	15,012	15,893	16,826	17,814	18,859	20,745
General cargo	1,500	1,575	1,654	1,736	1,823	1,914	2,010	2,111
Other bulk cargo	10,000	10,500	11,025	11,576	12,155	12,763	13,401	14,071
Export - Other bulk cargo	1,200	1,260	1,323	1,389	1,459	1,532	1,608	1,689
Export - Waste materials (bulk)	1,200	1,236	1,273	1,311	1,351	1,391	1,433	1,476
Metallurgical products (general)	1,100	1,100	2,200	2,200	2,200	4,400	4,400	4,400
Other occasional bulk cargo	2,000	2,080	2,163	2,250	2,340	2,433	2,531	2,632
Other occasional general cargo	2,000	2,080	2,163	2,250	2,340	2,433	2,531	2,632
Export - Other occasional bulk cargo	2,000	2,080	2,163	2,250	2,340	2,433	2,531	2,632
Export - Other occasional general cargo	2,000	2,080	2,163	2,250	2,340	2,433	2,531	2,632
Liquid cargo (oil derivatives)	0	0	0	0	0	0	0	108,000
Total	**278,007**	**363,585**	**418,107**	**463,669**	**497,549**	**519,201**	**539,448**	**754,272**

Table 4.17. Forecasts of transport volumes in Scenario 1 (part 1/4)

Cargo and trade direction	2030	2031	2032	2033	2034	2035	2036	2037
Fertilizers (bulk)	115,112	117,414	119,762	122,158	124,601	127,093	128,364	129,647
Grains (bulk)	4,111	4,152	4,194	4,236	4,278	4,321	4,364	4,408
Export - fertilizers (general cargo)	7,533	7,684	7,838	7,994	8,154	8,317	8,484	8,653
Export - grains (bulk)	423,528	440,469	458,088	476,412	495,468	515,287	525,593	536,105
Export - coal (bulk)	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Export - oilseeds (bulk)	21,535	22,396	23,292	24,224	25,193	26,200	27,248	28,338
Ores (bulk)	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320
Coal (bulk)	29,974	30,274	30,576	30,882	31,191	31,503	31,818	32,136
Oilseeds (bulk)	21,368	22,009	22,669	23,349	24,049	24,771	25,514	26,280
General cargo	2,153	2,196	2,240	2,285	2,330	2,377	2,424	2,473
Other bulk cargo	14,493	14,928	15,376	15,837	16,312	16,802	17,306	17,825
Export - Other bulk cargo	1,739	1,791	1,845	1,900	1,957	2,016	2,077	2,139
Export - Waste materials (bulk)	1,505	1,535	1,566	1,598	1,629	1,662	1,695	1,729

Metallurgical products (general)	4,840	5,324	5,856	6,442	7,086	7,795	8,574	9,432
Other occasional bulk cargo	2,685	2,738	2,793	2,849	2,906	2,964	3,023	3,084
Other occasional general cargo	2,685	2,738	2,793	2,849	2,906	2,964	3,023	3,084
Export - Other occasional bulk cargo	2,685	2,738	2,793	2,849	2,906	2,964	3,023	3,084
Export - Other occasional general cargo	2,685	2,738	2,793	2,849	2,906	2,964	3,023	3,084
Liquid cargo (oil derivatives)	111,240	114,577	118,015	121,555	125,202	128,958	131,537	134,168
Total	**779,189**	**805,023**	**831,809**	**859,586**	**888,395**	**918,277**	**936,410**	**954,987**

Table 4.18. Forecasts of transport volumes in Scenario 1 (part 2/4)

Cargo and trade direction	2038	2039	2040	2041	2042	2043	2044	2045
Fertilizers (bulk)	130,944	132,253	133,576	134,912	136,261	137,623	138,999	140,389
Grains (bulk)	4,452	4,496	4,541	4,587	4,633	4,679	4,726	4,773
Export - fertilizers (general cargo)	8,827	9,003	9,183	9,367	9,554	9,745	9,940	10,139
Export - grains (bulk)	546,827	557,763	568,918	580,297	591,903	603,741	603,741	603,741
Export - coal (bulk)	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Export - oilseeds (bulk)	29,472	30,651	31,877	33,152	34,478	35,857	37,291	38,783
Ores (bulk)	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320
Coal (bulk)	32,457	32,782	33,110	33,441	33,775	34,113	34,454	34,799
Oilseeds (bulk)	27,068	27,880	28,716	29,578	30,465	31,379	32,320	33,290
General cargo	2,522	2,573	2,624	2,677	2,730	2,785	2,841	2,897
Other bulk cargo	18,359	18,910	19,478	20,062	20,664	21,284	21,922	22,580
Export - Other bulk cargo	2,203	2,269	2,337	2,407	2,480	2,554	2,631	2,710
Export - Waste materials (bulk)	1,764	1,799	1,835	1,872	1,909	1,947	1,986	2,026
Metallurgical products (general)	10,375	11,412	12,554	13,809	15,190	16,709	18,380	20,218
Other occasional bulk cargo	3,145	3,208	3,272	3,338	3,405	3,473	3,542	3,613
Other occasional general cargo	3,145	3,208	3,272	3,338	3,405	3,473	3,542	3,613
Export - Other occasional bulk cargo	3,145	3,208	3,272	3,338	3,405	3,473	3,542	3,613
Export - Other occasional general cargo	3,145	3,208	3,272	3,338	3,405	3,473	3,542	3,613
Liquid cargo (oil derivatives)	136,851	139,588	142,380	145,227	148,132	151,094	154,116	157,199
Total	**974,022**	**993,533**	**1,013,539**	**1,034,058**	**1,055,111**	**1,076,721**	**1,086,837**	**1,097,315**

Table 4.19. Forecasts of transport volumes in Scenario 1 (part 3/4)

Cargo and trade direction	2046	2047
Fertilizers (bulk)	141,793	143,211
Grains (bulk)	4,821	4,869
Export - fertilizers (general cargo)	10,342	10,549
Export - grains (bulk)	603,741	603,741
Export - coal (bulk)	5,000	5,000
Export - oilseeds (bulk)	40,334	41,948
Ores (bulk)	4,320	4,320
Coal (bulk)	35,147	35,498
Oilseeds (bulk)	34,289	35,317
General cargo	2,955	3,015
Other bulk cargo	23,257	23,955
Export - Other bulk cargo	2,791	2,875
Export - Waste materials (bulk)	2,067	2,108

Metallurgical products (general)	22,240	24,464
Other occasional bulk cargo	3,685	3,759
Other occasional general cargo	3,685	3,759
Export - Other occasional bulk cargo	3,685	3,759
Export - Other occasional general cargo	3,685	3,759
Liquid cargo (oil derivatives)	160,343	163,549
Total	**1,108,180**	**1,119,454**

Table 4.20. Forecasts of transport volumes in Scenario 1 (part 4/4)

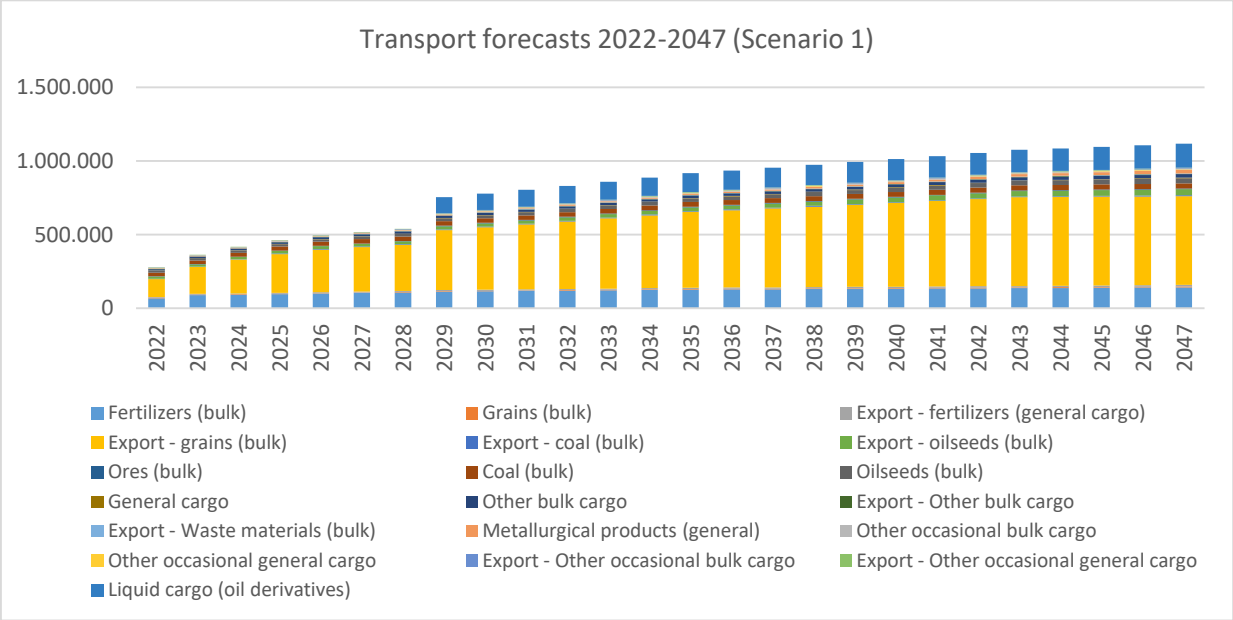

Figure 4.12. Forecasts of transport volumes in Scenario 1

The forecasted volumes are given in a different format in the summary table and figure below.

Cargo per trade and transport packaging	Export - bulk	Export - general cargo	Import - bulk	Import - general cargo	Domestic - liquid bulk	Total
2022	144,368	7,249	121,790	4,600	0	278,007
2023	206,228	7,591	145,011	4,755	0	363,585
2024	252,857	7,950	151,284	6,017	0	418,107
2025	290,195	8,326	158,961	6,186	0	463,669
2026	317,432	8,720	165,034	6,363	0	497,549
2027	329,960	9,132	171,361	8,748	0	519,201
2028	342,990	9,565	177,952	8,941	0	539,448
2029	438,742	10,018	188,370	9,143	108,000	754,272
2030	455,992	10,218	192,062	9,677	111,240	779,189
2031	473,931	10,422	195,835	10,258	114,577	805,023
2032	492,584	10,631	199,690	10,889	118,015	831,809
2033	511,982	10,843	203,630	11,575	121,555	859,586
2034	532,154	11,060	207,657	12,322	125,202	888,395
2035	553,129	11,281	211,773	13,136	128,958	918,277
2036	564,636	11,507	214,708	14,022	131,537	936,410
2037	576,395	11,737	217,699	14,988	134,168	954,987
2038	588,411	11,972	220,746	16,043	136,851	974,022
2039	600,690	12,211	223,850	17,194	139,588	993,533
2040	613,240	12,456	227,013	18,450	142,380	1,013,539
2041	626,066	12,705	230,237	19,824	145,227	1,034,058
2042	639,174	12,959	233,522	21,325	148,132	1,055,111

Cargo per trade and transport packaging	Export - bulk	Export - general cargo	Import - bulk	Import - general cargo	Domestic - liquid bulk	Total
2043	652,572	13,218	236,871	22,967	151,094	1,076,721
2044	654,191	13,482	240,284	24,763	154,116	1,086,837
2045	655,872	13,752	243,764	26,728	157,199	1,097,315
2046	657,618	14,027	247,312	28,880	160,343	1,108,180
2047	659,430	14,308	250,930	31,237	163,549	1,119,454

Table 4.21. Forecasted transport volumes per cargo group and trade direction – Scenario 1

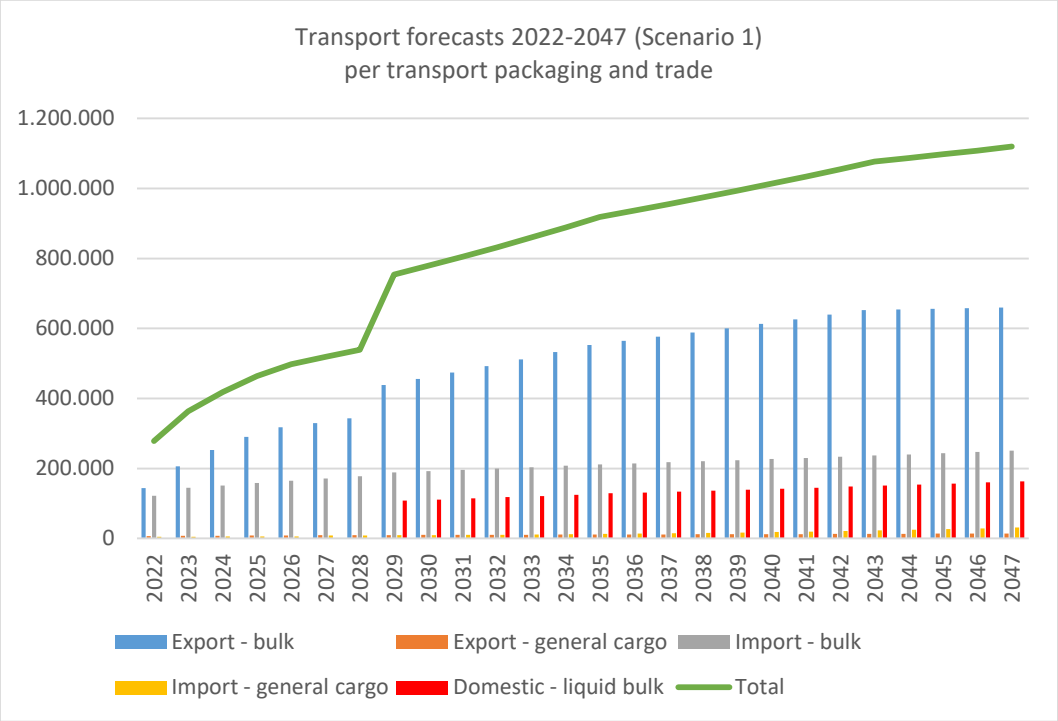

Figure 4.13. Forecasted transport volumes per cargo groups and trade direction – Scenario 1

In **Scenario 2**, the following assumptions and growth rates were adopted:

- **Fertilizers (import)**: in 2022, a drop of -10% is assumed, due to quotas[39] of grain exports introduced by the Government of the Republic of Serbia due to the Ukrainian crisis – these quotas (120,000 tons monthly as a maximum) are expected to cause less sowing in 2022 and therefore lower consumption of fertilizers; in 2023, assuming that the export quotas are abolished, the use of fertilizers is expected to rise immediately at a rate of 30% in 2023; as of 2024 and until 2029, it is assumed that the import of fertilizers will have the same growth as IMF import growth forecast for Serbia; thereafter, from 2030 to 2035 , a rise of 2% in each year is expected. Finally, in the period of 2036-2047, it is expected that the growth rate will be limited to 1% annually, as the maximum absorption rate of the agricultural producers will be near 100% (estimated maximum absorption (demand) of the market in the port's hinterland is 150,000 tons per year in this scenario).

[39] https://www.politika.rs/scc/clanak/505406/Vlada-odobrila-kvote-za-izvoz-zitarica-brasna-i-ulja - last accessed 23 April 2022. The Serbian government approved quotas for the export of wheat, corn, flour and refined sunflower oil. This decision allows the export of 150,000 tons of wheat, 150,000 tons of corn and 20,000 tons of flour per month, while the monthly export quota for refined sunflower oil is 8,000,000 litres. Upon request, it will be possible to ask for permission to export a maximum of 20 percent of the approved quantities per group of products on a monthly basis. In case exporters do not export or exceed the quantities approved, they will not be able to apply for the export permission the following month.

- **Grains (import)**: since Serbia is largely an export country for grains, import of grains is mostly limited to special kinds of grains that are not sowed (in an observed year) in Serbia, such as rye, barley, buckwheat and similar. It is expected that the annual growth rate of import grains remains at 2% annually until 2028 when it will rise for about 30% due to the assumed construction of the grain terminal and additional storage capacities. After that, in 2029 the growth is expected to slow to 5%. From 2030, the growth is expected to remain at a return to steady growth of 2% annually is expected until the end of the forecasting period in 2047.
- **Fertilizers (export)**: Since there are no fertilizer producers in the immediate vicinity of Bačka Palanka, it is expected that this cargo flow will be limited and it will represent a "spill off" from other ports in case of navigational hindrances (e.g. Port of Šabac) or congestion (ports of Pančevo or Novi Sad). Therefore, the annual growth is expected to remain at 5% until 2029 and in the next year it will drop down to 3% and remain steady until the end of the forecasting period.
- **Grains (export)**: in 2022, it is expected that the export quotas cause a drop of -20% in main grains (corn and wheat) exports compared to 2021. In 2023, it is expected that the quotas are abolished and that the growth will recover at a pace of 40% in 2023, 30% in 2024, 10% in 2025 and 2026. In 2027 it is expected that the export growth drops down to 4%. In 2028 a sharp jump in volume growth of 30% is expected due to the assumed construction of the grain terminal and additional storage capacities. In 2029, the growth is expected to return to more usual values, of 5%. In the period of 2030-2035, the growth will stabilize around 4%, while from 2036 to 2047 it will slow down to 3% annually until the maximum production in the hinterland is reached (estimated at 750,000 tons annually in this scenario).
- **Coal (export)**: this cargo is not a typical cargo for the port of Bačka Palanka, but it represents an occasional capture from other nearby ports. The same growth is assumed as in Scenario 1, that is, it is expected to double in 2022 and to grow for 100% every three to four years (due to the habitual formation of transport lots to match the typical barge load of 1000-1200 tons of coal). It is expected to remain below maximum 5,000 tons annually until the end of the forecasting period.
- **Oilseeds (export)**: Since the export of oilseeds, at the moment, is not limited by governmental export quotas, it is estimated that the export of oilseeds in general will follow the IMF export forecasts for Serbia, that is, 6.54% in 2022, 5.54% 2023-2025, 6.04% in 2026 and until the end of the forecasting period. Estimated maximum production in the hinterland of the port is around 90,000 tons/year in this scenario.
- **Ores (import)**: same as in Scenario 1, this cargo is not a typical cargo for the port of Bačka Palanka, but it represents an occasional capture from other nearby ports. It is expected to double in 2025, remaining at that level until 2029 when it is expected to have another growth of 100% (due to the habitual formation of transport lots to match the typical barge load of 1000-1200 tons of coal) and remain at 2029 level until the end of the forecasting period.
- **Coal (import)**: this cargo is imported for the needs of sugar production plans and, to a much lesser extent, for municipal heating plants that are not using natural gas. It is expected that the growth of these cargo flows will follow the IMF import forecasts for Serbia: 6.57% in 2022, 6.07% in 2023, 5.57% in 2024, 5.87% from 2025 to 2029. Thereafter, it is expected that it will drop down to 3% annually until the end of forecasting period in 2047, as it is expected that the users will switch to cleaner energy sources.
- **Oilseeds (imports)**: It is expected that the growth of these cargo flows will follow the IMF import forecasts for Serbia: 6.57% in 2022, 6.07% in 2023, 5.57% in 2024, 5.87% from 2025 to 2027. In 2028, the construction of the new storage capacities and the grain terminal is expected to trigger a

growth of 20% and 10% in 2029 in this scenario. From 2030 to 2047, it is expected that the growth becomes stable at 3% annually.

- **General cargo (imports)**: this occasional cargo is expected to remain at lower levels, starting as low as 2,000 tons in 2022 (approximately two barge loads of various cargo such as machinery parts, plant parts and similar, for the newly established industrial facilities in the 56 ha large planned industrial zone). Thereafter, these cargo flows are expected to follow the IMF import forecasts for Serbia: the growth of these cargo flows will follow the IMF import forecasts for Serbia: 6.07% in 2023, 5.57% in 2024, 5.87% from 2026 until the end of the forecasting period in 2047.
- **Other bulk cargoes (import)**: this cargo represents mostly the components for fertilizers being produced in Šabac (Elixir Zorka) which cannot be unloaded in Šabac due to the restricted navigational conditions on the Sava River. Elixir Zorka has established alternative supply chains through the Port of Bačka Palanka when the Sava River is not navigable. During the interview with the operators of the port, it has been estimated that such cargo could reach the quantity of 10,000 tons in 2022. After that, it is expected that the growth of these cargo flows will follow the IMF import forecasts for Serbia: 6.07% in 2023, 5.57% in 2024, 5.87% from 2025 to 2029. Thereafter, it is expected that it will drop down to 3% annually until the end of forecasting period in 2047.
- **Other bulk cargoes (export)**: this cargo encompasses non-typical grains (other than corn and wheat), that is, rye, buckwheat, oat, barley and similar. During the interview with the operators of the port, it has been estimated that such cargo could reach the quantity of 1,200 tons (one barge load, approximately) in 2022. Thereafter, the growth of this cargo is estimated to follow the IMF export forecasts for Serbia: 5.54 from 2023 to 2026, and 6.04% since 2027 until the end of the forecasting period.
- **Waste materials (export)**: mostly scrap metal, expected to reach 1,200 tons (single barge load) in 2022. Thereafter, the growth of this cargo is estimated to follow the IMF export forecasts for Serbia: 5.54% from 2023 to 2026, and 6.04% since 2027 until the end of the forecasting period.
- **Metallurgical products (import)**: various semi-finished products, mostly destined for the industrial companies being settled in the future industrial zone in Bačka Palanka. It is expected that this cargo flows starts in 2022 with a single barge load (ca. 1,200 t), being doubled every 2-3 years (due to the habitual formation of transport lots to match the typical barge load of 1000-1200 tons of general cargo) until 2030, when it will stabilize and reach 10% of annual growth until 2047.
- **Other occasional bulk and general cargo (import)**: uncategorized import cargo flows of bulk and general cargo are estimated to start with 2,000 tons for each type (2,000 t of bulk cargo imports and 2,000 t of general cargo imports). Thereafter, for both categories, the growth is estimated to follow the IMF import forecasts for Serbia: 6.07% in 2023, 5.57% in 2024, 5.87% from 2025 to the end of the forecast period in 2047.
- **Other occasional bulk and general cargo (export):** uncategorized export cargo flows of bulk and general cargo are estimated to start with 2,000 tons for each type (2,000 t of bulk cargo exports and 2,000 t of general cargo exports). Thereafter, for both categories, the growth is estimated to follow the IMF export forecasts for Serbia: 5.54% from 2023 to 2026, and 6.04% since 2027 until the end of the forecasting period.
- **Liquid cargo (oil derivatives):** it is estimated that the two vessels per week will call the oil terminal in the extended Port of Bačka Palanka, during the 43 weeks of navigation. Each vessel is estimated to carry 1200 tons of oil derivatives, which is a typical barge load for the liquid bulk cargo. This gives 43 x 2 x 1200 = 103,800 tons per year in the starting year of 2028 in this scenario. After that, the growth will remain at 4% (following the GDP forecast) until 2036, when it is expected to drop down to 3% due to market saturation.

Summary of the above analytics in **Scenario 2** is presented in the following table.

Cargo	2022	2023	2024	2025	2026	2027	2028	2029	2030-2035	2036-2047
Fertilizers	-10.00%	30.00%	5.57%	5.87%	5.87%	5.87%	5.87%	5.87%	2.00%	1.00%
Grains	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	30.00%	5.00%	2.00%	2.00%
Export - fertilizers (general cargo)	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	3.00%	3.00%
Export - grains	-20.00%	40.00%	30.00%	10.00%	10.00%	4.00%	30.00%	5.00%	4.00%	3.00%
Export - coal	100%	0.00%	0.00%	100%	0.00%	0.00%	0.00%	100%	2.00%	2.00%
Export - oilseeds	6.54%	5.54%	5.54%	5.54%	6.04%	6.04%	6.04%	6.04%	6.04%	6.04%
Ores	0.00%	0.00%	0.00%	100%	0.00%	0.00%	0.00%	100%	0.00%	0.00%
Coal	6.57%	6.07%	5.57%	5.87%	5.87%	5.87%	5.87%	5.87%	3.00%	3.00%
Oilseeds	6.57%	6.07%	5.57%	5.87%	5.87%	5.87%	20.00%	10.00%	3.00%	3.00%
General cargo	2,000	6.57%	6.07%	5.87%	5.87%	5.87%	5.87%	5.87%	5.87%	5.87%
Other bulk cargo	10,000	6.07%	5.57%	5.87%	5.87%	5.87%	5.87%	5.87%	3.00%	3.00%
Export - other bulk cargo	1,200	5.54%	5.54%	5.54%	6.04%	6.04%	6.04%	6.04%	6.04%	6.04%
Export - Waste materials	1,200	5.54%	5.54%	5.54%	6.04%	6.04%	6.04%	6.04%	6.04%	6.04%
Metallurgical products	1,200	0.00%	100%	0.00%	0.00%	100%	0.00%	0.00%	10.00%	10.00%
Other occasional bulk cargo	2,000	6.07%	5.57%	5.87%	5.87%	5.87%	5.87%	5.87%	5.87%	5.87%
Other occasional general cargo	2,000	6.07%	5.57%	5.87%	5.87%	5.87%	5.87%	5.87%	5.87%	5.87%
Export - Other occasional bulk cargo	2,000	5.54%	5.54%	5.54%	6.04%	6.04%	6.04%	6.04%	6.04%	6.04%
Export - Other occasional general cargo	2,000	5.54%	5.54%	5.54%	6.04%	6.04%	6.04%	6.04%	6.04%	6.04%
Liquid cargo (oil derivatives)	0	0	0	0	0	0	108,000	4.00%	4.00%	3.00%

Table 4.22. Assumptions and estimates of growth rates for different types of cargo in Scenario 2

Based on the above assumptions and estimates, the forecast for the transshipment volumes in the Port of Bačka Palanka, for the period 2022-2047, **Scenario 2**, are given in continuation.

Cargo and trade direction	2022	2023	2024	2025	2026	2027	2028	2029
Fertilizers (bulk)	77,184	100,340	105,929	112,149	118,734	125,706	133,088	140,902
Grains (bulk)	3,012	3,072	3,134	3,196	3,260	3,326	4,323	4,539
Export - fertilizers (general cargo)	5,249	5,511	5,787	6,076	6,380	6,699	7,034	7,386
Export - grains (bulk)	162,812	227,937	296,318	325,949	358,544	372,886	484,752	508,989
Export - coal (bulk)	2,124	2,124	2,124	4,248	4,248	4,248	4,248	5,000
Export - oilseeds (bulk)	16,119	17,012	17,955	18,949	20,093	21,307	22,594	23,958
Ores (bulk)	1,080	1,080	1,080	2,160	2,160	2,160	2,160	4,320
Coal (bulk)	24,038	25,497	26,917	28,497	30,170	31,941	33,816	35,801
Oilseeds (bulk)	13,406	14,220	15,012	15,893	16,826	17,814	21,376	23,514
General cargo	2,000	2,131	2,261	2,394	2,534	2,683	2,840	3,007
Other bulk cargo	10,000	10,607	11,198	11,855	12,551	13,288	14,068	14,894

Cargo and trade direction	2022	2023	2024	2025	2026	2027	2028	2029
Export - Other bulk cargo	1,200	1,266	1,337	1,411	1,496	1,586	1,682	1,784
Export - Waste materials (bulk)	1,200	1,266	1,337	1,411	1,496	1,586	1,682	1,784
Metallurgical products (general)	1,200	1,200	2,400	2,400	2,400	4,800	4,800	4,800
Other occasional bulk cargo	2,000	2,121	2,240	2,371	2,510	2,658	2,814	2,979
Other occasional general cargo	2,000	2,121	2,240	2,371	2,510	2,658	2,814	2,979
Export - Other occasional bulk cargo	2,000	2,111	2,228	2,351	2,493	2,644	2,803	2,973
Export - Other occasional general cargo	2,000	2,111	2,228	2,351	2,493	2,644	2,803	2,973
Liquid cargo (oil derivatives)	0	0	0	0	0	0	108,000	112,320
Total	**328,625**	**421,729**	**501,721**	**546,032**	**590,900**	**620,632**	**857,696**	**904,900**

Table 4.23.Forecasts of transport volumes in Scenario 2 (part 1/4)

Cargo and trade direction	2030	2031	2032	2033	2034	2035	2036	2037
Fertilizers (bulk)	143,720	146,595	149,527	152,517	155,568	158,679	160,266	161,868
Grains (bulk)	4,630	4,723	4,817	4,914	5,012	5,112	5,214	5,319
Export - fertilizers (general cargo)	7,607	7,835	8,071	8,313	8,562	8,819	9,083	9,356
Export - grains (bulk)	529,349	550,523	572,544	595,446	619,263	644,034	663,355	683,256
Export - coal (bulk)	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Export - oilseeds (bulk)	25,405	26,939	28,566	30,291	32,120	34,060	36,117	38,298
Ores (bulk)	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320
Coal (bulk)	36,875	37,981	39,121	40,294	41,503	42,748	44,031	45,352
Oilseeds (bulk)	24,219	24,946	25,694	26,465	27,259	28,077	28,919	29,787
General cargo	3,184	3,371	3,569	3,778	4,000	4,235	4,484	4,747
Other bulk cargo	15,340	15,801	16,275	16,763	17,266	17,784	18,317	18,867
Export - Other bulk cargo	1,891	2,005	2,127	2,255	2,391	2,536	2,689	2,851
Export - Waste materials (bulk)	1,891	2,005	2,127	2,255	2,391	2,536	2,689	2,851
Metallurgical products (general)	5,280	5,808	6,389	7,028	7,730	8,503	9,354	10,289
Other occasional bulk cargo	3,154	3,339	3,535	3,742	3,962	4,194	4,441	4,701
Other occasional general cargo	3,154	3,339	3,535	3,742	3,962	4,194	4,441	4,701
Export - Other occasional bulk cargo	3,152	3,342	3,544	3,758	3,985	4,226	4,481	4,752
Export - Other occasional general cargo	3,152	3,342	3,544	3,758	3,985	4,226	4,481	4,752
Liquid cargo (oil derivatives)	116,813	121,485	126,345	131,399	136,654	142,121	146,384	150,776
Total	**938,137**	**972,700**	**1,008,647**	**1,046,038**	**1,084,935**	**1,125,404**	**1,158,065**	**1,191,842**

Table 4.24. Forecasts of transport volumes in Scenario 2 (part 2/4)

Cargo and trade direction	2038	2039	2040	2041	2042	2043	2044	2045
Fertilizers (bulk)	163,487	165,122	166,773	168,441	170,125	171,827	173,545	175,280
Grains (bulk)	5,425	5,533	5,644	5,757	5,872	5,990	6,109	6,232
Export - fertilizers (general cargo)	9,637	9,926	10,223	10,530	10,846	11,171	11,507	11,852
Export - grains (bulk)	703,753	724,866	746,612	750,000	750,000	750,000	750,000	750,000
Export - coal (bulk)	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Export - oilseeds (bulk)	40,611	43,063	45,664	48,421	51,346	54,446	57,734	61,221
Ores (bulk)	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320
Coal (bulk)	46,712	48,114	49,557	51,044	52,575	54,152	55,777	57,450
Oilseeds (bulk)	30,681	31,601	32,549	33,525	34,531	35,567	36,634	37,733
General cargo	5,026	5,321	5,633	5,964	6,314	6,685	7,078	7,493

Cargo and trade direction	2038	2039	2040	2041	2042	2043	2044	2045
Other bulk cargo	19,433	20,016	20,616	21,235	21,872	22,528	23,204	23,900
Export - Other bulk cargo	3,023	3,206	3,399	3,605	3,822	4,053	4,298	4,558
Export - Waste materials (bulk)	3,023	3,206	3,399	3,605	3,822	4,053	4,298	4,558
Metallurgical products (general)	11,318	12,450	13,695	15,064	16,571	18,228	20,051	22,056
Other occasional bulk cargo	4,977	5,269	5,579	5,906	6,253	6,620	7,008	7,420
Other occasional general cargo	4,977	5,269	5,579	5,906	6,253	6,620	7,008	7,420
Export - Other occasional bulk cargo	5,039	5,343	5,666	6,008	6,371	6,755	7,163	7,596
Export - Other occasional general cargo	5,039	5,343	5,666	6,008	6,371	6,755	7,163	7,596
Liquid cargo (oil derivatives)	155,299	159,958	164,757	169,699	174,790	180,034	185,435	190,998
Total	**1,226,780**	**1,262,926**	**1,300,331**	**1,320,039**	**1,337,055**	**1,354,806**	**1,373,333**	**1,392,682**

Table 4.25. Forecasts of transport volumes in Scenario 2 (part 3/4)

Cargo and trade direction	2046	2047
Fertilizers (bulk)	177,033	178,803
Grains (bulk)	6,356	6,483
Export - fertilizers (general cargo)	12,207	12,574
Export - grains (bulk)	750,000	750,000
Export - coal (bulk)	5,000	5,000
Export - oilseeds (bulk)	64,918	68,839
Ores (bulk)	4,320	4,320
Coal (bulk)	59,174	60,949
Oilseeds (bulk)	38,865	40,031
General cargo	7,933	8,399
Other bulk cargo	24,617	25,355
Export - Other bulk cargo	4,833	5,125
Export - Waste materials (bulk)	4,833	5,125
Metallurgical products (general)	24,261	26,688
Other occasional bulk cargo	7,855	8,316
Other occasional general cargo	7,855	8,316
Export - Other occasional bulk cargo	8,055	8,541
Export - Other occasional general cargo	8,055	8,541
Liquid cargo (oil derivatives)	196,728	202,630
Total	**1,412,899**	**1,434,035**

Table 4.26. Forecasts of transport volumes in Scenario 2 (part 4/4)

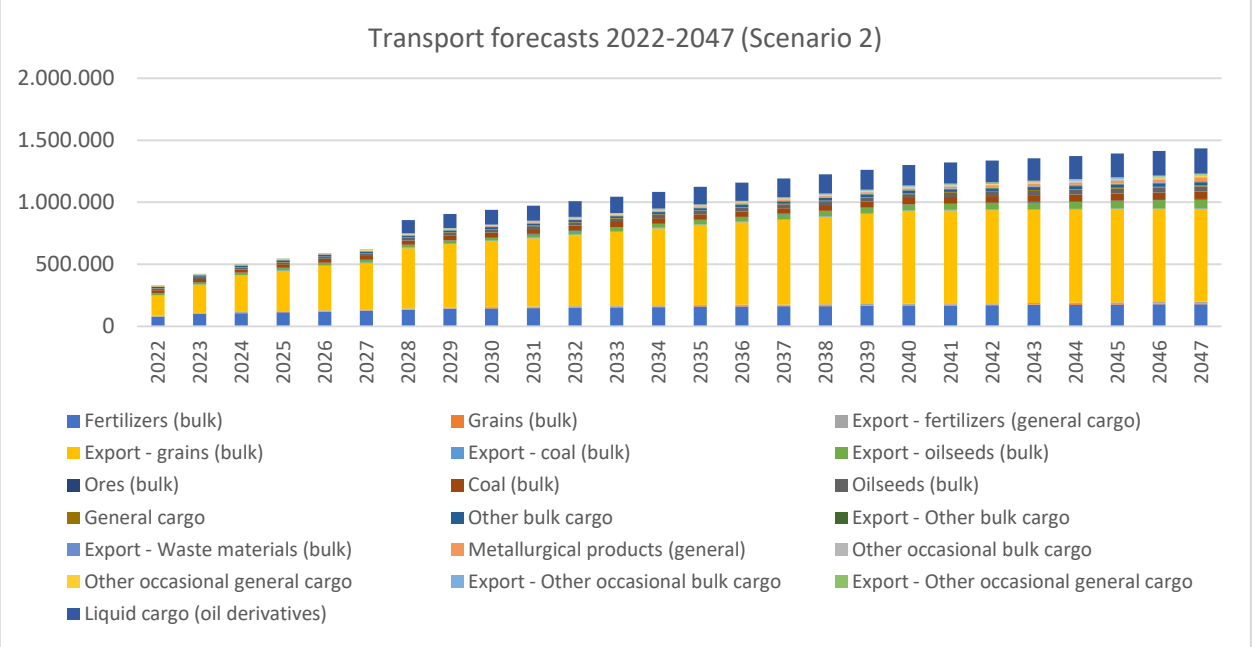

Figure 4.14. Forecasts of transport volumes in Scenario 2

The forecasted volumes are given in a different format in the summary table and figure below.

Cargo per trade and transport packaging	Export - bulk	Export - general cargo	Import - bulk	Import - general cargo	Domestic - liquid bulk	Total
2022	185,255	7,249	130,720	5,100	0	328,325
2023	251,528	7,622	156,937	5,353	0	421,440
2024	321,098	8,015	165,509	6,700	0	501,321
2025	354,108	8,427	176,122	6,958	0	545,615
2026	388,134	8,873	186,212	7,237	0	590,456
2027	404,006	9,343	196,892	9,733	0	619,973
2028	517,495	9,837	208,196	10,046	108,000	853,574
2029	544,205	10,358	225,937	10,378	112,320	903,198
2030	566,390	10,685	231,217	11,168	116,813	936,274
2031	589,498	11,026	236,633	12,024	121,485	970,667
2032	613,571	11,382	242,186	12,950	126,345	1,006,434
2033	638,649	11,753	247,881	13,952	131,399	1,043,633
2034	664,773	12,140	253,723	15,037	136,654	1,082,327
2035	691,990	12,543	259,714	16,212	142,121	1,122,581
2036	713,906	12,965	264,273	17,486	146,384	1,155,014
2037	736,557	13,405	268,943	18,867	150,776	1,188,548
2038	759,972	13,865	273,728	20,364	155,299	1,223,227
2039	784,177	14,346	278,630	21,988	159,958	1,259,100
2040	809,203	14,849	283,655	23,750	164,757	1,296,213
2041	816,069	15,375	288,805	25,663	169,699	1,315,610
2042	819,757	15,925	294,084	27,739	174,790	1,332,296
2043	823,668	16,501	299,497	29,995	180,034	1,349,694
2044	827,815	17,103	305,047	32,446	185,435	1,367,847

Cargo per trade and transport packaging	Export - bulk	Export - general cargo	Import - bulk	Import - general cargo	Domestic - liquid bulk	Total
2045	832,212	17,735	310,740	35,110	190,998	1,386,795
2046	836,875	18,396	316,579	38,006	196,728	1,406,585
2047	841,819	19,090	322,570	41,156	202,630	1,427,265

Table 4.27. Forecasted transport volumes per cargo group and trade direction – Scenario 2

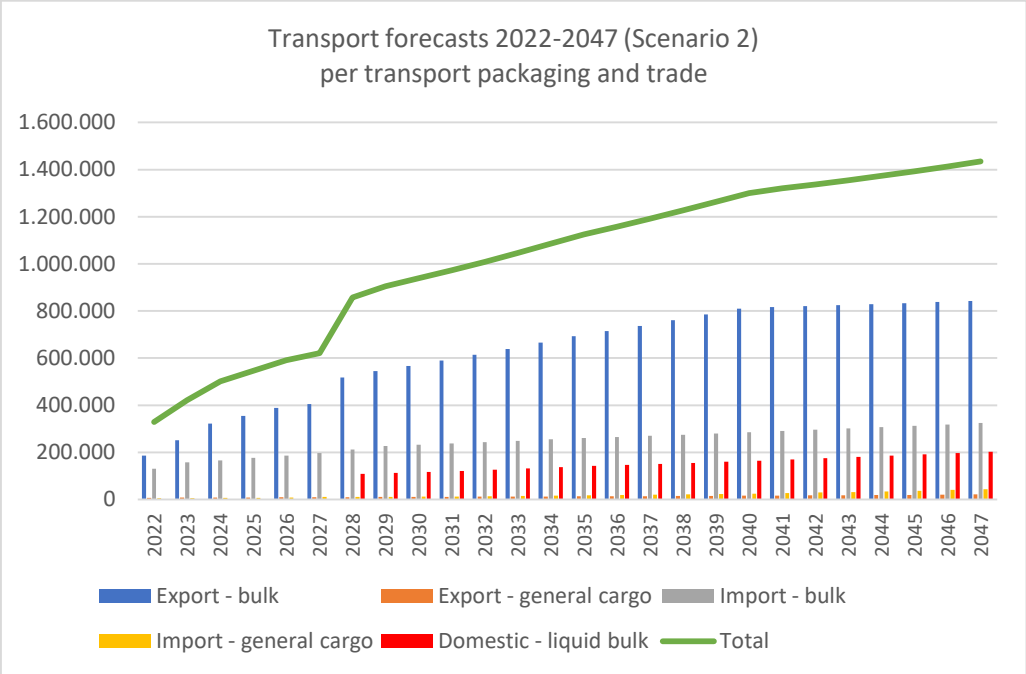

Figure 4.15. Forecasted transport volumes per cargo groups and trade direction – Scenario 2

Summarizing, the maximum cargo volume, at the end of the forecast period in 2047, reaches 1,119,454 tons in Scenario 1 and 1,434,035 tons in Scenario 2.

5 ASSESSMENT OF THE RELEVANT SPATIAL/URBAN DEVELOPMENT PLANS

5.1 The General regulation plan with elements of the Detailed regulation of block number 106 in Bačka Palanka

The General regulation plan with elements of the Detailed regulation of block number 106 in Bačka Palanka ("Official gazette of the municipality Bačka Palanka ", no 18/2007) and the General Regulation Plan of the settlement of Bačka Palanka ("Official gazette of the municipality Bačka Palanka ", no, 16/11 and 22/12) foresee a construction of new port capacities and expansion of the current port.

The planning basis for completion of the above-mentioned regulation plans are contained in the following higher ranged documents:

- The Spatial Plan of the Republic of Serbia ("Official Gazette of the Republic of Serbia", No. 13/96)

- The Spatial Plan of the Municipality of Bačka Palanka ("Official Gazette of the Municipality of Bačka Palanka", No. 7/2003)

The General regulation plan with elements of the Detailed regulation of block number 106 in Bačka Palanka has been put out of force because this work zone is equipped to a very small extent.

The existing port is the backbone of any new planning solution. In the hinterland and surroundings of the port, there is enough space for the development and expansion of the existing port.

General regulation plan with elements of the Detailed regulation of block number 106 in Bačka Palanka (hereinafter referred to as "the Plan") was analyzed in this study, considering the fact that the New Detailed Regulation Plan is not being prepared.

The existing port area defined by the Decree on Determination the port area of the Bačka Palanka („Official gazette of the Republic of Serbia“ no. 05/2016) is in accordance with the above-mentioned urban planning documentation andcovers cadastral lots no. 11041, 11042, 11043, 11045, 11046, 11047, 11049, 7234/6и 23374/2in the Cadastral municipality Bačka Palanka covering 74ha 17a 13m^2 surface area .

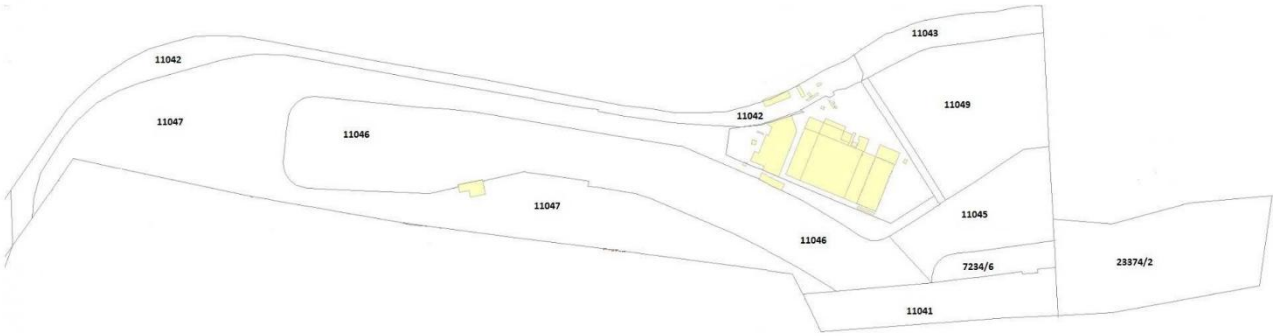

Figure 5.1. Determination of port area in Bačka Palanka[40]

The insight into the electronic cadastre determines that cadastral parcels number 11042 and 11047, total area 30ha 04a 52m2 represent constructed cadastral lots, while the remaining lots represent undeveloped land, which according to urban planning documentation is planned for he extansion of the port capacity.

The area contained in Plan 106 covers mostly a territory, and less anaquatorium of the Danube River.

[40](„Official gazette of the Republic of Serbia“ no. 05/16)

In the subject area contained in Plan 106, on the public construction land it is planned s follows: road corridors, railway corridor and embankment of the first line of defense against the high waters of the Danube and the Danube river aquatorium (without the port area aquatorium).

The Other land within this Plan consists of port terminals, warehousing and transshipment areas, business and management center and protective greenery.

The facilities, i.e. the subsystems of the port of Bačka Palanka which are planned at the location in the port area are as follows:

- Business management system;
- Liquid cargo terminal;
- Grain terminal and terminal of other goods that can be stored other than grain and agricultural products;
- Bulk cargo terminal;
- Production plants - systems for production, storage and transshipment;
- Container terminal;
- HUCKE-PACK terminal;
- RO-RO terminal;
- Supporting activities of the center.

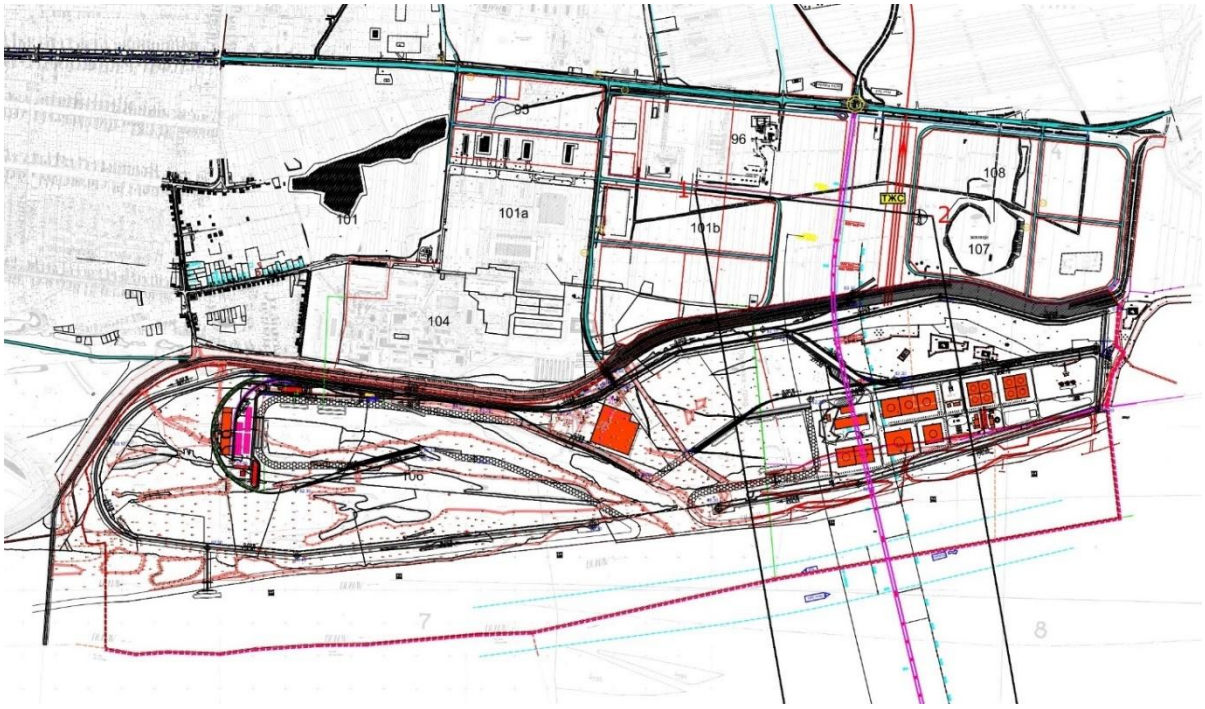

Figure 5.2. The boundary covers the General regulation plan with elements of the Detailed regulation of block number 106 in Bačka Palanka[41]

5.2 Functional units (zones)

As a result of the impact of a natural and created conditions, as well as developing factors in the future spatial-functional structure of the subject space, 8 functional units (zones) will be represented.

[41] ("Official gazette of the municipality Bačka Palanka ", no, 16/11 and 22/12)

The scope of the Plan is divided into the following functional units-zones:

The functional units of the remaining part of the construction land:

1. Terminal zone

2. Zone of storage-production-transshipment areas

3. Port business management center zone

4. Aquatorium of the international port "Bačka Palanka"

The functional units of public construction land:

1. Embankment zone of the 1st line of defense against the high waters of the Danube

2. Zone of infrastructure corridors

3. Aquatorium of the Danube River Basin 6

4. Protective green area

5.2.1 The terminal zone of the port of Bačka Palanka

The planned zone of the port terminal zone is part of the other construction land and includes three subunits:

- Zone 1 - Liquid cargo terminal
- Zone 2 - Bulk cargo terminal and Container terminal
- Zone 3 - Grain terminal and terminal of other goods that can be stored other than grain and agricultural products

The construction of the terminals for loading/unloading, processing and storage of various cargo is planned within this areas. The construction of various facilities, technological units and infrastructure is also planned in accordance with the use of the area and planned capacities. Besides, it is planned to connect the terminals to the public communal infrastructure.

This Plan defines the activities for the functioning of the zone 1 and 3, ant the Urban master plan defines the activities related to the zone 2.

5.2.2 The storage-production-transshipment zone

Zone 4 - Zone for the production of artificial fertilizers

Zone 5 - Planned zone

In zone 4, there is an existing production plant for the production of artificial fertilizers, which includes the following facilities:

- warehouse for storage of bulk ready-made fertilizers,

- plant for mixing of artificial fertilizers,

- packing facility,

- canopy,

- canopy facility for packing ready-made fertilizers,

- concrete base plant,

- energy facility (TS),

- weighbridge,

- tower for lighting and advertising purposes.

Zone 5 is planned as a construction zone for:

- facilities for production lines and storage;

- facilities and areas for providing of freight forwarding services: freight forwarding organizations (organization of commercial transport services, storage, packaging and other intermediary activities between the holder of goods and services);

- facilities and areas for providing storage services: storage organizations (storage of various forms of goods, transshipment, packaging, unpacking of goods, processing, processing and finishing of goods, commissioning, etc., specialized storage, heavy items, cold storage, etc.);

- specialized transshipment terminals: HUCKE-PACK terminals and RO-RO terminals for handling services.

The setting up, construction and reconstruction in zone 4 will be defined by the Excerpt from the Plan or the Urban Project. The arrangement and construction in zone 5 will be defined by the Urban Project.

5.2.3 The business-management center zone of the port Bačka Palanka

This zone system contains following subsystems and facilities: port management, information system, stock and information exchange, representatives of business, trade and service companies, forwarding, post office, import-export companies, security system, motel, hotel, restaurant, car parking loot etc.

If needed, there is always a possibility to set up certain special and significant services and facilities: port authority, custom services, border police, storage facility properly fenced for the cargo under custom supervision and control. All those services and facilities necessary for the Zone 6 functioning will be defined by the Urban master plan.

5.2.4 The aquatorium of the international port Bačka Palanka

This zone contains existing and planned aquatorium of the port Bačka Palanka. The existing aquatorium is planned for expansion and reconstruction: a new vertical and slope quay will be added, as well as ramp for Ro-Ro ships and ramp for ferryboat. This aquatorium is spatially and functionally connected with the grain terminal and storage-processing-transshipment areas of the port Bačka Palanka. A planned aquatorium of the port Bačka Palanka will be spatially and functionally connected with the liquid cargo and the bulk cargo terminals. A construction of a vertical and a slope quay is also planned.

5.2.5 The embankment zone of the first defensive line against Danube high waters

This zone actually is the existing corridor zone of the embankment of the first defensive line against Danube high water which is within this Plan. The planned capacities of the port Bačka Palanka do not by any mean change the basic functioning of the first defensive line against Danube high waters.

5.2.6 The infrastructure corridors zone

The infrastructure corridors zone contains road areas in its planned and regulated width for the public use and purpose of setting up traffic, hydrotechnical, energy and other planned communal infrastructure.

The railway corridor is mainly planned to form a rail belt for the construction of railway track – industrial rail track – between the existing rail track at railway station Bačka Palanka and the international port Bačka Palanka and all activities and facilities within the port. Along all road corridors there will be hydrotechnical communal installations accessible for connection of all planned complexes and facilities.

The road greenery is planned within the public traffic corridors matching the road profile width. A grass cover is planned for all area except the public traffic lines and railway track.

5.2.7 The zone of the aquatorium of the river Danube

This zone contains the aquatorium of the river Danube and its sector within Plan between the river bank and nut river. In this zone there is a part of the Danube waterway size in total of 200 m.

5.2.8 The protective greenery zone

The protective greenery zone will consist of the existing greenery in inundation within border parts of the area foreseen by Plan.

5.3 **The traffic infrastructure**

The block 106 belongs to the area complex of the south-east industrial zone in Bačka Palanka. Within tis area complex there are already existing facilities compatible with the dock activities (areas for bulk and general purpose cargo) with infrastructure for transshipment and manipulation and already built internal traffic lines and traffic-manipulative plateau. The existing traffic network is already in the function for the input-output goods processed and packed within the existing functional area set up.

The contemporary trends in the transportation market impose an integral approach to the organization of all transportation forms (waterway, road and railroad). All spatial and urban analysis have confirmed a possibility of an implementation of these system in the planned area achieving a high level of a traffic services for all parties involved.

5.4 **The road traffic**

The port Bačka Palanka has a favorable spatial micro location as it is directly connected with the corridor 10, ie with the relevant traffic corridors in the vicinity of the highway E-75 (30-40 km) and the highway e-70 (35 km)

The port Bačka Palanka is located in the southeast of the industrial zone within the Block 106 and it is actually already connected with the surrounding area with access road in the industrial zone. This particular

traffic capacity connects this area with the state road of the second rank – magistral road Bačka Palanka – Novi Sad which enable a spatial connection with the surrounding area nd it is connected with the road network of Vojvodina of various hierarchically ranks.

This access road in the existing condition enables accessibility to all road transportation vehicles and it will stay as such in the future accumulating all internal traffic in the area.

As the urban area and existing bike paths of Bačka Plananka are in a close vicinity, it is actually expected that the large number of employees will use this transportation form.

5.4.1 The railway traffic

There is no railway traffic within Block 106 complex and its surrounding. The closest railway track is at the railway station Bačka Palanka and existing spatial disunity of settlements prevents direct connection of the railway track with planned complex. Therefore, an industrial rail track for the port Bačka Palanka will lead from the open track Gajdobra – Bačka Palanka under uneven crossing with the magistral road (before the overpass from Gajdobra direction). An industrial rail track will lead to the port across the shunting station which is to be set up just before a protective embankment of the port complex.

A parent track for connection with the port will be built using rail Type 49 with a basic spatial elements (a rail radius of minimum 180 m) with all accompanying safety braking and turning systems.

A railway track within the port Bačka Palanka is spatially configurated in a shape of a one approaching and two circumferential (interconnected) industrial rail tracks, that is, with only one parent track which serves for all planned activities.

The functioning of a planned railway traffic should enable optimal conditions to form regular and correct connection with all other traffic forms.

5.4.2 The waterway traffic

The international port Bačka Palanka is connected with the international waterway – the river Danube - by direct access to the waterway across the aquatorium part which is functioning as navigational and needs to have a same navigational size and characteristics.

5.4.3 The internal traffic and manipulative areas

All planned zone will be circumferentially connected with public traffic utilities by a system of the internal traffic lines. A complete traffic system will enable efficient functioning of all subsystems within the zones providing a high traffic – transshipping – manipulative services with optimal and safe both internal and public traffic.

5.5 **The future steps**

To increase the capacity of Bačka Palanka port it is necessary to obtain corresponding technical documentation in accordance with the Law on planning and construction („The official gazette of the Republic of Serbia, no. 72/2009, 81/2009, 64/2010, 24/2011, 121/2012, 42/2013, 50/2013, 98/2013,132/2014 and 145/2014):

New Detailed regulation plan:

Draft disposition plan for obtaining location preconditions,

Feasibility study with conceptual design,

Technical documentation for obtaining construction permit,

All companying elaborates defined by the Law for the level of draft master plan (elaborate on fire protection, elaborate on geotechnical preconditions for construction).

6 SCENARIOS FOR PORT DEVELOPMENT

6.1 Institutional framework

In the Republic of Serbia, governance and exploitation of ports are regulated by the Law on Navigation and Ports on Inland Waters[42] (hereinafter: LNPIW). This Law stipulates that the port system in the Republic of Serbia is established according to a landlord port management model. This means that the public body, in this case Port Governance Agency acts as a port authority (in case of Serbia – national port authority), governing ports without any commercial exploitation of them, while private port operators operate ports under concession agreement or operating authorization.

6.1.1 Port concession as a recommended model for port development

In accordance with the basic goals of the European transport policy, as well as the Strategy on development of waterborne transport of the Republic of Serbia for the period 2015 – 2025[43], the volume of transport of goods on inland waterways is expected to increase to a total of 18 % compared to other modes of transport. In order to achieve this goal, it is necessary to improve the transport infrastructure on the network of inland waterways of the Republic of Serbia.

One of the options to develop transport infrastructure, and in this case port infrastructure, are port concessions. Apart from the LNPIW, port concessions are regulated also by the Law on Public-Private Partnership and Concessions[44] (hereinafter the PPP Law). Concessions are widely used in the port sector and subsequently represent a type of structure that is familiar to the established and diversified port operators.

Since investors and port operators around the world have a relatively good understanding of concession models, those interested in the development of the extended Port of Bačka Palanka are likely to be attracted to such a structure, ensuring that a sufficient number of potential investors participate in the process, thus contributing to competitive bidding (which will positively affect commercial terms offered by potential concessionaires).

A successfully implemented concession concept will also send a positive signal to the market, and ultimately increase interest for other port concessions in Serbia that are planned for implementation in the coming period allowing for the further development of both international as well as domestic waterborne transport.

Selection of a reliable port concessionaire will ensure that the extended Port of Bačka Palanka becomes part of larger supply chains, which would ensure the potential for increased traffic development as well as creation of a modern logistic hub primarily intended to serve the needs of agriculture industry and then to serve as a potential multimodal hub for its hinterland. Increased traffic in the Port of Bačka Palanka will be an economic development driver with positive socio-economic impact for the region of Bačka Palanka and wider, allowing it to realize its economic potential.

[42] Official Gazette of the Republic of Serbia", nr. 73 from 12 October 2010, 121 from 24 December 2012, 18 from 13 February 2015, 96 from 26 November 2015 – other law, 92 from 14 November 2016, 104 from 23 December 2016 – other law, 113 from 17 December 2017 – other law, 41 from 31 May 2018, 95 from 8 December 2018 – other law, 37 from 29 May 2019 – other law, 9 from 4 February 2020.
[43] "Official Gazette of RS", no. 3/15
[44] "Official Gazette of RS", no. 88/2011

Financially speaking, the concession will allow the Republic of Serbia to collect annual payments from the Concessionaire for the duration of the concession contract in the manner and under the conditions as will be provided for in the contract. Fixed and variable concession fee payments could serve as additional funds that could be used for further development of the Serbian infrastructure.

Another key reason for the development of concession is that this structure would allow the Republic of Serbia to retain ownership of the new terminals in the port. Following the end of the concession term, the Republic of Serbia would obtain full control of the new terminals (within the extended port) with a new, modern suprastructure and management model set according to the highest market principles.

According to Law on Navigation and Ports on Inland Waters, a port concession represents one of the two legal bases for conducting port activities.

A port concession is defined as a right acquired by a contract governing the provision of:

a) a port concession for services with the right to commercially use a specific service, or
b) a port concession for public works with the right to commercially use the works performed, or
c) simultaneous performance of port services and the construction of port buildings and facilities, with the obligation to maintain port infrastructure,

which is assigned by the the Ministry of Construction, Transport and Infrastructure (Ministry) to a domestic or foreign legal entity for a definite period of time, under specially stipulated conditions, against payment of a concession fee by the concessionaire who assumes the risk related to the commercial use of the subject of concession. Commercial risk in the use of works or services includes demand risk or supply risk or both demand and supply risk.

Under the Law on Navigation and Port of Inland Waters, the Ministry is the entity having the authority to engage into the concession agreement for a port in question. The mechanism for awarding the port concession will be controlled by the Law on Navigation and Ports on Inland Waters as well as the PPP Law, with the private partner/concessionaire being selected through a tender procedure as required by the PPP Law.

The PPP Law defines concessions in a complementary way: as PPPs with elements of concession as a "contractual or institutional PPP" whereby a public contract regulates the commercial use of a natural asset, a resource in general use that is in public ownership or a resource owned by a public authority, i.e. performing activities of general interest, which the public partner transfers to the private partner, for a certain period of time, under special conditions, with payment of concession fee by the private or public partner, and the private partner assumes the risk related to commercial use of the concession subject".

The PPP Law also regulates two types of special concessions:

- concession for public works and
- concession for public services.

From the aforementioned, a classic concession will mean that the concession fee is paid by either a public / private partner, and the private partner will have the right to use its subject commercially.

If the subject of the concession is the simultaneous performance of port service and construction of port buildings and facilities, the provisions of the Law on Navigation and Inland Ports and the, the PPP Law and the Law on Public Procurement shall apply to the procedure of granting a port concession

In terms of the concession duration, if the subject of the concession is the simultaneous performance of port service and construction of port buildings and facilities, the Law on Navigation and Ports on Inland Waters does not prescribe the term for which the port concession may be granted (unlike for other types of port concessions) refers to the period prescribed under the PPP Law. As the PPP Law prescribes a minimum of 5 to a maximum of 50 years of concession contract, 50 years period would be the maximum period for such type of concession.

In the concrete case of the Port of Bačka Palanka, it is recommended that the public partner, that is, the Government of the Republic of Serbia with its Ministry of Construction, Transport and Infrastructure invests in port infrastructure, while the construction of the suprastructure and equipping of the port for operations can be granted to a potential port operator as a concession.

Therefore, the form of concession recommended for the Port of Bačka Palanka extension encompasses the following (among others):

- provision of port services;
- construction of port superstructure, and
- maintenance of port infrastructure.

Such structure falls under the scope of a concession as defined under the Law on Navigation and Ports on Inland Waters.

Further details on concession procedures, scope and subject, selection of the concessionaire are subject of the special concession study which is a legal requirement for each concession of capital infrastructure.

6.1.2 Alternative model for port development

Beside the concession agreement, the Law on Navigation and Ports on Inland Waters enables port operators to operate ports under operating authorization.

Same Law has foreseen the possibility for public side (port authority) to give port operator the right for the construction of port infrastructure and/or superstructure, either through the separate contract or Annex of the existing contract (permit). Basically, same principles are applied as in the case of port concession, but some specifics of the port sector transition were taken into account.

In the concrete case of the Port of Bačka Palanka, existing operator has certain rights on the part of the port land, even though it is owned by the state. In case the port operator is interested in investment in further port development, beside the Annex of the existing contract on providing port services, financing agreement should be signed. According to the law, constructed infrastructure would be directly transferred to the ownership of the state, and port operator would be granted with the time limited right to use this infrastructure, while superstructure could remain the ownership of the port operator.

6.2 Proposed new capacities in function of transport forecast

According to the Strategy for the Development of Waterborne Transport of the Republic of Serbia 2015-2025[45] (hereinafter: the Strategy), the port development plans in Bačka Palanka are strategically oriented towards the construction of a container terminal, a liquid cargo terminal, as well as a grain transshipment and storage terminal. In order to enable the construction of these terminals, it is necessary to build a

[45] Official Gazette of the Republic of Serbia, no. 3 of 14 January 2014.

coastal fortification and a vertical quay in the length of 480 m, a grain silo with a capacity of 60,000 tons, procurement of new handling equipment to increase capacity, and construction of industrial tracks to connect this port with the national railway. network. The realization of the subject plans is conditioned primarily by the degree of economic activity in the region, as well as the expansion of the port area in accordance with the provisions of the Law on Navigation and Ports on Inland Waters.

However, since the transport forecast did not foresee any sufficient quantities of cargoes that are easily containerizable, this study will recommend the following reorganisation and expansion of the Port of Bačka Palanka:

- Existing port facilities should become a multipurpose terminal, where primarily fertilizers (in bulk and in big bags as general cargo) and general cargoes are transshipped;
- Liquid cargo terminal for handling of oil derivatives;
- Grains terminal for transshipment and handling of all sorts of grains.

At the multipurpose terminal, all sorts of cargoes can be handled, including containers, if they appear at any time in the future. Logically, a more detailed market study and more detailed forecast that are planned to be done in the later design stages (e.g. full fledged feasibility study) will provide additional and more precise directions on which terminals are more justified to be constructed.

6.2.1 Infrastructure

Port of Bačka Palanka should be strategically oriented towards building a liquid cargo terminal and a grains handling and storage terminal and towards converting existing terminal into multipurpose terminal.To do this, it is essential to build a vertical and semi-vertical quay of 360 m length.

It is necessary to construct industrial railway trucks in order to connect this port with the national railway network.

Liquid cargo terminal

For the movement of liquid cargo (crude oil and derivatives) pumping equipment is proposed at the terminal. Access to the terminal for crude oil and derivatives has to be marked with the waterway signs and markings for day and night navigation supported by berthing rules, signaling and reporting requirements as well as prevention of pollution of water and disposal of waste.

On the operational quay of the Liquid Cargo Terminal, the construction of a semi-vertical quay wall, a pontoon on piles (dolphins) with an access bridge and a system of protection against the spread of spilled fuel is planned.

All equipment necessary for movement of liquid cargo and auxiliary devices should be installed on the pontoon. In order to protect the quay construction and equipment from the impact of the vessel during docking, the front beam and the front piles of the quay are protected by rubber bumpers. The exact shape and dimensions of the pontoon, the layout and number of piles, depend on the adopted equipment.

The access bridge between the quay wall and the pontoon serves for carrying pipelines, fire-fighting and other equipment necessary for the safe process of refuelling. For protection against the spread of spilled fuel, a floating dam is provided. Dam is made of polyester-based laminate, reinforced with glass fibbers with a surface layer resistant to liquid cargoes. Flexible connections are used to connect the dam to the pier, which prevents the dam from breaking and sinking during waves. Floating trolleys on rails adjust the

dam to changes in water levels and are used to connect the dam with the sloping quay. The positioning of the dam is provided with appropriate concrete weights.

Collection of spilled oil is provided by appropriate equipment and depends on the applied method and the manufacturer. A warehouse for the collection of spilled oil, as well as hazardous waste (oily absorbents) is planned to be built and will serve for the temporary disposal of funds until they will be handed over to an authorized operator.

Within the Liquid Cargo Terminal Liquid cargo storage space will be provided.

For the transfer of liquid cargo and for the supply of fuel to ships, equipment with appropriate connections, pumps and pipelines is planned.

Grains terminal

Loading system that includes chain conveyor, gravity line and mobile loader is proposed to load grains from silos to vessels. The chain conveyor, parallel to operational quay accepts the grain from the silos and moves it to gravity line. Mobile loader is used for movement of grains from chain conveyor to cargo space of vessel. Grains are stowed uniformly over cargo space by translational motion of mobile loader along the rails.

For the needs of increased grain exports, a hopper loader will be used in combination with a belt conveyor, providing the possibility of direct loading from trucks to vessels.

Considering that Serbia is oriented mostly on grain export instead of import, only certain types of cereals (like rye, barley and buckwheat) and their smaller quantities should be accounted for unloading from vessels with a grapple on one portal crane.

Within the Grain Terminal, a closed storage for grains is planned, ie silos with a total capacity of 60,000 tons. Two silos with filling and emptying equipment, which consists of pipes and compressors of appropriate capacities, are suggested to be installed.

Silos are used to store grain. They are built of concrete with filling and emptying systems for all three modes of transport (road, rail and water).

Multipurpose terminal – reorganized existing terminal

In this study, the primary goal is to convert existing terminal into multipurpose terminal for handling bulk, general cargo and containers. Necessary mechanization for handling cargo includes forklifts, mobile self-propelled loaders and a portal crane with swappable handling devices like bulk grabs, hooks/pulley blocks, coil grabs, wire coil grabs, sheet lifters, spreaders, equalising spreader beams, long-hook spreader beam, rotating spreader beam, etc. Cargo handling can be direct or indirect over existing storages.

Technology of container handling includes reloading of full and empty containers from/to vessels, wagons and trucks, as well as their storage until further transport. Necessary equipment for relodading of vessels is a quay portal crane and forklifts for handling containers on storage areas. Handling can be done directly or through the storage.

Container handling from road to railway vehicles and vice-versa is also predicted.

In addition to the existing roads in the port area, other roads that are in the function of performing the technological process of transshipment, cargo storage and movement of machinery and vehicles within the

terminal depend on the layout of other facilities in the terminal area (track layout, layout and area of storages, types of machinery, etc.). The planned layout of terminals in the port of Bačka Palanka is presented in Figure 6.1.

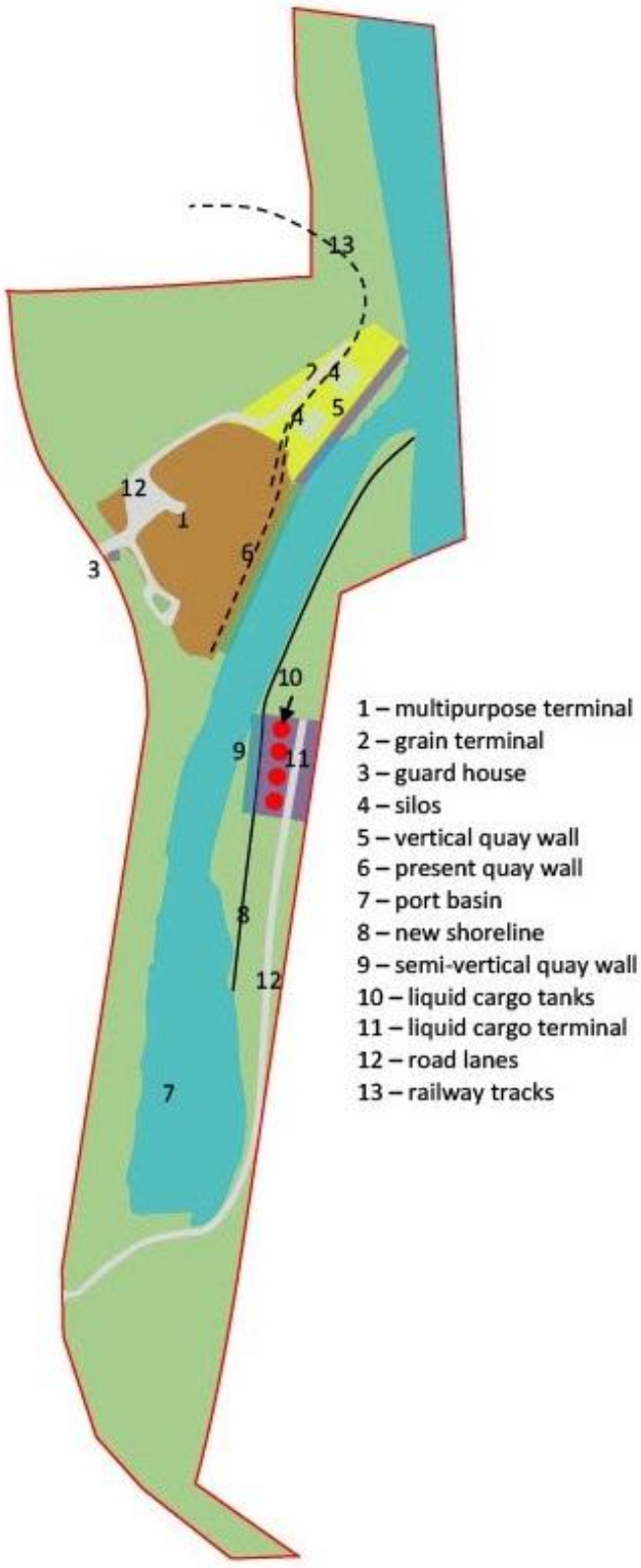

Figure 6.1. Planned layout of port of Bačka Palanka

As it can be seen in Figure 6.1, planned reconstruction covers conversion of the existing terminal into a multipurpose terminal. Next to the existing terminal, the construction of a grain terminal is planned, which area will extend all the way to the entrance of the port basin. There are two berths at the grain terminal and a 240-meter-long vertical quay wall. Necessary construction works should include port basin entrance widening, which would provide the required length of the operational shore. Grain silos with a capacity of 60,000 t are planned within terminal. Consequently, roads and railways as well as supporting infrastructure and associated facilities will be built.

The liquid cargo terminal is planned in the port area between the basin and the Danube River along the shore of the basin. Therefore, it is necessary to widen the basin by forming the new shoreline. On the operational quay of the liquid cargo terminal, the construction of a semi-vertical quay wall (120m), a pontoon on piles (dolphins) with an access bridge and a system of protection against the spread of spilled fuel is planned. Consequently, roads and railways as well as supporting infrastructure and associated facilities will be built.

The position of the liquid cargo terminal is defined to satisfy the no inhabited place in the diameter of 500 m condition.

The implementation of these plans depends primarily on the levels of economic activity in the region and on port area expansion in accordance with the detailed technical documentation.

6.2.2 Transshipment equipment

Based on the findings of the forecast, the new extended port should have adequate equipment with sufficient productivity in order to handle the forecasted volumes easily and to enable large capacity reserve.

In order to formulate adequate recommendations for the transportation equipment, a capacity analysis for the future cargo flows and new terminals needs to be done.

In this view, we will first assume the operational patterns and working times of the future port. The simplest way to do so is to adopt the same setup as for the capacity analysis of the existing port:

Mark	Capacity case description	Working hours/day	Working days	Working time
Q1	Normal capacity	16	Mon-Sun	06:00-22:00
Q2	Intensive capacity	24	Mon-Sun	00:00-24:00

Table 6.1. Future port capacity cases

6.2.2.1 ***Liquid cargo terminal***

Liquid cargo terminal is a first proposed addition to the existing infrastructure of the port. The basis for this proposal is found in the Strategy and in the forecasted quantities for different types of cargo in the Port of Bačka Palanka. This terminal is dedicated for handling oil derivatives, primarily diesel and unleaded gasoline coming mostly from the domestic refineries. Typical equipment for the transshipment of oil derivatives contains a berthing pontoon (where barges are berthed) which follows the water levels and thus enables easier unloading of derivatives from a vessel. Unloading equipment is located on a pontoon itself and consists of working pumps (one for diesel and one for unleaded gasoline), unloading arms, appropriate valves and manifolds. Thereafter, it is connected, via pipelines, to the tanks on shore. Tanks should have appropriate equipment for loading of liquid cargo into tank trucks.

The system for unloading, storage and distribution of oil derivatives should have the following elements:

- Berthing pontoon with pumps, measuring gauges, unloading arms, piping and valves
- Ground tanks
- Valve stations
- External piping
- Fuel pump station for supplying the transfer station
- Truck transfer station
- VRU (Vapor Recovery Unit) unit
- Pump fire station
- Fire station
- Automatic control and monitoring systems
- Command building in the function of transfer station
- Electricity part
- Roads
- Security of the complex
- Diesel generator
- Compressor station for instrument air
- Transformer station building
- Wagon transfer station
- Pump station for unloading fuel from tank wagons (with drain vessels)
- Measuring discharges for measuring the amount of fuel drained from tank wagons.

Details of each of the above elements are beyond the scope of this project and are to be specified in more detailed designs (conceptual design and construction design).

This study will limit itself to recommending the productivity of the unloading equipment. Typical equipment of this kind is of **180 m^3/h** (**or150 t/hour**, where 1 t of derivatives is roughly 1.2 m^3 of derivatives). With this capacity, the utilization of the transshipment equipment will be satisfactory and it will provide sufficient capacity reserve.

The simplest way to calculate the average annual (operational) capacity of the proposed grains terminals capacity is given in the following formula:

$Q = W_d \times W_h \times P_h$

Where:

Q – average annual capacity of a terminal with the proposed equipment (tons/year),

W_d – number of working days in a year

W_h – number of working hours in a day, in function of the adopted capacity case,

P_h – hourly productivity of all transshipment equipment or a berth (tons/hour).

Input data for the calculation:

- Design capacity of unloading pumps: 150 t/h
- Working time 1 (h/d): 16 h/day (Mon-Sun 06-22)
- Working time 2 (h/d): 24 h/day (Mon-Sun 00-24)

- Working days/year: 301 days

Therefore, the capacity of the liquid terminal, with the proposed equipment, is:

Liquid cargo terminal capacity	Tons/year
Capacity case Q1	722,400
Capacity case Q2	1,083,600

Table 6.2. Grains terminal capacity with the proposed equipment

On the basis of the forecasted quantities of liquid cargo and recommended productivity of the unloading equipment, the capacity utilization over the forecast period is illustrated in the following figure.

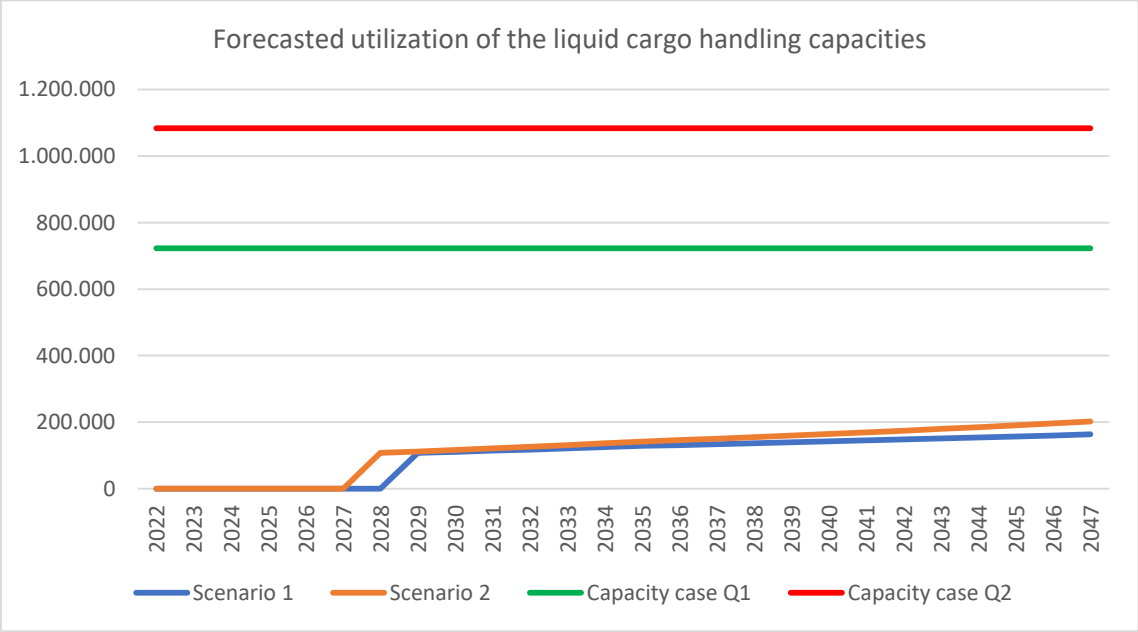

Figure 6.2. Forecasted capacity utilization at the liquid cargo terminal

From the above figure, it can be seen that no matter the operational pattern of the port, the recommended productivity of the transshipment equipment provides sufficient capacity reserve for the entire duration of the forecasted period and for all forecasted quantities. Capacity reserves are important for seasonal and peak loads which are either difficult or impossible to forecast within one observed year.

6.2.2.2 *Grains terminal*

At specialized grains terminals grains and oilseeds are loaded into the barges primarily from the silo. In the silo, there are two main directions for issuing cargo for loading into barges and one exit for eventual loading into road vehicles. A collection line with a chain conveyor, elevators and gravity lines typically dimensioned at 150 t/ h is provided for regular loading. Before leaving the silo, the grains are measured on flow bulk scales with a capacity of 150 t/h and directed to the system of chain conveyors. These chain conveyors transport the grains towards the line of chain conveyors parallel to the berth line. The grains are picked up by a mobile loader from the chain conveyors when loading into barges.

Loading into barges is done with a self-propelled loading device / mobile loader. It has a hydraulic system for lifting and lowering the loading pipe. The loading pipe can be turned, pulled in and pulled out with a positioner with a lock. The mobile loader moves along the rails with its own gearbox with brakes.

The capacities of the connected devices are designed to have a significant reserve of capacity according to the forecasted quantities of grains.

For unloading of imported grains and oilseeds, a portal crane with a grab is deemed sufficient, from the point of view of forecasted imported (unloaded) grains and oilseeds quantities. A much better solution could be to use a pneumatic grain unloader, but such equipment is too expensive to be justified for such small quantity of cargo.

Therefore, the proposed capacities for the grains terminal are:

- Mobile loader connected to a silo: 150 tons/hour
- Portal crane with a grab, 5/6 lift capacity: 90 tons/hour (at 18 cycles per hour)
- Total transshipment capacity: 240 tons/hour

If necessary, the capacity can be increased with a hopper loader coupled with a belt conveyor that can be brought into position at the berth very quickly and easily. This method of loading grains is especially convenient for the grains being loaded directly from trucks and not through a silo.

Figure 6.3. Mobile loader connected to a silo

Figure 6.4. Hopper loader with belt conveyor

The simplest way to calculate the average annual (operational) capacity of the proposed grains terminals capacity is given in the following formula:

$Q = W_d \times W_h \times P_h$

Where:

Q – average annual capacity of a terminal with the proposed equipment (tons/year),

W_d – number of working days in a year

W_h – number of working hours in a day, in function of the adopted capacity case,

P_h – hourly productivity of all transshipment equipment or a berth (tons/hour).

Input data for the calculation:

- Design capacity of a mobile loader: 150 t/h
- Design capacity of a smaller crane: 90 t/h
- Total handling capacity of a grain terminal: 240 t/h
- Working time 1 (h/d): 16 h/day (Mon-Sun 06-22)
- Working time 2 (h/d): 24 h/day (Mon-Sun 00-24)
- Working days/year: 301 days

Therefore, the capacity of the grains terminal, with the proposed equipment, is:

Grains terminal capacity	Tons/year
Capacity case Q1	1,155,840
Capacity case Q2	1,733,760

Table 6.3. Grains terminal capacity with the proposed equipment

Over the years of the forecasting period (2022-2047), the utilization of the grains terminal capacities would be as demonstrated in the figure below.

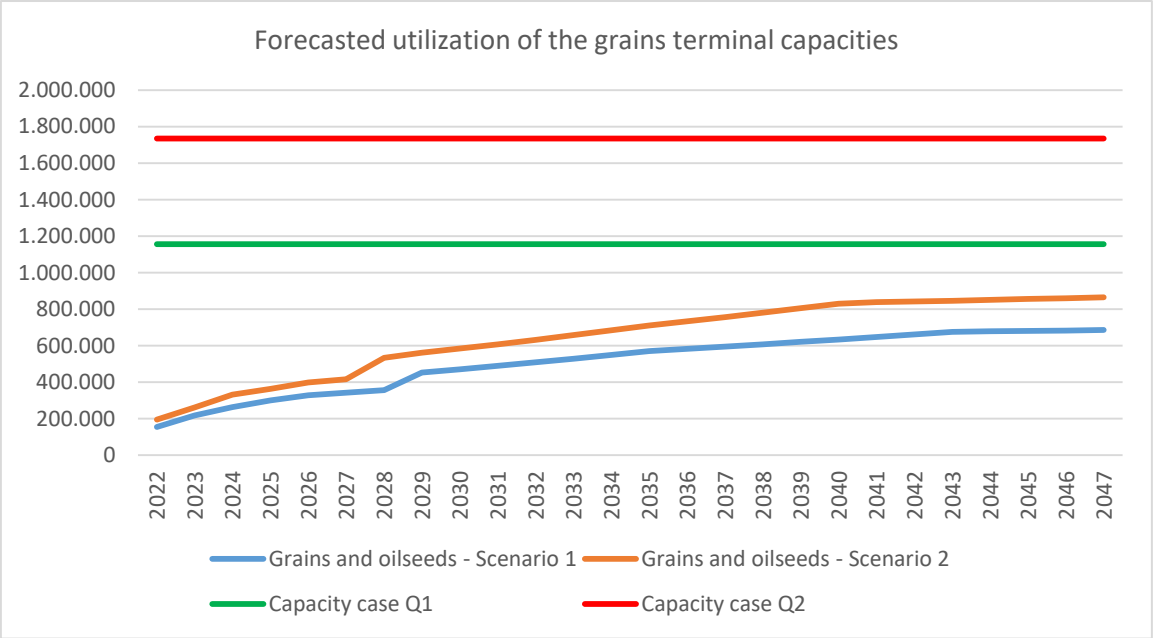

Figure 6.5. Forecasted utilization of the grain terminals capacities

If UNCTAD Port Development Handbook[46] recommendations are taken into account, the calculation of the utilization rates (when the forecasted amount in a given year for a selected scenario is divided with the capacity in a given capacity case Q1 or Q2) demonstrates that:

- If the grains terminal is designed with one berth only the maximum occupancy rate should be 40% at the most. In Scenario 1, capacity case Q1, this already occurs from 2030 and in Scenario 2, capacity case Q1, as of 2028. In Scenario 1, capacity case Q2, the 40% threshold is not breached in any year of the forecasted period, and in Scenario 2, capacity case Q2, the 40% threshold is breached as of 2035. In such cases, either a construction of an additional berth is needed, or additional loading capacity should be added to the berth in both capacity cases.
- If the grains terminal is designed with two berths, the maximum occupancy rate should not breach the 50% threshold. In Scenario 1, capacity case Q1, the breach occurs in 2036 and in Scenario 2, capacity case Q1, the 50% threshold is breached from 2030. In Scenario 1, capacity case Q2, the 50% threshold is not breached in the forecasted period, while in Scenario 2, capacity case Q2, this threshold is also not breached in the forecasted period.

Number of berths in the same group	Recommended maximum berth occupancy (%)
1	40
2	50
3	55
4	60
5	65
6-10	70

Table 6.4. UNCTAD recommendation on berth occupancy

[46] UNCTAD (1985), *Port Development: A handbook for planners in developing countries*, New York.

6.2.2.3 *Multipurpose terminal – reorganized existing terminal*

Under the given forecast setup and taking into account the development directions given in the Strategy, it is recommended that the existing terminal (existing two berths and related port facilities) are reorganized into a multipurpose terminal. Multipurpose terminals are properly equipped to handle almost all dry bulk and break-bulk (general) cargo and are usually planned when and where the forecasted cargo volumes do not include enough quantities of a single cargo packaging or cargo type to justify a specialized cargo terminal with specialized equipment.

In this view, it is interest to see what would happen with the port congestion if the forecasted volumes (of dry cargo only) would be handled only at the existing terminal. Such situation is represented in the figure below.

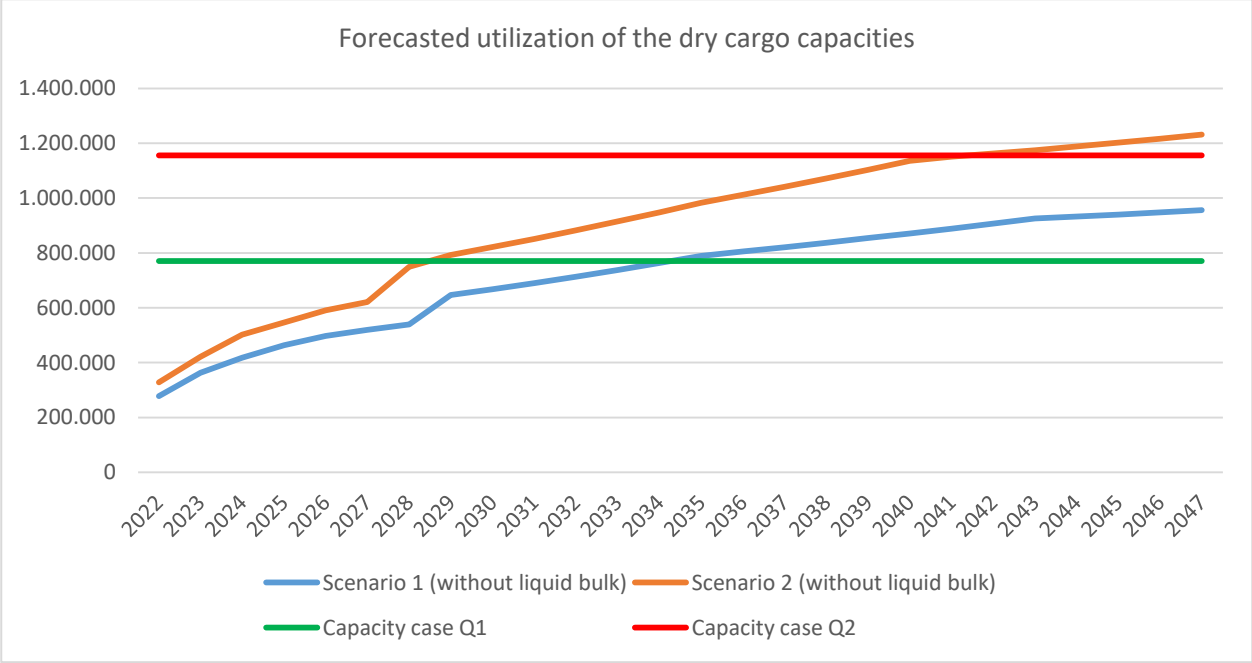

Figure 6.6. Utilization of the existing dry cargo capacities in case no new equipment is introduced

From the above figure it is clearly visible that a capacity maximum would be reached very early in both scenarios, if the port applies the capacity case Q1 (working time from Monday to Sunday, 06-22 h). If the port applies the capacity case Q2 (working time 24/7, Monday to Sunday, 00-24 h), the capacity maximum would be reached in the beginning of 2040's, in a (higher) Scenario 2.

In a different form, the criticality of such situation is equally well visible:

Year	Utilization in Q1 (Scenario 1)	Utilization in Q1 (Scenario 2)	Utilization in Q2 (Scenario 1)	Utilization in Q2 (Scenario 2)
2022	36.08%	42.65%	24.05%	28.43%
2023	47.18%	54.73%	31.46%	36.49%
2024	54.26%	65.11%	36.17%	43.41%
2025	60.17%	70.86%	40.12%	47.24%
2026	64.57%	76.68%	43.05%	51.12%
2027	67.38%	80.54%	44.92%	53.70%
2028	70.01%	97.29%	46.67%	64.86%

Year	Utilization in Q1 (Scenario 1)	Utilization in Q1 (Scenario 2)	Utilization in Q2 (Scenario 1)	Utilization in Q2 (Scenario 2)
2029	83.87%	102.86%	55.91%	68.57%
2030	86.68%	106.59%	57.79%	71.06%
2031	89.60%	110.47%	59.74%	73.64%
2032	92.63%	114.50%	61.76%	76.33%
2033	95.78%	118.70%	63.85%	79.13%
2034	99.04%	123.06%	66.03%	82.04%
2035	102.43%	127.61%	68.29%	85.07%
2036	104.45%	131.29%	69.64%	87.53%
2037	106.52%	135.11%	71.01%	90.07%
2038	108.64%	139.05%	72.43%	92.70%
2039	110.82%	143.14%	73.88%	95.43%
2040	113.06%	147.37%	75.37%	98.25%
2041	115.35%	149.29%	76.90%	99.52%
2042	117.70%	150.83%	78.47%	100.56%
2043	120.12%	152.46%	80.08%	101.64%
2044	121.04%	154.16%	80.70%	102.77%
2045	122.00%	155.95%	81.34%	103.97%
2046	123.01%	157.83%	82.00%	105.22%
2047	124.05%	159.81%	82.70%	106.54%

Table 6.5. Potential utilization of existing dry cargo capacities in case no new equipment is introduced

In every combination of capacity cases and forecast scenarios, wherever the utilization surpasses the physical limit of 100%, endless ship queues would appear if nothing is done with the port capacity. If UNCTAD recommendations (for the occupancy rates in the case of two berths) are taken into account, a potential congestion would occur wherever the utilization rate becomes higher than 50%.

Having analysed the consequences of the non-introduction of new port capacities it is obvious, that new capacities are needed. Since the largest share of forecasted cargo in both scenarios belongs to the grains and oilseeds it was logical to propose the construction of the new grains terminal.

For the existing port capacities, however, it is proposed to be reorganised into a multipurpose terminal, equipped with appropriate equipment to handle various bulk and break-bulk (general) cargoes. This proposal is made purely for the technological reasons from the port planning point of view. Legal arrangement with the existing operators is beyond the scope of this study.

In order to handle various types of cargoes, the optimal port crane would be:

- Capable of handling bulk and break-bulk cargoes, including project cargo and containers;
- Have swappable handling devices (bulk grabs, hooks/pulley blocks, coil grabs, wire coil grabs, sheet lifters, spreaders, equalising spreader beams, long-hook spreader beam, rotating spreader beam, etc.);
- 100 t lifting capacity up to a radius of 20 m and 80 t lifting capacity up to a radius of 24 m;
- Capacity of no less than 100 t/hour;
- Mobile (wheeler or crawler) for larger flexibility.

Since there are two berths available at the existing terminal, the second berth could be equipped with a slightly smaller crane of the same type, with the lower lifting capacity, and an hourly capacity of no less than 80 t/hour. The second crane should also be mobile, to allow for greater flexibility and exchange of

positions. Therefore, the capacity analysis will be made counting with the combined capacity of two cranes, that is 180 t/hour.

The simplest way to calculate the average annual (operational) capacity of the proposed multipurpose terminal capacity is given in the following formula:

$Q = W_d \times W_h \times P_h$

Where:

Q – average annual capacity of a terminal with the proposed equipment (tons/year),

W_d – number of working days in a year

W_h – number of working hours in a day, in function of the adopted capacity case,

P_h – hourly productivity of all transshipment equipment or a berth (tons/hour).

Input data for the calculation:

- Design capacity of a larger crane: 100 t/h
- Design capacity of a smaller crane: 80 t/h
- Total handling capacity of a multipurpose terminal: 180 t/h
- Working time 1 (h/d): 16 h/day (Mon-Sun 06-22)
- Working time 2 (h/d): 24 h/day (Mon-Sun 00-24)
- Working days/year: 301 days

Therefore, the capacity of the multipurpose terminal, with the proposed equipment, is:

Multipurpose terminal capacity	**Tons/year**
Capacity case Q1	866,880
Capacity case Q2	1,300,320

Table 6.6. Grains terminal capacity with the proposed equipment

Over the years of the forecasting period (2022-2047), the utilization of the multipurpose terminal capacities would be as demonstrated in the figure below.

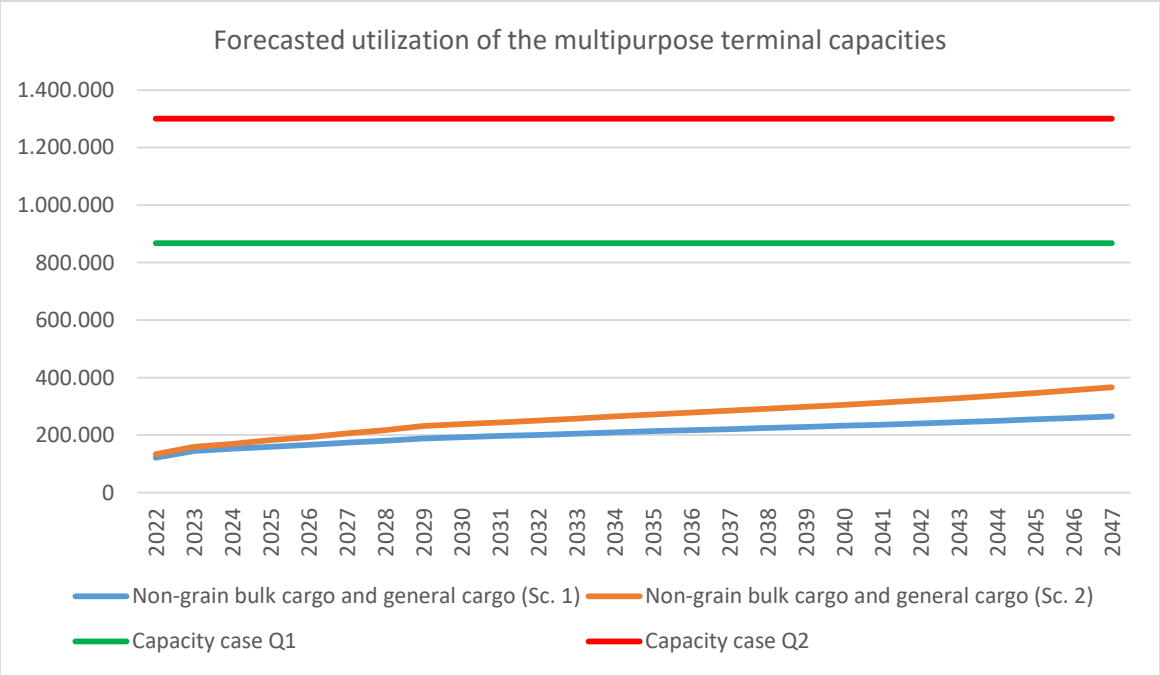

Figure 6.7. Forecasted utilization of the multipurpose terminal capacities

From the above figure it can be seen that the multipurpose terminal is planned with sufficient capacities in both capacity cases and in both scenarios. Moreover, from the point of view of capacity utilization, the intensive working time pattern (00-24 h) is not necessary at all. Further analysis (in further design stages) would give an optimum working pattern for both forecast scenarios and for the proposed equipment, but it is beyond the scope of this study.

If UNCTAD recommendations (for occupancy rates at terminals with two berths) are taken into account, the calculation of the utilization rates (when the forecasted amount in a given year for a selected scenario is divided with the capacity in a given capacity case Q1 or Q2) demonstrates that in no case the recommended threshold of 50% of occupancy rate is breached.

7 EXECUTIVE SUMMARY

With the transport network consisting of the Danube waterway in the length of 588 km with all its tributaries, along with the road and rail corridors, the Republic of Serbia holds a special importance within the overall European transport policy for the period 2014-2020. The new European policy opens up significant possibilities for better positioning and development of waterway transport in the Republic of Serbia foreseen by the Strategy on Development of Waterborne Transport of the Republic of Serbia, for the period 2015-2025. This Strategy lists the most important investments that are defined and initialised including: construction and reconstruction of Serbian ports, eliminating all critical sectors for navigation on the waterway network, further improvement of intelligent waterway transport systems.

According to the Strategy, the development plans for Port of Bačka Palanka are strategically oriented towards building a container terminal, a liquid cargo terminal and a grains handling and storage terminal. To do this, it is essential to build an embankment and a vertical quay in the length of 480 m, as well as a grains silo with a capacity of 60,000 t.

New handling equipment that would increase the capacities and operational railway tracks connecting the port to the national railway network would also be an asset. The implementation of these plans depends primarily on the levels of economic activity in the region and on port area expansion in accordance with the Law. A prerequisite for the expansion is an agreement between the Bačka Palanka Municipality, the Port Governance Agency and the current port operator regarding the property status of the land which could be used to fan out the port area. The rights of use are currently vested in “Port Bačka Palanka” d.o.o. A larger port area is highly important for the growth of port industry in Bačka Palanka and the overall economy in this municipality.

According to the Strategy, the required investment in the port infrastructure is estimated at 5.1 mill. euros, and in the port superstructure at 5.6 mill. euros. The precise amount to be invested in the expansion of Port of Bačka Palanka area will be known after the relevant documentation has been made and adopted.

The port of Bačka Palanka is located on the left bank of the Danube River, rkm 1,295 in the agrarian area of South Bačka. The port covers surface area of approximately 74 ha. Port of Bačka Palanka is a basin-type port with minimum available draft of 2 m. Total quay length is 400 m, out of which vertical quay is approximately 65 m and semi-vertical quay is 335 m. Four vessels can be simultaneously accommodated and serviced. Anchorage has the capacity for 30 vessels. Currently, the operator of the Port of Bačka Palanka, company “Luka Bačka Palanka” d.o.o.., operates a portal crane (with a max. lifting capacity of 12 tonnes and technical capacity of 80 t/hour), a floating crane (with a 6 tonne capacity and technical capacity of 30 t/hour) and a mobile crane grain loader (with a 9-tonne capacity and technical capacity of 50 t/hour) connected to a silo via belt conveyors.

From the point of view of capacity utilization, on the basis of volumes handled in the last seven years, the port has a determined capacity reserve. This, in turn, means that the port has no reason to work overtime from the point of view of potential congestion, taking into account the current and past volumes of handled cargo.

Furthermore, the capacity utilization of the transshipment facilities in the last seven years also demonstrated the average capacity utilization over the years. This means that the port does not need to work any overtimes in order to manage to handle the current volumes, unless specifically requested by the ship operator or cargo owner.

The depth of water in the port basin ranges from 3.93m to 8.86m. The average size of the vessels reloaded in the harbour is 90m in length, 11m in width, with a capacity of 1,500 tonnes and freeboard of 2.5m. The port handles dry bulk and break bulk cargo. Current annual capacity of the Port of Bačka Palanka varies from 722,400 tons to 1,083,600 depending on the number of shifts in a day in a working week that includes Monday to Sunday.

Storage facilities consist of open spaces that cover area of 14,138 m^2 and closed spaces of 658.8 m^2. The types of cargo handled in the port are bulk commodities including construction materials, metallurgy products, heavy loads and general cargo.

The port owns the tugboat Kapetan Vinarev, which provides maneuvering services to its clients. The Agroport Center which belongs to Port of Bačka Palanka also houses storage capacities for receiving and storing 50,000 tons of mineral fertilizers and 30,000 tons for packaged goods, as well as 30,000 tons of storage capacity for mercantile goods. The center has a line for packing mineral fertilizers with a daily packing capacity of 450 tons and a line for packing in a "big bag" with a daily capacity of 500 tons. The daily shipping capacity of packaged mineral fertilizer is 2.000 tons.

As a typical agricultural port, the Port of Bačka Palanka handled mostly grains and fertilizers, and, to a much smaller extent, determined quantities of natural aggregates (sand and gravel) and metallurgical products. Taking into account the overall volumes (all cargoes), the share of the Port of Bačka Palanka in the overall cargo volumes handled in Serbian ports was 2.19% in 2021.

Typical users of the Port of Bačka Palanka are from the agricultural industry, namely grain trading companies and importers of fertilizers. Future potential users will largely remain within this group, while new additions will be the oil trading companies and, to a limited extent, companies from the industrial production sector.

Considering the strategic plans of NIS (Oil Industry of Serbia – largest oil company in Serbia) development and preservation of the stability of the energy industry of the Republic of Serbia, it can be expected to have oil and oil products to be unloaded at the port of Bačka Palanka from domestic sources, while it is expected to be competitive in terms of purchase and transport price in relation to foreign sources. This, of course, can be done only if facilities for handling and storage of oil products are planned in the new, extended port.

Considering the pronounced agricultural production and the growth of the volume of production of the processing industry, it can be stated that there are needs of economic entities for oil and oil derivatives in the immediate hinterland of Bačka Palanka. In this view, the hinterland of Bačka Palanka is seen as a receptive area, that is, the final destination of the flows of this type of cargo. Currently, the transport of these cargoes to the hinterland of the Port of Bačka Palanka is performed by road transport.

Port of Bačka Palanka is characterized by an excellent strategic position thanks to the connection with Pan-European Corridor 7 (a river and canal system of the Rhine-Main-Danube Canal), which connects it with the countries from the North Sea to the Black Sea. The strategic position is contributed to by the immediate vicinity of the Novi Sad-Osijek-Sombor main road, closeness of the Belgrade-Subotica highway at a distance of 45 km and the Belgrade-Zagreb highway, which is 30km away, as well as the railroad track which is just 5 km from the port.

The port is not connected to the national railway network but is distanced about 5 km from the regional railway Bačka Palanka – Gajdobra which is connected with the Belgrade-Subotica railway and further with the Budapest.

The General regulation plan with elements of the Detailed regulation of block number 106 in Bačka Palanka ("Official gazette of the municipality Bačka Palanka “, no 18/2007) and the General Regulation Plan of the settlement of Bačka Palanka ("Official gazette of the municipality Bačka Palanka “, no, 16/11 and 22/12) foresee a construction of new port capacities and expansion of the current port.

According to the port development plans, the industrial track for the port of Bačka Palanka will start from the open track of the railway Gajdobra – Bačka Palanka, in front of the level crossing with the main road (before the overpass from the direction of Gajdobra). The industrial track is brought to the port via a marshalling yard, which is located before the protective embankment of the port complex in Bačka Palanka.

Port of Bačka Palanka should be strategically oriented towards building a liquid cargo terminal and a grains handling and storage terminal and towards converting existing terminal into multipurpose terminal. To do this, it is essential to build a vertical and semi-vertical quay of 360 m length. It is necessary to construct industrial railway trucks in order to connect this port with the national railway network.

Most important characteristics of the liquid cargo terminal are the following:

- The liquid cargo terminal is planned in the port area between the basin and the Danube River along the port basin.
- It is necessary to widen the port basin by forming the new shoreline.
- On the apron area of the liquid cargo terminal, the construction of a semi-vertical quay wall (120m), a pontoon on piles (dolphins) with an access bridge and a system of protection against the spread of spilled fuel are planned.
- Roads and railways as well as supporting infrastructure and associated facilities will be built.
- For the movement of liquid cargo (crude oil and derivatives) pumping equipment is proposed at the terminal.
- Access to the terminal for crude oil and derivatives has to be marked with the waterway signs and markings for day and night navigation supported by berthing rules, signaling and reporting requirements as well as prevention of pollution of water and disposal of waste.
- In order to protect the quay construction and equipment from the impact of the vessel during docking, the front beam and the front piles of the quay are protected by rubber bumpers. The exact shape and dimensions of the pontoon, the layout and number of piles, depend on the adopted equipment.
- The access bridge between the quay wall and the pontoon serves for carrying pipelines, fire-fighting and other equipment necessary for the safe process of refuelling.
- For protection against the spread of spilled fuel, a floating dam is provided. Dam is made of polyester-based laminate, reinforced with glass fibbers with a surface layer resistant to liquid cargoes. Flexible connections are used to connect the dam to the pier, which prevents the dam from breaking and sinking during waves. Floating trolleys on rails adjust the dam to changes in water levels and are used to connect the dam with the sloping quay. The positioning of the dam is provided with appropriate concrete weights.
- Collection of spilled oil will be provided by appropriate equipment and depends on the applied method and the manufacturer. A warehouse for the collection of spilled oil, as well as hazardous waste (oily absorbents) is planned to be built and will serve for the temporary disposal of funds until they will be handed over to an authorized operator.
- Liquid cargo storage space will be provided within this terminal.

- For the transfer of liquid cargo and for the supply of fuel to ships, equipment with appropriate connections, pumps and pipelines is planned.

Most important characteristics of the grains terminal are the following:

- There are two berths at the grain terminal and a 240-meter-long vertical quay wall.
- Loading system that includes chain conveyor, gravity line and mobile loader is proposed to load grains from silos to vessels. The chain conveyor, parallel to operational quay accepts the grain from the silos and moves it to gravity line. Mobile loader is used for movement of grains from chain conveyor to cargo space of vessel. Grains are stowed uniformly over cargo space by translational motion of mobile loader along the rails.
- A hopper loader will be used in combination with a belt conveyor, providing the possibility of direct loading from trucks to vessels.
- A closed storage for grains is planned, ie silos with a total capacity of 60,000 tons. Two silos with filling and emptying equipment, which consists of pipes and compressors of appropriate capacities, are suggested to be installed.
- Silos are used to store grain. They are built of concrete with filling and emptying systems for all three modes of transport (road, rail and water).

Most important characteristics of the multi-purpose terminal are the following:

- Necessary mechanization for handling general and bulk cargos and containers includes forklifts, mobile self-propelled loaders and a portal crane with swappable handling devices like bulk grabs, hooks/pulley blocks, coil grabs, wire coil grabs, sheet lifters, spreaders, equalising spreader beams, long-hook spreader beam, rotating spreader beam, etc.
- Technology of container handling includes reloading of full and empty containers from/to vessels, wagons and trucks, as well as their storage until further transport. Necessary equipment for reloading of vessels is a quay portal crane and forklifts for handling containers on storage areas. Handling can be done directly or through the storage.
- In addition to the existing roads in the port area, other roads that are in the function of performing the technological process of transshipment, cargo storage and movement of machinery and vehicles within the terminal depend on the layout of other facilities in the terminal area (track layout, layout and area of storages, types of machinery, etc.).

This study demonstrated the need for the new transshipment equipment with sufficient productivity in order to handle the forecasted volumes easily and to enable sufficiently large capacity reserve. For the loading of grains, specialized loading equipment connected to a silo is recommended. In addition, new cargo types will require specialized transshipment equipment, such as pumping systems for liquid bulk cargoes. The existing terminal should be reorganized into a multipurpose terminal with mobile cranes with swappable handling equipment (bulk grab, coil grab, wire coil grab, forks, hook, sheet lifter, magnet lifter, equalizing spreader beam, container spreader, etc.) for the bulk and break-bulk cargo.

In terms of future development, two scenarios (lower and higher), developed within this study, were assumed for the 25 years horizon cargo forecast, both of them being focused around the forecasted GDP growth and import/export forecasts of the International Monetary Fund. Besides the forecasts of typical existing cargoes handled in the port, determined quantities of new cargoes are forecasted, according to the strategic port development plans. In Scenario 1, the total forecasted quantity of all cargoes reached 1.12

million tons, while Scenario 2 forecast revealed a total forecasted quantity of 1.43 million tons of different cargo.

In the case of the Port of Bačka Palanka, it is recommended that the public partner, that is, the Government of the Republic of Serbia with its Ministry of Construction, Transport and Infrastructure invests in port infrastructure, while the construction of the suprastructure and equipping of the port for operations can be granted to a potential port operator as a concession.

Therefore, the form of concession recommended for the Port of Bačka Palanka extension encompasses the following (among others):

- provision of port services;
- construction of port superstructure, and
- maintenance of port infrastructure.

The implementation of these plans depends primarily on the levels of economic activity in the region and on port area expansion in accordance with the Law.

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