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DAPhNE

Danube Port Development Strategy & Network Formation

D.5.1.2: Good practices for Port Master Planning

Work Package 5

Activity 5.1

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Executive summary

Being very important, although sometimes put in the "second plan", ports require attention, security, care, and protection in order to facilitate their development, growth, maintenance, and sustainability. Regardless of their location and/or type, ports face numerous challenges, such as technological transformation, climate change, globalization, competitiveness, superstructure and infrastructure development, management and governance change, successful and unsuccessful privatizations, and changes in political ideologies which have a direct influence on how the ports are treated, governed and operated. Port managers require the capability to balance physical, economic, and social environments in order for their ports to thrive and develop.

While circumstances vary depending upon a port's location, decisions and approaches to sustainability and growth are achievable through the development, adoption, and implementation of a document which is frequently called "Port Master Plan". Master plans can assist port authorities and port management in developing clear sets of recommendations and implementation approaches to projects identified and approved by stakeholders and governmental officials during the planning process.

Port master planning consists of a series of activities that help shapes a port's development and growth. Port planning is essential and brings value to facilities and services. However, master plans are useless if they just become another report filed away on a shelf. A master plan must remain a living document that is understood, adhered to, and is flexible enough to allow adaptability in unforeseen circumstances.

This report provides an overview of the port master planning processes in Austria, Slovakia, Serbia, Romania and Bulgaria. Although not all Danube countries are represented in this report, authors are convinced that these five countries represent significantly different port legislation and management systems so that their examples of port master planning can be used as a guidance throughout the entire Danube region. In addition, to avoid making a simple mash and a copy-paste exercise from national legislations or practices into this report, the authors have extended their contributions towards "what would be good to have in a harmonized master plan". Taking into account that port master plans are not recognized (from a legal point of view – no laws regulate the existence or contents of the master plan) as a strategic or design stage in some countries, this report may serve as a guidance for further processes in the reform of port master planning as an important strategic and development tool for ports.

Key findings and recommendations of the report are, inter alia, the following:

- port master planning must be based on a 'beyond the port' methodology, rather than the traditional 'introspective' approach;
- countries should have their own port policy and port development strategy on a national level so as to facilitate enhanced conditions for the development of the entire port industry, not just in their respective countries, but in the entire Danube region as well;

- policy alignment must be achieved through National-State-Regional-Local planning frameworks;
- port master planning frameworks should be generally consistent between jurisdictions (municipalities, regions and, if possible, countries);
- enhanced governance support must be provided at the jurisdictional level and within organisations, to assist with comprehensive port master planning;
- supporting frameworks/operational plans such as comprehensive land use plans, port policies, port development strategies must facilitate the elaboration of port master plans at the operational, 'on the ground' level;
- "greening" of ports should be integrated into the master planning from the very beginning - SEA and EIA on the overall strategic level (national port policies and strategies) and on the port strategic level (port master plans), respectively;
- "greening" of port suprastructure, operations and equipment (energy from renewable sources, port equipment fuelled by alternative fuels, mandatory shore-side power supply for vessels at berths, etc.) should be subsidized, supported or facilitated in any convenient way in the beginning so as to encourage the administrations and operators to extend the "greening" of port industry from infrastructure interventions towards operations as well;
- regulatory/policy frameworks regarding 'strategic assessments' of master plans should be further examined to improve the identification, protection and management of environmental values and to address the need for regulatory streamlining;
- recommended minimum contents of the port master plan is given.

On the basis of findings of this report, the following "next steps" are recommended:

1. adoption of this report to guide/assist port master planning at Danube ports;
2. proceed with guidelines for common port policy in the Danube region and for the common port development strategy of the entire Danube region;
3. officially suggest strong advocacy for regulatory reform at the multilateral, national, regional, local levels to:
   a. promote better alignment of strategic land use planning frameworks in and near ports;
   b. recognition of ports as strategic national transport infrastructure, especially in landlocked countries (AT, SK, HU, RS);
   c. protection of critical port infrastructure and corridors; and
   d. ensure more harmonized development of the Danube region ports.
4. launch an initiative to introduce a voluntary "environmental certification", similar to the "Port Environmental Review System" (PERS)[1] applied in seaports;
5. undertake a pilot for inland PERS preparation from the phase of master plan for existing ports.

It can be concluded that if, comprehensively developed, port master plans can:

[1] https://www.ecoports.com

- articulate the medium and long term 'port vision' to a wide range of stakeholders;
- create additional economic value through increased industry and investment confidence;
- assist in overall supply chain management by:
  - integrating the port into broader network consideration (by promoting greater understanding of the port needs within national, regional and local planning agencies),
  - ensuring that vital port (and logistic chain) infrastructure is delivered when and where it is needed (via well-considered phasing options).
- maximise significant economic and productivity improvements through efficient management of critical infrastructure delivery and protection;
- provide increased environmental protection by identification of critical environmental values early in the design process; and
- address interface issues (social and environmental) in and around port areas (i.e. help to inform port users, employees and local communities as to how they can expect to see the port develop over the coming years).

1 Introduction

Port development is seen as a catalyst to stimulate economic activity and create employment. In Europe, port developments relate mainly to building new terminals and upgrading the super- & infra-structure within existing ports rather than developing new greenfield sites.

As such, much of the reform process has more to do with the organization and operational aspects of ports. This WP will assess the situation along the Danube and will focus on 3 pillars that contribute to transforming ports into key-hubs of the European transport network and help trigger the reform process: infrastructure investments, funding sources for stimulating investments and innovation.

The goal is to provide a comprehensive package of the issues to be approached jointly in order to help compensate the unbalanced development level between the Upper Danube ports and the other river sections.

For this, four activities have been planned. In Activity 5.1 the focus will be on means of stimulating the upgrade of the port infrastructure & industrial development. This activity corresponds to the 1st pillar. The second activity will target the issue of financing port investments, as experienced via public-private partnerships (2nd pillar). In regards to the 3rd pillar dealing with innovation two activities have been planned.

Activity 5.2 will focus on public-private partnerships (PPP) for port investments which have become a very interesting and convenient development option in the last 25 years. The most common form of PPP is the operation of a concession agreement.

In Activity 5.3 the consortium will focus on the simplification of the work flow within the ports with the help of a modular port community system.

A pilot implementation of this IT system will be planned & implemented in 3 ports along the Danube. Other Danube ports will be able to apply this system by adapting to their own needs the IT model architecture developed by the DAPhNE PPs.

In Activity 5.4 innovative markets will be investigated in order to identify potential types of cargo that could be transported on the Danube and the special conditions that the ports have to comply with to accommodate these future changes. The findings will be reflected in the case studies for new markets - circular economy.

1.1 Objectives of the activity 5.1

The objective of Activity 5.1 is to provide a comprehensive image of the state of the port infrastructure along the Danube and clarify questions related to ownership, rehabilitation plans, missing infrastructure, etc. These facts are incorporated in an overall Report on the status of the port infrastructure development.

This document will also be used as a tool for the update and validation of the Rhine-Danube Work Plan and will thus be further capitalized on by other entities at regional & European level.

Another objective of Activity 5.1 is to provide a knowledge sharing source for port planning issues, through a Report on Good Practices for Port Master Planning (D.5.1.2) which illustrates the available port master planning models in the Rhine-Danube area and lists those that are more relevant to the situation in the region.

Final objective of this activity is to explore the possibilities available to port-cities to boost their industrial features by creating linkages with the local economy (alignment of local, regional strategies) and compile the findings in the report Guidelines for industrial development initiatives in ports (D.5.1.3).

2 Scope of the report

This report illustrates the available models for port master planning in the Rhine-Danube area and lists those that are more relevant to the situation in the region.

Relevant legislations of all participating countries are briefly examined for requirements affecting the port master planning. Following the assessment of related mater planning legislation, a best practice examples are presented.

Finally, a recommended port master plan structure and guidelines are given.

2.1 Legal basis for port master planning in the Danube region

First, all national legislations (Austria, Slovakia, Serbia, Romania and Bulgaria) are tackled and relevant acts and by-laws are briefly presented by project partners from each country. Port master plans are commonly applied in all countries and are usually a part of the legislation related to planning and construction or form a standalone legislation (in law on ports, or similar). Although applied worldwide, the legal of official "name" of the document reflecting the port master plan may differ from country to country. This is why brief legal comparison is needed on a country-by-country basis.

2.2 Best practices for port master planning

Second, best practices are given for different countries and different ports.

Following ports are selected for best practices in port master planning:

- Austria: Port of Enns,
- Slovakia: Port of Bratislava,
- Romania: Port of Constanta.

2.3 Guidelines and recommendations for port master planning

Last, but not least, a recommended structure of the port master plan is given, reflecting all inputs and national specificities of the involved countries, as well as the aspects of modern port master planning. Step by step approach into port master planning is given only as an assisting tool for ports, not to impose them the contents and dictate the steps in port planning. Different steps of port master planning are also explained in brief, pointing out towards the recommended scope of each necessary step.

3 Characteristics of port master planning

3.1 Rationale behind port master planning

Very much like living organisms, ports require attention, security, care, and protection in order to facilitate their development, growth, maintenance, and sustainability. Regardless of their location and/or type, ports face numerous challenges, such as technological transformation, climate change, globalization, competitiveness, superstructure and infrastructure development, management and governance change, successful and unsuccessful privatizations, and changes in political ideologies which have a direct influence on how the ports are treated, governed and operated. Port managers require the capability to balance physical, economic, and social environments in order for their ports to thrive and develop.

While circumstances vary depending upon a port's location, decisions and approaches to sustainability and growth are achievable through the development, adoption, and implementation of a document which is frequently called "Port Master Plan". Master plans can assist port authorities and port management in developing clear sets of recommendations and implementation approaches to projects identified and approved by stakeholders and governmental officials during the planning process.

The decision by port authorities and/or national or local governments on how to best approach financing projects - rather through public-private partnerships, public-public partnerships, or entirely financed by the port authority - do not result from a single non-directional meeting. Deciding on the types of projects requires extensive reviews of existing conditions, strategically reviewing the national and international markets, conducting plan development, market forecasting and market projections, and obtaining stakeholder inputs. Moreover, many ports are land constrained and have limited resources, so in order to facilitate growth and properly direct investments, ports need clear and educated guidance. Master plans can be the right tool for these purposes, and may also be a basis for fiscal planning.

Port master planning consists of a series of activities that help shapes a port's development and growth. Port planning is essential and brings value to facilities and services. However, master plans are useless if they just become another report filed away on a shelf. A master plan must remain a living document that is understood, adhered to, and is flexible enough to allow adaptability in unforeseen circumstances.

Updating master plans better enables ports to buffer any economic downturn. Moreover, a port may strategize to prepare proposals for grants and other funding and partnership opportunities should they arise. European ports with a master plan in place may potentially be more "eligible" for, say, Connecting Europe Facility funds (CEF funds) of the European Commission, as such plans suggest that a port authority or port management has conducted a thorough economic, capital, and infrastructure assessment of the port project, be it related to a completely new facility or to a rehabilitation or upgrade of an existing port facility.

The master plan of a port allocates the land within the port to the various uses required, describes the projects needed to implement the plan, and gives an indicative implementation scheme by development phase. These phases are related directly to the projected port traffic which has to be monitored closely. When in due course a decision is reached to proceed with implementation of a development scheme, this should be integrated smoothly with, or derive from, the master plan for the port. Therefore, it is important that a master plan exists, and drafting one should be among the primary concerns of port management. Of course, a variety of continuously varying factors have a bearing on such a plan, ranging from statistical data on port traffic to international treaties. For this reason, the plan should be revised regularly, at least every five to ten years. Moreover, if during the design of a particular development phase the need arises for a review of the plan, this should be conducted concurrently, if possible, to ensure compatibility with the other functions and operations of the port. However, the lack of a master plan at a particular port should not delay the making of decisions for small-scale immediate improvement, although it is recommended that at the first opportunity an effort should be made to draft a master plan for the port.

3.2 Planning levels and objectives of port master plans

Port master plan are frequently elaborated within the framework of wider port policy or port strategies or port strategic planning, encompassing a larger variety of aspects than a single port master plan.

From the view of the integral concept of port planning the main objective of port planning (including the port master planning) is to optimise the functioning of the overall transport system and boost regional development.

Aspects which are considered in the so called integral concept of port planning are shown in Figure 1.

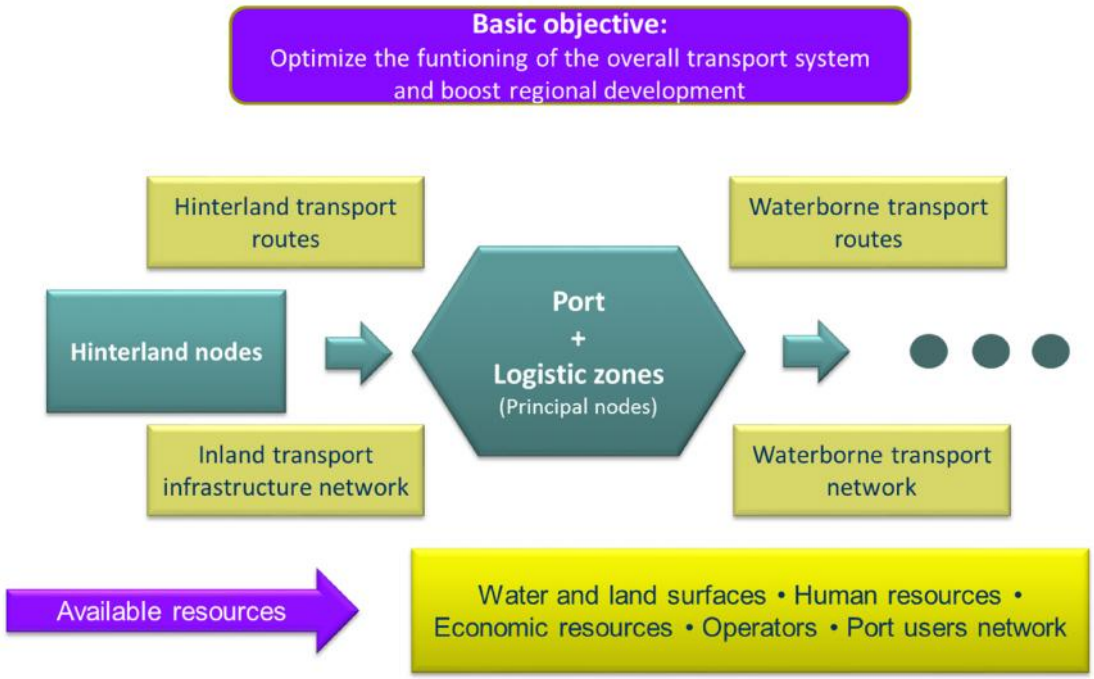

Figure 1: Aspects taken into account in integral port master planning

(Source: S. Jovanović, "Port planning", Handouts of "Port Management Basics" lectures given at the World Maritime University, Malmö, Sweden)

In order to properly understand the objectives of port master planning, two levels of planning need to be discussed. Depending on the level of centralization of strategic transport issues in a country, the planning of the port system can be on a national and/or regional level on the one hand, and on the local level, on the other hand. Planning on national and/or regional level includes wider planning aspects of the entire port system or even entire transport system of a country, while local planning involves port master planning on a level of a single port with a more concrete development options and engineering, economic, financial and environmental aspects.

Different authors have different approaches in making a difference between the port strategic planning (or port development strategy) and the port master plan. For example, Institute of Chartered Shipbrokers (ICS)[2] defines port master planning as long-term planning, hierarchically above the strategic planning which the authors consider as mid-term planning. ICS defines a master plan as a long-term document with the time horizon of 10 years or more, where port development is planned in terms of new or large infrastructure facilities and long-life span suprastructure and equipment. In addition, ICS defines a strategic port plan as a mid-term plan with the time horizon of 3-5 years where main tasks are focused on allocation of existing resources and those to be acquired in the medium-run to existing and anticipated activities in line with traffic forecasts.

[2] Institute of Chartered Shipbrokers, *Port and Terminal Management*, London, 2007.

However, iC consulenten as the author of this section disagrees with the above definitions. In its long experience with port planning, iC came across a number of quite opposite definitions and practical applications which, in iC's expert's opinion, are more in line with the logical division of port planning levels. For example, Frankel[3] states that aggregate port planning (i.e. port master planning) is always considered in line with national port policy or national port strategy, which implies that on the planning level master plans are below strategic plans, even though both master plans and strategic plans are considered as two layers on the strategic level of port planning. In addition to this, Coeck[4] (2006) claims that the strategies on the long term are the basic building blocks for master planning in ports. The same author claims that a master plan needs to be considered as the implementation on a project level of the development strategies described in a long-term strategic plan. This means that master plan contains more concrete engineering, economic, financial, environmental and other specific issues than a strategic port plan or the port development strategy which cannot go into these technical details.

Finally, Dooms and Verbeke[5] (2005) and Moglia and Sanguineri[6] (2003) recognize that the long-term planning (time horizon of 10-25 years) encompasses "master planning" (10-15 years) and "long-term strategic planning" (15-20+ years), meaning that, again, the strategic plan or the port strategy is "above" the port master plan in terms of hierarchy and sequencing.

Taking the above statements and arguments, the port planning levels can, generally, be divided into three main categories, as shown in Figure 2.

[3] Ernst G. Frankel, *Port Planning and Development*, John wiley & Sons, New York, 1987.
[4] Chris Coeck, "An Evaluation of the Strategic Planning Processus in Port Areas: Recommendations based upon Spatial, Economic, Organisational, Ecological and Political Considerations" in Theo Notteboom (Ed.), *Ports are more than Piers*, Uitgeverij De Lloyd, Antwerp, 2006.
[5] Dooms, M., Verbeke, A. (2005), „An Integrative Framework for Long-Term Strategic Seaport Planning: An Application to the Port of Antwerp", International Association of Maritime Economists Annual Conference
[6] Moglia, F., Sanguineri, M. (2003), "Port planning: the need for a new approach?", Maritime Economics and Logistics, 5(4), 413-425.

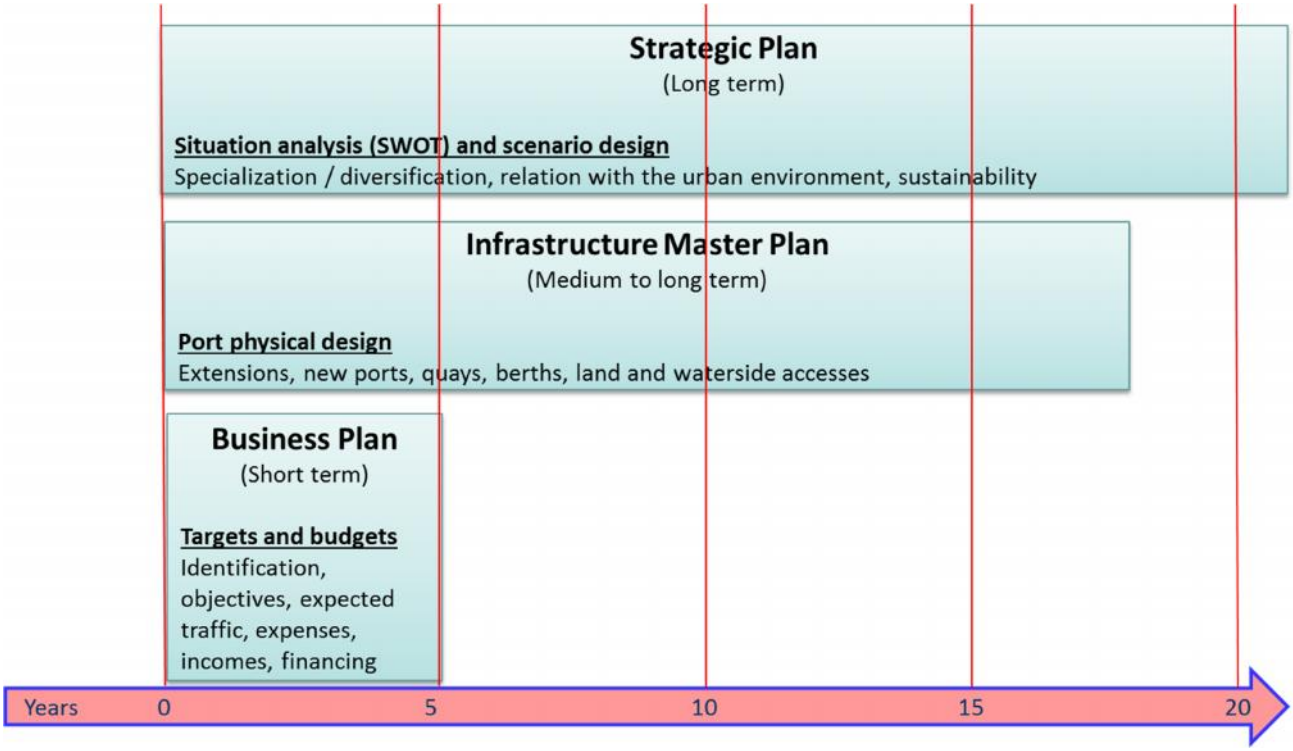

Figure 2: Port planning levels and general time horizons

(Source: S. Jovanović, "Port planning", Handouts of "Port Management Basics" lectures given at the World Maritime University, Malmö, Sweden)

Main objectives of the *strategic port plan* (or the port strategy) are the following:

- Port system efficiency enhancement.
- Strengthening territorial and social cohesion.
- Improving the overall port system sustainability.
- Contribution to economic development and competitiveness.
- Setting the "vision" of the future development of ports or a single port in terms of foreseen or expected economic development in the hinterland and foreland.
- Development of new business opportunities.
- Assessment of available and planned resources and unexploited opportunities.

Main objectives of the *port master plan* are the following:

- Transfer the "vision" of the port development for the port, with the concrete technical details, to the widest possible range of stakeholders.
- Develop the port from the "vision" to concrete project(s), in accordance with relevant national and/or international legislation and guidelines.

- Integrate economic, financial, engineering, traffic, environmental and safety considerations in the overall plan.
- Promote the phased long-term development and extension of the port by establishing or re-arranging functional areas for port facilities and operations.
- Provide technical foundations and guidance for further design and construction (re-construction, expansion, rehabilitation, upgrade, etc.) steps.

As an illustration, guidance in terms of port layout and establishment of functional areas for port facilities and operations, is given in Figure 3.

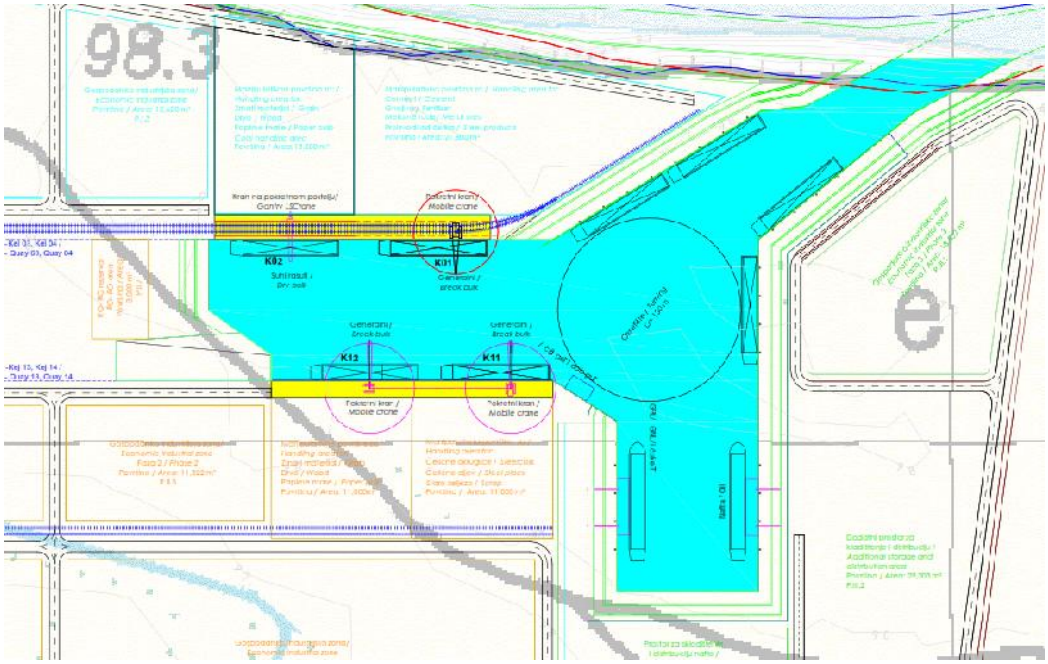

Figure 3: From the Master plan of the new port of Sisak (Croatia)

(Source: iC consulenten)

4 Austria

4.1 Legislative and regulatory basis for port master planning

In Austria the primary regulations derive from national level. In former times (when the four existing public ports have been erected) a different legal situation was in force – the ports have been regulated in the framework of "preferred hydraulic engineering / bevorzugter Wasserbau". In those times a very huge and comprehensive procedure was performed with participation of all relevant national and local authorities with the lead of the Austrian ministry – see more information in the best practice section on the example of Ennshafen port. Today other legal requirements and frameworks are present if a new port would be started (even it is quite unlikely that a new great public port will be built due to enough capacity and to less free spaces along the Danube).

First you need a strategic environmental assessment as a basis for the dedication process (regional laws of the federal districts) of the total area in order to dedicate land for berthing zones and industrial zones which are in general necessary to start with a special port project. After this very basic investigation you have to get to detail in the permission line as described afterwards.

The **environmental impact assessment** ("**EIA**") is an important instrument for environmental precaution that aims at examining possible environmental impacts of a project during the planning phase. In particular, the impacts on humans, animals, plants and their habitats, the soil, the water, the air, the climate, the landscape and material and cultural assets are assessed. If an EIA is required the competent authority also has to take into account the requirements of all other permits that are required under different laws (e. g. Trade Act, Water Rights Act). The permitting procedure is concentrated and only one permit is required for the whole project. The applicable legislation is the Environmental Impact Assessment Act which implemented the EU Environmental Impact Assessment Directive. The types of ports that require an EIA are listed in Annex 1 no 15 (a) (b) (e) (f) EIA Act. An EIA is required for the construction of new ports and berthing areas (*Länden)* for coal or oil, which are accessible for ships with a carrying capacity of more than 1350t. Amendments of ports are also subject to an EIA if the water surface is expanded by at least 25% or the port is deepened by at least 25%. The requirement of an EIA for the construction of new ports and berthing areas (*Länden)* for coal or oil in protected areas of category A or C (e.g. nature conservation area, water protection area) has to be assessed individually. If an EIA is required, a simplified EIA procedure is conducted. The same applies to amendments of ports in protected areas if the water surface is expanded by at least 12,5% or the port is deepened by at least 12,5%. If it is unclear whether an EIA obligation applies, a separate determination procedure is conducted (*Feststellungsverfahren*). The competent authority is the regional government (*Landesregierung*).

Special items and chapters of the EIA are: water, air, soil & ground, noise, energy, climate impact, waste, traffic, biosphere (animals, fauna, ecosystems), landscape, culture, people. This means that a very compulsory and expensive investigation and very huge elaborations,

descriptions and expertises are necessary for this process and ordinary longterm authority proceedings will follow.

The authority for legislation and implementation in the area of construction lies with the Austrian states according to the Austrian Constitution. This means that there are nine different Building Acts in Austria and that the rules, thus, may vary depending on where the building is constructed. The Building Acts relevant for the Danube region are those of the provinces of Lower Austria, Upper Austria and Vienna. The Building Act of Upper Austria (*Oberösterreichische Bauordnung*) does not apply to constructions which are subject to port legislation (Article 1 para 3 no 1). Shipping facilities in Upper Austria therefore do not require a special construction permit. The Building Act of Lower Austria (*Niederösterreichische Bauordnung*) does not apply to the construction of public shipping facilities (Article 1 para 2 no 1). However, private shipping facilities require a permit under the Building Act of Lower Austria. The Building Act of Vienna (*Bauordnung für Wien*) does not explicitly exclude shipping facilities. However, in general, it is not applicable to matters regulated by federal law (Preamble Article 1 para 2 Building Act of Vienna). As mentioned in 2.1 the authority for legislation and implementation in the area of shipping on the Danube lies with the federal government. Shipping facilities are thus generally excluded from the Building Act. However, according to Austrian case-law the Building Act applies to private shipping facilities. Therefor the Building Act of Vienna applies to private shipping facilities, but not to public shipping facilities.

In conclusion, shipping facilities that require a permit under the Navigation Law generally do not require a construction permit. However, a permit may be required for private shipping facilities as well as other buildings or superstructure in the port area.

The **Water Rights Act** primarily regulates the use of water, the protection and cleanliness of the water and the protection from dangers caused by water. However, it does not apply to the use of water by shipping (Article 6 (1) Water Rights Act). Shipping facilities thus generally do not require a permit under the Water Rights Act. But in practice the water rights are very important regulations for construction of ports due to other legal requirements of the running business of the port areas, surface pavement & drainage and precipitation water pretreatment etc. Therefor the water authority is actually a very important thematic for all the running businesses in the ports as well the erection processes due to the activities in the water (not specified for shipping facilities but every kind of work or activity in the water).

In Austria the main legal regulation governing ports is the **Federal Navigation Law** (*Schifffahrtsgesetz*). It consists of several individual parts and governs all regulatory aspects of Austrian navigation and port law. For the purpose of this report the most relevant part is the third part, which stipulates rules for the construction and operation of shipping facilities such as ports. The application of the Navigation Law depends on the type of body of water concerned. The Navigation Law applies i. a. to the Danube which is defined as waterway pursuant to Article 1 (1) in connection with Article 15 (1) Navigation Law and Article 2 (1) Water Rights Act (*Wasserrechtsgesetz).*

On the level of secondary legislation, the most important regulations are the **Shipping Facilities Ordinance** (*Schifffahrtsanlagenverordnung)* and the **Waterway Traffic Ordinance** (*Wasserstraßen-Verkehrsordnung).* Both ordinances were passed by the Minister of Transport, Innovation and Technology ("**BMVIT**") and specify primary legislation. The Shipping Facilities Ordinance regulates, in particular, the operation and use of shipping facilities as well as port fees. The Waterway Traffic Ordinance, inter alia, lays down general rules for the navigation of the Danube and also stipulates rules for ports.

As far as EU port legislation is concerned the rules have generally been implemented in the Navigation Law. On the level of international law Austria is a contracting party to the **Danube Convention** (Belgrade Convention). The general principle of this convention is that navigation on the Danube shall be free and open for the nationals, vessels of commerce and goods of all states, on a footing of equality in regard to port and navigation charges and conditions for merchant shipping. While the convention mainly sets out rules regarding shipping, it also contains general rules for port fees. The Danube Convention has the quality of a federal law in Austria. All the aforementioned legal regulations are general laws and thus apply to parties from the private and public sector. The highest port authority in Austria is the **Minister of Transport, Innovation and Technology** (*"**BMVIT**"*). The BMVIT also has the authority to pass secondary legislation in certain areas of port legislation. In addition, in the Austrian provinces the **district administrative authorities** (*Bezirksverwaltungsbehörden*) are competent in port matters. In particular, the district administrative authorities are responsible for granting permits for the construction of shipping facilities (ports) pursuant to Article 71 Navigation Law.

Austrian port legislation does not use the term port infrastructure. However, certain aspects defined as port infrastructure in the above-mentioned regulation, fall under the definition of shipping facilities pursuant to Article 2 (19) Navigation Law. A **shipping facility** is defined as a facility that directly serves the purpose of shipping (e.g. port, berthing area (*Lände)*, lock, ferry dock, transshipment facility, supply facility). A supply facility (*Versorgungsanlage*) is further defined as a shipping facility that supplies vessels with fuels and operating materials (e.g. bunker station, service station for ships) pursuant to Article 2 (24) Navigation Law. These elements are subject to port legislation.

In general, the construction of a new shipping facility and major amendments to an existing shipping facility are subject to an **approval (*Bewilligung*) under the Navigation Law** (Article 47). An approval is further necessary for the reutilization of a shipping facility after an approval has expired or has been revoked. Measures to maintain or repair a facility are not considered to be major amendments, even if they lead to an improvement of the facility (Article 47 (3)). The maintenance of a port, thus, does not require a permit under the Navigation Law.

Austrian port legislation does not provide for an **economic needs test**. However, as mentioned above the approval for the construction of shipping facilities for commercial transshipment on waterways may only be granted if an **economic interest** exists pursuant to Article 49 (7) Navigation Law.

Moreover, on waterways, such as the Danube, the approval for the construction of a shipping facility for commercial transshipment may only be granted if an economic interest (*volkswirtschaftliches Interesse*) exists (Article 49 (7)). If it is necessary to fulfill these prerequisites the approval can be granted under certain terms and conditions and only for a limited time. The authority further has to determine whether the shipping facility is public or private (Article 49 (6)).
„Economic interest" is compulsory for getting the permission of the construction of a shipping facility: [*original text in German: § 49 /7): Auf Wasserstraßen darf die Bewilligung zur Errichtung von Schifffahrtsanlagen für den gewerbsmäßigen Umschlag unbeschadet des Abs. 1 nur erteilt werden, wenn hiefür ein volkswirtschaftliches Interesse besteht; dabei ist auf die gesetzlich vorgesehenen Pflichten bereits bewilligter öffentlicher Häfen Bedacht zu nehmen. Eine Ausfertigung der Bewilligung ist der Bundesanstalt Statistik Österreich zuzustellen.]*

The competent authority is the district administrative authority (*Bezirksverwaltungsbehörde*) of the district where the port is located (Article 71). The authority has to grant the approval, if third party rights are not infringed and if the following points are taken into account:

- the needs of shipping (safety, order and flow of traffic on waterways);
- environmental protection (in particular protection of water and air);
- public interests (safety of persons, safety and order of traffic on roads, customs control, military interests, operation of power plants, regulation and maintenance of waterways);
- intergovernmental agreements;
- the rules on building and operating a port pursuant to Article 58 Navigation Law; and
- worker protection.

Apart from the permit under the Navigation Law other approvals may be required depending on the specific facility. For instance, approvals may be required under the Water Rights Act and the Trade Act (*Gewerbeordnung)*. In Austria there are no legal restrictions or limitations as to who can construct a new port. An existing port can only be amended by the current holder of the approval. Article 57 (2) and (3) Navigation Law stipulates limitations for the construction or major amendment of transshipment facilities for liquid dangerous goods as bulk cargo, which are not mixable with water or which have a flashpoint under 60°C. These facilities can only be constructed outside of ports if certain safety requirements are met. Due to practical reasons specially the whole range of railway laws and ordinances are very important for master planning of a port – even it is not written in laws – but no public port business can in practice be done without railway lines and this thematic has very great influence in port master planning. The general infrastructure situation by high quality access roads is basic for all the activities and if this item is not clear no other processes of port master planning will be started.

4.2 Practice beyond legislation and regulation

Business aspects (internal – between port company and his owners/shareholders)

Besides the above mentioned "economic interest" according to art. 49(7) of the federal navigation law which investigates the economic situations on a very high level (general economic considerations) the details financial aspects will totally be done in internal economic calculations and considerations of the owners of a port. These means that all business calculations a business plans in all details (ROI, risk analysis and assessments, finance and funding planning, …) will be done due to the responsibility of the public or other owners (public: general responsibility for public money). In Austria for the public section there exists a very stringent framework of governmental rules for good practice and good business governance of public investments and multistage compliance proceedings for approval of investing money for projects like this. Surely all this together is absolutely very more stringent than legal aspects for permissions in port master planning. Due to practical situation in Austria this is arranged on local governmental area or on the level of very big cities who are financially able to run port projects (e.g. Linz, Vienna) and not concentrated in national level; only funding items of investing is arranged on national level.

There is no specific funding system for ports in Austria. Regarding State aid schemes and allocation in general the regulations of the Federal Organic Budget Act apply (*Bundeshaushaltsgesetz*), which regulates the federal allocation system. If public funding is granted, the federal government has to comply with EU regulations. Pursuant to Article 107 in connection with Article 108 Treaty on the Functioning of the European Union the European Commission shall be informed of any state aid granted by a Member State. Before a positive and final decision is made by the Commission, the Member State is not allowed to put its proposed measure into effect. There are a number of recently extended and authorized State aid schemes relating to the support of inland waterway transport and necessary infrastructure. These can be granted in different ways, such as direct financial support or loans with a low level of interest. For example, there is "The prolongation of a program supporting the development of connecting railways and transfer terminals in intermodal transport (2018-2022) and "Special guidelines for the program of aid for innovative combined transport for 2015 to 2020. Additionally, the recently fixed general block exemption regulation can have a great influence on the financial perspective of port master planning in general.

Table 1: Obligatory or customary contents of the port master plans in Austria

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
1. Current situation analysis				
1.1 Land use analysis	Y			SUP, UVP, WID
1.2 Existing hinterland connections	Y			SUP, UVP, WID
1.3 Assessment of capacity and degree of utilization of existing facilities	Y			SUP, UVP, WID
1.4 Institutional framework	Y			SUP, UVP, WID
1.5 Assessment of existing infrastructure services	Y			SUP, UVP, WID
2. Demand (traffic) forecast				

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
2.1 Export & import flows	Y			SUP, UVP, WID
2.2 Foreseen modal split	Y			SUP, UVP, WID
3. Engineering aspects				
3.1 Berth capacity planning	Y	Y		both legal & internal
3.2 Land side capacity planning	Y	Y		both legal & internal
3.3 Hydraulic modelling	Y			permit process
3.4 Geotechnical study	Y			permit process
3.5 Land survey study and expropriation study	Y	Y		if necessary
3.6 Layout planning	Y			permit process
3.7 noise study	Y			permit process
4. Financial and socio-economic analysis				
4.1 Funding options analysis				Business plan ; very roughly due to law
4.2 Financial aspects (ROI, NPV, IRR, ….)		Y		Business plan ; very roughly due to law
4.3 Economic aspects (ENPV, EIRR, B/C ratio, etc…)		Y		Business plan ; very roughly due to law
4.4 Sensitivity and risk analysis		Y		Business plan ; very roughly due to law
5. Analysis of alternatives				
5.1 Land use comparison		Y		Business plan
5.2 Cost comparison		Y		Business plan
5.3 Justification of the selected option		Y		Business plan
6. Environmental impact assessment				
6.1 water (emissions)	Y			UVP
6.2 air (emissions)	Y			UVP
6.3 soil & ground (contamination)	Y			UVP
6.4 noise	Y			UVP
6.5 energy	Y			UVP
6.6 climate impact	Y			UVP
6.7 waste	Y			UVP
6.8 traffic	Y			UVP
6.9 biosphere (animals, fauna, ecosystems)	Y			UVP
6.10 landscape, culture, etc.	Y			UVP
6.11 people	Y			
7. Federal navigation law				Incl. ordinances
7.1				
7.2				
8. Water rights act				Incl. ordinances
8.1				

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
8.2				
9. **Railway law**				Incl. ordinances

(Source: EHOÖ)

"SUP" – strategic environmental assessment" (Strategische Umweltprüfung)
"UVP" – environmental impact assessment (Umweltverträglichkeitsprüfung)
„WID" – dedication process (Widmungsverfahren / Raumordnungsgesetz)

5 Slovakia

5.1 Legislative and regulatory basis for port master planning

The contents of Master plans for Danube ports in Slovakia are not exactly determined by any of national law or regulations.

The Master Plan should be approved by the authorizing officer appointed by the Ministry of transport and construction of the Slovak Republic and approval of the SEA document by authorizing officer appointed by the Ministry of environment of the Slovak Republic. These documents should only respect and follow the legislations and related documents:

The most important act, which enforces the operation and development conditions of the public ports in the Slovak Republic, is the Act No. 338/2000 Coll. on Inland Navigation and on the amendment and supplementation of certain laws as amended (hereinafter "Act No. 338/2000 Coll.").

Act No. 338/2000 Coll. stipulates conditions of performing inland navigation, the rights and obligations of entities participating in inland navigation, conditions of business in water transport, terms of market regulation in water transport, competences of state administration authorities and state supervision authorities, classification and capability of vessels, rights and obligations of vessel crew, investigation of navigation accidents and sanctions for the breaking the law stipulated by this act.

Act No. 500/2007 Coll., amending Act No. 338/2000 Coll. defines the way and purpose of establishment, the legal relations and the tasks of the public port manager in the Slovak Republic. The law defines the tasks that VP, a.s. as a manager of the public ports in the Slovak Republic should fulfil. However, the current setting of the ownership relations between the company VP, a.s., which owns the land and other entities that own the majority of infrastructure and superstructure, does not allow to fulfil these statutory tasks.
Among other limitations stipulated by Act No. 500/2007 Coll. can be found the classification of VP's, a.s. land into the category of priority investment property, with regard to its location in the boundary area of the public ports. This restriction primarily relates to the limitations on the possible financing an investment event. The reason is that the priority investment property cannot be the subject of a lien. In the case of another investor's entry to the VP, a.s., the Act No. 500/2007 Coll. establishes to leave a permanent state shareholding of at least 67%. However, this assures the protection of state property and the security of the public ports.

From the international legislation point of view, VP, a.s. is obliged to protect underground sources of drinking water located on Rye Island.

Activities in the Bratislava port are also influenced by law. Roles, responsibilities and opportunities of the port are stipulated by the following legislation:

- Act No 580/2003 Coll. amending the Act No 338/2000 Coll. on Inland Navigation.

- These acts identify division and management of waterways. Ports are mentioned in § 4 Parts of Waterway and Activities Performed on Waterways and mainly in § 5 Operation and Using of Ports.
- Act No.364/2004 Coll. on Water Sources – identifies conditions for use of water for navigation, floatation as well as using the necessary amount of water in connection with the operation of vessels.
- Decree no. 1740/M-2001 of the Ministry of Transport of Slovak republic by which are issued the safety rules of operation of the vessel on inland waterways in SR.

Furthermore, for the operational and commercial activities in the port, the relevant rules and regulations of different lengths and coverage are issued on demand by the State Navigation Administration or VP, a.s.

Regulation of the Government of the Slovak Republic no. 755/2004 Coll., Stipulating amount of unregulated payments, the amount of charge and details related to the charging of water use - the unregulated payment is the payment provided for the maintenance of the navigability of the waterways and route tracking of the voyage for navigation on the waterways for the purposes of using the waters for navigation and other services of general interest.

Convention regarding the regime of navigation on the Danube ("Belgrade convention"), the Danubian States undertake to maintain their Danube sections navigable for river ships and for the seagoing ships, to ensure and improve the conditions of the voyage, as well as not to make difficulties or obstacles to navigation on the Danube navigable waters. The Slovak Republic, as a signatory to the Convention regarding the regime of navigation on the Danube, does not charge the Danube waterway, in order to guarantee the freedom of navigation to all vessels.

European Agreement on Main Inland Waterways of International Importance ("AGN") - this agreement has been taken to build a legislative structure defining a coordinated planning of the development and construction of a network of inland waterways of international importance based on mutually approved infrastructure and operational parameters to increase the efficiency of inland waterway transport in Europe and to make it more attractive to its users.

The Trans-European Transport Network TEN-T - the TEN-T program approved by the European Commission is one of the main sources of financial support for the support of infrastructure projects within the trans-European transport network. Technical and financial management of the program is ensured by the Trans-European Transport Network Executive Agency. TEN-T projects cover all types of transport including inland waterway transport. By Decision No. 884/2004 were defined 30 priority projects with a status of "project of European interest" and for this implementation is a Member State obligation to allocate available financial resources (both EU and national). For the Slovak Republic, as part of the development of water transport on the Danube, concerns Priority Project no. 18 Rhine -

Mohan - Danube. The project's activities are aimed at improving the navigational potential of this transcontinental waterway linking the North Sea and the Black Sea.

The White Paper – Roadmap to a Single European Transport Area – "Towards a Competitive and resource efficient Transport System" is one of the key initiatives to increase transport competitiveness and reduce the environmental impacts till 2050. The further development of the transport system must be based on a number of basic elements:

- improving the energy efficiency of vehicles in all modes of transport. Development and deployment of sustainable fuels and propulsion systems
- optimizing the performance of multimodal logistic chains, including greater use of energy-efficient modes of transport where other technological innovations may be insufficient
- more efficient use of transport and infrastructure through improved transport and information systems

EU Strategy for the Danube Region ("the Danube Strategy") has a macro-regional dimension and it is a result of joint efforts by the Danube River regions. It is focused in particular at intensifying and improving cooperation within transport, energy and the environment. Implementation of the Danube Strategy implies efficient and coordinated use of financial, personnel and other stakeholders' resources, intensifying cross-border cooperation and the gradual engagement of relevant neighbouring and non-EU countries.

The strategic plan for the development of the transport infrastructure of the Slovak Republic till year 2020 is the strategic document of the Slovak Republic for the medium-term development of transport infrastructure. The subject of the document is the analysis of the current development of transport policy of the SR and the EU, the prognosis of its further development and the challenges that affect the achievement of the stated goals within transport. The strategy defines visions, objectives, priorities and measures in the field of transport development, which will support the increase of the competitiveness of the Slovak economy, contribute to the social development of the society and allow the elimination of regional disparities so that the economic potential of the Slovak Republic in the 2020 horizon is closer to the average EU level with the requirements of sustainable development.

Concept of Development of Water Transport of the Slovak Republic (approved by Government Resolution No. 469/2000) and its latest update (02/2004).

Operational programme integrated infrastructure 2014 - 2020 - is a strategic document through which money from EU funds will be funding from 2014 to 2020 for the transport and development of the information society in Slovakia. OPII was approved by the European Commission on 28.10.2014.

Transfer of competences for the management and development of waterways - approved by Government Resolution no. 275/2009 which has been achieved a systemic measure to improve the competency relations in order to ensure the responsibilities of the European inland waterway development, the implementation of measures in the areas of

infrastructure, safety, reliability and efficiency of water transport. Submitted alternative to completion the competencies of the newly-developed water transport infrastructure to the transport sector respond to a solution to improve the situation in the area concerned.

General Program of NAIADES Implementation in the Slovak Republic (approved by Government Resolution No. 642/2009) - the material represents the general plan for the implementation of the NAIADES program for Slovakia for the next period in terms of material, time and financial aspects in the following themes:

- Strategic Infrastructure Development Plan, after consideration the most important navigational barriers and the institutional framework of inland waterway infrastructure - including the preparation of a strategy for the development of Slovak ports,
- Development of river information services and their extended offer,
- Enhancing the compatibility of vessels with the environment,
- Preventive measures to protect against vessel crash
- State aid support programs for transfer facilities,
- A water transport education support program.

Updated Concept of Development of Public Ports Bratislava, Komárno and Štúrovo (approved by Government Resolution No. 846/2010) - the document defines the long-term concept of the development of public ports Bratislava, Komárno and Štúrovo. The whole concept of the development of public ports is formulated on the basis of the restrictions that results from the current situation and are built on the assumptions and estimates of further developments. These constraints and assumptions thus represent the context in which the whole concept is has to be understood. Among the main factors influencing the formulation of the concept of the development of public ports are in particular legislation on water transport in the Slovak Republic and the EU, trends in water transport, property law relations and financial resources for the development of public ports.

The National Position on the EU Strategy for the Danube Region (approved by Government Resolution No. 149/2010) - in the national position of the Danube Strategy, the development of the transport infrastructure, especially the development of the continuous Danube waterway and ensuring the Danube's navigability, respecting the principles of sustainable development, of the main priorities that should be reflected in the Danube Strategy. In terms of both environmental, energy and social aspects, water transport is considered to be one of the most advantageous types of transport in Europe. In this context, attention should be paid to the development of freight and passenger transport as part of the West-European waterway network and to the effective completion of the Danube waterway, in line with the parameters recommended by the Danube Commission and UNECE (Blue Book and AGN Agreement). This solution will remove the barriers to navigation and subsequently the differences in use of the potential of inland waterway transport between the western and eastern parts of Europe and the creation of conditions for the implementation of the North-South transport links on the basis of water transport.

The Territorial Development of Slovakia 2001 (KÚRS) sets out regulations of the territory of the state from the point of view the development of the transport equipment (Decree of the Government of the Slovak Republic No. 528/2002 Coll., which declares obligatory part of the Slovak Spatial Development Concept 2001). Government Resolution no. 270 of 8.4.2009, the role of the MVRR SR was submitted to the Government of the Slovak Republic for the amendment no. 1 KURS 2001. The Cabinet approved the updated concept of territorial development of the Slovak Republic at its meeting in August 2011.

5.2 Practice beyond legislation and regulation

During the preparation of Master Plans for Danube port, the scope of the Master Plan is optional and depends on its developer (Ministry of transport and construction of the Slovak republic or port authority – Public ports Slovakia). The scope and content is discussed between interested parties and national authorities.

In case, that Master Plan contains also SEA or CBA, the analysis should follow the methodology for CBA given by Ministry of transport and construction of the Slovak republic, especially if the projects identified in Master plan will be financed by EU funds.

Cost - Benefit Analysis - The CBA Manual is a methodological aid and the manual for drawing up expenditure and income analyses for applicants or eligible beneficiaries of assistance from the Operational Programme Integrated Infrastructure 2014-2020, for the transport infrastructure projects implemented under the priority axes 1-6 of the Operational Programme Integrated Infrastructure. The document is also supportive material for the managing authority for evaluating the effectiveness of funds that are part of investment projects being submitted.

Strategic Environmental Assessment, ("SEA") – will be an integral part of the development of the Master Plan which is undertaken in parallel. It will provide the necessary evaluation of the environmental impacts arising from the Master Plan.

In developing the SEA, it is obligatory to comply with the provisions of the following relevant Slovak legislation and EU Directives:

- Law on Environmental Protection, Law act no 17/1992
- Law on Nature Protection, Law act no 543/2002
- Law on Water Protection, Law act no 364/2004
- Regulation on strategic environmental impact assessment on plans and programs
- European Union Directive 2001/42/EC.

Table 2: Obligatory or customary contents of the port master plans in Slovakia

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
1. Current situation analysis				
1.1 Land use analysis	Y			
1.2 Existing hinterland connections	Y			
1.3 Assessment of capacity and degree of utilization of existing facilities	Y			
1.4 Institutional framework	Y			
1.5 Assessment of existing infrastructure services	Y			
2. Demand (traffic) forecast	Y			
2.1 Export & import flows	Y			
2.2 Foreseen modal split	Y			
3. Engineering aspects		Y		
3.1 Berth capacity planning		Y		
3.2 Land side capacity planning		Y		
3.3 Hydraulic modelling			Y	
3.4 Geotechnical study			Y	
3.5 Land survey study and expropriation study			Y	
3.6 Layout planning			Y	
4. Financial and socio-economic analysis				
4.1 Funding options analysis			Y	
4.2 Financial aspects (ROI, NPV, IRR, ….)	Y			
4.3 Economic aspects (ENPV, EIRR, B/C ratio, etc…)	Y			
4.4 Sensitivity and risk analysis	Y			
5. Analysis of alternatives	Y			
5.1 Land use comparison	Y			
5.2 Cost comparison	Y			
5.3 Justification of the selected option	Y			
6. Environmental impact assessment			Y	SEA is required and more appropriate
6.1				
6.2				
7. Strategic Environmental Assessment	Y			

(Source: VPAS)

6 Serbia

6.1 Legislative and regulatory basis for port master planning

Port master planning has not been regulated within the Law on navigation and ports on inland waters. Yet, some studies containing certain elements of master planning are obligatory in the process of Port area determination.

However, Feasibility study with the preliminary design of the port can be considered as the port master plan. These documents are regulated with the Law on planning and construction ("Official Gazette RS", No 72/2009, 81/2009 – correction 64/2010 – decision of the Constitutional Court, 24/2011, 121/2012, 42/2013 - decision of the Constitutional Court, 50/2013 - decision of the Constitutional Court, 98/2013 - decision of the Constitutional Court, 132/2014 and 145/2014).

Being obligatory for all projects financed from the state budget, documents have to be prepared by licensed engineers and companies, and need to be evaluated by the state (or province) committee for project evaluation. The evaluation committee verifies the concept of the facility, especially with respect to:

- Suitability of the location with regard to the type and intended use of the facility;
- Facility construction conditions with respect to application of the environmental protection measures;
- Seismic, geotechnical, traffic, and other conditions;
- Providing energy conditions in relation to the type of planned fuels;
- Technical and technological features of the facility;
- Technical, technological and organizational solutions for construction of the facility;
- Modernity of technical solutions and compliance with development programs in this area;
- Other stipulated conditions for the facility construction.

The feasibility study determines in particular the spatial, ecological, social, financial, market and economic justification of the investment for the selected solutions, elaborated in the preliminary design, which is its integral part.

Content of the feasibility study is given in the Rulebook on the content and extent of the preliminary work, pre-feasibility study and feasibility study. For the designs financed from the state budget, the decision on feasibility of the investment is made based on the feasibility study.

Preliminary design is a set of mutually harmonized designs that determine:

- Intended use;
- Position, shape, and appearance;

- Capacity, technical-technological and functional features;
- Optimal routes, under specific conditions and limitations, with all supporting facilities, for the line infrastructure facilities;
- Provisional evidence of the fulfilment of the basic requirements for construction of the facility.

Detailed content of the preliminary design is given in the Rulebook on Content, Method and Manner of Development and Performing Control of Technical Documentation According to Class and Intended Use of the Constructions (RTD) ("Official Gazette RS", No 23/2015, 77/2015, 58/2016, 96/2016 and 67/2017).

Environmental impact assessment is obligatory, but it is not a part of the port master plan and not regulated under the Law on Planning and Construction.

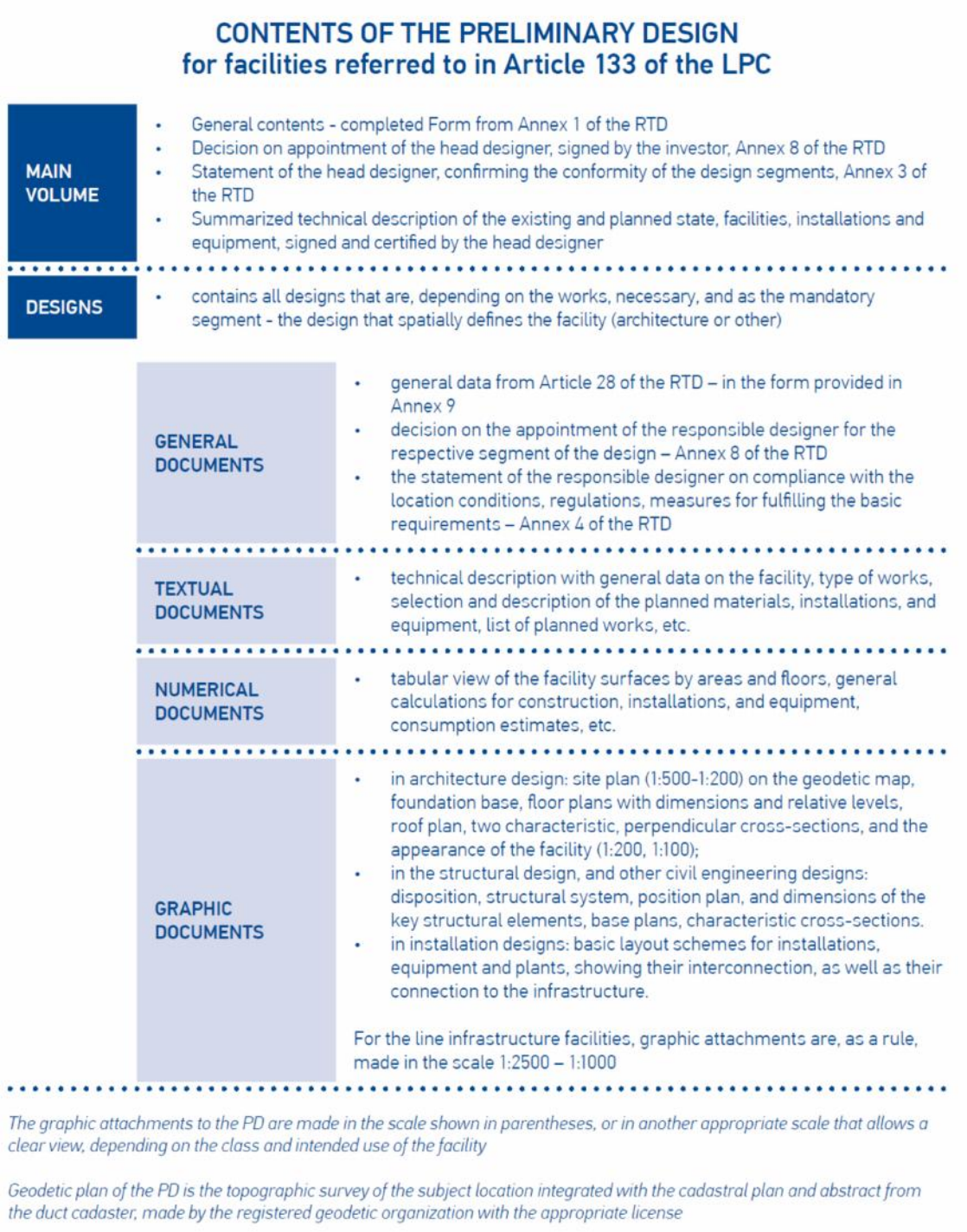

Figure 4: Contents of the preliminary design for structures including ports

(Source: Port Governance Agency (PGA), Serbia)

6.2 Practice beyond legislation and regulation

In principle, no contractor is obliged to take into account or to require any additional aspects or activities of the feasibility study and master plan (or preliminary design) other than those required by the laws and by-laws. Nevertheless, no restrictions exist in terms of any novel or experience based "additions" to the obligatory contents. Below table shows the obligatory and customary contents of the feasibility study and the preliminary design, which are the closest planning and design documents to the port master plan.

Table 3: Obligatory or customary contents of the port master plans in Serbia

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
1. Current situation analysis				
1.1 Land use analysis	Y			
1.2 Existing hinterland connections	Y			
1.3 Assessment of capacity and degree of utilization of existing facilities	Y			
1.4 Institutional framework	Y			
1.5 Assessment of existing infrastructure services	Y			
(add more if necessary)				
2. Demand (traffic) forecast				
2.1 Export & import flows	Y			
2.2 Foreseen modal split	Y			
2.3				
(add more if necessary)				
3. Engineering aspects				
3.1 Berth capacity planning		Y		
3.2 Land side capacity planning		Y		
3.3 Hydraulic modelling				
3.4 Geotechnical study	Y			
3.5 Land survey study and expropriation study	Y			
3.6 Layout planning	Y			
(add more if necessary)				
4. Financial and socio-economic analysis				
4.1 Funding options analysis	Y			
4.2 Financial aspects (ROI, NPV, IRR, ….)	Y			
4.3 Economic aspects (ENPV, EIRR, B/C ratio, etc…)	Y			

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
4.4 Sensitivity and risk analysis	Y			
(add more if necessary)				
5. Analysis of alternatives				
5.1 Land use comparison		Y		
5.2 Cost comparison		Y		
5.3 Justification of the selected option		Y		
(add more if necessary)				
6. Environmental impact assessment				
6.1				
6.2				
6.3				
(add more if necessary)				

(Source: PGA)

7 Romania

7.1 Legislative and regulatory basis for port master planning

In Romania the Government Decision no. 21/2015 *on the organization and functioning of the Ministry of Transport with further completions and modifications* (MT), stipulates that the Ministry of Transport, as central public authority, elaborates and implements **strategies**, **policies**, and **development programs** in the field of transport infrastructures, in the limits of its competencies, as well as for transport activities in accordance with national and international strategies.

The Government Ordinance no. 22/1999 *concerning the ports and inland waterways administration, the use of waterborne transport infrastructure belonging to the public domain and the carrying out of the naval transport activities in ports and on the inland waterways*, republished, with further completions and modifications[7], stipulates in art. 4 that MT is the state authority in the field of naval transport which elaborates and coordinates the **policy** and **development programs** of the naval transport system.

A Master Plan is a document that establish future policies, goals, investments in a certain area and period, usually on a long term. A General Transport Master Plan for Romania was developed and approved through the Government Decision no. 666/2016 and has as a time horizon the year 2040. Anyway, the document recommends a revision for the investments planned after 2030. The General Transport Master Plan was a necessary tool for the decision makers and an ex-ante condition from COM for providing the EU financing under the operational programmes for transport.

There are no legal requirements in Romania related to the content of a strategy or development program (assimilated to a Master Plan). It is worth to mention that according to the Romanian legislation[8] and international legislation[9] and conventions[10] a strategy need to have a SEA (Strategic Environment Assessment) and to follow the SEA procedure.

In parallel with the elaboration of the General Transport Master Plan it was carried out a deeper analysis of the biggest ports of Romania (Constanta and Galati) and there were developed their own master plans which were integrated in the General Transport Master Plan for Transport approved through the Government Decision no. 666/2016 as we mentioned before.

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[7] Ordonanţa Guvernului nr. 22/1999 privind administrarea porturilor şi a căilor navigabile, utilizarea infrastructurilor de transport naval aparţinând domeniului public, precum şi desfăşurarea activităţilor de transport naval în porturi şi pe căile navigabile interioare, republicată, cu modificările şi completările ulterioare.
[8] Law no. 349/2009 for ratifying the Protocol related to the environment strategic evaluation, open for signature at Kiev, on 21 – 23 of May 2003 and signed by Romania on 21 May 2003, at Convention on Environmental Impact Assessment in a Transboundary Context, adopted at Espoo on 25 February 1991
[9] Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment
[10] Convention on Environmental Impact Assessment in a Transboundary Context (UN ECE)

The MPAC Master Plan is a strategic document, based on the necessity and opportunity to carry out strategic planning of Constanta Port (including Mangalia and Midia ports)in the short, medium and long term (by 2020, 2021-2030 and 2031-2040 respectively), while ensuring the continuity of the port development , with the efficient exploitation of existing resources and infrastructure, geared to the real needs of the market, capable of serving both national requirements and those of its hinterland. The Constanta Port Master Plan is not a restrictive document but a development strategy whose implementation is conditioned by a number of relevant factors. It is based on a common knowledge base at the time of the study (2014-2015) and not on the legislative aspects that are applicable to the Constanta Port activity.

The design of the Master Plan was not based on the elaboration of a feasibility study. Feasibility studies are prepared for investments implemented through the Master Plan.

The Strategic Plan for Galati Port Development analyzed the current situation (2015), contain a traffic study, SWOT analysis and the strategic plan. Project finches were presented in the annexes of the Strategic Plan.

In Romania, a strategy or a development program does not contain and not represent feasibilities studies for individual projects. The master plan is a strategic vision that integrate different elements for future developments and shows the advantages that can be achieved. For individual projects, it is necessary to carry out a feasibility study. The Government Decission no. 907/2016[11] establish the steps for the preparation of a public investment as well as the compulsory content of the studies which prepare a public investment. The Romanian legislation, same Government Decision no. 907/2016, foresee that in case of a project included in a strategy / development plan, it is not necessary to carry out a prefeasibility study.

So in Romania a port master plan describes the development strategy of a port for a long period and for every individual project included in the port master plan a feasibility study is needed.

In Romania, the concept of “port feasibility study” does not exist.

7.2 Practice beyond legislation and regulation

Although there is no specific legal requirement related to the content of a strategy / development plan, in the practice, at national level as well as at the port level (Constanta and Galati), the strategic document includes a lot of common chapters and information like: analysis of the current situation, traffic studies, general and specific objectives for future developments, socio – economic analysis, implementation strategy including financial sources and environmental assessment.

[11] Government Decission no. 907/2016 on the phases of elaboration and the framework content of the technical and economic documentation related to the public-financed investment objectives / projects, with further modification and competitions.

Table 4: Obligatory or customary contents of the port master plans in Romania

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
1. Current situation analysis				
1.1 Land use analysis		Yes		
1.2 Existing hinterland connections		yes		
1.3 Assessment of capacity and degree of utilization of existing facilities (berths, warehousing, parking, platforms)		yes		
1.4 Institutional framework		yes		
1.5. Management system/ Quality Mangement Sistem		yes		
1.6 Assessment of existing infrastructure services		yes		
1.7 Safety and control of navigability		yes		
1.8 Manpower planning		yes		Used for the port of Constanta
1.9 Equipment and installations planning		yes		
2. Demand (traffic) forecast				
2.1 Export & import flows		yes		
2.2 Foreseen modal split		yes		
2.3 Mapping of activities		yes		
2.4 Characteristics of vessels		yes		
3. Engineering aspects				
3.1 Berth capacity planning		yes		
3.2 Land side capacity planning		yes		
3.3 Hydraulic modelling			no	
3.4 Geotechnical study		yes		
3.5 Land survey study and expropriation study		yes		
3.6 Layout planning		yes		
3.7. Port mapping		yes		
3.8. Compatibility between port areas		yes		
3.9 Design principles		yes		
3.10 Access for different types of terminals		yes		
3.11. Possibility of land extension		yes		
4. Financial and socio-economic analysis				
4.1 Funding options analysis		yes		

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
4.2 Financial aspects (ROI, NPV, IRR, ….)		yes		
4.3 Economic aspects (ENPV, EIRR, B/C ratio, etc…)		yes		
4.4 Sensitivity and risk analysis		yes		
5. Analysis of alternatives				
5.1 Land use comparison		yes		
5.2 Cost comparison		yes		
5.3 Justification of the selected option		yes		
6. Environmental impact assessment				
6.1 reduction, collection and treatment of waste		yes		
6.2 improvement of water quality and eliminating water consumption		yes		
6.3 improvement of air quality		yes		
6.4. emissions control		yes		
6.5.dangerous goods		yes		
6.6. attenuating / eliminating noise		yes		
7. Competition				
7.1 Efficiency of port operations		yes		
7.2 adaptability of market changing conditions		yes		
7.3 preferences of owners in selecting ports		yes		
7.4. Diversification of services		yes		
8. Future developments				
8.1 General objectives and specific objectives		yes		
8.2 Infrastructure projects		yes		
8.3 Implementation strategy		yes		

(Source: Ministry of Transport of Romania & MPAC)

For the General Transport Master Plan[12], which includes the master plan of the port of Constanta and the strategic plan for the port of Galati, it was developed and used a mathematical modelling – National Transport Model.

[12] http://www.mt.ro/web14/strategia-in-transporturi/master-plan-general-transport/documente-master-plan1

8 Bulgaria

8.1 Legislative and regulatory basis for port master planning

The obligation for elaboration of a port master plan is determined on **national level** and is laid down in the Maritime spaces, Inland waterways and ports of the Republic of Bulgaria Act (MSIWPRBA). Special provisions are contained in Chapter Four "Ports", Part IV Construction of new ports and specialized port sites, extension, reconstruction and rehabilitation of ports and specialized port facilities. Master plans have to be in line with the **Strategy for Development of the Transport System of the Republic of Bulgaria and the Master Plan on the transport of the Republic of Bulgaria.**

The elaborated and approved port master plans are detailed development plans within the meaning of the **Spatial Development Act.**

The master plan of a port for public transport is adopted by an interdepartmental expert council appointed by the **Minister of Transport, Information Technology and Communications and the Minister of Regional Development and Public Works**. The Council must include representatives of municipalities and districts depending on the location of the port for public transport and experts from the Ministry of Finance, the Ministry of Defense, the Ministry of the Interior and the Ministry of the Environment. Depending on the specifics of the port the council can include representatives of other interested agencies.

During the process of preparation and approval of the master plan for ports, there are applicable procedures under Chapter Six of the **Environmental Protection Act** and Art. 31 of the **Biological Diversity Act**.

Where protected areas for the protection of cultural heritage are included in the territorial scope of the master plan, the approved assignment for the elaboration of a master plan shall be agreed with the Ministry of Culture under the conditions and by the order of the **Cultural Heritage Act (Art. 12 (2) from the Ordinance 10/31.03.2014).**

Contents and scope of the master plans are described in detail in **Ordinance No. 10 of 31 March 2014 (in force as of 09.01.2015) for the scope and content, the elaboration, approval and amendment of the master plans for ports fort public transport.** The Ordinance is issued on the basis of Art. 112a, para. 6 of the the Maritime Spaces, Inland Waterways and the Ports of the Republic of Bulgaria Act.

A distinction between **two basic situations** can be extracted from the logic of MSIWPRBA and Ordinance 10/31.03.2014:

1. **Expansion of existing and construction of new ports for public transport of national importance. The decision in this case is taken by the Minister of transport and is preceded by a preliminary (preinvestment) study, and a draft Master Plan of the port.**
   According to the law natural or legal persons registered as traders who have an investment initiative to build a new port for public transport of national importance or its terminal on or off the territory of an existing port shall file an application with the Executive Agency Maritime Administration.

The application shall contain:

1. technological and financial justification of the investment initiative;
2. an investment program and data on the financial security of its realization;
3. individualization of the territory on which the port can be built, together with preliminary studies of the availability of appropriate geographic, hydrological, hydrogeological and other conditions and the possibilities for its connection with the road network and with railway infrastructure
4. a draft master plan, respectively modification of an effective master plan upon extension of an existing port;
5. research on the traffic of the type of cargo concerned;
6. the need and amount of public investment for the expropriation of land property, for the construction of road and / or rail links to the aquatory or its separate zones, to parts of the general technical infrastructure of the port, and in cases when international ships will be served at the port - and a border crossing zone.

2. **Bringing master plans of existing ports in line with the current situation and with the legal framework in force (without explicitly declaring an extension or construction initiative).**

Below are some excerpts from Ordinance 10/2014 referring to the exact contents and procedures required:

Art. 1. (1) This Ordinance defines the requirements for the scope and content of the Master Plans of Ports for Public Transport, the related feasibility studies and design tasks, as well as the rules for the elaboration, approval and amendment of the Master Plans of ports for public transport.

(2) The Ordinance shall be applied when creating new and amending existing master plans of the public transport ports.

Art. 2. (1) The master plan of a port for public transport shall be the basis for the construction and development, including the extension of the port. The master plan of the port for public transport defines the concepts of long-term development of the respective territory and the aquatory, based on technological and marketing conclusions and the interrelation of these concepts with the Strategy for development of the transport system of the Republic of Bulgaria approved by the Council of Ministers and with the General transport masterplan for Bulgaria as well as the corresponding concepts and spatial development plans and plans of higher degree.

(2) The master plan of a port for public transport shall be based on the results of a pre-investment survey on the development of the port and has to:

1. define the development of the existing and the necessity to reserve new territories, intended for carrying out port activities and services, zoning them functionally according to the technological and organizational separation of the necessary territory of the port and planning the mode of their construction and the parameters of their construction;
2. provide reasoned solutions to the transport, technological, infrastructure and environmental issues related to the implementation of port activities and services;

3. reflect the existing situation, to define the overall technical infrastructure of the port and to determine the development of the communications and transport network (railways and roads) and other technical infrastructure facilities and facilities in the port area as well as other port infrastructure elements;
4. determine the terrain of terminals and the zones for carrying out activities under Art. 116a of the MSIWPRBA;
5. provide reasoned decisions on the parameters (boundaries and design depths) and the navigational provision of the port area and of each of its zones;
6. give summary parameters of the zones for future investment initiatives as well as the characteristics of the existing facilities and buildings, road and railway connections, open warehouses and the general technical infrastructure networks within the port.

…**Art. 4. (1) The process of making a master plan shall include:**

1. preparation of an **assignment** for a draft master plan;
2. preliminary (pre-investment) **study** and preparation of a **draft master plan**.

(2) The preparation of an assignment for a draft master plan, the preliminary (pre-investment) study and the drafting of a master plan shall be carried out at the initiative of the contracting authority of the plan for its account and risk, subject to the requirements of this Ordinance.
(3) The Contracting Authority may provide for a pre-investment study to be carried out before or at the same time as the assignment is being prepared or as part of the preparation process of the draft master plan.
(4) The draft master plan of a port for public transport shall be made by persons with the necessary legal capacity when a legal act requires so, in compliance with the permit issued by the Minister of Transport, Information Technology and Communications and by the Minister of Regional Development and Public Works, approved by it and agreed in accordance with Art. 12 assignment for a master plan project and the results of the preliminary (pre-investment) study.

Other related by-laws that are applicable for elaboration of master plans are **Ordinance No. 8 of 14 June 2001 on the volume and content of the development plans** and **Ordinance № 4 of 21 May 2001 on the scope and content of investment projects** (both last amended in 2014).

In general, the content and stages of elaboration of a port master plan include:

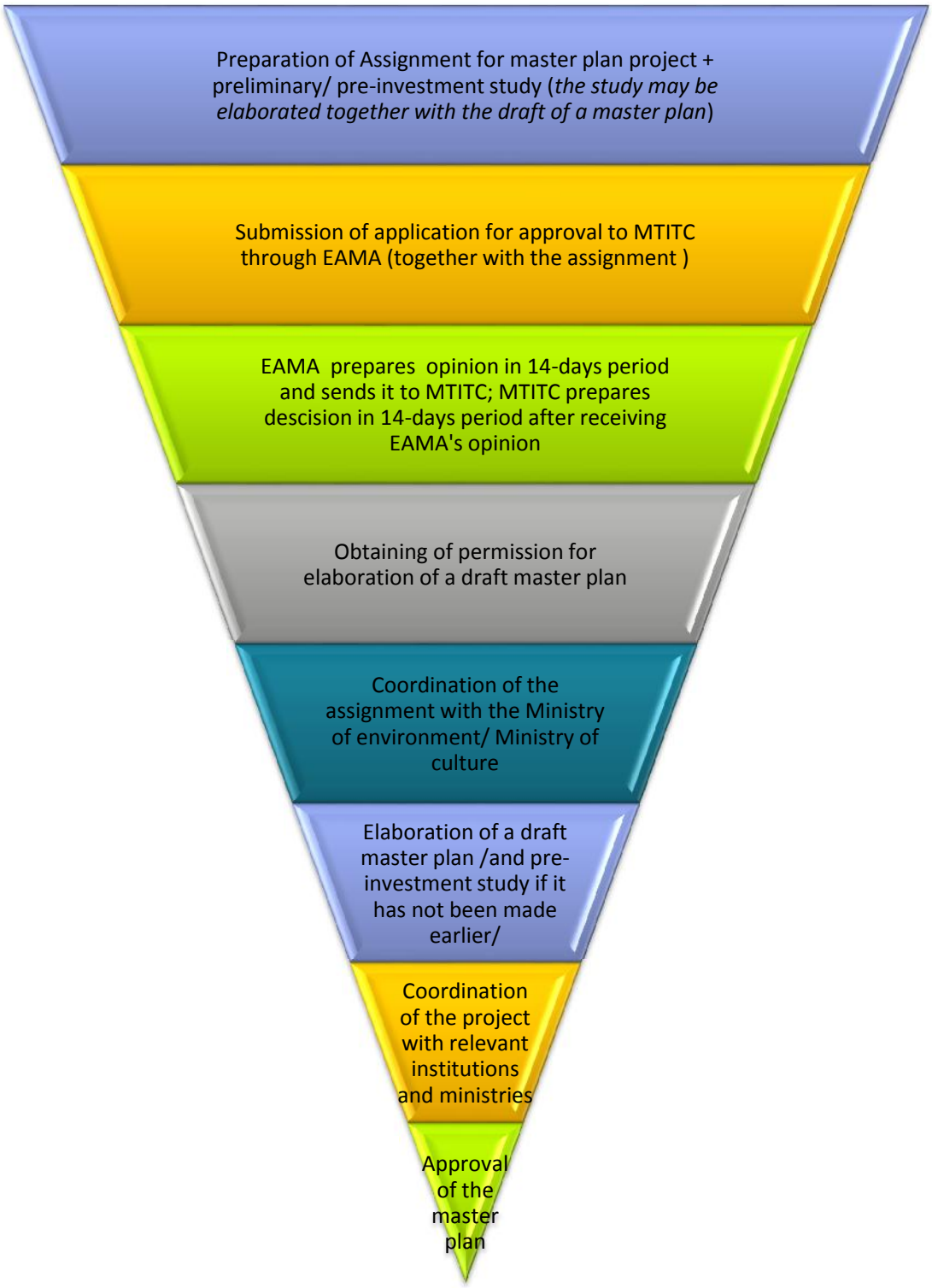

Figure 5: Procedures in the elaboration of the master plan for ports

1. Preparation of an assignment for a draft master plan

- justifies the need for elaboration of the master plan;
- considers the compliance with the approved Transport Development Strategy and with the General Transport master plan of the Republic of Bulgaria;
- defines the territorial range;
- describes the contents of the master plan;
- defines deadlines and stages;
- defines tools and methods for graphical execution, scale for the production of graphic parts;
- defines additional requirements.

2. Preliminary (pre-investment) study - *may be reffered as feasibility study*

- makes an analysis of the existing situation (description of the site, findings of previous spatial studies and developments, findings of ownership of the affected areas, state of existing buildings, networks and facilities, navigation conditions, presence of cultural and historical heritage sites);
- analysis of the terrain, geological, hydrological and climatic conditions;
- marketing analysis (statistics on cargo volumes by types, passengers, forecasts for the structure and dynamics of activities and services, freight traffic, concomitant activities, etc., influence of the used technologies);
- technical and technological analysis (description of existing or envisaged technological units and facilities, used / envisaged technologies, capacities, technological assessments and conclusions, modernization options, social aspects of changing technologies);
- environmental analysis (availability of existing developments, preliminary own environment impact assessment at putting in exploitation of the foreseen capacities and protection measures;

3. Elaboration of a draft master plan includes:

- text parts (explanatory note) including: analysis of the existing situation, description and justification of the development proposals, rules and norms for the implementation of the master plan, specific rules and norms for the implementation of the master plan;
- graphical parts contain: a comparative base plan (drawing of the existing facilities), a plan for regulation and construction of a port territory, a parcelling plan for the port aquatory, technological drawings of individual terminals and / or berths, sectional models of existing and proposed quay wall structures and other stationary or floating hydrotechnical facilities for ships stay, access channels, etc.

8.2 Practice beyond legislation and regulation

All master plans that were developed according to the former port legislative system are not in line with the ongoing reform. **In fact, many operators or owners of river ports have fulfilled their obligations to elaborate an assignment for a draft master plan, often including preparation the draft. Furthermore, concessionaires have presented an investment programme for the period of the concession, an assignment and a draft**

master plan on concluding a contract for concession. Due to changes in the legislation the procedures were not entirely completed.

According to the current situation[13] described in a motivated proposition for amendment of the MSIWPRBA from the side of EAMA:

In the period between the entry into force of the MSIWPRBA *(promulgated, State Gazette No. 28 of 2013) to date: 1) there is 1 (one) approved master plan of an existing terminal from a port of public transport of national importance (entered into force) and 1 (one) master plan of a port for public transport of regional importance (not yet in force due to appeal to the order for its approval); 2) 7 (seven) draft master plans of existing public transport ports or terminals from such ports are being considered and accepted; 3) 4 (four) authorizations for draft master plans have been given and another 23 (twenty-three) applications for permission to prepare a master plan are in the process of being rectified; 4) for 19 existing public transport ports and terminals from such ports no procedure has been initiated for bringing their development plans in compliance with the requirements of the law.[14]*

It must be stressed that the proposed changes in MSIWPRBA were mostly in connection with establishment into Bulgarian legislation the requirements of Directive 2014/89 / EU of the European Parliament and of the Council of 23 July 2014 on the maritime spatial planning. Clarifications have been made for the elaboration of port master plans also. The changes were accepted on a ministerial council meeting on 16-th march 2018! There is yet to be a process of promulgation and bringing ports' masterplans in compliance.

BPICo has practical experience in organizing public procurements for the seaports of Varna and Burgas for services with the subject of: elaboration and approval of master plans for the two public transport ports of national importance, related preliminary / pre-investment / development studies and draft assignment in compliance with Ordinance No. 10 of 31.03.2014).

BPICo has determined the following steps for fulfillment of the activities:

1. Preparation of a pre-investment study;
2. Elaboration on development alternatives of preliminary conceptual solutions, including technical-economic justification and a SWOT analysis of the alternatives;
3. Preparation of an assignment for a draft master plan on the basis of the chosen alternative as per point 2. above;
   The assignment is to be accepted by a Technical Council of the Contracting Authority (BPICo.). After the acceptance of the assignment without comments, it is forwarded under the envisaged legal order for issuance of permission for the drafting of a Master Plan by MTITC. Upon receiving of the permit, the next step under item 4 shall be

[13] The date of the document is not clear, but should be accepted approximately in the beginning of 2018.
[14] Source: https://www.mtitc.government.bg/bg/category/170/proekt-na-zakon-za-izmenenie-i-dopulnenie-na-zakona-za-morskite-prostranstva-vutreshnite-vodni-putishta-i-pristanishtata-na-republika-bulgariya

accomplished. The assignment shall be submitted for coordination to the Ministry of environment / Regional environment inspection, the Ministry of Culture.

4. Preparation of a draft master plan;
   The draft shall be approved by the technical council of BPICo. Subsequently, the contractor shall coordinate the draft with the operating companies whose network and facilities are available or planned to join, as well as the relevant authorities and institutions.
5. Entering into force of the master plan.

As the owner of infrastructure in the ports for public transport of national importance, BPICo sets specific requirements related to the different ports. As a next step in the development of river ports in the scope of BPICo, it is foreseen contemporary master plans to be developed for their development in compliance with the requirements of the legal framework and the current situation.

Table 5: Obligatory or customary contents of the port master plans in Bulgaria

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
1. Current situation analysis	Y			
1.1 Land use analysis /regime of property of the land/	Y			
1.2 Existing hinterland connections	Y			
1.3 Assessment of capacity and degree of utilization of existing facilities	Y			
1.4 Institutional framework			Y	
1.5 Rules and legislation for implementation of the master plan	Y			
1.6 Assessment of existing infrastructure services	Y			
1.7 current navigation conditions	Y			
1.8 Analysis of previous studies, plans/ master plans for development	Y			
1.9. findings about objects of cultural and historical heritage	Y			
2. Demand (traffic) forecast	Y			Part of the marketing analysis
2.1 Export & import flows		Y		The specific requirement set is "*prognosis for the structure and dynamics of the different port activities and services, for the cargo turnover (volumes by type) and or passenger flow, range and scope of other*
2.2 Foreseen modal split		Y		

Topics	Mandatory (Y/N)	Customary (Y/N)	Not required (Y/N)	Remarks
				related activities, as well and the factors that determine them".
3. Engineering aspects				
3.1 Berth capacity planning	Y			
3.2 Land side capacity planning	Y			
3.3 Hydraulic modelling	Y			
3.4 Geotechnical study	Y			
3.5 Land survey study and expropriation study	Y			
3.6 Layout planning	Y			
4. Financial and socio-economic analysis				
4.1 Funding options analysis	Y			For construction of new port/ terminal or expansion of an existing port for public transport
4.2 Financial aspects (ROI, NPV, IRR, ….)	Y			
4.3 Economic aspects (ENPV, EIRR, B/C ratio, etc…)	Y			
4.4 Sensitivity and risk analysis				
(add more if necessary)				
5. Analysis of alternatives				
5.1 Land use comparison	Y			Required by BPICo. procedures
5.2 Cost comparison	Y			
5.3 Justification of the selected option	Y			
6. Environmental impact assessment	Y			
6.1 Analysis of existing documents	Y			
6.2 Measures for environment protection	Y			
6.3 Preliminary own assessment for environment impact	Y			

(Source: BPICo)

9 Best practices in port master planning

This Chapter contains brief description of several master plans chosen by participating Project Partners as examples of good master planning practice in their countries.

Master plans for the ports of **Enns, Bratislava and Constanta** will be briefly described in continuation.

In case of Bulgaria, the situation is somewhat peculiar due to the recent change of the legislative background and lack of any port of national importance with their master plans legally approved. There are old master plans and not all of them have been approved by all competent authorities. There are two master plans in force for two private terminals with regional importance that are not at the disposal for the current analysis. Since there is no port or terminal with approved master plan, BPICo is not able to identify best practices in this field. Approval and more intensive activities are expected after the promulgation of the amendment of the Maritime spaces, Inland waterways and ports of the Republic of Bulgaria Act. Examples could be given on the contents of previous documents, which have to be re-modelled or entirely re-written.

Example content of a river port draft master plan in ***Bulgaria***:

I PRE-INVESTMENT STUDY:

1. Characteristics and analysis of the existing situation
   - 1.1. Description of the site – location, border lines, dimensions of the property
   - 1.2. Analysis of previous documents (master plans) and studies about the port
   - 1.3. Description of the existing infrastructure, including buildings, port facilities, as well as the existing aquatories, approach channels, navigation conditions and devices
2. PROPOSITIONS FOR DEVELOPMENT
   - 2.1. Technological part
   - 2.2. Part “Transport and communication”
   - 2.3. Part “Technical infrastructure”
     - 2.3.1. Power supply, lighting, electrical networks and equipment
     - 2.3.2. Water supply and sewerage - networks and facilities
     - 2.3.3. Heating, ventilation and air conditioning - networks and equipment
     - 2.3.4. Information technologies and automatized systems
     - 2.3.5. Facilities for monitoring environmental and water parameters
     - 2.3.6. Technological pipelines and conveyors
     - 2.3.7. Fire safety
   - 2.4. Hydro technical part
     - 2.4.1. Construction of quay walls
     - 2.4.2. Typical river water levels
     - 2.4.3. Seismic characteristics of the area
   - 2.5. Part “Buildings and facilities”
   - 2.6. Part “Ecological issues”
   - 2.7. Part “Social issues”

2.8. Part “Safety and security issues”
2.9. Stages of development and alternatives for construction of new berths
2.10. Preliminary evaluation of expenses
2.11. Project evaluation
2.12. Recommendations, conclusion

II Master plan
Drawings, different alternatives.

The above exemplary contents will be taken into account in Section 10, where general recommendations for the scope and contents of the port master plans will be summed up and harmonized.

Descriptions of port master plans in Austria, Slovakia and Romania are given in the next sections.

9.1 Austria –Ennshafen Port

The port master planning of Ennshafen port was chosen for Austria because it is a very good example for the development of a port area in combination with a great business park site which has developed over several master steps and adaptions were done in close connections to necessary changes in market conditions and general business development of the region.

History of ENNSHAFEN PORT

The beginnings of Ennshafen port go back more than 50 years ago. The idea of constructing a port at the confluence of the rivers Enns and Danube was first developed in the 1960s by Prince Kraft Alexander of Hohenlohe-Oehringen. The concept originated from plans he had drawn himself, and was turned into reality when construction began in 1974. Initially the port of Enns was planned as a purely industrial port for the petro-chemical industrial complex. In those times a second site of a great Upper Austrian chemical industrial site was started in Enns – former Chemie Linz AG, a great company producing fertilizers, N-specific chemical, fine chemicals, pharmaceuticals, pesticides, etc. Originally a great area of about 500 ha port and industrial business park was planned with very huge rearrangements in the whole surroundings (regarding flood prevention, street and railway access lines, expropriation of land, huge diggings in the rivers Danube and Enns, …).

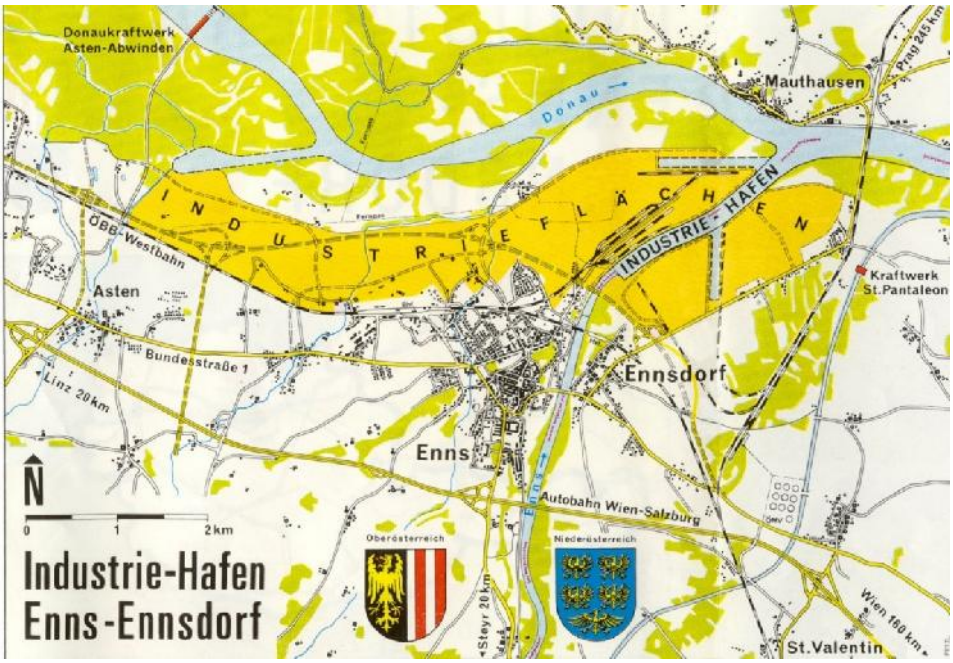

Figure 6: Original master plan with about 500 ha

But due to some changes in general business development in the world (especially energy crisis in the 70s) and in Austrian public industries (rearrangements due to economic problems) and other internal strategic decisions of the chemical company they decided to divest the started investments in the industrial business park Enns and rearrange all the infrastructure, selling the ground and some of the built plants to third companies. An emigration of chemical industry from Enns followed and concentration to the main site in Linz where the company did very good development over decades and performed to a modern chemical business park with a lot of different companies of great European importance today (Borealis, DSM, Nufarm, etc.).

When the chemical industry left Enns, the development of a new concept, to evolve from an industrial port to a public trade port with private handling companies, became necessary. So the actual long term strategy started with the focus based on a land lord port and core PPP-competences (public private partnership). With the implementation of this project in 1994 the start of commercial port operations began. Close beneath the port facilities and in permanent good cooperation a great industrial business park developed with a lot of different owners of the ground due to the selling off process of the chemical company. Especially all infrastructure elements (roads, railways, sewer, drain water system and other utilities) have been developed together between the port and the companies in close cooperation.

Important Development Stages (some milestones of port facility development)

1974	Policy decision by the ministry for the construction of the port of Enns
1976	Founding of the port of Enns corporation

1979-1994	Transformation of the river Enns into a port basin in three phases 1st phase: broadening the Enns from 50 m to approximately 200 m over a length of 2.5 km excavation to achieve the depth necessary for inland shipping gravel was applied to raise the level (high-water protection) removal of the peninsula between the Danube and the estuary of Enns 2nd phase: from 1993 onwards the western and eastern port basins were built. 700 m of quays constructed. 1994 - beginning of commercial port operations 3rd phase: western port basin extended to 900 m. Further quay construction (1,050 m)
2000-2007	Construction of a logistics center in three stages – headquarter of Ennshafen OÖ
2004	Opening of the container terminal Enns
2009-2010	Great expanding the transfer station from four to six block train tracks.
2011	Add additional stuffing centers to the container terminal office building. Create additional container storage space.
2015	Great enlargement of Container terminal ("doubled") after new PPP-contract with private operator (contract for 20 years)

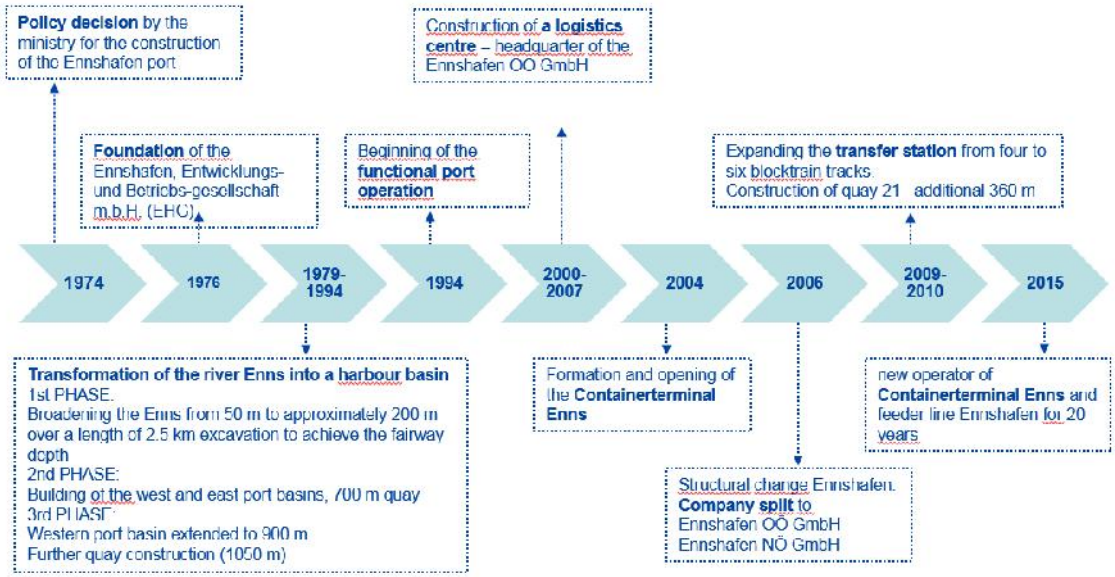

Figure 7: Important milestones in master plan development of the port facilities

First master planning permission of 1974

The rearrangements led to a reduced total site which has been developed until now; actually about 352 ha are dedicated and in use as port area and industrial business park.

Regarding port master planning affairs, the first permission of 1974 is essential. In those times different legal framework compared to today was in force. Ennshafen port – as other Austrian ports in the history – has been regulated in the framework of "national preferred hydraulic engineering / bevorzugter Wasserbau". This meant a very huge and comprehensive procedure with participation of all relevant national and local authorities with the lead of the Austrian ministry.

In the permission process a lot of topics were evaluated with a lot of partners and authorities (slightly comparable with today's environmental impact assessment – but not comparable to today´s volume):

- economics: Upper Austrian economics department, neighbor cities Linz and Enns, chamber of commerce, chamber of agriculture, industry partners of the region, …
- forestry department, Austrian Danube river departments, power plants on the Danube and Enns, electricity and gas providers for the site, …
- a lot of Austrian ministries, police, military, regional government of Upper Austria and Lower Austria, all neighboring villages and companies and ground owners of the whole site and the relevant surroundings, fishery, railway company of Austria, road department, …
- authority partners dealing with shipping, water, noise, air, machinery, safety, …

Even gross economic interest topics where discussed in this process. At the end a very huge permission paper was established which is the basis for many activities till today and will be prolonged in all the other following port permission acts. Only for special projects and erection of suprastructure, etc additional permission acts have to be done but all of them in accordance with the general master permission of 1974. Even prolongation of rights are done in accordance with to old rights.

So over the decades the development of the whole integrated port and industrial business park was done according the general lines of the master planning from 1974. The strategic lines and infrastructure projects of the past decades led over several steps to the actual situation which is visualized in the following milestone pictures.

Figure 8: Master plan development of Ennshafen Port and business park from 1974-2018

Figure 9: Ennshafen port today

Even for the future perspective the master plan of 1974 is the basis for all activities and great projects. Today only very great changes in the principles or huge capacity increases of several plants or facilities would make it necessary to run a completely new permission act according to today´s standards of environmental impact assessment. But master planning decisions of 1974 are still "the red lines for the future" and therefore are very important for the future development of this site.

9.2 Slovakia – Port of Bratislava

The document **Master Plan of Public port Bratislava** consists of two main parts: analytical and strategic.
The analytical part assesses the current status of inland waterway conditions in the Slovak Republic and describes the starting position for the development of the Public Port of Bratislava. In the introductory part of the document, the macroeconomic indicators that affect water transport in Slovakia are created. Data on basic documents and legislation, including organizations affecting waterborne transport, was also provided. The baseline status of the cargo port of Bratislava was assessed in terms of external and internal impacts. The external impacts assessed as part of the assessment of the baseline of the cargo port of Bratislava included: competition, economic impact of the port, business schemes, demand factors, market shares by traffic segments, critical supply chain and stakeholder analysis. The internal impacts that were assessed: existing infrastructure and port facilities, port operation and operational characteristics.

Subsequently, the results from the comparative benchmark analysis of the Bratislava Public Port with other foreign ports on the Danube are presented, resulting in the definition of recommendations for the Bratislava port. This part of the Master Plan describes Bratislava as an ideal place for the transhipment of commodities to other transport corridors through which goods can be transported mainly to the Czech Republic, the Slovak Republic and Poland. The port facility survey shows that port of Bratislava has a competitive advantage in terms of equipment, especially in the case of high-capacity cranes, in front of the surrounding ports in Vienna and Budapest, and as the only one of these ports can handle over 50 tons of cargo. Of all the ports assessed, to manipulate with over 50 tons are only able in the port of Bratislava and Linz.

Potential risk for the Bratislava port is to equip the port in Vienna with machines for transhipment of very tangible bodies over 50 tons and to secure related conditions and thereby to increase direct competition. The advantage of the Bratislava port is the already established machinery and, above all, the geographical location, which means that the introduction of a very tangible freight transport service at the Vienna port has only limited potential. The condition for ensuring the dominant position of the Bratislava port in this area is, however, the provision of quality and fast services that will not create a space for improving the conditions of competition.

When transporting commodities by tankers, there is an obvious trend in most of the tankers arriving in the ports considered to end in the ports in Bratislava and Vienna (in relative and absolute values).

From the point of view of the share of passenger vessels on all the vessels of the port it can be observed that the largest share is reached at the ends according to the temperature map of the busiest section of Vienna - Budapest. In the case of Bratislava, there is a potential for improvement and it is recommended to carry out a survey of the reasons for passenger transport in the mentioned corridor and considering the possibility of creating a marketing campaign aimed at promoting the Bratislava region and using the Bratislava port.

From these conclusions, the following recommendations are made for the port of Bratislava:

- Maintain a competitive advantage over the surrounding ports in the field of transhipment of very tangible goods over 50 t through maintenance and renewal of necessary machinery;
- Ensuring the quality of services and the speed of transhipment;
- Identification of commodities transported by tankers and the possibility of expanding the import; Performing a questionnaire survey on requirements and needs among major carriers;
- The development potential in the area of passenger transport was identified in Bratislava. It is recommended to carry out a survey of the reasons for passenger transport through waterways and the possible creation of a marketing campaign aimed at promoting the Bratislava region and the Bratislava port.

An important part of the analytical part is also a sub-chapter with a demand analysis, which presents the results of the prediction of freight and passenger transport in conditions of the Slovak Danube River. The results of the demand analysis of freight transport result from a combination of top-down and bottom-up approaches that guarantee a comprehensive and at the same time detailed view of the potential development of inland waterway transport in Slovakia in container transportation, commodity transport, automotive and passenger transport.

The assessment of the port status in terms of strengths and weaknesses, opportunities and threats was made on the basis of the SWOT analysis.

The analytical part of the presented document served to indicate the current state of operation and infrastructure and the identification of weaknesses as well as potential space for improvement. The following will address these findings and analyse the optimal model of further development at Bratislava Public Port.

The strategic part of the document is structured according to strategic units, respectively the steps that need to be analysed to design optimal port development. In the first step, a closer look at the reason for the establishment of the Public Ports Organization, respectively on its

strategy. Several models of port operations in Bratislava are then analysed and compared, in order to make appropriate arrangements for organizational and process relations in the port. Following the recommendation of an optimal model of operation, it is necessary to answer the question of how to deal with the current property-legal relations in the port, which are one of the barriers to the further development of the port. In the next step, the various alternatives for the development of the Public Port of Bratislava are presented and an optimal alternative is provided based on the evaluation of the multi-criteria analysis. The development of the port is then described in detail at the level of individual development.

The strategic part, following the findings from the analytical part and through the multi-level perspective, formulates the recommended strategic scenario for the development of the Public Port of Bratislava.

In the first part there is a view of the mission of Public Ports (as the owner of the Bratislava Public Port) and the vision of the company for the future, which represents in the long term the restoration of the status of public ports of the Slovak Republic within the national economy and within the international TEN-T corridor as an equivalent, ecological and efficient part of combined transport with active road- rail transport.

Subsequently, the current model of port operation is evaluated and the recommendations for selecting the optimal operating model are presented. The trend survey shows that the Tool port model was a significant port model and the Landlord model is now dominant. In order to decide on the optimal port operation model, an ideal status is defined in the main areas, defined in accordance with the priorities of the Strategic Road Infrastructure Development Plan of the Slovak Republic until 2020, as well as the strategic direction of Public Ports, while respecting the shortcomings of the current operation model.

The main areas of the optimal model of operation of the Public Port Bratislava are:

- Control and decision-making - the port should have control over the infrastructure and decide on its own development strategy
- Providing of quality services - The port should be able to provide quality services in the short term to meet the required quality standards and use qualified personnel for this purpose.
- Ensuring stable returns - the port should have a fixed or easily determinable component of revenue from operating activities.
- Competitiveness of services - Port services should be valued on the basis of market mechanisms to ensure the highest possible demand.

In connection with the establishing of the new model of operation, the need to settle institutional relations within the port was identified and the recommended settlement method is indicated. In this step of defining the development of the Public Port of Bratislava it is necessary to address the ownership relations in the internal environment of the port. The

current setting of ownership is, compared to practice in other public ports in Europe, quite unusual, since a large part of the infrastructure is owned by a private entity that is also the dominant operator in the port. This infrastructure includes engineering networks as well as all roads and railways in the defined area of Bratislava Public Port.

A key step to ensure optimal port development is to acquire the infrastructure into the ownership of Public Ports. To this end, three options for resolving the current non-standard setting of port relations in a port are analysed, namely:

- Acquisition of infrastructure by a private entity;
- Establishment of a joint venture with a private entity (current operator);
- Replace part of the land owned by Public Ports for infrastructure owned by a private entity.

The last level is the definition of a port development variant that was selected on the basis of a multi-criteria analysis. The analysis of the development possibilities of the public port Bratislava is based on the analytical part, where strengths and weaknesses, as well as opportunities and threats, were identified. Based on the survey conducted, four options for the possible development of a public port were defined, and proposed ways of financing these activities were presented. The options considered are listed in the following points:

- Preservation of the current port state -
- Concentration of activities to the Pálenisko basin;
- Restoration of the entire port;
- Complete transfer of the port to a new location.

At the end of the strategic part, the recommended strategic scenario for the development of the Public Port of Bratislava is described, the implementation of which is divided into several steps. The optimal variant of the development of the Public Port of Bratislava is selected on the basis of a multi-criteria analysis, the results of which are made from the evaluation of the different criteria. Based on the applied multi-criteria decision-making methods, with regard to the defined criteria and their weighting, it is possible in the context of the assessed criteria to clearly recommend the variation of the Activity – Concentration of Activities to the Pálenisko basin as an optimal variant of the further development of the port. In the context of the current conditions, this option is an optimal combination of economic and time requirements that addresses all key risks while meeting the key conditions for further port development in order to increase its attractiveness on the market.

Master Plan of Public port Bratislava could be seen as a best practice because the current infrastructure as well as the superstructure are designed to handle the goods and the loading units of combined transport. They are owned by a private entity (SPaP, a. s.) which has de facto monopoly position on the freight water transport market in Slovakia. The starting point for the development of freight water transport as well as combined transport is the fact, that

the port authority owns, develops and operates the infrastructure and superstructure necessary to provide the main port activity, i.e. the transhipment (Landlord model).
Such position should be made mainly through trade negotiations with the current tenants and the owners of infrastructure and superstructure in the territories of public ports in Bratislava.

9.3 Romania – Port of Constanta

Master Plan for the Port of Constanta

In the year 2014 MPAC, as Beneficiary, concluded a contract with the consortium Ernst & Young SRL - INROS LACKNER SE, having as a general objective the strategic planning of Constanta Port in the short, medium and long term (until 2020, 2021-2030 and 2031-2040, respectively), under the conditions of continuity of the port development, with the efficient exploitation of the existing resources and infrastructure, oriented to the real needs of the market, able to serve both the national requirements and those of its hinterland, in terms of efficiency and in the context of competition with other ports and globalization. All activities carried out within the project refer to the three ports managed by MPAC, namely the ports of Constanta, Mangalia and Midia. Within the project, the following specific objectives were achieved:

- Analysis of the existing infrastructure situation and port superstructure;
- Analyse and evaluate the administrative, institutional and legal situation;
- Assessing current and future demand for port infrastructure and superstructure;
- Identification of deficiencies and development of possible interventions;
- Evaluating and prioritizing possible interventions as part of the portfolio of funding sources;
- Elaboration of the Master Plan in the short, medium and long term, including the realization of the cost-benefit analysis (phased development);
- Elaboration of the development strategy of Constanta Port;
- Carrying out the Strategic Environmental Assessment (ESM).

The Master Plan should be seen as a development strategy whose implementation is conditioned by a relevant number of factors.

The three ports operate in a dynamic commercial environment and it is essential that they have the flexibility to adapt to demand in the context of commercial competition on the market. As a consequence, the Master Plan's role is to support MPAC in the decision-making process.

The Master Plan is based on a common knowledge base at the time of the 2014-2015 study. It is structured thinking and targeted recommendations, and all results will need to be revised dynamically when new data is available.

It is expected that the development of the Constanta Port development strategy will focus on accelerating development in all sectors, taking into account the diversity of products / goods handled in the port. So the three ports will no longer be regarded as mere transit points. In order to achieve this, account will be taken, inter alia, of the following:

- Creating logistic spaces for single / multiple users;
- Construction of new processing capacities of imported and imported goods
- Developing customer-oriented practices at the administrative level.

Development strategies and public policy tools are expected to support the development of Constanta Harbour. Port of Constanta is a serious competitor of the other Black Sea ports, but also of Central and Northern Europe as a logistic and industrial centre of the Black Sea.

This should be done by generating new trade flows and using the Danube - Black Sea Channel as an effective alternative to trade in Central and Western Europe and Asia. Among the key objectives of the Master Plan are the development of links with hinterland and local communities as well as the protection of the environment.

Finally, the Master Plan for Constanta Port will also take into account the short, medium and long term strategic objectives envisaged by MPAC, namely:

- Developing the port as an efficient, sustainable and safe complex;
- Promoting partnerships with clients and developing close relationships with them;
- Developing the port entrepreneurial potential;
- Making investments to strengthen the position of Constanta Port within hinterland networks, maritime and port networks and within regional transport networks;
- Ensuring port accessibility by road, rail and sea;
- Recognition of EU requirements on civil society, the social environment, human resources and the general public, and
- Sustainable port development in line with EU green port policy.

Under the Constanta Port Master Plan, a series of short, medium and long-term projects have been set up, through which Constanta Port develops its network of roads, railways and access for ships in order to increase the traffic of goods and opening up to new markets in Europe and the whole world as follows:

Development plan for 2020:

- Dredging plan for Constanta Port - capital costs: 47,302,148 Euro;
- Implementation of a specialized tax in an area with deep depths (Dana 80) - cost of capital: 4,800,000 Euro;
- Terminal RoRo and for passenger cars in Constanta South Port (Mol IIIS) - cost of capital: 290,300,000 Euro;

- Implementation of the port-community system, including traffic management - capital cost value: 2,300,000 Euro;
- Doubling of CF Agigea Ecluza line - Constanta Ferry-Boat and systemization of the Agigea lock point - value of capital costs: 5,000,000 Euro;
- Development of railway capacity in Constanta Port South Agigea - Object II.b.1 - Railway equipment on Pier II S CSAT - capital cost value: 3,150,000 Euro;
- 4-lane extension of the road between Gate 7 and the junction with the objective "Road Bridge at km 0 + 540 of the Black Sea Danube Canal" with the road connecting the Gate 9 and Gate 8 to the North Zone of Constanta Port - capital cost value : 19,677,000 Euro;
- Extension to 4 lanes of the existing road between Gate no. 10 bis and Gate no. 10 and the systemization of the area behind the gate no. 10 - Port Constanta - cost of capital: 3,100,000 Euro;
- Roamed roadway access to the new Ro-Ro terminal in Constanta port South Agigea - cost of capital: 27,561,000 Euro;
- Cheat at the mouth of access to the Danube-Black Sea Canal - capital cost value: 17,000,000 Euro;
- Mudguard adjacent channel of connection between berths 85-89 - cost of capital cost: 24,000,000 Euro;
- Road bridge over the fluvial-seam connection channel and connections with the inner and outer road network of Constanta Port - capital cost value: 31,641,000 Euro.

Development plan for 2030:

- Terminal for barges from Constanta Port - Stage II - capital costs: 37,300,000 Euro;
- Container terminal on the island Stage I - cost of capital: 126,500,000 Euro;
- Capacity development CF fluvial-maritime area - Stage II - capital cost value: 7,150,000 Euro;
- Connection of the railway to the island (Pod CF CF parallel to the road) - capital cost value: 26,000,000 Euro.

Development plan for the year 2040:

- Container terminal on the island (Stage 2) - capital cost value: 224,500,000 Euro;
- Container terminal on the island (Stage 3) - capital cost value: 224,500,000 Euro;
- The cereal terminal on the island, including the export processing area - capital cost value: 143,500,000 Euro.

Port of Constanta is at the intersection of commercial routes linking the markets of European countries without land to Transcaucasus, Central Asia and the Far East. The port is linked to

the Central and Eastern European countries by rail and road and the Rhine-Danube Corridor (inland waterways) to which it is connected via the Danube-Black Sea Canal.

The railway network in Constanta Port is connected to the Romanian and European railway network.

North Port of Constanta is a railway system complex, designed to handle most of the port cargo; only a small percentage was foreseen for road transport. In this area of the port, rail traffic declined in the 1990s and many operators prefer road transport by lorries.

In the South Constanta Port, the railway network was not completed. However, from the Feasibility Studies for the southern part of the port, it must be seen that rail traffic is on the increase. For this reason, MPAC carries out expansion and modernization works on the southern lines of Constanta Harbor, where most of the lines are under the MPAC administration. The total length of a Railway Port is 300 km.

Therefore:

- In 2016 the investment project "Development of railway capacity in the River - Maritime Sector of Constanta Port" was completed, amounting to 17,537,000 Euros. The project was carried out within the program "Operational Program for Transport 2007-2013", being funded by structural funds of the European Union and the State Budget.
- The newly built railway device assures the take-over of railway freight traffic for the current and future economic operators in the River-Maritime Sector of Constanta Port, making a direct connection with CN CF CFR SA railway network in the south of the Port by the railway station the Agigea Nord railroad where trains arrive from both the country and other countries.

Constanta Port is linked to the Danube - Black Sea Canal. Entry into the Canal is in the Southern part of the Port and connects the Black Sea with the interior of a European inland waterway network. The canal offers an alternative route from the Black Sea ports to the Danube ports of Central Europe, which is shorter by about 400 km.

The Channel that connects the Danube with Constanta Port has a length of 64.4 km. The southern branch, which is most important, extends from Cernavoda, the Danube (km 300) to Constanţa. A great opportunity offered by the Danube is the transport of dry and liquid cargo in bulk between the neighbouring countries on the Danube, namely Serbia, Hungary, Slovakia, Bulgaria, Austria and the Black Sea.

Access to the port and to the domestic road network was designed before 1989 and was linked to the road network which was strongly trafficked. The total length of the roads in the port is 100 km. The A2 motorway connects the Constanta Port with the national road network.

Therefore:

- In 2015 the MPAC completed the investment project "Road Bridge at Km 0 + 540 of the CDMN and works on road infrastructure and access to Constanta Port", amounting to 51,142,000 Euros. The project was carried out under the program "Operational Program in Transport 2007-2013", financed by structural funds of the European Union and of the State Budget.

The bridge over the Danube-Black Sea Canal ensures the take-off of the motorway traffic on the A2 and DN 39 Motorways for the entire southern part of Constanta Port, linking it to areas around the country or in the vicinity (Bulgaria, Hungary, Serbia etc.).

10 Recommendations for high quality port master plans

A port master plan is a document which should describe how a port should be built (in case of new ports) or how it must grow and adapt (in case of existing ports) in line with the forecast economic development and in accordance with the growth and dynamics of the demand and other influencing factors.

In order to prevent problems with the port construction and expansions a port master plan should not only be a recommendation but a must for a responsible port authority or similar organisation. However, the contents of a master plan which will be presented here is not a must but a recommendation. The purpose of this document is not to dictate to ports but to assist them. Many ports face difficulties in selecting the future port area or extending their existing port area and port facilities for cargo handling, storage and processing due to a range of urban, spatial, environmental, physical, technical and socio-economic constraints. Some of these difficulties are present due to a lack of long-term or mid-term planning.

Master planning of ports does not only involve port design and construction (or extension in case of existing ports), but its integration into the surrounding environment and the overall transport network. For this purpose, port master plans must be completely integrated into the transport and urban planning strategies of cities and the regions. This is why it is of utmost importance that the land use just outside the port area be compatible with that of the port, whenever possible. This means that the port and municipal plans at the regional and local levels must be consistent and that should be the key goal not only for port planners but also for any contemporary urban planning endeavours.

Depending on the practices and/or legislation requirements in different countries along the Danube, the contents and the very concepts of the port master plans may vary significantly. In this section, we will try to demonstrate the recommended scope and contents of the port master plan, based on the inputs from the countries of origin of the project partners participating in this activity and in this report. In addition to this, additional and slightly changed contents (with respect to inputs received from PPs) may be included in the "recommended port master plan" so as to reflect the best practices from all over the globe and to be compatible with the "soundly justifiable" project proposal, as submitted for EU co-funding application.

Contents of the ***recommended scope of the port master plan does not have the aim to dictate to ports, but to assist them and guide them when and if necessary***. In this view, recommendations in Table 6 are no more than that – recommendations. Each port, based on its own country regulations or customs will, of course, apply parts of the below recommendations as they see fit and appropriate for given purposes. Needless to say, below contents, even if a port decides to follow it to the point, does not require that the process is complied with in the order as given below. However, below sequence of activities is certainly a reflection of gained experience.

Table 6: Recommended contents of the port master plan

Topics
1. Current situation analysis
1.1 Land use analysis
1.2 Existing and planned hinterland connections
1.3 Inventory and assessment of capacity and degree of utilization of existing facilities
1.4 Institutional framework (includes rules and regulation for the implementation of the master plan)
1.5 Assessment of existing infrastructure and port operation services
1.6 Safety and control of navigability
1.7 Manpower planning
1.8 Current navigation conditions
1.9 Analysis of previous studies, plans, master plans…
1.10 Findings about objects of cultural and historical heritage
2. Demand analysis and traffic forecast
2.1 Market study
2.2 Traffic forecasts (import, export, transshipment, domestic)
2.3 Foreseen modal split
2.4 Characteristics of vessels
2.5 Competition analysis
3. Engineering aspects
3.1 Berth capacity planning
3.2 Land side capacity planning
3.3 Hydraulic modelling
3.4 Geotechnical study
3.5 Seismic characteristics
3.6 Topography and bathymetry
3.7 Meteorological and hydrological conditions
3.8 Material supply
3.9 Dredging and reclamation
3.10 Options for quay wall construction
3.11 Land survey study and expropriation study
3.12 Layout planning
3.13 Access for different types of terminals
3.14 Possibility of land extension
3.15 Utilities
3.16 Maintenance
3.17 Safety, security and border control
3.18 Terminal planning
3.19 Phasing of the development
4. Financial and socio-economic analysis
4.1 Funding options analysis
4.2 Financial analysis (ROI, NPV, IRR, ….)

Topics
4.3 Economic analysis (ENPV, EIRR, B/C ratio, etc…)
4.4 Sensitivity and risk analysis
5. Analysis of alternatives
5.1 Land use comparison
5.2 Cost comparison
5.3 Justification of the selected option
6. Environmental impact assessment
7. Public and stakeholders consultations
8. Strategic Environmental Assessment (SEA)
9. Future developments
10.1 General objectives and specific objectives
10.2 Infrastructure projects
10.3 Implementation strategy

(Source: iC consulenten, based on inputs from MT (RO), MPAC, EHOO, BPICo)

Each of the topics and their components will be very briefly elaborated in continuation, without going too much into details of each component, especially in cases where there are international or EU regulations and/or recommendations for specific topics (e.g. environmental impact analysis, etc.).

10.1 Current situation analysis

This topic is a must when a master plan is elaborated for an existing port which needs to go under a process of upgrade, rehabilitation on extension.

10.1.1 Land use analysis

As a first glimpse of an existing port, a layout map of an entire port area, including detailed division and specification of the used land slots should be prepared.

As an example, this plan should contain a clear picture of the land slots in the port area, its uses and all existing facilities existing in the port area, as follows:

- Industrial and/or port cargo handling and operational areas and yards;
- Waterside access and manoeuvring areas and anchorage(s) and waiting areas;
- Existing terminals, separated by type and organization;
- Logistic areas;
- Open and closed (covered) storages;
- Buildings (port authority, harbour master office, customs, police, office buildings, etc.);

- Other commercial areas in the port area (free zones, internal industrial zones, etc.);
- Environmental areas;
- Buffer zones;
- Safety distances;
- Road and rail accesses, roads, tracks and gates;
- Conveyor and product pipeline routes, if any;
- Public transport routes and stops in the port area;
- Additional, unused or expansion (planned for further development) areas.

Example of a land use plan is given in Figure 10.

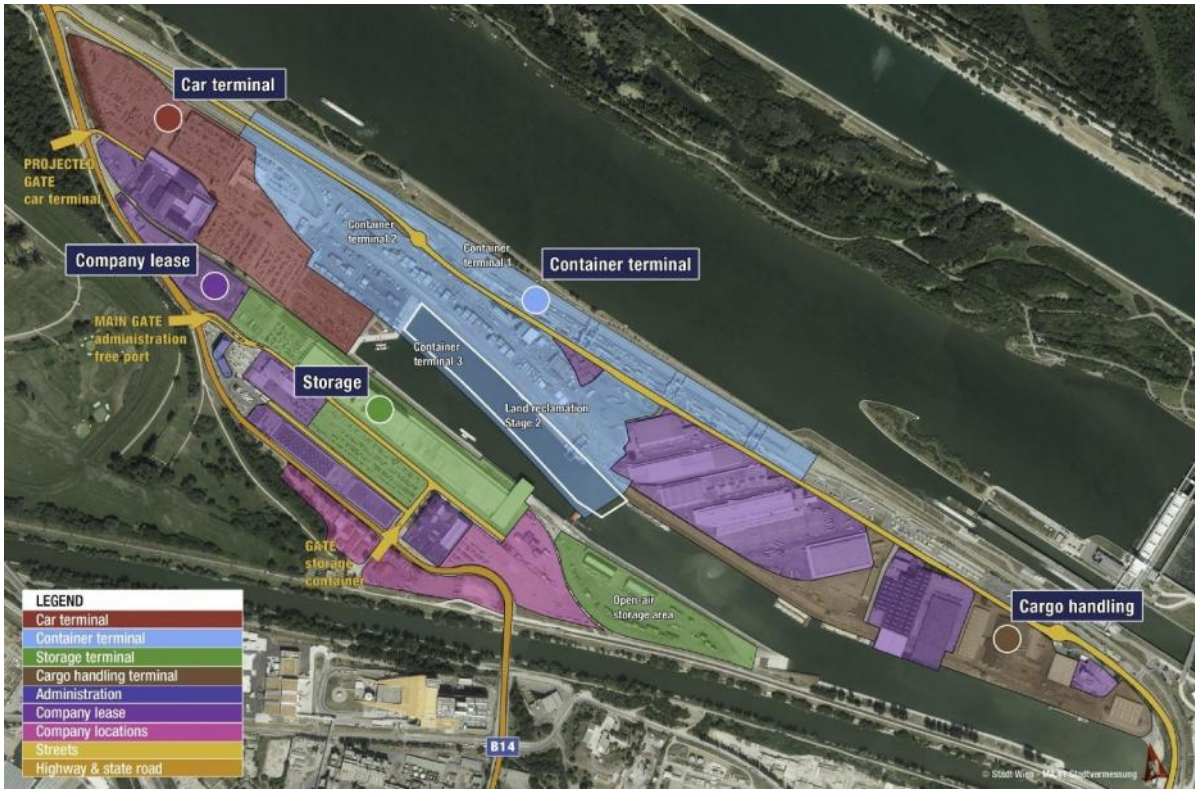

Figure 10: Land use plan in the Port of Vienna (Freudenau)

(Source: Courtesy of Hafen Wien)

A plan of land use is usually a good start for any extension, rehabilitation or reconstruction works in existing ports. New ports, however, require similar land use plan, but this will be discussed in later sections of this report.

10.1.2 Existing hinterland connections

The main purpose of ports is to serve their hinterland and to provide facilities enabling the use of the most economic transport mode for the industry in the hinterland. In this view,

routes linking the port by rail and road (and inland waterways in case of seaports) with the hinterland are of utmost importance for the success of a port. In some specific cases, links of a port with its hinterland via conveyor belts or product pipelines are as important as the road or rail links.

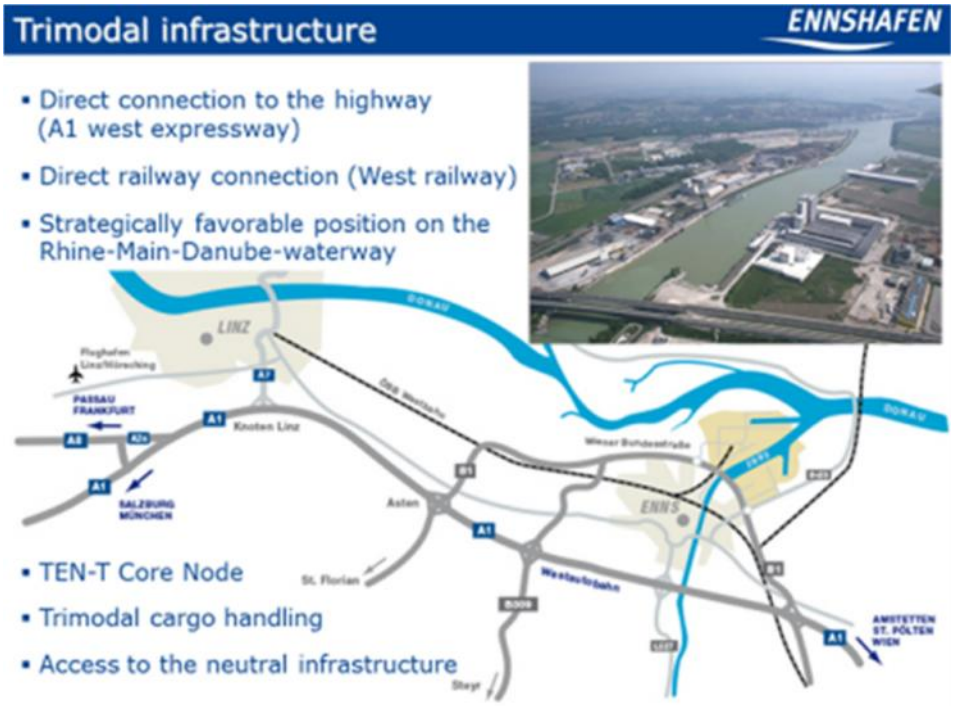

Figure 11: Hinterland connections of the Port of Enns

(Source: EHOÖ)

When reviewed, the state of existing hinterland connections is usually checked against port's connectivity with major agricultural and/or industrial centres and cities as large consumption centres (all commonly called "economic centres"). In addition, hinterland (IWW, road, rail) connections of a port are investigated, inter alia, for their density, reliability, accident records, capacity, axle load, maximum speeds allowed and frequently for the transport costs from the port to major economic centres or vice-versa. All these parameters of hinterland connections together influence the overall competitiveness of a port.

Major issue in port planning related to hinterland connections is the fact that port authorities are, in most if not all cases, not responsible for planning, construction and maintenance of hinterland connections. Quite logically, these connections are managed by national, local or regional entities and their development is frequently decided far away from ports. In order to avoid conflicting situations, to enable the integral transport infrastructure planning and to use as many synergies as possible, it is highly recommended that the countries (or regions, or municipalities) establish "transport infrastructure planning committees" (or any similar

entity) where all transport infrastructure managing entities would have their interests heard and taken into account when transport infrastructure assets are planned.

The process of elaboration of port master plans in many cases does not only take into account the existing hinterland connections, but it also reviews regional and local transport strategies, investment plans and development projects. This is important in order to assess future situation with cargo collection towards the port or distribution from the port to its hinterland.

10.1.3 Inventory and assessment of capacity and degree of utilization of existing facilities

For existing ports, an inventory of the existing infrastructure and other port facilities should be elaborated. Once completed, an assessment of the operational and/or physical capacity (under given conditions, or maximum capacities) of facilities is calculated. The measure of realistic use against capacity yields a degree of utilization of a facility under assessment.

The inventory of port facilities usually includes the following:

- Dimensions of port approaches (channels from the fairway towards the port, or marine access channel in case of seaports);
- Dimensions (width, depth) of the entrance to the port basin area;
- Maneuvering area (diameter and depth of the turning circle);
- Dimensions of the anchorage;
- Dimensions of the waiting areas along the river bank;
- Operational berth length;
- Depths along the berths;
- Covered storage areas;
- Open storage areas;
- Road accesses and gates;
- Rail accesses and gates;
- Inland waterway access in case of seaports;
- Workshops and offices;
- Utilities;
- Any concessions, ownership issues or long-term leases;
- Type of equipment (cranes, mobile cranes, tractor/trailer units, reach stackers, straddle carriers, reach stackers, forklifts, loaders, etc.) and its ownership;
- Equipment capacity;
- Manufacturers and production dates for each piece of equipment;
- Current condition of existing infrastructure, suprastructure and equipment and an estimation of the remaining life cycle.

For each of the above listed assets, an estimation or calculation of capacity and productivity (utilization degree) needs to be elaborated.

In case of new ports, the capacities of infrastructure and equipment are planned and specified before further stages of the design and construction processes.

10.1.4 Institutional framework and master plan related rules and regulations

Institutional framework is of crucial importance for the successful elaboration of a useful port master plan. Quite logically, it is compulsory to comply with all national regulation related to the process of port master planning or each of its segments, even if there is no "overall" legislation (law) which govern the exact contents and process of port master plan elaboration. In case there is no "overall" law, each country has a number of other laws (e.g. on planning and construction) or by-laws, or even acts issued by port authorities themselves. Whatever the case may be, the port master plan must stick to all these legal requirements. The first step, of course, is to determine which laws, by-laws and other rules and regulations need to be complied with.

In addition, each port needs to determine how could it be affected by its own national, regional and local planning framework. Urban planning documents, zoning documents, etc. also need to be consulted in order to avoid any conflicting situations. Last but not least, many countries may have a "roof" document in a form of "National Port Development Strategy" or similar document which may, or may not, be a result of a transport or port policy of a country. In this respect, the *generic* hierarchy of planning documents and their port related background documents is given in Figure12.

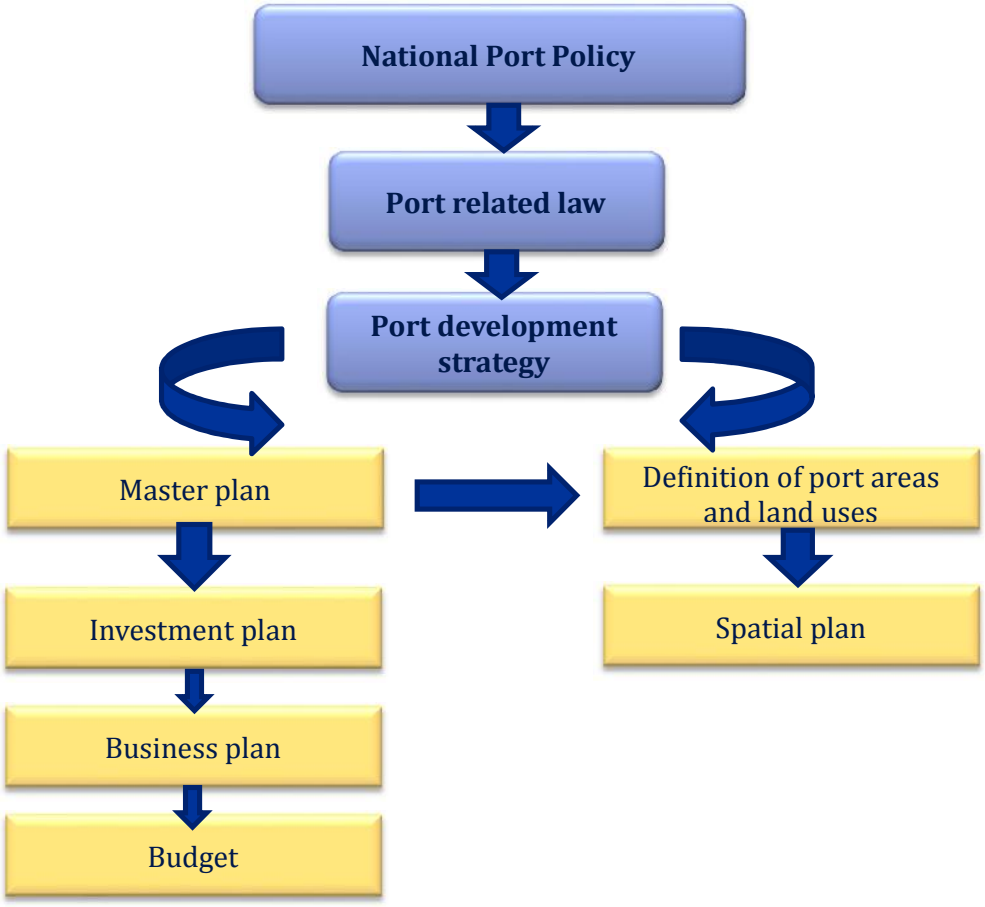

Figure 12: Generic planning and legislative hierarchy related to port planning

(Source: iC consulenten)

10.1.5 Assessment of existing infrastructure and port operation services

In order to obtain a full insight of the current situation in a port a card and/or analysis of infrastructure and port operation services is usually elaborated. The following activities, among others, are usually included in this "card":

- Tug / push boat service (tug service mostly in seaports, while push boat services are mostly offered in inland ports);
- Pilotage services (mostly in seaports);
- Bunkering of vessels;
- Waiting berths (areas);
- Shore-side electricity supply;
- Water supply for vessels;
- Solid waste collection from vessels;

- Liquid waste collection from vessels;
- Mooring/berthing services (line handling);
- Lay-up berths;
- Ship repair facilities;
- Dredging services.

Infrastructure facilities in a port combined with the existing machinery and devices and with the related personnel determine the types and quality of port services. Infrastructure also defines which options for cargo handling, storage, etc. are available – whether there is a ro-ro ramp or direct access to railway under cranes, whether there are appropriate warehouses for grain (silos) or food products. The so called "technological cards" may be evaluated and improved. Such a card includes all options of handling certain cargo type describing exactly each operation during loading/ unloading, separation, lashing, internal port transport, way of storage, number of workers needed, number and type of machinery and equipment, any special requirements, etc.

All these characteristic form the range of current services. Missing infrastructure could be planned in amendments of existing master plans. On the other side, when planning a new port site, the contractor may provide for specific services/ infrastructure, not offered in the corresponding region.

In case of port operation services, an assessment is made for services themselves, as well as for current logistic chains in order to get a closer insight into realistic port operations and cargo flows currently being a port business.

In this view, port operation services which are the usual assessment subject are listed in continuation:

- Loading/unloading;
- Apron/yard handling;
- Stripping/stuffing;
- Storage in open and covered storages;
- Weighing;
- Repairing;
- Customs;
- Documentation;
- Quality control;
- Packaging and labelling;
- Etc.

As regards to existing logistic chains, they are usually recorded in case of regular (liner) shipments or in case of cargoes which are regularly loaded/unloaded throughout years, but

which do not have a regular liner schedule of arrivals and departures. For example, a logistic chain of export wheat from a Serbian port is given in the following table:

Table 7: Sample logistic chain via one Serbian port

Export wheat	
Source	Northeast Serbia
Incoming transport	Trucks, 25 tons, ca. 120 trucks/day, 2-3 days for max convoy
Port operation	Loading of wheat, 3000 t/day, duration: 2-3 days
Storage	No storage, direct transshipment from trucks to barges
Outgoing transport	Barge convoys, 3600 – 7200 t max, once a week
Destination	Port of Constanta

(Source: iC consulenten)

Once all services and regular or relatively stable cargo flows (and/or logistic chains) are carefully assessed, the results can provide a valuable input for the analysis of potential improvements, reconstruction needs, capacity surplus or capacity needs, need to adapt the operational procedures and to extend the facilities, etc.

10.1.6 Safety and control of navigation

This element of the master plan is related to the technical, i.e. practical rather than legislative aspect of safety and control of navigation in the port areas. It includes, inter alia, the following activities of importance for the port master planning:

- Requirements for navigation management in ports (mandatory pilotage, VTS, RIS, etc.);
- Monitoring and communicating with port traffic (radar stations, VHF antennas, transmitters, etc.);
- Port Passage Planning (navigation aids and procedures, mostly in seaports);
- Master / Pilot exchange (mostly in seaports, although not unusual in inland ports);
- Harbour Patrols (frequency, vessels used (if any), their waiting/station areas, etc.);
- Recreational navigation (if permitted in the commercial/cargo area);
- Requirements for waiting areas, anchorages, mooring points;
- Traffic separation schemes and berthing areas for vessels with dangerous goods and other vessels;
- Navigational aids and signalization;
- Restrictions and limitations for certain vessels and/or vehicles (speed, lanes, berths, parking, etc.);
- Underwater pipelines and cables, wrecks, reefs, etc.

Control of the port is a function usually exercised by the harbour master and/or designated deputies or an appropriately qualified / experienced individual. The level and complexity of

control required by the organisation to manage navigation should be determined by risk assessment and may vary dramatically dependant on the size, location and complexity of vessels or craft using the port or terminal.

10.1.7 Manpower planning

Depending on the legal requirements in a country, manpower planning may be a requirement for the port master plan. Since skilled and qualified manpower is critical for the success of a developing port, port master plans can have a plan for support from a pool of qualified and quality manpower[15]. The port itself should provide a good career prospect, job stability and job flexibility for its employees.

Since the right estimation of a stable number of employees, a careful assessment of needed workforce is a must.

10.1.8 Current navigation conditions

In order to properly plan the future safety of navigation in the port itself or its approaches, current navigation conditions must be carefully assessed and later compared with the changes imposed by the interventions foreseen in the master plan. Currents, downstream or upstream flow speeds, wind, ice occurrence, depths – are just a few aspects checked in this segment of the current situation analysis.

10.1.9 Analysis of previous studies and other planning and design documents

In this section, all previous studies, development plans, old master plans and any other planning or design documents are reviewed and checked for eventual consistency with the current plans and ideas for future port development.

10.1.10 Findings about objects of cultural and historical heritage

When a master plan is elaborated for an existing port, especially for those ports which are at the more or less same locations for centuries, it is important to take into account the possibility of finding items of historical, cultural and industrial heritage, as well as archaeological sites which may need protection. Such sites may be protected by law in many countries. Caution should be exerted in planning of future construction and dredging works within an overall master plan since submerged wrecks which may have historical significance will need to be identified and protected or removed for conservation[16].

[15] Group of authors, (2014), "Masterplans for the Development of Existing Ports", PIANC Report no. 158.
[16] Ibid.

10.2 Demand analysis and traffic forecasts

10.2.1 Market study

Production and consumption of goods are the basic "ingredients" for trade, and trade, in turn, makes the "world go round". In order to have physical preconditions for seamless functioning of the trade, ports are included in the transport and supply chains. Therefore, it is the market which makes the ports "go round" and it is the market which heavily influences the success of a port.

In order to facilitate more accurate forecast, the demand analysis should begin with the identification of the different economic activities which are convenient for ports, so that the ports could take over the physical products of such activities and distribute them further along the transport and supply chains. Economic activities such as mining, agriculture, construction, oil industry, steel industry and other industries involving bulk raw materials, semi-finished products and finished products (e.g. cars are convenient for transport in Ro-Ro vessels), inter alia, are of prime interest for ports and their business. In this view, an assessment of available industries in the captive hinterland of a port is usually done in the beginning of a market study. This gives planner an overview of potential cargoes that could be captivated for ports loading and unloading business. On a more local level, the economic assessment can be done through the collection and review of data on population and Gross Domestic Product (GDP), which can serve as a basic input for forecasts.

As per PIANC Report no. 158[17] on port master planning, the market study should address the following questions:

- Which types of cargo and products are handled or likely to be handled in the port of
- study?
- Who are the customers and consumers of this cargo and where are they located?
- What are the expected flows of products and cargo (in tonnes and also in TEUs and
- HGVs, when applicable)?
- Who are the competitors/competing ports:
    - in terms of products and cargo?
    - in terms of delivery and supply? (addressing this latter issue also contributes to
- the assessment of competitive transportation routes)
- What are the plans for future developments at competing ports?
- Is there any opportunity for transshipment business?

10.2.2 Traffic forecasts

Demand analysis usually starts with traffic forecasts. Traffic forecasts can go deep into details and be divided into forecasts of export, import, transshipment (transit) and domestic flows, or simply loading and unloading flows. Traffic forecasts are frequently done for each type of

[17] Ibid.

cargo handled or expected to be handled in a port. It is customary that the traffic forecasts are prepared for the time horizon anywhere between 15 and 25 years. Sometimes, this time horizon can be extended to 40 years and this is applied mostly for calculus purposes used in cost-benefit analyses. Nevertheless, a golden rule in traffic forecasts is: the longer the time span the poorer the accuracy of forecasts.

Port traffic forecasts are prepared for:

- Cargo flows (loading/unloading);
- Vessel traffic (type and number of vessels expected to call);
- Hinterland (road, rail and IWT – in case of seaports) traffic.

Traffic forecasts usually involves statistical records of cargo flows in the last 10-15 years. Historical overview of the past cargo flows is needed if the traffic forecasts are to be based on historical trends and time series. Forecasts can be based on econometric modelling or on a bottom up approach. In the bottom up approach, consultants usually interview 10-20 major port users and a determined number of potential users, using their production plans for the next 3-5 years as a basis for the forecasts of at least some cargo flows. Traffic forecasts are usually correlated with the growth Gross Domestic Product (GDP), depending on the type of cargo, where each type of cargo has a different elasticity factor used to correlate the growth of cargo flows with the growth of GDP.

Traffic forecasts can be conservative and progressive. Conservative option takes into account realistic growth, based on past and current traffic and economic growth and usually neglects potential new traffic or future projects. On the contrary, progressive option takes into account new traffic, new operators, prospective liner services, new companies and new captive markets. However, most traffic forecasts contain two or three different scenarios, usually taken to be as pessimistic, realistic and optimistic, with all possible variations.

10.2.3 Foreseen modal split

In order to properly assess the necessary facilities, internal road capacity, rail capacity, loading/unloading capacity, size of the handling areas for road and rail vehicles (and inland vessels in case of seaports with inland waterway connections), complete forecast must contain forecast of cargo which will be distributed from, or collected in the port, by different modes of transport. Depending on the level of details needed, such forecasts may go deep into details and determine the modal split for every direction (from port / to port) and for every type of cargo on every terminal (or for the entire port). In addition, apart from the quantities of cargo being shipped in or shipped out on the land side, forecasts needed for the more precise modal split can contain even the type and number of trucks and wagons (and barges, where applicable) and their seasonal effects.

Modal split depends on a variety of factors: type and quantities of cargo shipped in or shipped out, storage time, hinterland connections and their quality and capacity, transport prices for road or rail transport to/from final destinations deep inland, etc.

10.2.4 Characteristics of vessels

This activity is more convenient for seaports and those inland ports which are close enough to sea so that they can accept and handle some seagoing vessels. This is for a simple reason of the greatest possible variety of vessels navigating seas and calling seaports and nearby inland ports capable of receiving seagoing vessels. On the contrary, inland ports further into the continent usually serve either non-propelled barges with push boats or self-propelled vessels with their own cargo space. Such vessels are usually classified into vessel classes and standard types.

Seaports and mixed inland-sea ports can handle both seagoing vessels, short sea shipping vessels and inland vessels of different classes. Knowing and forecasting the type of vessels ("Capemax", "Panamax", "Jowi", "Europa IIb", etc.) helps determining the requirements for berth dimensions, dimensions of the handling equipment (cranes, etc.), necessary depths along the berths and in the approaches, etc.

Ports handling only or mostly inland vessels should take care to plan enough space for the largest vessels navigating in their area and to reserve either larger number of berths, or high-productivity equipment or to work on 24/7 basis when and where legally possible. This is mostly due to the fact that inland ports are called by pushed convoys, where a large number of barges (up to 24 in most extreme cases, on the middle and lower Danube, for example) arrive at the same time and require a quick turnaround so that the pusher as a mother vessel for pushed barges can be engaged on next voyages.

10.2.5 Competition analysis

Ports can compete with other modes of transport (inter-modal competition) and with other ports (inter-port competition). In assessing the influence of these two types of competition, it is important to consider the degree of substitutability between them – e.g. how substitutable is road or rail transport for waterborne (inland waterway or maritime) transport, or port A for port B?

Generally, demand for transport can be met by various transport modes, including sea, inland waterway, road, rail or air. Therefore, theoretically, waterborne transport may compete with these other modes of transport. For example, if the price of one or more port services increases, some port users might switch to using a different mode of transport, such as rail or road.

Apart from inter-modal competition, a port may be influenced by inter-port competition. As neither the initial origin nor the final destination of freight or passengers tends to be ports themselves, customers may in principle choose between different ports of origin and ports of destination. The degree of substitutability between ports at or around these locations will determine the extent of competition between ports. The ability of different ports to serve customers in a given area needs to be assessed on a port-by-port basis, although, in principle,

a distinction can be made between captive and contestable hinterlands. All regions where one port has a substantial competitive advantage because of lower transport costs to these regions (for example, owing to short distances to its customers' final destinations) belong to the captive hinterland. Such a port is likely to handle the majority of all cargoes to and from these regions. Competition between ports is more likely to occur in regions where no single port has a significant cost advantage over other ports. These ports may therefore operate in the same geographic market.

In addition to hinterland traffic, ports may compete for transshipment traffic, whereby larger vessels use a port to transfer cargo to smaller feeder vessels, which is a more frequent situation in seaports and those inland ports capable of handling some seagoing vessels. These feeder vessels then transport the cargo on to ports that serve the required hinterland. The distinction between hinterland and transshipment traffic means that two ports that do not serve the same hinterland may still operate in the same geographic market with respect to the relevant goods if they compete for the same transshipment traffic. Where ports compete for transshipment traffic, the relevant geographic market is likely to be wider than in the case where ports compete for hinterland traffic only.

10.3 Engineering aspects

10.3.1 Berth capacity planning

Berth capacity is needed for the determination of a number of berths for each type of cargo or for a terminal in a port. Basic "unit" for capacity planning of a port or a terminal is a berth. Berth capacity planning is necessary in order to determine the needs in cargo handling equipment and manpower gangs when and if necessary. Berth capacity is determined by the capacity of the handling equipment and the maximum number of cargo handling equipment (CHE) units engaged on one berth, and is expressed in hourly, daily, monthly or yearly capacity. This is, in general, a technical capacity, which is different from throughput capacity, also known as berth productivity.

There is a number of ways to plan and calculate the berth capacity, and only a few methods will be very briefly described here.

Mean daily i^{th} berth's capacity is determined from Frolov' equation[18]:

$$C_{bi} = \frac{24 GT\sim_o k_{sh} k_{met} \sum \overline{P}}{GT\sim_o + t_{aux} \sum \overline{P}} \qquad (10.1)$$

where:

[18] Frolov, A.S., Kuzmin, P.V. and Stepanets, A.V., *Organisation, Planning and Technology of Cargo Work in Sea Ports*, (in Russian), Transport, Moscow, 1979.

GT - gross tonnage (sea going ships, D – registered carrying capacity for river ships)
α_o - utility coefficient of the part of capacity used on a given berth or load coefficient if a ship is serviced completely at one berth only
k_{sh} - shift coefficient determined from the ratio of actual work hours per day and total daily hours ($t_f/24$)
k_{met} - coefficient which covers work stops due to meteorological conditions

$$k_{met} = \frac{720 - t_{met}}{720}$$

t_{met} - duration of stops due to meteorological conditions
$\sum \overline{P}$ - mean cumulative productivity of cargo handling equipment (t/h)
t_{aux} - planned auxiliary operations time

Kazakov[19] defines the port (terminal) capacity as the maximum quantity of determined cargo which a berth is capable to load/unload to/from ships under certain work conditions and for a determined period of time (day, month, duration of navigation period). Total capacity of the port or terminal is equal to the sum of individual berths capacities.

Daily berth capacity at the berth equipped with the single type cargo handling equipment can be calculated as:

$$C_b = n_e P_e t_h k_{red} k_{no} \tag{10.2}$$

where:

n_e - number of single type cargo handling equipment (CHE) units (cranes, forklifts, etc.)
P_e - mean hourly productivity of one cargo handling equipment unit (depending on number of shifts in a day, number of hours dedicated to "rear" links – cargo handling on delivery or reception to/from the warehouse on the land side), $t_h = 24k_d$
k_d - utility coefficient of the daily time spent on ship – berth link
k_{red} - reduction coefficient which covers the reduction of productivity of each cargo handling equipment unit due to concentration of several CHE units at the same ship or berth
k_{no} - coefficient which covers the time spent on non-operational movements and manoeuvres (berthing, de-berthing, fastening, unfastening, etc.)

$$k_{no} = \frac{t_{lu}}{t_{lu} + t_{no} + t_{aux}} \tag{10.3}$$

t_{lu} - time of loading and unloading operations
t_{no} - time of non-operational activities (berthing, de-berthing, fastening, unfastening, etc.)
t_{aux} - time of auxiliary operations (commercial works, cargo docs issuing, cargo control, etc.)

[19] Kazakov, A.P., *Technology and Organisation of Cargo Work in River Transport*, (in Russian), Transport, Moscow, 1984.

Values of t_{lu}, t_{no} and t_{aux} depend on concrete conditions and characteristics of each ship and cargo type.

$$t_{lu} = \frac{G}{n_e P_e k_{red}} \tag{10.4}$$

where: G - quantity of cargo on a given ship

For example, in discharge system "ship – wagon" (s-w) with productivity $P_{s\text{-}w}$, mean productivity of a single cargo handling equipment unit is found from:

$$P_e = \frac{1}{\frac{1-\sim}{P_{s-w}} + \frac{\sim}{P_{s-wh}}} \tag{10.5}$$

From Equation (10.2) we obtain further:

$$C_b = \frac{n_e t_h k_{red} k_{no}}{\frac{1-\sim}{P_{s-w}} + \frac{\sim}{P_{s-wh}}} \tag{10.6}$$

where: $P_{s\text{-}wh}$ - productivity of a single CHE unit in discharge system "ship – warehouse"
α - coefficient of cargo throughput through the warehouse, usually determined in the preliminary plan for the fiscal year

In many cases berth mechanisation (CHE) is not used only for loading or unloading of ships, but it is also used for handling of determined quantities of cargo to/from the warehouse (Q_{wh}) in systems "warehouse – wagon" and "wagon – warehouse". Part of cargo throughput handled in these two systems in relation to the total cargo throughput (Q_t) is expressed with the following coefficient:

$$= \frac{Q_{wh}}{Q_t} \tag{10.6a}$$

If we combine the daily expense of time of al single type CHE units working in all systems we obtain

$$\frac{C_b(1-\sim)}{n_e P_{s-w} k_{red}} + \frac{C_b \sim}{n_e P_{s-wh} k_{red}} + \frac{C_b}{n_e P_{wh-w}} = t_h k_{no} \tag{10.7}$$

From (10.7) we yield the berth capacity as (tons/day):

$$C_b = \frac{k_{red} k_{no} t_h n_e}{\frac{1-\sim}{P_{s-w}} + \frac{\sim}{P_{s-wh}} + \frac{}{P_{wh-w}}} \qquad (10.8)$$

If we have the CHE of various types than we have to consider the summary productivity of each type working in all three systems:

$$C_b = \frac{k_{no} t_h}{\frac{1-\sim}{\sum P_{s-w}} + \frac{\sim}{\sum P_{s-wh}} + \frac{}{\sum P_{wh-w}}} \qquad (10.9)$$

Handling various types of cargo to/from a single ship leads to a reduction of capacity due to different time fraction needed for handling of each type of cargo. Ro-Ro terminals are the perfect example of this capacity reduction; while a driver can handle a passenger car very easily, his production will be reduced when loading a mobile crane for example.

Further, Kazakov says that, sometimes, berth capacity is expressed by the number of ships handled in a determined period of time (day, month, navigational period of a year). In this case, the berth capacity (ships/day) can be obtained from:

$$n_s = \frac{k_{no} t_h}{t_{lu}} \quad \text{or} \quad n_s = \frac{24}{t_{lu} t_{no}} \qquad (10.10)$$

Therefore, the berth capacity (tons) will be:

$$C_b = n_s G \qquad (10.11)$$

All above methods have their own drawbacks, but they are more than fit to be used in the planning phase of a berth capacity.

Thereafter, the number of berths can be determined from the following equation[20]:

$$n = \frac{C}{C_b} \qquad (10.12)$$

Where:
n = number of berths (dimensionless)
C = required throughput through the terminal (tons/year, month, day, hour)

[20] Group of authors, (2014), "Masterplans for the Development of Existing Ports", PIANC Report no. 158.

C_b = productivity per berth (tons/year, month, day, hour)

10.3.2 Land side capacity planning

Calculated for the same purposes as the berth capacity, the land side capacity is needed in order to provide a seamless flow of goods through the port and to enable that the cargo is kept in the port only due to agreed conditions, not due to lack of adequate capacities.

Landside capacity planning provides an adequate number of truck loading/unloading stations, wagon loading/unloading sites, length of railway tracks, size of the storage areas, number of gates at the delivery/reception stations, etc.

10.3.3 Hydraulic modelling

Knowledge of the currents or river flows in the vicinity of the port or terminal will be required for studies of ship handling and mooring, sediment transport and water quality in the approach channel, port basin and its entrance and berth areas. Information about the currents can be obtained from hydrological databases for rivers, tidal atlases, field measurements or by using physical and computational models. For detailed studies of sediment transport or navigation either a physical or computational model will be required to fully define the current field. Typically, where a large area needs to be represented or the flow is stratified, a computational model will be used.

10.3.4 Geotechnical study

Planning and Design Stages

The geotechnical characteristics of the sub-soil will influence the design of the structures especially the quay walls, jetties, breakwaters and buildings. However, also the planning of land reclamation and dredging works will be affected by the sub-soil. In case one still has the possibility to choose the location of the port expansion, then it is generally advantageous to avoid areas with rocky and/or very hard sub-soils, especially if such formations would be situated in areas that require to be dredged. Also, areas with very soft clayey layers or loose sands are generally not considered to be attractive conditions for port construction, even though dredging of such layers is relatively easy. Clayey layers or peat layers are often highly compressible and will be subject to settlement in case the load on such layers is increased as a result of e.g. reclamation or breakwaters. If such soft layer is only encountered locally, the layout plan may be generated in such a way that building on top of such layers can be avoided. It may also be advantageous to avoid building on top of layers consisting of loose fine sands especially in areas prone to earthquakes and where a risk of liquefaction is identified. In case the soil that needs to dredged, has appropriate characteristics (e.g. sandy soil with a suitable grain size distribution and not polluted) it is worthwhile to consider re-use of the dredged materials (e.g. to reclaim new land for the envisaged port expansion).

Construction Stage

The construction methods and time will be influenced by the sub-soil. In harder soils pile driving works and dredging works will require more effort and it will influence the choice of the equipment as well as the time and costs. When soils are soft or loose, then dredging will be relatively easy, but these soil layers are not the most suitable as bearing layers for foundations. Also for land reclamation, soft layers in the sub-soil are generally not favorable as they will tend to settle due to the load of the fill and these settlements sometimes take so much time that additional measures are required like vertical drainage, (temporary) surcharge load or even soil improvement[21].

10.3.5 Seismic characteristics

Seismic characteristics of the soil where a port is planned needs to be investigated. In case of existing ports expansion, the seismic activity of the soil also needs to be taken into account. Seismic activities will affect the design of several structures, however, it will generally play a minor role in the port master planning process. In special cases where e.g. a fault line crosses the area assigned for the expansion or where another geological feature may adversely affect the future expansion, adjustment of the layout plan may be a remedial measure to reduce the risk of damage during earthquakes.

10.3.6 Topography and bathymetry

Topographic maps show the existing land levels and bathymetric maps show the existing sea or river bed levels[22].

It is highly preferable that the levels indicated on the topographic and the bathymetric maps are expressed relative to the same reference level. Also the use of the same coordinate grid is very useful. If the topographic and bathymetric maps do not use the same reference level and/or coordinate grid, then at least the relation between the reference levels and the coordinate grids must be known.

The information on the maps is likely to influence the layout plan of the port expansion. The maps indicate, e.g. whether an area is relatively flat or is hilly and/or has (steep) slopes and/or whether its level needs to be raised to prevent it from flooding. The bathymetry (together with water level information) gives an indication about the existing water depths and the need for dredging. In the case of an existing port, most likely bathymetric maps will be available in the form of nautical charts.

The bathymetry of the future port area and of a significantly larger seaward area is also required in case the local wave data need to be generated by means of a numerical model or a physical model. Also in this respect nautical charts can be of use even though the data on the larger scale charts is highly indicative.

Preferably, the topographic and bathymetric maps also show the location of existing structures (with a description thereof) or other remarkable features as well as location of sub-

[21] Ibid.
[22] Ibid.

sea pipelines and/or cables. In this respect it is recommended that ports establish a baseline of the present conditions using a GPS grid format and produce frequent updates.

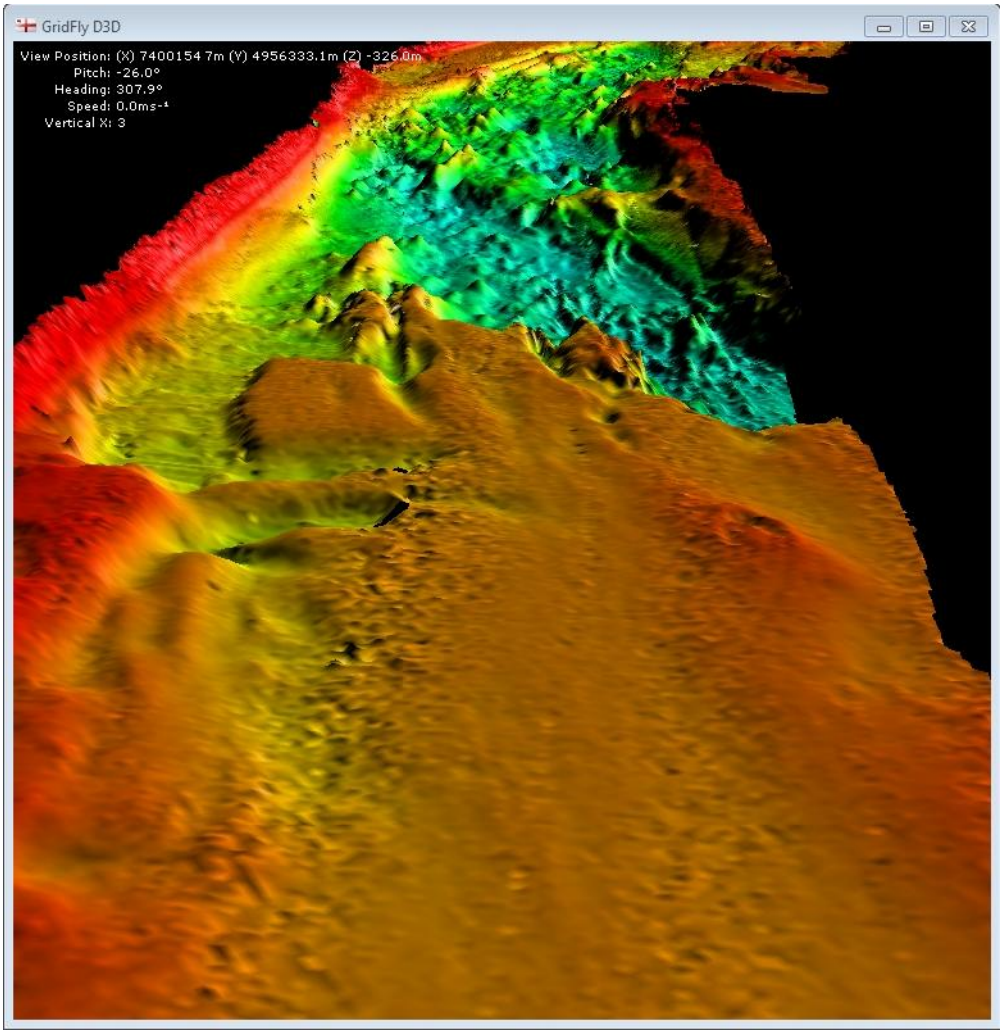

Figure 13: Bathymetric scan of the Port of Šabac (Serbia)

(Source: iC consulenten)

10.3.7 Meteorological and hydrological conditions

These conditions usually refer to water level conditions, waves, ice, currents, coastal processes, wind, rain, fog and snow.

Water level conditions do not have a decisive power on the new port site selection, but they do have influence on various design issues, such as design of breakwaters in seaports, elevation of quay walls and terminal areas, capacity of the crane booms and reaching capacity of the other quay handling equipment also.

Natural and artificial waves, such as wind waves and vessel wake induced waves influence the safety of vessels when in port. Natural waves can therefore have a decisive influence on breakwaters design, while both natural and artificial waves can influence the design of quay walls in such way that quay walls may be designed with wave dissipating chambers so as to reduce the energy of waves impacting quay walls.

Ice can have a detrimental effect on both new and existing ports due to its energy and force with which it can impact surface or underwater structures, especially in ports with strong currents or in inland waterways ports where water is on the constant horizontal (with the river flow) move and vertical (with the rising or declining water levels) move. That is why it is necessary to investigate the influence of ice in the area where new or existing port under expansion is located.

Currents (tidal, wave, wind-driven or river flows) may influence ship handling and manoeuvring and on morphological processes related with sediments transports. Currents may also influence the port layout as well as the cross-section design of the approach channel and the layout of the port basin entrance. The layout/orientation of the port basin entrance should preferably also be such that sediments will not enter into the port basin but that they will pass by the entrance, otherwise an extensive maintenance dredging will be required. Since the current flow in seaports is often not in one and the same direction all year round, it should be assessed which layout and design deals in an optimum way with the different current and/or sediment conditions. On the other hand, port basin entrances are usually oriented in such way that the angle between the entrance axis and the tangent of the river flow at the entrance is less than 45 degrees.

Coastal and river bank processes can have a strong influence on port construction. Littoral drift, i.e. the transportation of sediments along the coast, can either be obstructed by port structures that protrude from the shoreline into the sea or be influenced by dredged channels or the like in which sediments may be trapped. Such morphological effects can be either on a small local scale or on a larger scale. These larger morphological effects may result in erosion on the one side and sedimentation at adjacent areas of the port. Small scale morphological effects deal with sedimentation of the access channel and or port basin. Morphological effects must therefore be assessed. If it is concluded that they may affect either the port or the port's surroundings, the main sediment transport directions and transport volumes need to be quantified to estimate the erosion and/or accretion. If the erosion or accretion takes place where it is not acceptable for e.g. functional/operational, social or environmental reasons, then measures should be taken. If the sedimentation would take place within the port basin or in the access channel, then this will require maintenance dredging. If erosion would take place where it is not desirable, then that particular stretch could be provided with some kind of coastal protection or regular recharge of material could be done. The latter can also be regarded as a kind of maintenance dredging because in many cases the material will be dredged where the littoral drift is obstructed and accretion takes place and subsequently it will be used as replenishment material in the area where erosion is expected.

Wind can have a strong influence on vessels while being loaded/unloaded, while they are at anchor or moving in and out of the port. In this view, wind can have influence on the

orientation of the entrance to the basin, quays and waiting areas, and therefore it needs to be taken into account when planning a new port or when expanding an existing one.

Rain, fog and snow are taken into account in master planning only when experience in existing ports demonstrates that cargo handling or any other port operations are heavily influence by these meteorological conditions.

10.3.8 Material supply

When constructing a new port, or when expanding a new one, it is highly advisable to consider the quick and efficient supply of building materials like sand, gravel and rock. The ideal situation is when the building materials are available in the port itself or its immediate vicinity, so as to avoid lengthy and costly transport from a faraway reclamation site. When the port basins are dredged, the dredged material should be analysed in order to check if it is suitable for land reclamation in adjacent port zones.

10.3.9 Dredging and reclamation

Construction of new ports or expansion of existing ports requires, in most of the cases, substantial amount of dredging works, for the purposes of construction of new basins or approach channels, and for expansion and deepening of the existing basins, channels or berths. From the view of port master planning, the costs of capital dredging and maintenance dredging can be a decisive criterion. When ship handling and river flows or sea currents are taken into account it may happen that the shortest way from the basin to the fairway or deep waters is not the most advantageous one even though it has the lowest cost. It is the task of the port master plan to investigate all possible options and to cross-check them before proposing the most favourable solution.

From the planning perspective, dredging activities are closely related to bathymetry. The construction of a port basin may involve more or less dredging depending on the location selected for such basin. Port master plan should contain a comparison between the dredging volumes for alternative locations taking into account various other aspects. First and foremost, the overall masterplan should offer safe, logically integrated and cost-efficient solutions that provide sufficient space to satisfy both the land area and the water area requirements in the ultimate year of the masterplan. When dredging is required, it is always worthwhile to find out whether use can be made of the dredged material, e.g. to reclaim new land areas for the port expansion or other purposes. In case reclamation areas form part of the port layout plan alternatives, both bathymetric and topographic data are necessary to try to achieve a 'cut and fill balance' where the volumes of dredged ('cut') and reclamation ('fill') materials will be more or less equal[23]. The advantage of such approach is clear as no external material needs to be bought and delivered to the construction site and at the same time no excess dredged materials (apart from those that do not have the right physical and/or chemical characteristics for reclamation) need to be transported to a disposal site. The use of disposal sites for unsuitable material may also involve all kinds of environmental procedures

[23] Ibid.

which need to be followed. Ultimately, the 'cut and fill balance' approach may influence the layout plan of the port. By means of the bathymetric maps, it will be possible to identify the relatively shallow areas where land reclamation (and breakwater construction) is still cost-efficient (hence without consuming excessive material volumes to reach the required surface level). It should be emphasised that when determining the required fill volumes, the material required to compensate for settlements of the sub-soil (as a result of filling) should also be taken into account.

10.3.10 Options for quay wall construction

The type and layout of quays is an important job of port planning. The layout of quays depends on the types and number of terminals and on the area just behind the quay line, that is, on the area needed for cargo handling before loading or just after unloading from a vessel. For large terminals requiring considerable berth length and handling a large range of different vessel and barge sizes, a long continuous berth line is most likely better from the point of view of operational flexibility. When that is not physically possible, a combination of multiple basins and so called finger piers is a convenient choice. In terms of type, quay walls can be made of sheetpiles, blocks or caissons. Jetties, a finger-like structure with a deck on a sheetpile foundation, are used mostly in seaports, although they are frequently seen in inland ports and terminals for oil or liquid bulk cargo.

In river ports, quays can be vertical, semi-vertical and sloped (inclined). From the operational point of view, it is strongly recommended that all quay walls are built as vertical quay walls, since the water level does not affect the distance of a vessel from the shore crane, like in case of sloped or semi-vertical quay walls. Vertical quay walls therefore facilitate the most efficient way of crane handling regardless of the water level in a port.

10.3.11 Land survey study and expropriation study

Land survey includes geodetic survey of the relevant section of the river bank or sea coast. Land survey in river ports comprises of following activities:

- hydrographic and geodetic survey of river between the highest lines of the both riverbanks by cross sections every 100 m. On these cross sections additional surveying points are often established every 5 m. Surveying points within the water flow are geo referenced through 3D points in vectorized form.
- the river bank is surveyed geodetically usually with grids of 100m. Left and right embankment are often geo referenced through 3D polylines in vectorized form.
- A detailed survey with more points in cross section, which is performed on the right slope and on certain sections.

Expropriation study serves to determine the ownership status of the land slots (parcels) which are needed for the new port or for the extension of the existing port. Based on the review of the basic property ownership analysis the expropriation study often requires the following steps:

- Obtaining cadastral data at relevant authority
- Vectorization of cadastral map and owner database
- Merging of cadastral map with digital orthophoto 1:1000 in order to have comprehensive cadastral orthophoto
- Integration of future port areas into comprehensive cadastral orthophoto
- Creation of general maps
- Elaboration of the Expropriation Report

10.3.12 Layout planning

In the widest possible sense of the term, the port "layout" is a plan of zones, terminals, quays, berth lines, aprons, handling areas, internal roads and rail tracks, parking areas, administration buildings, storage areas, etc. A port layout defines the usage of both water and land areas. In general, a port can include areas for:

- Commercial cargo handling operations,
- Value added services zones (power or processing plants, industrial bulk handling, packaging, etc.),
- Waiting areas for vessels,
- Anchorages,
- Internal road and rail routes,
- Customs, immigration, administration zones,
- Environmental areas (buffer zones and safety distances),
- Expansion areas,
- Parking areas, etc.

Commercial cargo handling operations areas are further broken down into:

- Oil or dangerous cargo terminals which are usually placed in a separate zone of a port,
- Dry bulk terminals for "clean" cargoes (agri-bulk terminals),
- Dry bulk terminals for "dirty" cargoes (ore, coke, coal, sand and gravel terminals, etc.),
- Container terminals,
- Ro-Ro terminals,
- Passenger terminals,
- General cargo or multipurpose terminals, etc.

Port layout planning should allow for the consideration of land use compatibility within port areas and enables certain users to be allocated adjacent to specific related port land uses thus possibly adding significant operational advantages and smoothing out landside operations.

It is always recommended to include a physical description of port terminals in port layout plan. Any port terminal needs its own specific conditions to meet the requirements of capacity and service quality: waterside access, quay line, terminal area, geometry of the terminal, land accesses, etc. Port layout plan should provide strategic clarity regarding the probable and planned use of different port areas. This often helps all port users to have a clear overview of the planned port development and may attract different stakeholders towards the port.

10.3.13 Access for different types of terminals

This part of the engineering aspects of the port master plan refers to the existing and/or planned road, rail and waterside access for different terminals. This is a very important aspect of master planning as safe and efficient access routes may have a detrimental influence of the productivity and efficiency of any terminal. From the waterside, access to the terminal must take into account all aspects of navigational safety, paying special attention to the vessel paths from the entrance to the port basin, via transiting of zones of other terminals or common zones all the way to the quay line of a terminal in question. As regards to land accesses, a planner should take care to interrupt as few cargo/vehicle paths as possible in order to keep the landside vehicle traffic safe and efficient.

10.3.14 Possibility of land extension

Some professors at the European universities where port planning is taught usually start their first lecture in port planning with the following words: “Kids, when you plan a port, you have to plan it for one hundred years in advance”. This could not be more true. Throughout their life cycle, ports tend to grow with time, following closely the economic growth of their host cities and their captive hinterlands. In this view, a good port planner will always take into account the possibilities of land extension of a port at any time in the future. This can happen already in the early phases of the new port planning, or in the phase of land acquiring for the purposes of expansion of the existing port. Whenever possible, port planners should have strong and sincere relations with urban planners, so that port interests, which are often the same as the interests of a host city fully aware of the importance of its port, protected continuously. In this view, port planners and urban planners should, whenever physically possible, make sure that the expansion space is reserved for port or port related uses, such as industrial uses – of those industries which are most likely to use the port. When that is not physically possible, a solution of the so called “satellite” terminals, outside the main port area, should be considered. Last, but not least, when ports become fully surrounded by the growing city, a full relocation of a port may be the only reasonable solution.

10.3.15 Utilities

Utilities within a port usually encompass power, water, firefighting, liquid and solid waste, sewer and drainage. Port planner should always take care that each terminal and each building should have the possibility to connect to the public networks.

10.3.16 Maintenance

Proper port planning always includes areas for maintenance – of quay walls, decks, pavements, buoys, bollards, etc. Maintenance areas usually contain various workshops, parking for wheeled equipment and a portion of handling areas.

10.3.17 Safety, security and border control

Many ports include terminals for specific or dangerous cargo (LNG, oil, etc.). The positioning of such terminals within a port requires specific attention and in many cases risk analyses need to be performed to assess the required safety distances to nearby terminals or even residential areas. Sometimes, these terminals are placed in a separate basin of a port, in an attempt to physically separate the traffic of dangerous vessels from traffic of other vessels.

Security issues are also taken into account during the elaboration of a port master plan, especially in case of ports with passenger terminals. Security issues are of special importance for seaports. All international seaport terminals (both cargo and passenger ones) need to fulfil the requirements of the International Ship and Port Facility Security Code (ISPS). ISPS code has been adopted as supplementary to the SOLAS (Safety of Life at Sea) of 1974 and has become compulsory since 1st July 2004. It does not refer to war ships, government ships and non-commercial government ships. ISPS code is compulsory at ships in international voyages and refers to: passenger ships, fast passenger ships, cargo ships, fast cargo ships above 500 GT and mobile sea platforms. However, neither IMO nor any other relevant international organisations have not yet proposed measures for security protection of ships and ports in inland navigation at rivers, lakes and channels which are used by Convention and Non-Convention inland and maritime navigation. Non-Convention ships are all other ships which are not subject to SOLAS Convention regulations, e.g.: fishing boats, yachts, boats, recreational boats, inland vessels and war ships.

Even though inland ports are not subject to strict requirements of ISPS, it is recommended that port planners take into account various security aspects which may, or may not become compulsory requirements for inland ports, such as:

- Port facility security plans,
- Certain security equipment,
- Port security personnel,
- Monitoring and controlling access,
- Monitoring the activities of people and cargo
- Ensuring that security communications are always available.

One of the ISPS requirements which can easily be applied in inland ports as well is related to fencing of the port areas. This rule requires that a port area should be secured with a fence not lower than 2,10 meters in a distance not closer than 30 meters to the vessel or cargo handling areas.

Last, but not least, ports should have facilities for execution of border control. This means that a port planner should take into account the need to perform these activities and to provide sufficient facilities for border control officers and adequate waiting and parking areas.

10.3.18 Terminal planning

Function of a port terminal is to enable space, infrastructure, suprastructure, equipment (with manpower) and services at a ship-berth, berth-storage, storage-loading/unloading landside area and loading/unloading landside area - reception/delivery area links of a port system. Figure 14 shows a visual representation of these links and areas on an example of a Ro-Ro terminal in a seaport.

The services at a terminal include loading/unloading of cargo from ship to shore and vice-versa, temporary or long-term storage of cargo, loading/unloading of cargo from/to land vehicles and reception and delivery of cargo at the terminal gates.

All these elements need to be planned carefully in order to facilitate smooth and efficient terminal operations. Terminal planning therefore involves detailed spatial planning of the physical infrastructure such as quays/berths, storage areas, internal roads and rail tracks, buildings and utilities. In addition, it involves non-physical aspects, such as planning of services whereas their productivity is determined by terminal dimensions, number of berths and quay length, terminal capacity, number of cargo handling equipment units, number of operational hours per day/week/month/year, berth occupancy factor, handling and storage area size, etc. All these aspects need to be planned carefully and separately for each terminal, since each type of terminals has its own characteristics and peculiarities of equipment, infrastructure, suprastructure and operations.

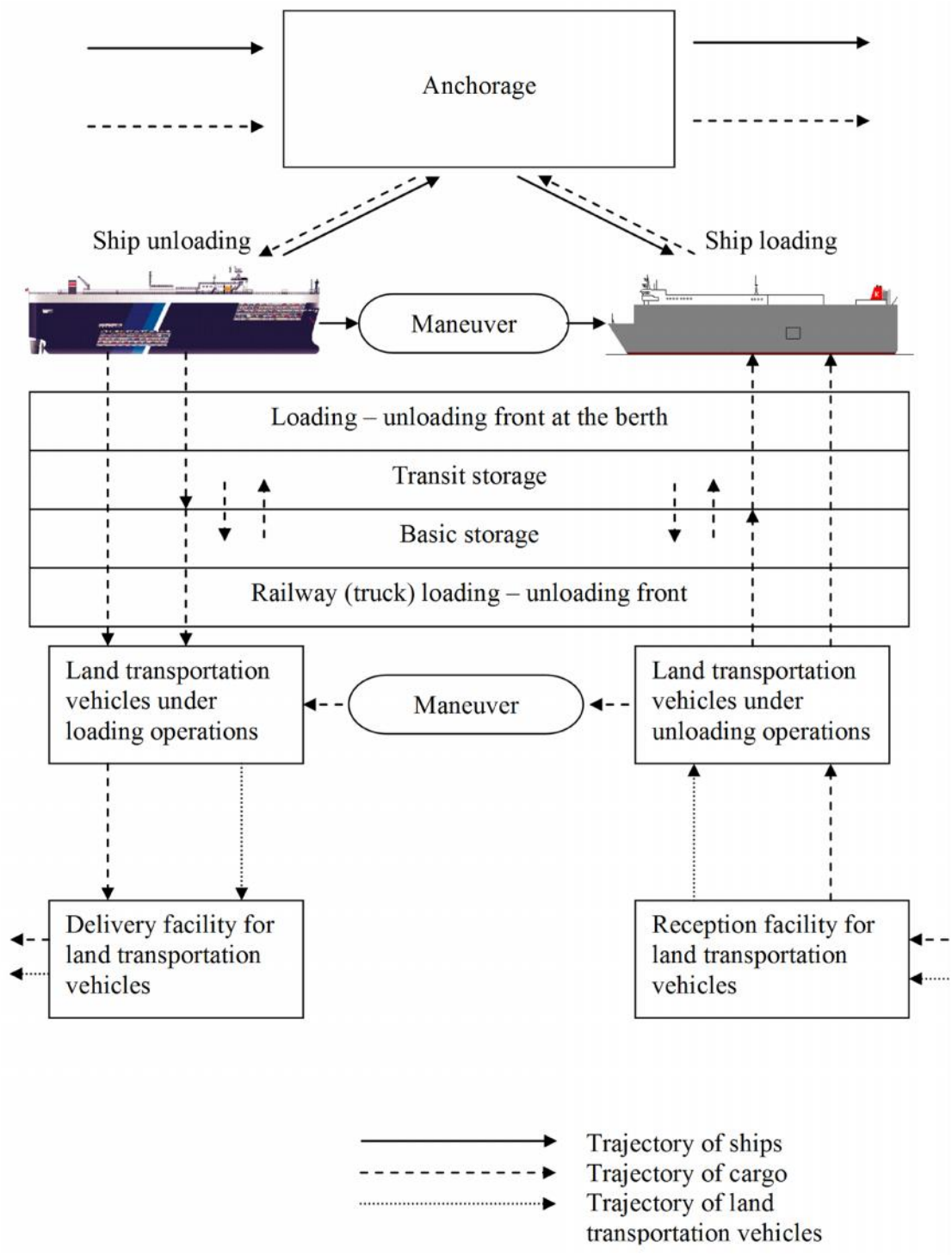

Figure 14: Critical areas and links of a Ro-Ro terminal[24]

[24] Jovanović, S. (2008), *Stochastic and Analytic Models for Planning, Design and Operation of a Ro-Ro/Vehicle Terminal*, PhD Thesis, Technical University of Catalonia, Barcelona.

10.3.19 Phasing of the development

Depending on the scope of the port master plan, the time horizon taken into account for planning and the timing of infrastructure and land interventions, port development may be divided in phases. This is usually required already in the terms of reference for a port master plan, or a port planner may suggest this to the port authority or any other beneficiary requesting an elaboration of a port master plan. Number of phases depends on requirements, investment plans, plans of eventual concessions and budgeting. Usual number of phases is 3-4, but this is not a rule.

10.4 Financial and socio-economic analysis

The main purpose of the financial analysis is to use the project cash flow forecasts to calculate performance indicators of the projects in particular net return indicators. The method used for the determination of the financial return is the Discounted Cash Flow (DCF) approach. A schematic representation of the approach is shown in the figure below:

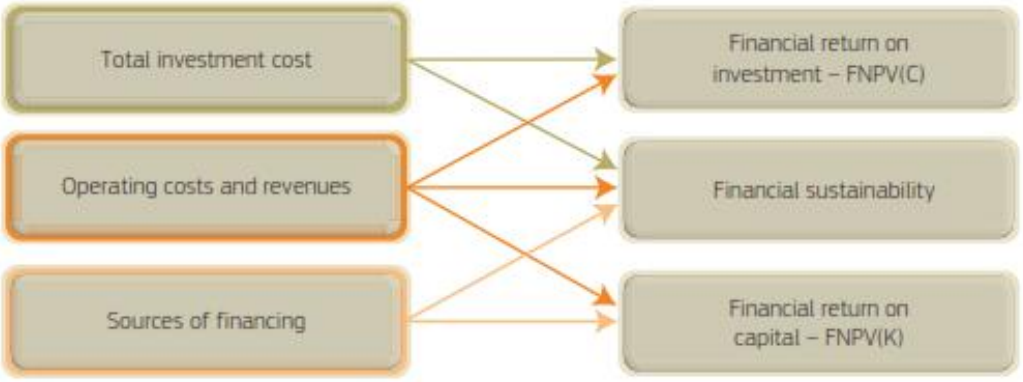

Figure 15: Structure of financial analysis[25]

Financial appraisal is a major step in the evaluation and prioritization of port projects since it aims at identifying the most financially sustainable option usually from the point of view of the infrastructure owners (generally managers of the Port Authority).

The financial analysis of projects differs from their economic analysis for it focuses on the impacts to Port Authority, whilst the Cost Benefit Analysis takes a social perspective and considers all those who experience an impact of the considered project.

Financial analysis is also important as often the operation and maintenance of the as-set, and requires a stream of expenditure from the Port Authority. Long term financial sustainability of the project may therefore require that incoming revenue, meets the maintenance and port operating cost requirements.

[25] EC Guide to Cost-Benefit Analysis of Investment Projects, DG REGIO 2014

The financial analysis provides the examiner with essential information on inputs and outputs, their prices and the overall timing structure of revenues and expenditures.

10.4.1 Funding options analysis

Ports require expensive infrastructure to be able to compete successfully. Until recently, port authorities mainly relied on contributions and subsidies from national governments for building or improving basic port infrastructure. Such contributions usually were excluded from port financial accounts and therefore helped ports to exhibit positive financial positions. Whether national governments finance basic port infrastructure depends on the government's political and economic policies. For example, if ports are considered part of the general transport infrastructure of the country, then investments in them may be considered to promote the national interest.

In some countries, financing basic infrastructure is considered a public task (for example, in France, Italy, Serbia and Croatia) because this part of infrastructure belongs to the public domain, which is protected by law. To carry out construction activities or port operations in this domain, a public license is required.

For the government, there are two key issues[26] associated with making large direct investments in port facilities: how to find the necessary funds and how to recover the investment.

The ways in which the government (or any other public body) funds investments are diverse:

- Direct investments coming from the government investment budget.
- Direct investments coming from a special (port) fund.
- Loans from international financing institutions (IFIs).

Direct investments, paid for by the investment budget or a special fund, are based on the assumption that they will have a substantial positive effect on the economy, as shown by the positive results of a cost-benefit analysis (always heavily dependent on traffic forecasts). For investments broadly benefiting the entire nation, it is not unusual that a government would not seek direct financial repayment.

However, there are also situations where the government may receive direct reimbursement for the funds it invested via a variety of rates and charges assessed against the beneficiaries of the investments. These may take the form of[27]:

- Compensation paid by the port authority in proportion to the volume of goods transported through a newly dredged channel (per ton or per TEU).

[26] Group of authors (2003), *Port Reform Toolkit*, World Bank, Washington.
[27] Ibid.

- A fixed amount per year paid by the port authority to the government.
- A percentage of the annual port dues paid by the port authority to the government.

Often, basic infrastructure elements are financed by an IFI under a government guarantee. However, even when IFI financing is made available, ports and governments must still face the challenge of providing matching shares for a period of 30 to 50 years and making interest payments over a period of some 20 years.

When considering financing of operational infrastructure, port authorities have a number of options from which to choose. For service ports or tool ports, governments will usually finance the operational infrastructure, with or without the assistance of an IFI. For landlord ports made up of self-contained terminals, investment in the terminal should be financed by the terminal concessionaire or the lessee, while the port provides the land (often in a condition ready for construction). The port may also provide the quay wall with the land, but, increasingly, private concessionaires have been willing to invest in this infrastructure.

The most attractive situation, both from the point of view of the landlord port authority as well as of the operator, is the conclusion of a long-term lease contract with the operator (running for a period of 20 to 30 years) for the use of part of the port area. This type of long-term lease has the legal character of a property right and has four advantages:

- At the end of the contract, possession of the land reverts to the government or port authority.
- The contract represents a property right that under certain conditions can be transferred to a third party. There usually is a clause in such contracts stating that such transfer of property rights requires prior permission from the port authority.
- All superstructures (buildings and equipment) may be financed and owned by the operator.
- It can be used as security for a bank loan.

Last, but not least, very attractive funding option are the funds from the Connecting Europe Facility – a financing instrument of the European Union.

The Connecting Europe Facility (CEF) for Transport is the funding instrument to realise European transport infrastructure policy. It aims at supporting investments in building new transport infrastructure in Europe or rehabilitating and upgrading the existing one.

TEN-T policy objectives foresee:

- completion by 2030 of the Core Network, structured around nine multimodal Core Network Corridors.
- completion by 2050 of the Comprehensive Network in order to facilitate accessibility to all European regions

CEF Transport focuses on cross-border projects and projects aiming at removing bottlenecks or bridging missing links in various sections of the Core Network and on the Comprehensive Network (link), as well as for horizontal priorities such as traffic management systems.

CEF Transport also supports innovation in the transport system in order to improve the use of infrastructure, reduce the environmental impact of transport, enhance energy efficiency and increase safety.

10.4.2 Financial analysis

10.4.2.1 Inputs of financial appraisals

It should be noted carefully that contrary to the economic analysis, market prices are used as the price base.

The inputs of a financial appraisal are money flows to and from the Port Authority and contrary to the economic appraisal, they do not include externalities (either external costs or external benefits). They represent the financial flows of the investment and are broken down in:

- *Investment costs/capital expenditures (CAPEX)* and residual value (including the expenses for renewals and extraordinary maintenance operations). This data/info needs to be collected in order to prepare the foundations of the financial.
- *Operating Revenues and Costs (OPREV and OPEX)* including labour, utilities and the maintenance costs of planned works as well possible revenue items such as cargo handling tariffs and port dues to ships.

Another important input for the financial appraisal are the sources of financing, including private equity and all public contributions (local, national, community level), loans and other sources of financing). It should also be noted that in the calculation of operating costs all items that do not give rise to an effective monetary expenditure must be excluded. In particular, the following items are to be excluded:

- Depreciation and amortisation, as they are not effective cash payments.
- Any reserves for future replacement costs.
- Any contingency reserves, because the uncertainty of future flows is taken into consideration in the risk analysis and not through figurative costs.

Likewise, the following items should not be included in the calculation of future revenues:

- VAT (other indirect taxes should be included only if they are charged to the investor),
- Any other subsidies (transfer from authorities, etc.).

In other terms, the revenues to be considered in the financial analysis should be the ones that accrue to the owner of the infrastructure. The sources of financing are mainly made up of:

- community assistance (the EU grants),
- national public contribution (grants or capital subsidies at central, regional and local government level),
- national private capital (i.e. private equity under a PPP),
- other resources (e.g. EIB loans or loans from other lenders).

10.4.2.2 Parameters of financial analysis

The parameters of the financial analysis spreadsheet are the following:

Time Horizon/ Appraisal Period: this parameter is 25-30 years according to the Guide to Cost-Benefit Analysis of Investment Projects, DG REGIO 2014, where this reference time horizon is for ports and airports sector.

Residual Value of investment Components: calculated by computing the net present value of cash flows in the remaining life-years of the project. In this respect Residual value will be calculated with the following formula: Residual life = (remaining lifetime / total lifetime) X capital costs. Remaining life time is computed as it follows: Total Lifetime - Appraisal Period. The default values as regards the total lifetime for different assets in case of port investment can be used from the UNCTAD studies (Port Performance Indicators, 1976) presented below.

TABLE I

Berthing facilities for one berth at Port of Piraeus

Berth group: section I, general cargo berths, Berth number: 1

Facility code	*Facility*	*Length (metres)*	*Draught (metres)*	*Area (sq. (metres)*	*Date in service*	*Amortization period (years)*	*Capital cost (thousands of dollars)*
0101	Quay	140	11.5	–	1930	100	285
0102	Open berth area	–	..	12800	1930	–	..
0103	Shed	100	–	4000	1961	50	200

Source: Data collected by the UNCTAD secretariat in the case-study port.

Figure 16: Example of amortization periods for general cargo berths[28]

If mobile assets are included in the calculation (depending on the beneficiary), then the following table from the aforementioned source can also be helpful.

[28] Group of authors (1976), *Port Performance Indicators*, UNCTAD Monographs Series, New York.

TABLE II

Summary of berthing facilities and equipment costs of study section for ship/transit area operation

(Thousands of dollars)

Asset	*Capital cost*	*Amortization period (years)*	*Annual capital charge*[a]	*Annual maintenance and operating charge*[b]
Quays	1140.0	100	95.6	0.6
Cranes	244.3	25	22.8	40.0
Forklifts	181.9	8	31.6	36.4
Mobile cranes	128.0	10	9.0	10.0
Tractors	53.3	8	9.3	10.7
Trailers	48.0	10	7.1	2.4
Trucks	10.0	8	1.8	4.0
TOTAL			177.2	104.1

Source: See table I.

[a] Assumed rate of interest 8 per cent.

[b] Estimates based on a 1972 sample for the whole port.

Figure 17: Amortization period for quays and mobile equipment in ports[29]

Financial discount rate: reflects the opportunity cost of capital, defined as "the expected return foregone by passing other potential investment activities for a given capital"[30]. There are many practical ways of estimating the financial discounting rate but for the sake of simplicity the Consultant will use a benchmark (default) value of it of 5% as it is recommended by the Guide to Cost-Benefit Analysis of Investment Projects, DG REGIO 2014.

Adjustment for inflation: The European Commission recommends using in the financial analysis current prices rather than constant prices for "the effect of inflation, or rather the general increase in the price index, or oscillations in relative prices, may impact on the calculation of the financial return of the investment". Thus, the prices considered in the financial analysis must be adjusted for inflation if the examiner chooses to use current prices.

10.4.2.3 Outputs of financial appraisals

Three summary tables are produced by the financial analysis to be then used for the calculation of the financial performance indicators. They are:

The financial sustainability table: this includes all the items presented above (investment cost, operating revenues and costs as well as sources of financing).

The table for calculating the return of the project: In this table, expenditure (out-flows) includes all investment and operating costs and revenues (inflows) include any possible income plus the residual value.

[29] Ibid.

[30] EC Working document No.4: Guidance on the methodology for carrying out Cost-Benefit Analysis, 08/2006

By calculating the balances of such expenditures and revenues (using an appropriate discount rate), it is possible to define the following financial performance indicators: the Financial Net Present Value of the Investment (FNPV/C) and the Financial Internal Rate of Return on the investment (FIRR/C).

The table for calculating the return on the invested capital: in this table, the outflows include the own equity of the private investor (when it is paid up), the national contribution at all levels (local, regional and national), the financial loans at the time they are paid back, in addition to operating costs and related interest. The inflows include all possible revenues.

By calculating the balances of such expenditures and revenues (using an appropriate discount rate), it is possible to define the following financial performance indicators: the Financial Net Present Value of the Capital (FNPV/K) and the Financial Internal Rate of Return on the Capital (FIRR/K).

It should be noted that the main difference between financial and economic performance indicators is that economic indicators use accounting prices or the opportunity cost of goods and services instead of imperfect market prices and it includes as far as possible any social and environmental externalities.

10.4.2.3.1 Financial outputs

The financial sustainability of a project is evaluated by establishing the above-mentioned "financial sustainability table". Indeed, by calculating the balance between inflows (revenues, e.g. sales and sources of financing that include receipts and any king of cash transfers) and outflows (expenditures including total investment costs and total operating costs), the examiner can estimate the accumulated generated cash flow.

Financial sustainability is ensured if the accumulated generated cash is positive or, at most, equal to zero for all the years considered.

On the contrary, if the accumulated generated cash is negative even for just one year, the project is not feasible from the financial point of view and it will be necessary to modify the structure of the project in order to evaluate it.

10.4.2.3.2 Financial Performance Indicators

A. Financial Net Present Value (FNPV)

The Financial Net present value (FNPV) is the discounted balance between monetary revenues and expenditure.

$$FNPV(S) = \sum_{t=0}^{n} a_t S_t = S_0 + \frac{S_1}{(1+i)} + \frac{S_2}{(1+i)^2} + \ldots \frac{S_n}{(1+i)^n} \quad (10.13)$$

Where:

S_t = balance of cash flow at time t (inflows – outflows)

$a_t = \frac{1}{(1+i)^t}$ = financial discount factor

i = financial discount rate

n = time horizon/ appraisal period

In the financial analysis of projects, two different FNPV are calculated:

- The Financial Net Present Value of the Investment (FNPV/C)
- The Financial Net Present Value of the Capital (FNPV/K)

B. Financial Rate of Return (FRR)

The Financial Rate of Return (FRR) is defined as the interest rate that zeros out the net Financial Net Present Value (FNPV). It can be calculated using the following formula:

$$FNPV(S) = \sum_{t=0}^{n} \frac{S_t}{(1+FRR)^t} = 0 \quad (10.14)$$

Where:

S_t = balance of cash flow at time t (inflows – outflows)

In the financial analysis of projects, two different FNPV are calculated:

- The Financial Rate of Return of the Investment (FRR/C)
- The Financial Rate of Return of the Capital (FRR/K)

10.4.2.3.3 Return on Investment - Specific Indicators

The return on the investment is the capacity of the project to operate net revenues to sustain the investment costs. The return on the investment is estimated regardless of the way in which they are financed. In the "return on investment table" there are:

- the inflows that include all possible income (tariff and non-tariff related) plus the residual value,
- the outflows that include all investment and operating costs.

The balance of flows of this table allows the examiner to then determine the two following financial performance indicators:

- The Financial Net Present Value of the Investment (FNPV/C),
- The Financial Rate of Return of the Investment (FRR/C).

The FRR/C aims at estimating the overall financial profitability of the project or, most often, the net cost for public finance when project revenues are zero or insufficient.

10.4.2.3.4 Return on Capital - Specific Indicators

The return on the capital is the capacity of the project to generate cash flow relative to the invested capital, regardless the investment costs. In the "return on capital table":

- the inflows include all possible income (tariff and non-tariff related),
- the outflows include the own equity of the private investor (when it is paid up), the national contribution at all levels (local, regional and national), the financial loans at the time they are paid back, in addition to operating costs and related interest.

The balance of flows of this table allows the examiner to then determine the two following financial performance indicators:

- The Financial Net Present Value of the Capital (FNPV/K),
- The Financial Rate of Return of the Capital (FRR/K).

FRR/K gives the rate of return of the project considering its financial burden regardless the investment costs. FRR/K is usually expected to be higher than FRR/C but should not exceed a given threshold.

10.4.3 Economic analysis

10.4.3.1 Overview and structure

The purpose of conducting economic evaluations of transport investment projects is to assess the magnitude of the economic impacts to the region where a port is located resulting from the proposed investment, ideally comparing all the costs and benefits associated with the project as illustrated in the following[31] figure:

[31] Notes on the Economic Evaluation of Transport Projects: A Framework for the Economic Evaluation of Transport Projects", Transport Note No. TRN-5. Transport Economics, Policy and Poverty Thematic Group, World Bank. P. 5.

Overall Economic Impact	=	Change in Transport User Benefits (Consumer Surplus)	+	Change in System Operating Costs and Revenues (Producer Surplus and Government Impacts)	+	Change in Costs of Externalities (Environmental Costs, Accidents, etc.)	-	Investment Costs (Including Mitigation Measures)

Figure 18: Economic evaluation approach

The comparison of the cost and benefits are done between "do-nothing" ("do-minimum" or "without-project") and "with-project" scenarios.

A schematic representation of the approach is shown in the figure below:

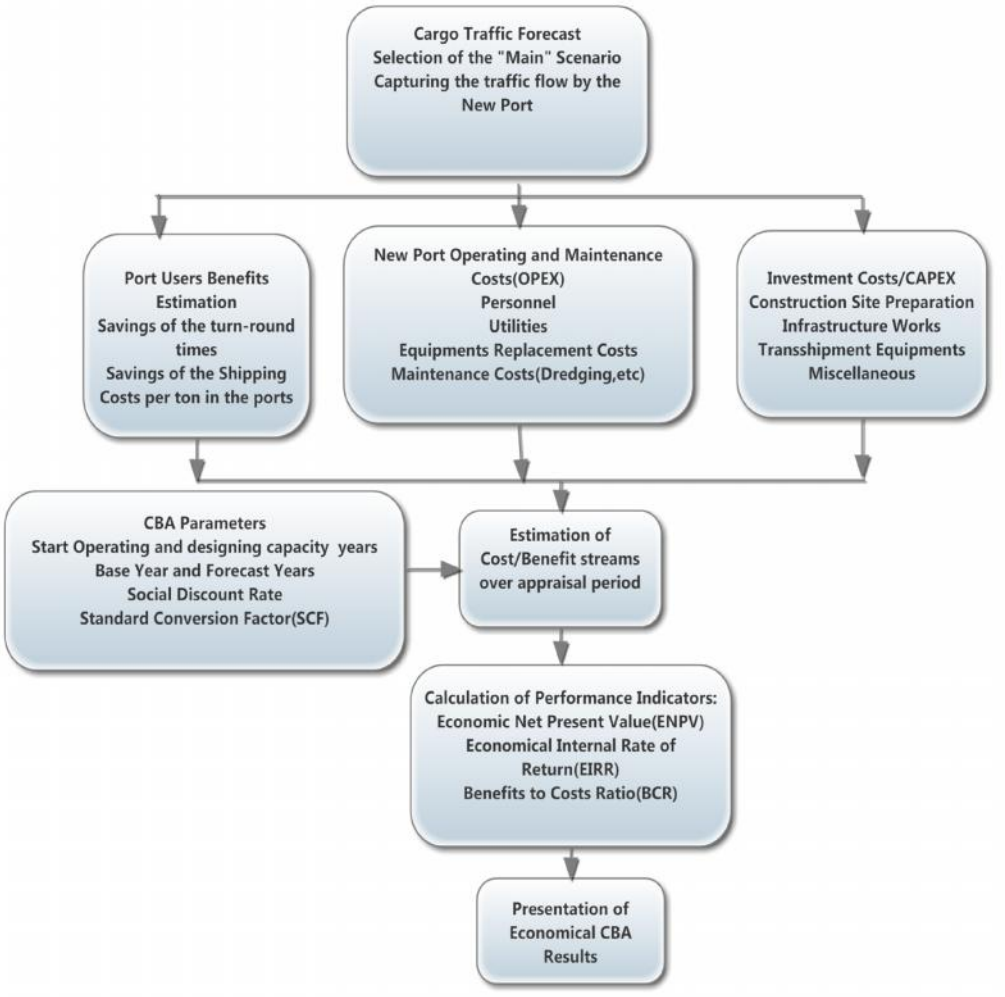

Figure 19: Economic analysis process[32]

[32] iC consulenten own archives on methodologies

10.4.3.2 Economic CBA parameters

The same parameters as for the financial analysis (CAPEX, OPEX, OPREV and sources of financing) are used in economic analysis.

10.4.3.2.1 Time horizon

This parameter is 25 years according to the Guide to Cost-Benefit Analysis of Investment Projects, DG REGIO 2014.

10.4.3.2.2 Residual value of investment components

This parameter is the same calculated within financial analysis for which it is applied the Standard Conversion Factor- SCF.

10.4.3.2.3 Standard Conversion Factor (SCF)

For economic evaluation and appraisal purposes, it is the economic value of an item's price or cost that is the important consideration. This is because of the scarcity, or opportunity cost[33], of limited resources, whether they be capital or human resources. The results of a cost-benefit analysis are therefore evaluated in terms of the real economic impact on the national economy.

All prices must be corrected for price distortions caused by a market imperfection before conducting an economic analysis. Indeed, in reality, market prices are often distorted due to market rigidity (e.g. labour market) and government taxation. Thus, in order to avoid any distortions or misalignments in the analytical process, all transfer payments within the domestic economy such as value added and excise taxes, import duties and tariffs, and subsidies are excluded from an appraisal. This exclusion represents the difference between financial values (in which all costs and prices are included in the total price or cost of an item) and economic values. Such transfer payments merely represent transfers of financial flows between different accounting sectors in the economy.

The SCF for the economy as a whole, for obtaining economic price/cost values from financial price/cost values that is conventionally applied in economic appraisal, is based on the Little and Mirrlees[34] equation:

(Value of Imports + Value of Exports) / (Value of Imports + Value of Exports + Import Duty and Tax Revenues – Export Subsidies)

Or :

$$SCF = \frac{M + X}{(M + T_m + T) + (X - S_x)} \qquad (10.15)$$

where:

M = value of total imports in one calendar year or 12 month fiscal period

[33] The opportunity cost of a resource (skilled labour, capital equipment, productive land) refers to the alternative use or uses to which that resource can be put. Ideally, any given resource should be allocated to its optimum use in terms of achieving the highest benefit to the economy as a whole.

[34] I M D Little & James Mirrlees: *Project Appraisal and Planning for Developing Countries*. April 1974.

X = value of total exports in one calendar year or 12 month fiscal period
Tm = import taxes
To = other tax revenues
Sx = export subsidies

SCF = 0,8 for standard port projects, based on experience.

10.4.3.2.4 Social Discount Rate - SDR

Costs and benefits occurring at different times must be discounted. The discount rate in the economic analysis of investment projects – the social discount rate (SDR) –reflects the social view on how future benefits and costs should be valued against the present ones. SDR will usually differ from FDR because the capital market may be inefficient due to the financial crisis condition, in particular when the credit is rationed.

10.4.3.3 User benefits estimation

Based on the Consultant's experience as well as various documents elaborated by UNCTAD Secretariat the following benefits were considered:

Port User Benefits:

- Savings in the Shipping Costs per ton of cargo
- Savings of turn-round time.

Savings in the Shipping Costs per ton of cargo

The shipping cost savings made possible by applying the economy of scale concept i.e. the use of ships which can carry the goods at lower cost per ton of cargo (e.g. larger ships)

Savings of turn-round time

The reduced turn-round time of ships in port is often the largest single benefit and it is essential to estimate both the waiting time and the time at berth. Irrespective of the fact that this benefit often accrues in the first place to foreign ship-owners, it is now standard practice to include it in the appraisal on the understanding that in the long run this benefit will filter through to the national economy, for example, through lower freight rates.

10.4.3.4 Investment costs/Capital expenditures (CAPEX)

Dealing with investment costs is fairly straight forward. Investment costs for transport infrastructure projects are typically derived from a project's engineering design and associated cost estimates. They include, but are not necessarily limited to:

- Preparation and administration costs,
- Engineering consulting service costs for preparation and project design,
- Construction costs,
- Labour, including project management,
- Construction materials and their transport,

- Procurement of equipment, as appropriate,
- Land and property costs,
- Cost of land acquisition and property compensation. This can include resettlement cost (land acquisition and resettlement compensation) if resettlement is necessary.

While the sub-categorization of the investment costs may be slightly different from each other depending on the type of project and country/organization, the principle remains the same. These costs are also included in the financial analysis, and the same cost stream should be used for the economic analysis after adjusting them to reflect the "real costs" of the investment to the economy, taking into account opportunity costs.

10.4.3.5 Port operating and maintenance costs/Operational expenditures (OPEX)

System operating and maintenance costs include the following:

- Costs of maintenance (dredging),
- Operation and administration are costs accrued during the operating life of the port infrastructure by the Port Authority (personnel costs, utilities),
- Equipment replacement costs - for transport projects that involves new equipment/ facility acquisition it is often recommended that the cost of the program to be separately identified, depending on the value of such a program (usually the initial value of investment) and applied from time to time as appropriate. Depending of the type of equipment needed for the purpose of transhipment the costs of equipment replacement could be applied taking into account the life time of the assets according to the earlier mentioned UNCTAD[35] studies.

10.4.3.6 Calculation of the economic performance indicators

10.4.3.6.1 Economic net present value (ENPV)

The first summary value to be determined in the economic evaluation of a project should be the Net Present Value.

The Economic Net Present Value (NPV) is the discounted sum of all future benefits less the discounted sum of all future costs over the appraisal period. The NPV gives therefore a measure of the absolute welfare gain over the whole life of the project.

The following gives the formula to calculate theENPV of a project:

Economic Net Present Value=

[35] Group of authors (1976), *Port Performance Indicators*, UNCTAD Monographs Series, New York.

$$B_0 - C_0 + \frac{B_1 - C_1}{(1+r)} + \frac{B_2 - C_2}{(1+r)^2} + \ldots + \frac{B_t - C_t}{(1+r)^t} + \ldots + \frac{B_n - C_n}{(1+r)^n}$$

$$= \sum_{t=0}^{n} \frac{B_t - C_t}{(1+r)^t} \qquad (10.16)$$

where:
Bt = Benefits in year t
Ct = Costs in year t
r = Discount rate
n = Horizon year

$\frac{1}{(1+r)^t}$ = Discount factor in year t

In other terms, ENPV = PVB – PVC = Present Value of Benefits – Present Value of Costs = $\sum_{t=0}^{n} \frac{B_t}{(1+r)^t} - \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$

In principle, a project is worthwhile when its NPV > 0.

Projects with a negative ENPV cannot therefore be recommended unless they have other positive effects that are not included in the CBA which might make the project implementation worthwhile.

10.4.3.6.2 Benefit to cost ratio (BCR)

The Benefit to Cost Ratio (BCR) is the ratio of the discounted sum of all future benefits to the discounted sum of all costs. The BCR attempts therefore to summarize the overall value for money of a project, which indicated how much net benefit would be obtained in return of each unit of cost. Contrary to the NPV, the BCR is independent of the year for which it is calculated.

Projects can be recommended when BCR > 1.

One of the major problems when using BCR to evaluate a project is the definition of costs and benefits. Indeed, costs and benefits should be clearly defined since considering effects of a transport project such as noise or pollution whether as reduction of benefits or as additional costs can change dramatically the result of the evaluation.

10.4.3.6.3 Economic internal rate of return (EIRR)

The Economic Internal Rate of Return (EIRR) is the annualized effective compounded return rate which can be earned on invested capital, i.e. the yield on the investment. In other terms, the EIRR is the rate at which benefits are realized over the appraisal/evaluation period of the transport infrastructure project following an initial capital investment.

IRR is closely related to NPV since it is the rate of discount at which the NPV of the considered project is reduced to zero.

The following gives the formula to calculate the IRR of a project:

$$B_0 - C_0 + \frac{B_1 - C_1}{(1+IRR)} + \frac{B_2 - C_2}{(1+IRR)^2} + \ldots + \frac{B_t - C_t}{(1+IRR)^t} + \ldots + \frac{B_n - C_n}{(1+IRR)^n} = 0 \qquad (10.17)$$

where
B_t = Benefits in year t
C_t = Costs in year t
r = Discount rate
n = Horizon year
EIRR = Internal Rate of return

A project is considered a good investment if its IRR is greater than the discount rate r, e.g. IRR> r.

Indeed, if IRR> r, this means that the project yields a higher return than is required to break even in social terms.

According to EC Guide to Cost-Benefit Analysis of Investment Project, DG Regio 2008, there is a benchmark of 26.84% regarding the EIRR in 20 port projects that could be used for further reference.

10.4.4 Sensitivity and risk analysis

Sensitivity analysis

Sensitivity analysis allows the determination of the 'critical' variables or parameters of the model. Such variables are those whose variations, positive or negative, have the greatest impact on a project's financial and/or economic performance. The analysis is carried out by varying one element at a time and determining the effect of that change on IRR or NPV.

The critical variables in the Consultant opinion are the follows:

- CAPEX/Investment Cost
- Savings of Shipping Costs per a ton of cargo
- Savings of Turn-Round Time costs
- Cargo Traffic Flow

The switching values for the mentioned critical variables are +/- 20%

Risk analysis

The above switching values – have a couple of great weaknesses in common. It allows analysing the impact of changes in one variable at a time, keeping others constant, thus do not take into account how other related variables may behave. In addition, the sensitivity analysis method does not provide the probability of the identified risks.

The risk probability analysis with Monte Carlo simulation enables to overcome these weaknesses of the two analysis methods mentioned above. Monte Carlo simulation enables producing a single probability distribution for IRR (or NPV) based on the risk profiles for all the relevant "critical" variables. The procedures are:

- Define a probability distribution for each variable – cargo traffic demand, investment cost, saving in shipping cost per ton of cargo, and saving in turn-round time costs.
- The Monte Carlo procedure samples randomly from each of the different distributions and calculates the IRR (or NPV), many times over. By taking a very large number of samples from each distribution, the sampling distribution is made to approximate closely the theoretical distribution.
- The outcome is a distribution in terms of IRR (or NPV). The more samples are taken the more stable distribution becomes.

10.5 Analysis of alternatives

10.5.1 Land use comparison

Port master plans usually contain three alternatives for the layout of a new or expanded port. The first aspects which are considered is a land comparison in terms of the total surface needed for the different layout alternatives, connections between land slots or between "fingers" positioned between port basins, routes of internal roads and rail tracks, ease of manoeuvring of cargo handling equipment in the handling yards, compactness of storage areas, etc.

The solution which is selected does not necessarily need to be the cheapest one or the one which occupies the least space. From the land use point of view, it is usually the most compromising solution that is chosen.

10.5.2 Cost comparison

Each engineering solution, including a port layout plan, is accompanied with the so called "bill of quantities", that is, the cost estimate for the turn-key ready asset. Different alternatives of a port layout are also thoroughly examined for construction and sometimes even operating & maintenance costs before a designer recommends one of the presented solutions.

Different alternatives are then compared against financial and economic indicators, benefit to cost ratio, etc.

10.5.3 Justification of the selected option

Apart from the basic land and cost comparison, a number of other parameters of all alternative solutions are compared in what is called a multi-criteria analysis. In this analysis, a set of criteria is selected and a "weight" is assigned to each criteria, while each alternative gets "points" for each selected criteria, following an expert discussion between various experts. Moreover, it is not uncommon to include a wider public in the stakeholder consultation process, so as to obtain a widest possible consensus on the selected option for the port development or construction. Following table from the Master plan[36] of the new Port of Sisak in Croatia demonstrates the comparison of various aspects of all three variants for the new port and their final valuation.

Table 8: Multi-criteria analysis of three variants for the new Port of Sisak (Croatia)

CRITERION	Variant A	Variant B	Variant C
HYDRAULIC-HYDROLOGICAL ASPECTS			
Flood protection	25	100	100
Collision with trees during floods	25	100	100
Sedimentation at the port entrance and within port	25	75	50
Score	75	275	250
NAVIGATION & TRAFFIC ASPECTS			
Rail access	50	100	50
Internal rail (to and within quays)	75	100	50
Grounding & collision probability for vessels and barges	50	100	100
Vessel handling (approach & entrance)	75	100	75
Vessel handling (exiting the port area)	50	100	75
Vessel handling (turnaround and off-berth)	100	100	100
Unforeseen de-berthing impact	25	100	100
Road access	75	75	75
Internal roads	50	75	75
Score	550	850	700
CONSTRUCTION & QUALITY ASPECTS			
Excavation volumes	100	50	75
Construction costs	50	100	75
Maintenance costs	50	100	75
Dredging needs	25	75	75
Safety & location of waiting berths	25	100	50
Construction time & complexity	25	75	100
Flexibility of expansion in stages	50	100	75
Score	325	600	525
OPERATIONAL ASPECTS			
Transhipment access to the operational quays	75	100	75
Possibility of cargo separation	50	100	50

[36] iC consulenten (2014), „Technical Assistance for the Master Plan of the New Sisak Port"

Flexibility of handling of different type of cargoes	100	75	100
Size, location and shape of storage & handling areas	50	100	75
Score	275	375	300
ENVIRONMENTAL IMPACT			
Protection against leakage / spillage / transshipment pollution	50	100	100
Impact on the river channel (water levels, flow velocities)	25	75	75
Area of land use	100	75	50
Score	175	250	225
SAFETY & SECURITY ASPECTS			
Ease of security measures application (fencing, gates, CCTV)	25	75	75
Score	25	75	75
TOTAL SCORE	**1425**	**2425**	**2075**

10.6 Environmental impact assessment

Transport projects in the European Union are subject to The EIA Directive (85/337/EEC) as amended in 2011[37], which is is in force since 1985 and applies to a wide range of defined public and private projects, which are defined in Annexes I and II.

Mandatory EIA: all projects listed in Annex I are considered as having significant effects on the environment and require an EIA (e.g. long-distance railway lines, motorways and express roads, airports with a basic runway length ≥ 2100 m, installations for the disposal of hazardous waste, installations for the disposal of non-hazardous waste > 100 tonnes/day, waste water treatment plants > 150.000 p.e.).

Discretion of Member States (screening): for projects listed in Annex II, the national authorities have to decide whether an EIA is needed. This is done by the "screening procedure", which determines the effects of projects on the basis of thresholds/criteria or a case by case examination. However, the national authorities must take into account the criteria laid down in Annex III. The projects listed in Annex II are in general those not included in Annex I (railways, roads waste disposal installations, waste water treatment plants), but also other types such as urban development projects, flood-relief works, changes of Annex I and II existing projects…).

The EIA Directive of 1985 has been amended three times, in 1997, in 2003 and in 2009:

- Directive 97/11/EC brought the Directive in line with the UN ECE Espoo Convention on EIA in a Transboundary Context. The Directive of 1997 widened the scope of the EIA Directive by increasing the types of projects covered, and the number of projects

[37] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment

requiring mandatory environmental impact assessment (Annex I). It also provided for new screening arrangements, including new screening criteria (at Annex III) for Annex II projects, and established minimum information requirements.

- Directive 2003/35/EC was seeking to align the provisions on public participation with the Aarhus Convention on public participation in decision-making and access to justice in environmental matters.
- Directive 2009/31/EC amended the Annexes I and II of the EIA Directive, by adding projects related to the transport, capture and storage of carbon dioxide (CO2).

The initial Directive of 1985 and its three amendments have been codified by DIRECTIVE 2011/92/EU of 13 December 2011. Directive 2011/92/EU has been amended in 2014 by DIRECTIVE 2014/52/EU.

The EIA procedure can be summarized as follows: the developer may request the competent authority to say what should be covered by the EIA information to be provided by the developer (scoping stage); the developer must provide information on the environmental impact (EIA report – Annex IV); the environmental authorities and the public (and affected Member States) must be informed and consulted; the competent authority decides, taken into consideration the results of consultations. The public is informed of the decision afterwards and can challenge the decision before the courts.

During EIA preparation, all positive and negative impacts caused by planned actions will be considered. Direct and indirect impacts are to be analysed for the preparation, construction, operation and possible decommissioning phases, including potential ecological incidents. Wherever possible, impacts shall be described as: direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects.

Description of the effects impacts on the environment during the development and/or use of the project, includes in particular:

- effects on population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors and in relation to the project,
- effects resulting from noise, vibration, light, heat, radiation, etc.,
- direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects,
- description of the natural resource requirements,
- description of likely significant trans-boundary effects,
- description of potentially reduced natural values (losses) of the environment in relation to the potential social and environmental benefits,
- brief description of the forecasting methods used in the development of the study.

Data referred to in this item which relate to the description of the effects shall be provided based on using relevant professional – scientific based models, other models accepted in the general environmental impact assessment methodology as well as the combined application of models.

In particular, the following impacts are considered the most important ones, and they will be observed with special attention:

- Impact on flora and fauna of a river
- Impact on ornithofauna of near-by ecological network area,
- Impact on water quality of the river,
- Impact on the river channel (preparation of hydraulic model and analysis)
- Impact on visual values of the area of the port's location.

The development of inland port infrastructure would probably need some changes of the river channel on the river section around the new or expanded port. In order to accommodate ship mooring and vessel manoeuvring widening and deepening of the river channel will be most likely required. In order to assess the impact of river channel changes to the environment, the **hydraulic analysis** of water levels and flow velocities will be required. The study should analyse the influence of a river channel changes at the new or expanded port hydraulics and in particular the impact on the water levels and velocity fields. One of the main concerns is decreased water levels and the consequential increase in flow velocities through the port section. To perform comprehensive analysis, a 2d hydrodynamic model of a river reach is usually developed, as average velocity calculations for the port area would not be sufficient to assess potential changes. An impact assessment will be made on the basis of a comparison of flow velocities and flow patterns between the existing and proposed Design River Systems for different flow conditions of the river.

Mitigation Measures

Mitigation measures include any deliberate action taken to eliminate or contain adverse effects –whether by controlling the sources or origins of the impacts or the exposure of affected environments (water, atmosphere, soil, habitats, organisms, built ecological, etc.) to them.

The measures will be divided as follows:

- Measures during project design: This will consider how to best design the project so that it causes the least amount of adverse environmental impacts.
- Measures during construction: Protection measures during construction for mitigating the consequences of increase in noise, pollution of atmosphere, soil and water, for the protection of flora and fauna, the existing facilities and municipal infrastructure, and for mitigating the consequences of traffic disruption within the settlement and when approaching it.
- Measures during operation: Protection measures based on subordinate legislation for the protection against pollution of atmosphere, soil and water, state the measures for

maintaining the value of the surrounding land, measures for protecting the ecological diversity and landscape.

- Measures during possible decommissioning.
- Measures to prevent and mitigate possible accidents: Measures that need to be undertaken when designing, constructing, and using the railway in order to prevent and mitigate the consequences of potential accidents at each part of the system.
- Monitoring program will provide key information about construction and operational environmental impacts of the project – particularly the effectiveness of mitigation measures. Such information then allows for corrective action. The EIA monitoring section will include:

The monitoring programme will be prepared at least for:

- River water quality
- Biological surveys

Proposal of environmental protection measures and environmental monitoring program will include as well:

- proposal of the implementation plan for environmental protection measures
- proposal of the implementation plan for environmental monitoring program
- proposal of the decision on environmental acceptability of the project.

EIA finalization

Before finalizing the EIA, EIA conclusion and non – technical summary are to be prepared.

Summary of the study includes:

- extract of only the relevant information referred to project description, project location, impacts and mitigation measures and the conclusions of those items (typically a summary of the study has 10 to 20 pages)
- enclosed graphic presentations with the drawn-in project and its relation towards other existing and planned projects and towards the protected and ecological network areas.

A non-technical summary includes:

- the summary of project description, project location, impacts and mitigation measures in textual and graphical format, composed in a way as to be substantially understandable to the public – for instance: avoid technical terms, detailed data, scientific explanations, etc.
- the summary, typically, has 10 to 20 pages,
- the summary is submitted as an attachment to the study in the form of a special report.

As regards to the detailed contents of the EIA, since the European legislation on EIA limits itself to a "directive" (not Regulation), it is up to each member state to transpose the Directive into its legislation in the best possible way. In this view, we will not go into details of the EIA and its contents, but we will limit ourselves to pointing out a very useful "***Guidance on the preparation of the Environmental Impact Assessment Report***"[38] of the European Commission, published in 2017.

10.7 Public and stakeholders consultations

Principles such as transparency regarding procedures and public participation are clearly encouraged. These principles should not be considered as a duty imposed by regulations but a means to achieving a truly sustainable masterplan not only from an environmental point of view but also in terms of socio-economics. Therefore, even where legal procedures do not require the application of those principles, it is extremely advisable to implement a public enquiry and participation policy to improve the quality of the output.

Ports recognise that they have a significant impact on their surroundings and they must work hard to strengthen links with the local community and reduce any negative impact of their business whilst delivering the best possible level of service within the constraints of their commercial and legislative status.

Consultation is a two-way process of dialogue between the port and its stakeholders and community. Consultation is really about initiating and sustaining constructive external relationships over time. Ports that start the process early and take a long-term, strategic view are, in essence, developing their Corporate Social Responsibility.

Communities are taking an increasing interest in port-related matters and it is incumbent on ports to ensure that as many different individuals and groups are consulted during the master planning process. A Stakeholder Management Plan (SMP) should be developed to outline the consultation process as to how and when the port will solicit views from a wide circle of stakeholders, customers, employees, users and the local community in delivering the masterplan. The promoter should endeavour to engage as many people as possible to help shape the decisions the port makes.

The consultation process should include outlining the context of the masterplan and an awareness of how the port operates. Ports should consider briefings, media information, leaflet drops, targeted outreach programmes, seminars, websites and events to raise the awareness of the masterplan and encourage participation and submissions.

It may be possible to include 'open sessions' to allow stakeholders the chance to talk directly with key port staff. This technique has been used effectively in Australia at various ports and helps 'communicate the longer term vision' of the port.

[38] http://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf

Once the SMP is in place, the next phase would focus on the identification of all stakeholders and to generate a register of individuals or bodies that have an interest in, or that may affect or be affected by, the masterplan and therefore the ability to influence its outcome.

To facilitate a full identification of stakeholders and regulators and their interests or potential influence on the masterplan it is necessary to agree the following:

- Who has an interest in the masterplan and its outcome?
- Who is affected by the masterplan and its outcome?
- Who can influence the masterplan and its outcome?

The next step is to analyse and categorise the stakeholders and regulators, to inform the development of a communication strategy. In particular, this would include:

- Understanding why the stakeholders and regulators may be interested in the masterplan,
- Prioritising (assessing their level of interest, influence, impact and likely attitude), enabling attention and resources to be directed to the areas that are highest risk,
- Assessing the timing of any engagement

It is important to agree the key messages, and to define roles and responsibilities and processes for managing the regulator and stakeholder participation.

Even before embarking upon formal consultation on a fully worked draft of the masterplan, it will almost always be wise to engage in less formal dialogue with key interested parties. From the outset, these should encompass all major categories of prospective respondent, potentially including shipping lines, hauliers, tenants, and local community groups, regulators, transport planning authorities, local government and environmental interests. Port user consultation forums would prove useful for such considerations.

Adequate time should be allowed in each consultation process for responses, particularly where the consultation period encompasses public holidays or the main summer/winter holiday periods. This should allow sufficient time for responses allowing for absences and for committee cycles to run their course, to ensure that responses from consultees have sufficient consideration and weight.

Depending on the scale, immediacy and contentiousness of proposals, the port may find it useful to arrange one or more public exhibitions or seminar events in order to stimulate discussion. Where there is an existing consultation forum that could be used to help focus responses of those most intimately involved with the port. It is important, of course, to listen carefully to what consultees have to say and consider arguments on their merits, but almost as important is to make it clear to them that it will be impossible to satisfy every representation made and indeed that consultation is not a vote-counting exercise and even a majority view will not always necessarily prevail.

Along with draft port masterplans, consideration should also be given to the publication of research and other evidence upon which port master planning needs have been forecast or estimated. Transparency in respect of such information can prove very helpful in ensuring that stakeholders are appropriately informed about future port needs. Specifically, worldwide experience has demonstrated that there is a direct correlation between the level of investment in research and consultation with the success of planning applications for major port infrastructure developments. It is important to gather feedback on common themes as this will help to clarify the strength of any possible objections.

It is possible that a number of additional reports or studies are undertaken to address specific concerns as part of the master planning process as a result of the responses to the consultation. If so this should be clearly identified in any response so that respondents can recognise that their concerns have been properly addressed.

The published masterplan is normally accompanied by a statement setting out why port development is needed and who has been consulted. It is recognised that the different groups and individuals that make up the port community have different needs and expectations. By recognising these needs and expectations it is hoped to find a way for as many people as possible to access the plans and comment on them should they wish to do so. A key outcome of this is to strengthen support for the development plans. The process for delivery should set out how stakeholders will be engaged such that there is active, meaningful and continued involvement throughout the implementation process.

10.8 Strategic Environmental Assessment (SEA)

Strategic Environmental Assessment is directly linked to the *Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context* (SEA Protocol, Kyiv 2003).

The Protocol was adopted by an Extraordinary meeting of the Parties to the Espoo Convention, held on 21 May 2003 during the Ministerial "Environment for Europe" Conference in Kyiv). The Protocol on Strategic Environmental Assessment augments the Espoo Convention by ensuring that individual Parties integrate environmental assessment into their plans and programmes at the earliest stages, and thus help in laying down the groundwork for sustainable development. The Protocol entered into force on 11 July 2010.

The EU ratified the Protocol on Strategic Environmental Assessment on 21 November 2008. The SEA Directive (Directive 2001/42/EC) transposes the Protocol in the EU legislation.

Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA Directive)

The SEA Directive applies to a wide range of **public** plans and programmes (e.g. on land use, transport, energy, waste, agriculture, etc). The SEA Directive does not refer to policies. The SEA Directive is in force since 2001 and should have been transposed by July 2004.

Plans and programmes in the sense of the SEA Directive must be prepared or adopted by an **authority** (at national, regional or local level) and be **required** by legislative, regulatory or administrative provisions.

The SEA Directive does not have a list of plans/programmes similar to the EIA.

An SEA is **mandatory** for plans/programmes which are:

- are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste/ water management, telecommunications, tourism, town & country planning or land use and which **set the framework** for future development consent of projects listed in the EIA Directive.

OR

- have been determined to require an assessment under the Habitats Directive.

Broadly speaking, for the plans/programmes not included above, the Member States have to carry out a screening procedure to determine whether the plans/programmes are likely to have significant environmental effects. If there are significant effects, an SEA is needed. The screening procedure is based on criteria set out in Annex II of the Directive.

The SEA procedure can be summarized as follows: an environmental report is prepared in which the likely significant effects on the environment and the reasonable alternatives of the proposed plan or programme are identified. The public and the environmental authorities are informed and consulted on the draft plan or programme and the environmental report prepared. As regards plans and programmes which are likely to have significant effects on the environment in another Member State, the Member State in whose territory the plan or programme is being prepared must consult the other Member State(s). On this issue the SEA Directive follows the general approach taken by the SEA Protocol to the UN ECE Convention on Environmental Impact Assessment in a Transboundary Context.

The environmental report and the results of the consultations are taken into account before adoption. Once the plan or programme is adopted, the environmental authorities and the public are informed and relevant information is made available to them. In order to identify unforeseen adverse effects at an early stage, significant environmental effects of the plan or programme are to be monitored.

The SEA and EIA procedures are very similar, but there are some **differences**:

- the SEA requires the **environmental authorities** to be consulted at the screening stage;
- **scoping** (i.e. the stage of the SEA process that determines the content and extent of the matters to be covered in the SEA report to be submitted to a competent authority) is obligatory under the SEA;

A very good guidance on the SEA can be found in Strategic Environmental Assessment – Better Practice Guide[39].

10.9 Options for "greening" of ports

Equally important for both sea and inland ports, the "greening" of ports is a process of going beyond the mitigation measures from the Environmental Impact Assessment done for this or that port. Ports have a clear environmental responsibility towards the citizens of their cities. Yet they are also interested in generating opportunities for their customers to become greener and more sustainable. They must act as hubs, adapted to the environment, within a transport chain, from origin to destination. "Greening" of ports is one way of enabling sustainable port development and it comprises examples of green installations, systems and innovations implemented by relevant partners along the corridor.

Port greening options include, inter alia, the following actions:

- "Green" power supplies: charging stations for land vehicles and shore-side power supply for vessels;
- LNG infrastructure: supplying LNG to vehicles and vessels, and using LNG-fueled equipment whenever possible;
- Wastewater treatment facilities: fixed port reception facilities for black and grey water at all berths directly connected to the municipal sewage system and wastewater treatment plant (WWTP);
- Storm water cleaning: storm water pipes and sedimentation basins for partial cleaning of storm waters;
- Terminal noise management: noise management systems which measure the noise levels at prearranged spots and send warning signals to operators, noise traps positioned at coolers or other convenient places of handling equipment, soft touch-down of containers, etc;
- Air pollution management: Euro 5 and Euro 6 standards for all equipment using fossil fuels;
- Use of intelligent transport systems: involve the streamlining of goods handling, which reduces the amount of driving in ports and terminals, and, in turn, emissions.
- Energy efficiency: solar panels, led lighting, in-port wind turbines, Combined Heat and Power (CHP) or co-generation which is an electricity-generating method that recovers the waste heat produced. This excess heat can be used to heat or cool buildings or as industrial process heat, etc.

[39] http://ec.europa.eu/environment/eia/pdf/2012%20SEA_Guidance_Portugal.pdf

10.10 Future developments

This element of a port master plan has a role of the executive summary. In this section, a list of objectives, both general and specific, is discussed and analysed, a list of infrastructure projects resulting from a port master plan, with the necessary technical, economic and financial details, is given. Last, but not least, an implementation strategy includes a prioritisation of projects and different financial scenarios.

10.10.1 General objectives and specific objectives

This section lists and explains general objectives of a port master plan. As in illustration, general objectives of a port master plan can be the following:

- Articulation of port vision;
- Increased investment confidence and productivity improvements/operational efficiencies;
- Increased protection of port infrastructure, assets and key transport corridors;
- Careful management of growth (over a 15-20 years timeframe);
- Sound environmental and cultural heritage management and protection;
- Soundly based capacity analysis and forecast;
- Increased interface management;
- Increased safety and security;
- Open and accountable governance, etc.

Specific objectives are related to the very concrete situation in each port (or ports) which is (are) the subject of the port master plan.

10.10.2 Infrastructure projects

This element is related to a simple list, card or project fiche for all projects resulting from a port master plan. This list, or individual project fiche, contains the necessary financial, technical, economic and other important data necessary for decision-making.

10.10.3 Implementation strategy

This element of the master plan includes a prioritisation of projects and different financial scenarios.

11 Conclusions

Properly done strategic planning and port master planning at and around inland ports can bring increased investment confidence and greater transparency for all stakeholders – the port itself, industry, government and environmental/community groups. Looking forward, it is clear that port master planning within the Danube region must be broader in application – looking beyond the port areas – considering a range of economic, social and environmental interface issues.

It is also clear that a 'one size fits all' master planning approach will not be appropriate for the Danube region's port industry. Port master plans must be tailored to the individual context – however, port authorities are encouraged to use the key principles and suggestions contained in this report.

Key findings and recommendations of the study include:

- port master planning must be based on a 'beyond the port' methodology, rather than the traditional 'introspective' approach;
- countries should have their own port policy and port development strategy on a national level so as to facilitate enhanced condition for the development of the entire port industry, not just in their respective countries, but in the entire Danube region as well;
- policy alignment must be achieved through national-state-regional-local planning frameworks;
- port master planning frameworks should be generally consistent between jurisdictions (municipalities, regions and, if possible, countries);
- enhanced governance support must be provided at the jurisdictional level and within organisations, to assist with comprehensive port master planning;
- supporting frameworks/operational plans such as comprehensive land use plans, port policies, port development strategies must facilitate the elaboration of port master plans at the operational, 'on the ground' level;
- "greening" of ports should be integrated into the master planning from the very beginning - SEA and EIA on the overall strategic level (national port policies and strategies) and on the port strategic level (port master plans), respectively;
- "greening" of port suprastructure, operations and equipment (energy from renewable sources, port equipment fuelled by alternative fuels, mandatory shore-side power supply for vessels at berths, etc.) should be subsidized, supported or facilitated in any convenient way in the beginning so as to encourage the administrations and operators to extend the "greening" of port industry from infrastructure interventions towards operations as well;
- regulatory/policy frameworks regarding 'strategic assessments' of master plans should be further examined to improve the identification, protection and management of environmental values and to address the need for regulatory streamlining;
- recommended minimum contents of the port master plan is given.

On the basis of findings of this report, the following "next steps" are recommended:

1. adoption of this report to guide/assist port master planning at Danube ports;
2. proceed with guidelines for common port policy in the Danube region and for the common port development strategy of the entire Danube region;
3. officially suggest strong advocacy for regulatory reform at the multilateral, national, regional, local levels to:
   a. promote better alignment of strategic land use planning frameworks in and near ports;
   b. recognition of ports as strategic national transport infrastructure, especially in landlocked countries (AT, SK, HU, RS);
   c. protection of critical port infrastructure and corridors; and
   d. ensure more harmonized development of the Danube region ports.
4. launch an initiative to introduce a voluntary "environmental certification", similar to the "Port Environmental Review System" (PERS)[40] applied in seaports;
5. undertake a pilot for inland PERS preparation from the phase of master plan for existing ports.

It can be concluded that if, comprehensively developed, port master plans can:

- articulate the medium and long term 'port vision' to a wide range of stakeholders;
- create additional economic value through increased industry and investment confidence;
- assist in overall supply chain management by:
  - integrating the port into broader network consideration (by promoting greater understanding of the port needs within national, regional and local planning agencies),
  - ensuring that vital port (and logistic chain) infrastructure is delivered when and where it is needed (via well-considered phasing options).
- maximise significant economic and productivity improvements through efficient management of critical infrastructure delivery and protection;
- provide increased environmental protection by identification of critical environmental values early in the design process; and
- address interface issues (social and environmental) in and around port areas (i.e. help to inform port users, employees and local communities as to how they can expect to see the port develop over the coming years).

[40] https://www.ecoports.com

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