PROMOTING MARITIME AND MULTIMODAL FREIGHT TRANSPORT IN THE ADRIATIC SEA (PROMARES)

Activity 3.2
Analysis of the current situation on maritime and multimodal freight transport

D.3.2.9
Territorial Needs Assessment for the Port of Ploče

September 30th, 2019

Table of Contents

1. Introduction

This report presents Territorial Needs Assessment with the analysis of bottlenecks related to port of Ploče and analysis on potential market flows of Port of Ploče.The report is carried out for the purpose of the elaboration of activities defined in the WP3 of the PROMARES project related to Territorial Needs Assessment. Report is based on the bottleneck analysis of port of Ploče and its hinterland, according to approved methodology in WP3, collected data and through and comprehensive research.

Report represents analysis of port of Ploče itself, including its location, port facilities, processes, current situation of the port and competition analysis. Also, the whole hinterland bottlenecks were also examined, evaluated and presented, including road and rail border crossings. The report includes quantitative as well as qualitative description and explanation of the outputs.

Report is based also on potential market flows between port of Ploče and Italian ports collected data and through comprehensive research.

This report represents the analysis of port of Ploče itself, including its location, port facilities, processes and current situation of the port. Also, the analysis of existing and potential market is also examined, evaluated and presented, including projection of future traffic flows between Italian-Croatian ports. The report includes quantitative as well as qualitative description and explanation of the outputs.

2. Methodology

Alongside analysis of respective documentation of Port of Ploče Authority (transport forecasts, business plan, transport data, offered products) and interviews with port operators, major clients, stakeholders and shipping companies in the port, we have applied the following practical methodology:

- Customs data: The customs data concerning transport flows, as well as type of goods, are the most reliable ones, since they are based on the actual transport flows.
- Port transport data: Another set of data from the ports, since the ports can be considered as the gate to the SEETO flagship corridors, which, in all likelihood, carry the largest portion of freight and passengers in the region and are, at the same time, the backbone for certain strategies and policies.
- Direct contacts with the regional and some global freight forwarders, container shipping companies, most of them located outside the region, or their regional representatives, regional shippers and/or their representatives and the chambers of commerce/export/industry.
- Outcomes from the stakeholder´s questionnaire that was filled in by the participants and delivered back to Port authority.
- Due to direct contacts with the market, we also tried to find out what their investment plans and strategies in the future are or what in their view, the future transport development plan in the region should look like. Unfortunately, it is a fact that the market participants, in particular the private sector, do not regularly participate in the ministerial transport planning processes. As a result, there is a missing link between those who plan transport and those who will operate on the planned infrastructure.
- In general, the following questions were examined:
    a. Which are the non-physical barriers existing within the port and on the corridor (legal, institutional, operational);
    b. Which are the physical barriers within the port and on the corridor (rail/road infrastructure, hinterland logistics);
    c. What are the port-to-door transport times, average time, average speed and related pricing to evaluate bottlenecks for major type of cargo on every node and link along the rail Corridor Vc from Ploče to north Croatian / BiH border or even to Budapest;
    d. What are the transport times, breakdown of the time spent (i) idling on the corridor: at the port, and at other transport nodes (border, clearance etc.) (ii) loading / unloading time for wagons, (iii) customs control, (iv) rail operation requiring

different rail companies and change in locomotives, and (vi) insufficient coordination among participants in the port community;

While the focus clearly lies on the situation of the Port of Ploče, respectively Corridor Vc, the report includes, at various points, information on the overall competitive situation of the Adriatic ports and their hinterland. This is particularly important in view of the analysis of transport times and costs encompassing information regarding other SEETO routes and/or TEN-T corridors. Where, in the course of the report, it seemed to be crucial for a holistic understanding of the situation, further information on competing routes, ports, border crossing on competing routes etc. have been mentioned. The figures provided by the different entities have not been entirely stringent. Thus, figures are to be treated with some caution with regard to their accuracy.

3. Port of Ploče

3.1 Location and characteristics of the port of Ploče and port area

The Port of Ploče is situated at the Central Adriatic coast line, approximately 120 km south from the city of Split and 100 km North from Dubrovnik. The ports central-Adriatic location, as well as its position in the south of Croatia (HR) leads to an international hinterland, covering the Dalmatian coastline, as well as Bosnia and Herzegovina (BiH), Serbia (SR), Montenegro (MNE) and Hungary (HU).

Through a 24 km railway line and road, the port is linked with its immediate hinterland of BiH and further to the North-East of Croatia and Central Europe. Further, it is the end/starting point of the Corridor Vc (Budapest-Osijek-Sarajevo-Ploče). Through the Adriatic Highway (as part of the European route E65), it is connected to the Northern cities of Split, Rijeka and Trieste; and to Montenegro in the South.

The Pelješac peninsula to the South and West of the port provides for a natural breakwater.

Equally important is the connection to Corridor X via Corridor Vc, connecting the Port of Ploče also with Serbia to the East and even Austria to the North-West.

The Port of Ploče is also connected to international inland waterways. They are the Sava River from Sisak to Belgrade and the Danube River, constituting pan-European transport Corridor VII. Through the latter, a connection to other European inland waterways, such as the Rhine is possible via the Rhine-Main-Danube Canal.

The nearest international airports are located in Mostar (70km), Dubrovnik (120 km) and Split (150 km).

The port is an EU port and open to domestic and international traffic.

Other ports in the eastern Adriatic region and with similar catchment areas, in particular landlocked Serbia, and therefore potential competitors are:

- Port of Durres (Albania)
- Port of Bar (Montenegro)
- Port of Rijeka (Croatia)
- Port of Koper (Slovenia)

Outside the Adriatic regions, the Greek and Black sea ports can also be considered competitors when it comes to markets of the land-locked Serbia and Macedonia.

An integral part of the Port of Ploče is the Port of Metković. Situated 25 km upstream on the banks of river Neretva in the town of Metković, situated along the BiH-HR border. The terminal disposes of a connections to the rail and road systems and provides facilities for the transshipment of cement (silo), cinder and granulized stone.

The following figure gives a schematic overview of the location of the port along the Adriatic coast and a more detailed view of the location of the port facilities and the major transport connections.

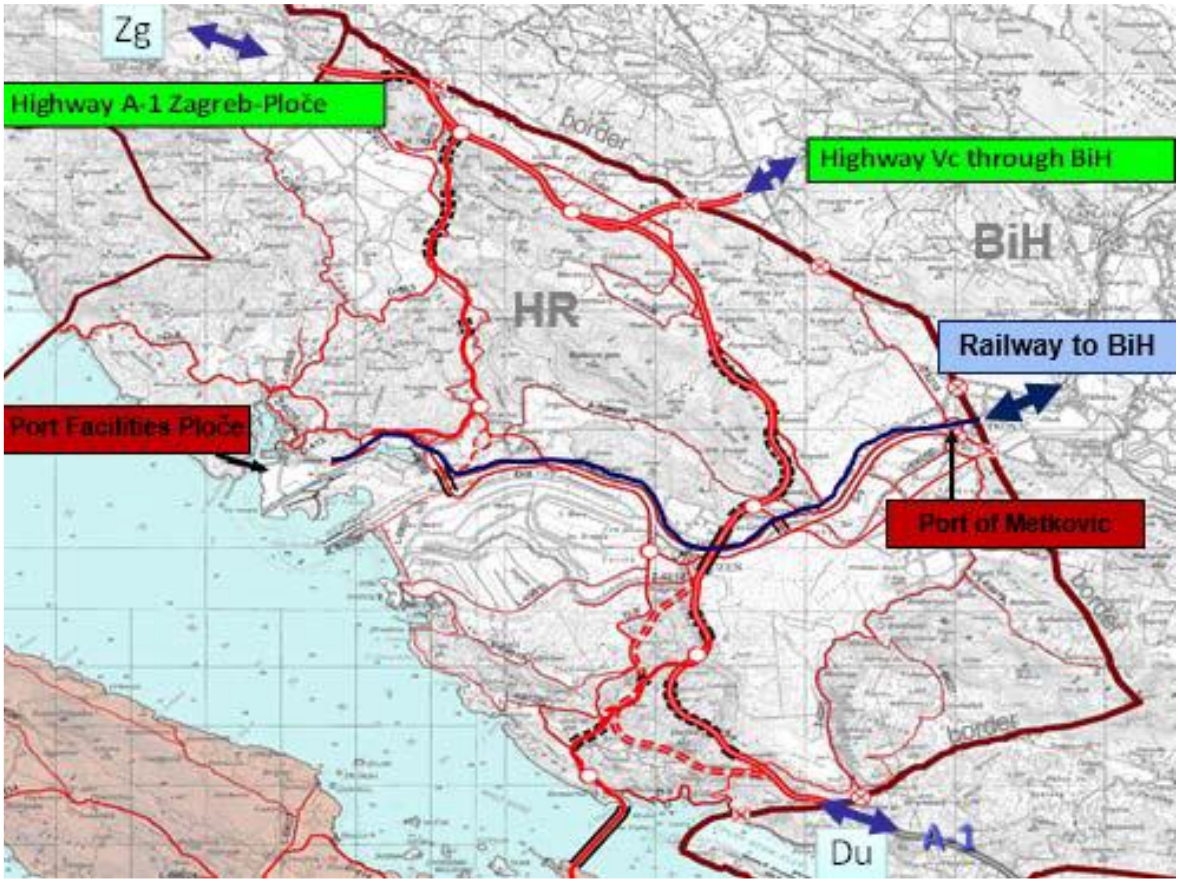


Figure 1 - Location of the Port and major rail and road connections

Port of Ploče is geographically the biggest cargo port and the second largest cargo port in Croatia in total throughput volume, after Rijeka, and it is a classical landlord port. The capacity of the port is presently estimated to be at approximately 10 million tons per anno for dry bulk and general cargo and amounts to 1.2 million tons for liquid bulk.

3.2 Port facilities and related processes

Port of Ploče is the second largest port in Croatia, after Rijeka, and it is a classical landlord port. The capacity of the port is presently estimated to be at approximately 5 million tons per anno for dry bulk and general cargo and amounts to 0.6 million tons for liquid bulk.

The following table gives an overview on the general capacities of the port.

Area (land part)	2.340.000 m^2
Area (sea part)	1.406.430 m^2
Area of external anchorage	23.000.000 m^2
Open storage area	315.000 m^2
Sheltered storage area	9.400 m^2
Indoor storage area	50.540 m^2
Total number of quays	7
Length of quays	1.815 m
Depth	5-13,5 m
The length of rails within the port area	19.944 m
Length of crane tracks	1.545 m

Table 1 - General capacities of the port

The major concessionaire is Luka Ploče d.d., which has undergone a privatization in recent years. Luka Ploče dd. operates several facilities for reloading and storage of various types of cargo located on seven shores with a draught of up to 14m. These are:

General cargo terminal:

- Quay with a length of 705 m and a draught of 9.2 m,
- Warehouses with an area of about 300,000 m^3,
- Equipped with:
  - 8 shore cranes,
  - 9 auto cranes with capacity of 15-60 tons,
  - 100 fork lifters with a capacity of 2-28 tons,
  - 16 electric fork lifters of a capacity of 1,2-2,5 tons,
  - Floating crane with a 100 tons capacity,
  - Railway tracks with a length of 5,600 m.

Dry bulk cargo warehouse:

- Quay with a length of 510m and a draught of 14 m,
- Storage capacity of 300,000 tons,
- Mooring possible for ships of up to 75.000 DWT,
- Reloading capacity 15.000 tons/ day,
- Equipment with:
  - 14 loaders,
  - 2 bulldozers,
  - 5 Shore cranes with a capacity of 10 tons,
  - 1 mobile crane with a capacity of 63 tons,
  - 1 mobile crane with a capacity of 140 tons.

Alumina and petrol coke terminal:

- Quay with a length of 180m and a draught of 9,8m,
- Alumina silo with a storage capacity of 20,000 tons,
- Petrol coke storage of 10,000 tons.

Timber transit terminal:

- Quay with a length of 110m,
- Covered warehouse of 2000 m^2,
- Open storage area of 153,925 m^2,
- Equipped with 10 fork lifters.

Two liquid cargo terminals:

- Storage capacity of 160,000 tons in total separated for different kinds of liquid bulk.

Cold store and other phytosanitary equipment

New container terminal

- Quay with length of 260 m and draught of 13,0 m,
- Warehouse area of about 40.000 m_2,
- Equipped with:

-
  - 1 STS crane,
  - 1 mobile crane with capacity of 63 tons,
  - 1 mobile crane with capacity of 140 tons,
  - 6 container stackers.

New dry bulk cargo terminal

- Quay with length of 373 m and draught of 17,2 m,
- Storage capacity of 6,2 million tons,
- Mooring possible for ships of up to 120.000 DWT,
- Reloading capacity 25.000 tons/ day,
- Equipment with:
  - Ship unloader,
  - dozers,
  - stacker/reclaimers,
  - hoppers,
  - 1 mobile crane with a capacity of 63 tons,
  - 1 mobile crane with a capacity of 140 tons.

The following figure gives and overview of the port, the concessionaires and sub-concessionaires and the facilities operated by them.

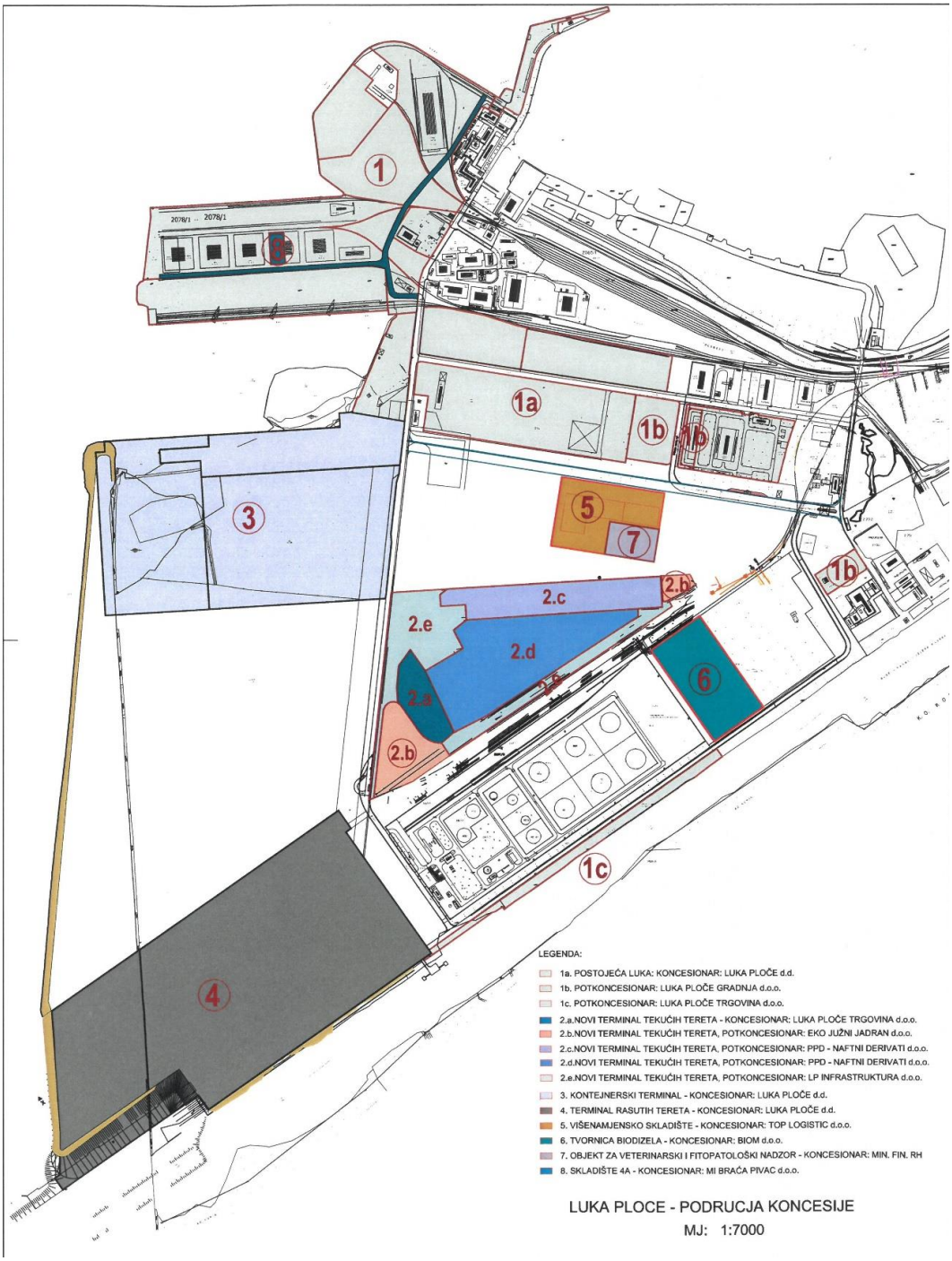


Figure 2 - Plan of the port, port concessionaires and sub-concessionaires

The Port of Ploče geographical location leads to the fact that it has a rather small immediate inland catchment area along the Dalmatian Coast line. It is only connected to the larger northern regions of Slavonia and Croatia properly via Bosnia and Herzegovina or lengthy detours. Thus, the international hinterland is of an even greater importance with BiH, Serbia, Montenegro, Hungary, Slovakia and Slovenia. The hinterland countries are only to a small extend congruent with the markets. The Port of Ploče is currently active in BiH, HR and SRB. To a bigger extent, they constitute the potential catchment area.

Figure 3 - Port of Ploče´s hinterland

While not even 1% of the goods leaving the port are directed towards the southern neighboring state of Montenegro (MNE) and roughly 8% are distributed directly to the Croatian surroundings (HR), 91% of the goods are heading towards BiH.

This is not to say that BiH constitutes the final destination of these goods in their entirety. However, it underlines the importance of the transport route along Corridor Vc through BiH. Since exact numbers on the final destinations of goods leaving the port are not available, a comparison with the ports of similar catchment/destination areas and thus posing as competitors to the Port

of Ploče deems to be wise – always keeping in mind the slightly different geographical positions. Looking at the destinations of goods handled by the Port of Rijeka for example, it becomes clear that of the 70% of the total throughput of Rijeka nearly all goes to Hungary and Slovakia, countries of destination which the Port of Ploče can claim to be its hinterland as well.

3.4 Competition

Competing sea ports are ports located on the Eastern Adriatic coast: Rijeka (Croatia), Koper (Slovenia), to some extent Bar (Montenegro) and Durres (Albania) and, to an even lesser extent, Trieste (Italy). Even Constanta (Romania) and the North Sea ports can be considered to be a competitor for the potential HU and Slovakian markets. On top of that are the Greek ports operating regular trains with the landlocked countries of Serbia and Hungary.

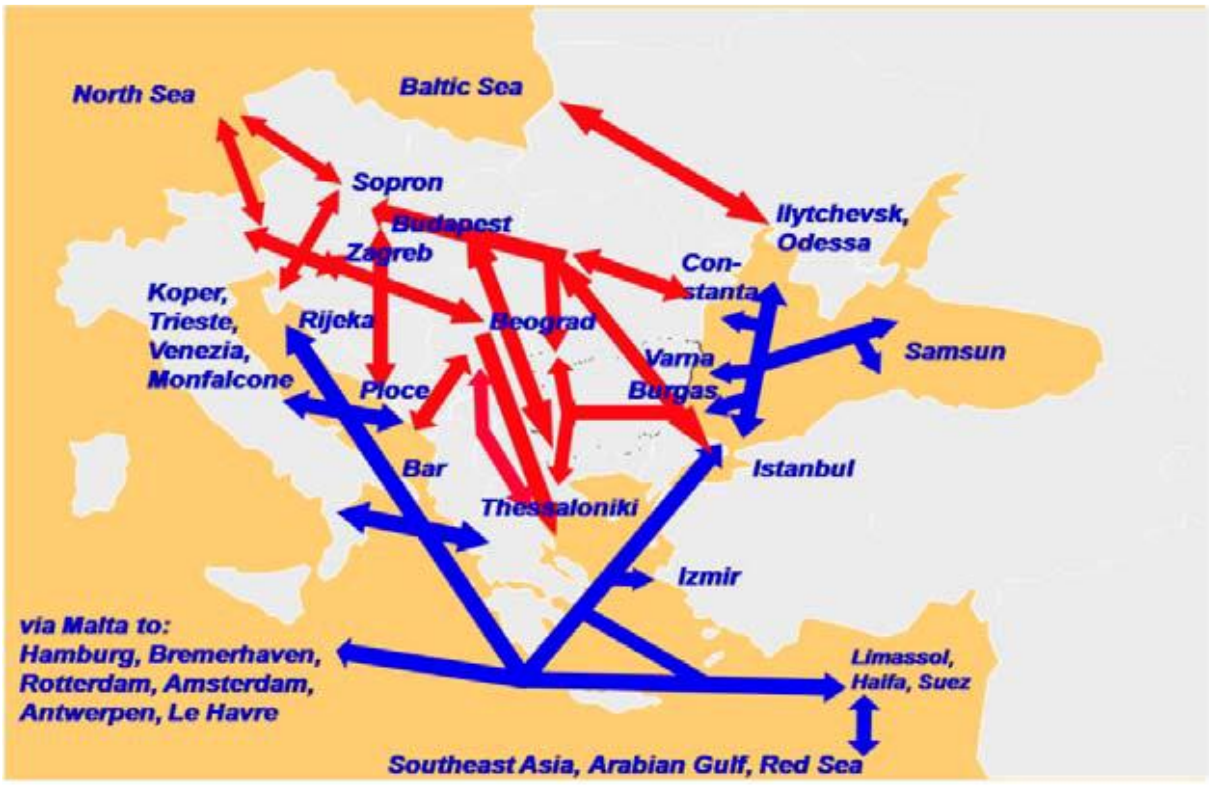


Figure 4 - Competitive situation for the Port of Ploče

With regard to the potential catchment area of Hungary and Slovakia and the Region of Northern Croatia, port of Ploče can be considered to be in direct competition with Rijeka, Koper, Trieste and the North-Sea ports and to an extent – especially concerning the Serbian market – with Bar. In fact, the north-Sea ports catch the majority of goods from Hungary and Slovakia although the distance to the ports is double and sometimes treble to the Adriatic ports. Transports to the Black-Sea ports is also competitive. Serbia, Macedonia and Kosovo also use the Greek ports.

A distinctive characteristic of the Port of Ploče is the importance of BiH as its direct hinterland, an area which is – up to now - not served to the same extent by Koper or Rijeka. The Port of Koper is main competitor to Ploče in terms of transshipment cargo, but has no significant volumes for BiH, at least, not yet. But the port of Rijeka is increasing its transports with BiH by road.

The Port of Ploče does not possess the infrastructure to handle large vessels because of the situation of draught. Rijeka, Koper and Trieste do offer this possibility. The Port of Ploče is restricted in its competitive force due to the fact that it can only handle smaller vessels and finds itself in the same “league” as Bar and Durres.

The competing ports all face development constraints in terms of bulk cargo. More specifically, the Port of Bar is hampered by a mountainous hinterland raising the cost of its rail and road connection; whereas Rijeka’s bulk terminal is facing capacity constraints.

Comparing Ploče with the competing ports, Koper and Rijeka have not suffered such a severe decline in cargo throughput in the past years indicating that they are not as vulnerable to market changes as Ploče. In terms of container traffic, it can be observed that both Rijeka and Koper have recovered after the 2009 crisis, and the growing traffic trends through Koper and Rijeka indicate a strong demand for Adriatic ports.

Even though the Port of Ploče serves a slightly different market, it seems that Ploče has not been able to use the new terminal and improved facilities to attract new container lines, and to expand its reach beyond the BiH market. The situation is similar in terms of bulk cargo. Even though it should be noted that Ploče’s lost bulk traffic has not been reallocated to other ports, although it is primarily a result of changed business environment of port’s main clients. Ploče has not yet succeeded to replace the lost customer by a new one and should aim to expand its client base beyond the current BiH market.

4. Current situation and port statistics

The port primarily serves three market segments: (i) container traffic, whose evolution is based on macroeconomic situation in BiH and Croatia; (ii) bulk traffic, driven by the production of main clients in BIH, dependent on the global demand for steel, coke and aluminum; and (iii) liquid cargo, driven by economic growth in BiH.

The port has had a continuous growth in cargo throughput until 2008; it was a record year for the port, with a total of 5.1 million tons handled. However, since 2009, the port has faced two major setbacks. First of all, the global economic crisis has had a severe impact on the metal industry in BiH, consequently impacting the production and cargo traffic of the port's main clients. Cargo throughput fell by 44 percent in 2009 (to 2.9 MT), and has managed to partially recover in 2010 and 2011. Secondly, the loss of a major client in 2012 (coal transshipment to power plants in Italy) was another major shock for the port. It decreased the overall volumes by 1.4 MT annually, but also significantly narrowed the client base. The total throughput in 2012 amounted to 2.6 MT, which is below the 2005 level and it has still not recovered until 2014. In 2015, the throughput was 2.9 MT. Since the metal industry in BiH is still operating below its capacities, and the port is facing difficulties in attracting new clients, the current situation and future prospects present a major concern.

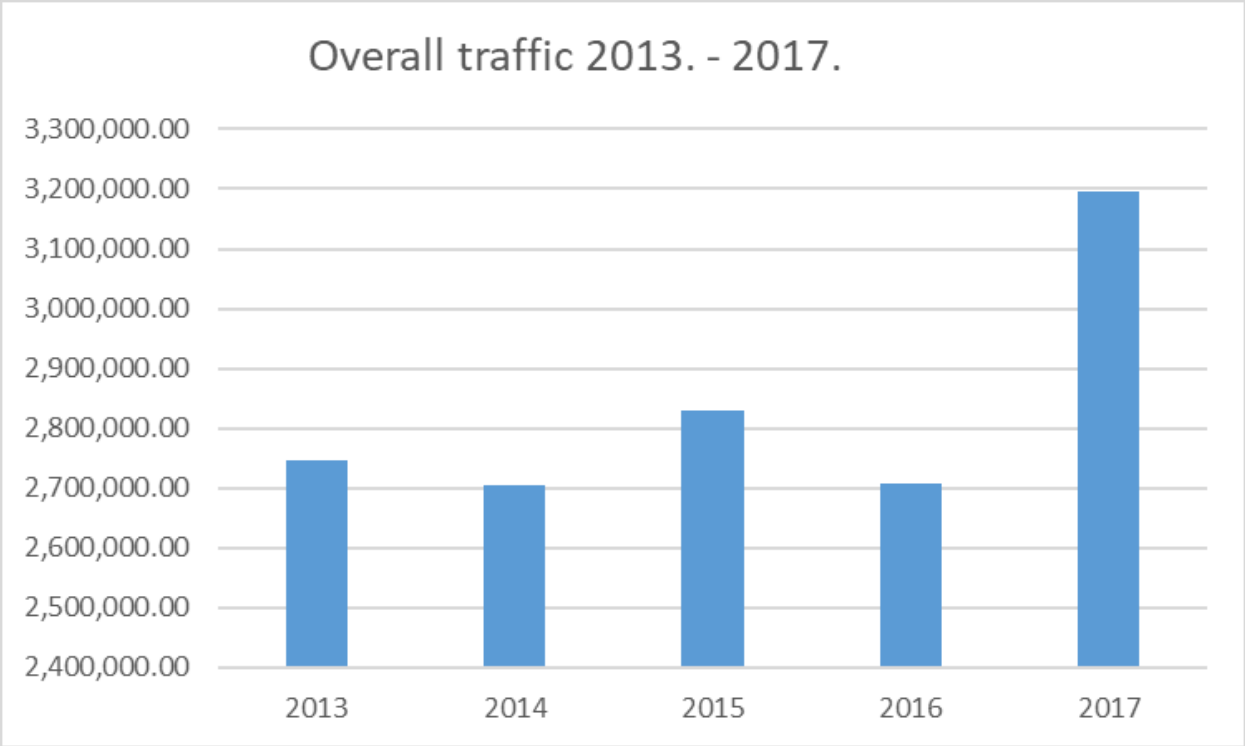
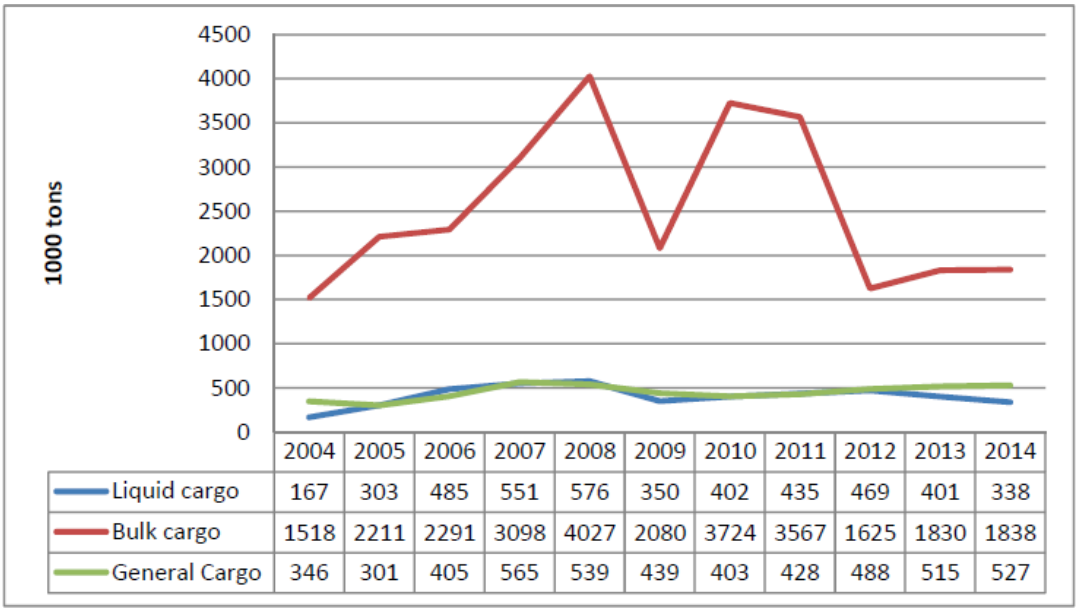


Table 2 - Cargo Throughput in the Port of Ploče 2013.-2017.



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Liquid cargo	167	303	485	551	576	350	402	435	469	401	338
Bulk cargo	1518	2211	2291	3098	4027	2080	3724	3567	1625	1830	1838
General Cargo	346	301	405	565	539	439	403	428	488	515	527

Figure 5 - Cargo Throughput in the Port of Ploče 2004.-2014.

Due to its location, the Port of Ploče is of paramount importance for the economy of the neighboring country BiH. According to studies on empty containers, 70% of BiH sea freight imports go via the Port of Ploče. The port management, freight forwarding companies and shipping agencies, have also confirmed this figure. Container transport with BiH amounts to 18,000 TEU per anno, accounting for 80 % of the total container throughput of the Port of Ploče (22,000 TEU per anno). The following chart underlines the increasing importance of BiH for the Port of Ploče. At the same time it shows the dangerous dependence of the Port of Ploče on the BiH market.

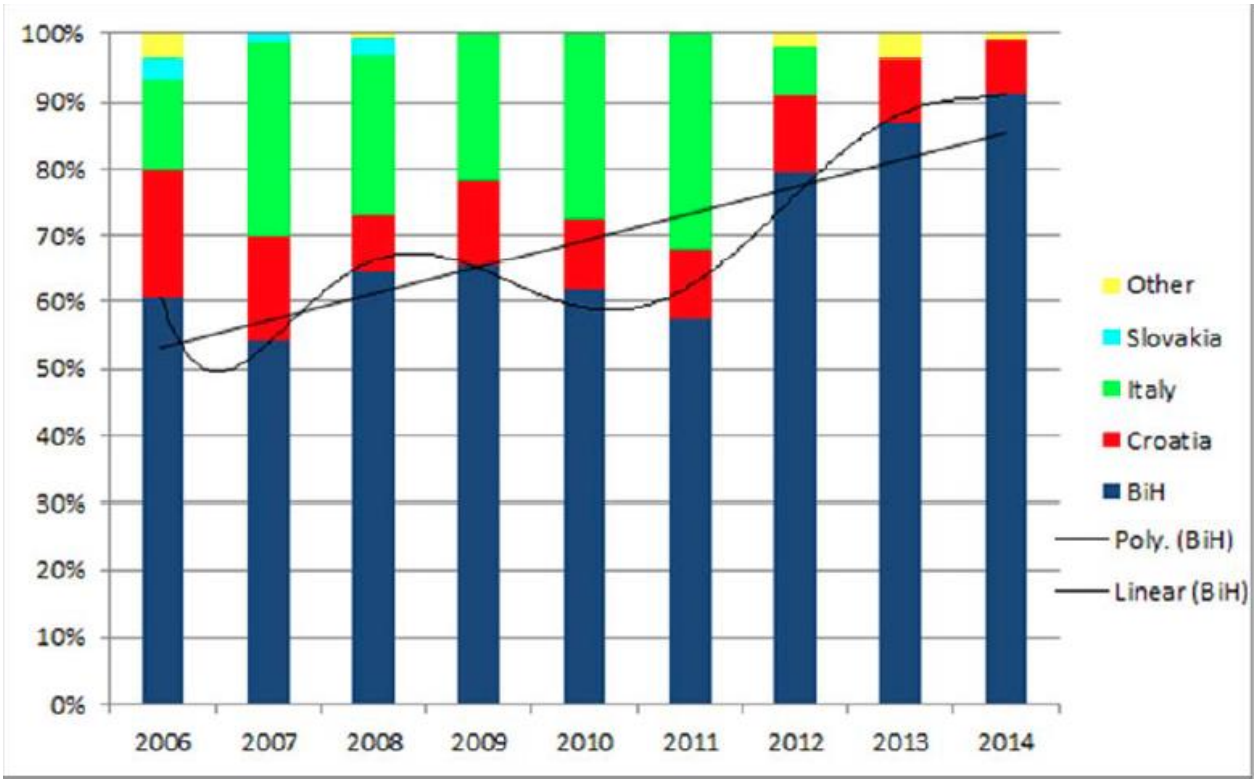


Figure 6 - Freight traffic leaving from the port by direction 2006-2014

Year	General	Bulk	Liquid	Overall	TEU
2013.	515,168.36	1,829,691.64	401,375.87	2,746,235.87	18,752
2014.	527,239.86	1,838,346.14	338,140.94	2,703,726.94	16,948
2015.	503,028.91	1,863,114.26	464,508.81	2,830,651.98	20,764
2016.	441,585.33	1,697,234.41	567,602.65	2,706,422.39	21,161
2017.	417,583.40	1,973,160.43	804,219.49	3,194,963.32	24,307

Table 3 - Overall cargo throughput in the Port of Ploče 2013-2017

When analyzing the freight volumes leaving the Port of Ploče by the means of transport, it can be stated that the number freight transports by rail has again risen over the last years to up to 80%. This underlines the importance of rail-related actions.

4.1 Freight traffic statistics

Container traffic

In the period of 2013-2017, port of Ploče had a growth of container traffic at a rate of 28,9%, passing from 18.713 TEUs in 2013. to 24.121 TEUs in 2017. Most of the growth was international traffic, mostly for Bosnia and Herzegovina.

2013					
Containers		TEUs		Container ships	
Loaded	6672	Loaded	9365		
Discharged	6761	Discharged	9348		
Total	13433	Total	18713	Total	98

2014					
Containers		TEUs		Container ships	
Loaded	5965	Loaded	8429		
Discharged	5934	Discharged	8430		
Total	11899	Total	16859	Total	94

2015					
Containers		TEUs		Container ships	
Loaded	7214	Loaded	10343		
Discharged	7248	Discharged	10333		
Total	14462	Total	20676	Total	94

2016					
Containers		TEUs		Container ships	
Loaded	7406	Loaded	10365		
Discharged	7589	Discharged	10600		
Total	14995	Total	20965	Total	92

2017					
Containers		TEUs		Container ships	
Loaded	8074	Loaded	11792		
Discharged	8387	Discharged	12329		
Total	16461	Total	24121	Total	92

Table 4 - Container cargo throughput in the Port of Ploče 2013-2017

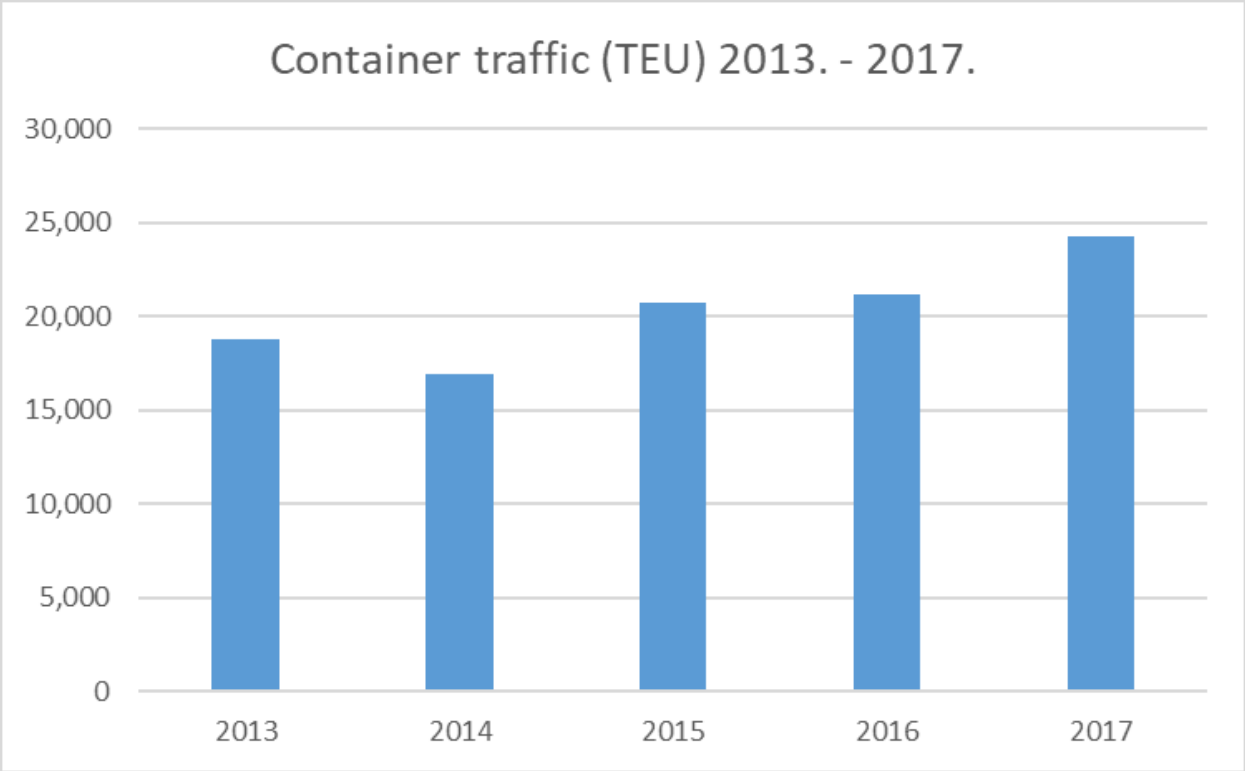


Table 5 - Container cargo throughput in the Port of Ploče 2013-2017

General cargo traffic

In the period of 2013-2017, port of Ploče had a slight decline of general cargo traffic because of the strong decline of steel and aluminum products. Although there was significant increase of bagged and containerized cargo, it was not enough to annul the decrease caused by mentioned decline.

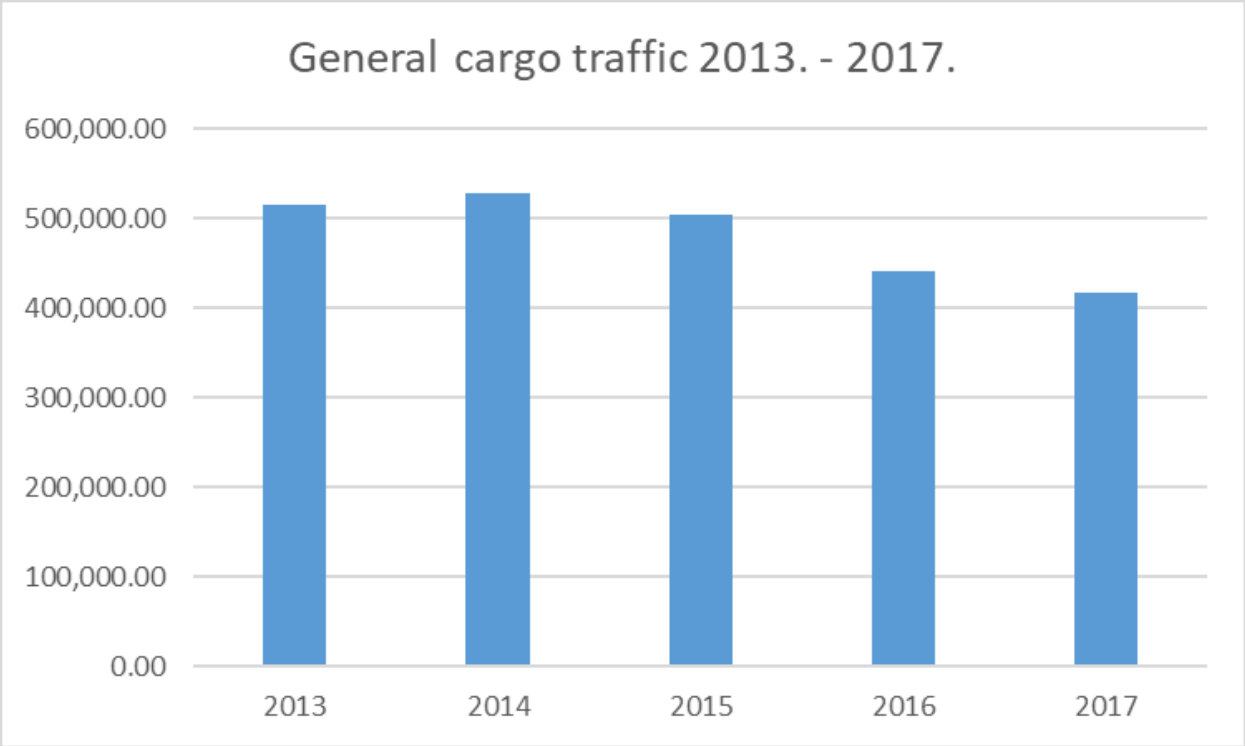


Table 6 - General cargo throughput in the Port of Ploče 2013-2017

GENERAL CARGO	2013	2014	2015	2016	2017
wood products	18,323.00	28,374.00	29,211.00	30,917.00	12,904.00
aluminum products	76,745.00	57,517.00	24,169.00	4,427.00	12,987.00
steel products	178,075.00	193,421.00	158,134.00	97,608.00	35,493.00
bagged cargo	35,269.00	70,006.00	46,766.00	68,022.00	79,673.00
containerized cargo	195,805.00	173,064.00	236,374.00	234,512.00	259,676.00
other general cargo	10,951.00	4,857.00	8,374.00	6,099.00	16,850.00
overall (tons):	515,168.00	527,239.00	503,028.00	441,585.00	417,583.00

Table 7 - General cargo throughput in the Port of Ploče 2013-2017

Liquid cargo traffic

In the period of 2013-2017, port of Ploče had a strong increase of liquid cargo traffic because in 2016. the new concessionaire for storage of liquid cargo (ATT) has built whole liquid cargo terminal with increased capacities, which has reflected on port's traffic numbers that have doubled in the projected period. Almost all of liquid cargo traffic refers to refined oil products.

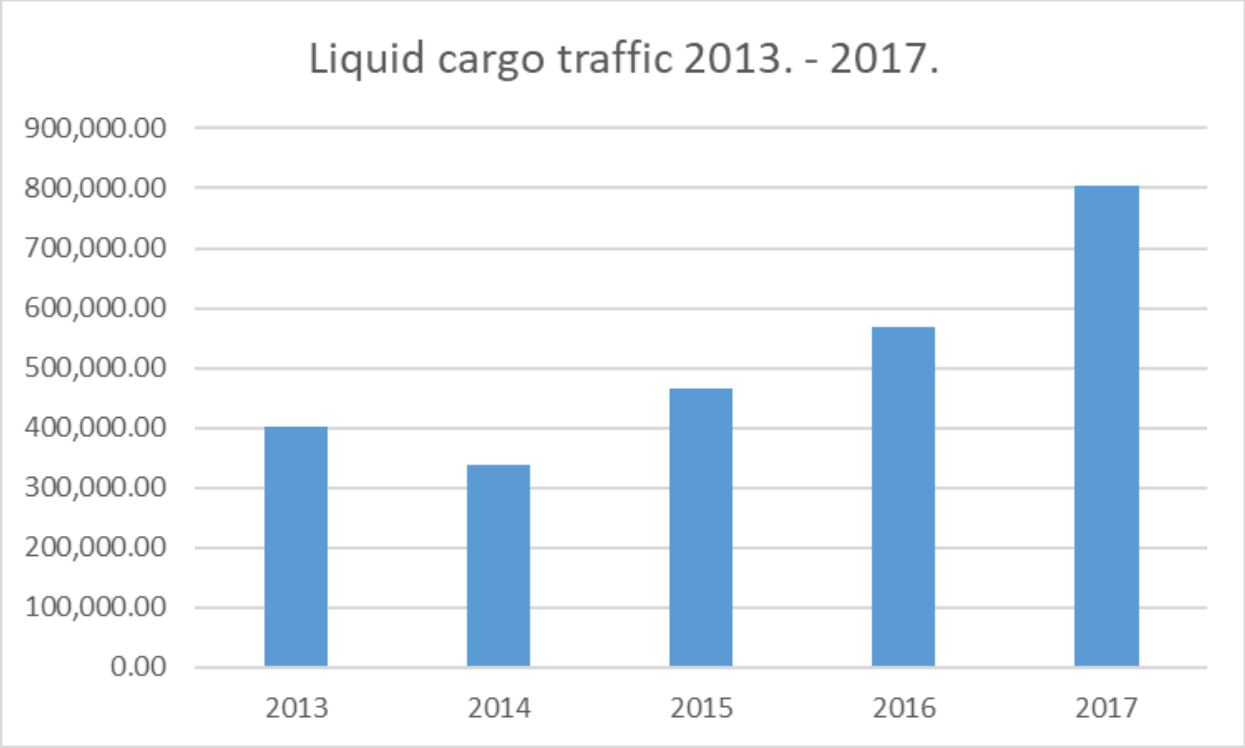


Figure 7 - Liquid cargo throughput in the Port of Ploče 2013-2017

LIQUID CARGO	2013	2014	2015	2016	2017
refined products	365,771.00	331,840.00	459,382.00	567,602.00	804,219.00
other liquid buld	35,604.00	6,300.00	5,126.00	0.00	0.00
overall (tons):	401,375.00	338,140.00	464,508.00	567,602.00	804,219.00

Table 8 - Liquid cargo throughput in the Port of Ploče 2013-2017

Bulk cargo traffic

In the projected period, bulk cargo traffic had a slight (8%) increase, mainly due to increase of coal traffic, which has increased for 22%.

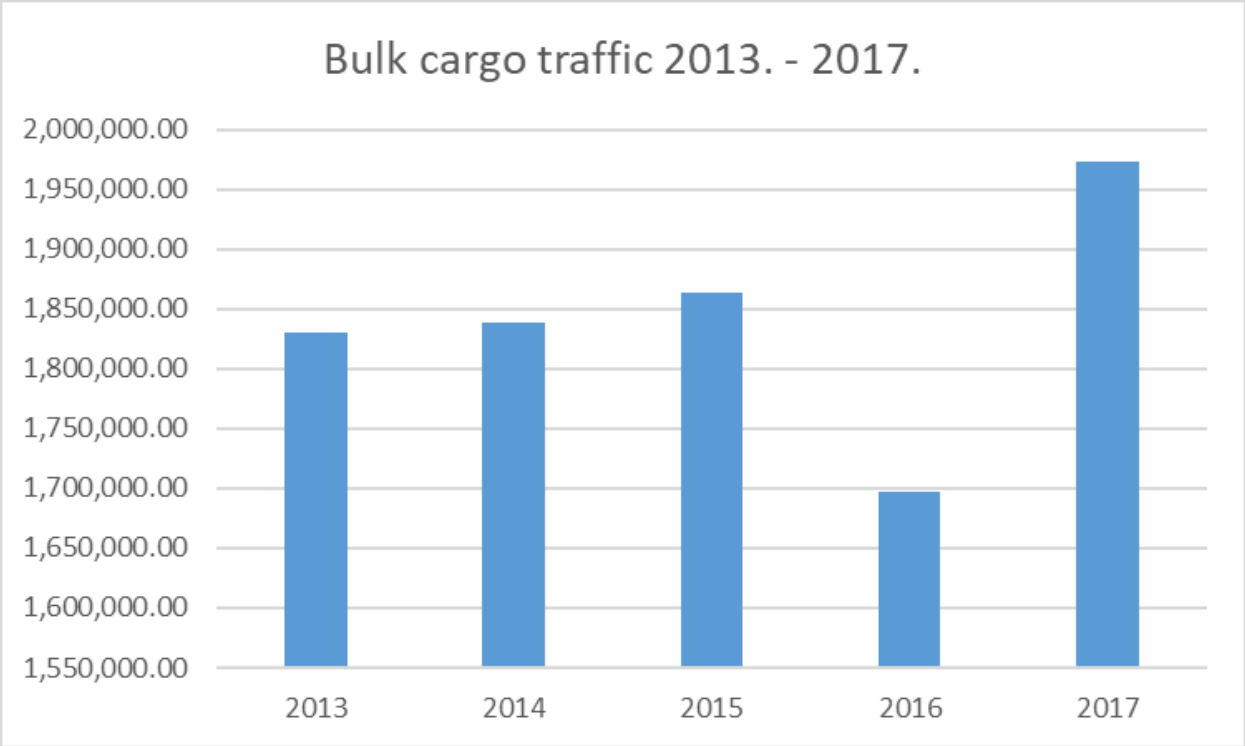


Figure 8 - Bulk cargo throughput in the Port of Ploče 2013-2017

DRY BULK CARGO	2013	2014	2015	2016	2017
alumina	219,903.00	186,890.00	155,491.00	182,582.00	181,378.00
coal	1,072,484.00	1,257,721.00	1,368,281.00	1,145,124.00	1,305,435.00
coke/pet-coke	234,595.00	138,896.00	50,762.00	47,510.00	163,330.00
scrap metal	73,962.00	74,112.00	32,871.00	33,205.00	99,097.00
sand	8,990.00	19,810.00	20,853.00	15,890.00	4,200.00
foodstuff/cereals	196,111.00	75,347.00	159,765.00	189,568.00	117,388.00
other dry bulk cargo	23,646.00	85,570.00	75,091.00	83,355.00	102,332.00
overall (tons):	1,829,691.00	1,838,346.00	1,863,114.00	1,697,234.00	1,973,160.00

Table 9 - Bulk cargo throughput in the Port of Ploče 2013-2017

Passenger traffic

In the projected period, there was a significant (55%) increase of passenger traffic. Since port of Ploče is predominately a cargo port, whole passenger traffic comes from a single ferry line that connects Ploče with Pelješac peninsula (ferry line Ploče – Trpanj). With the ongoing construction of Pelješac bridge, it is projected that these numbers will decrease.

Small cruiser ships sometimes call in port of Ploče, but the number of passengers is irrelevant (less than 1 thousand per year).

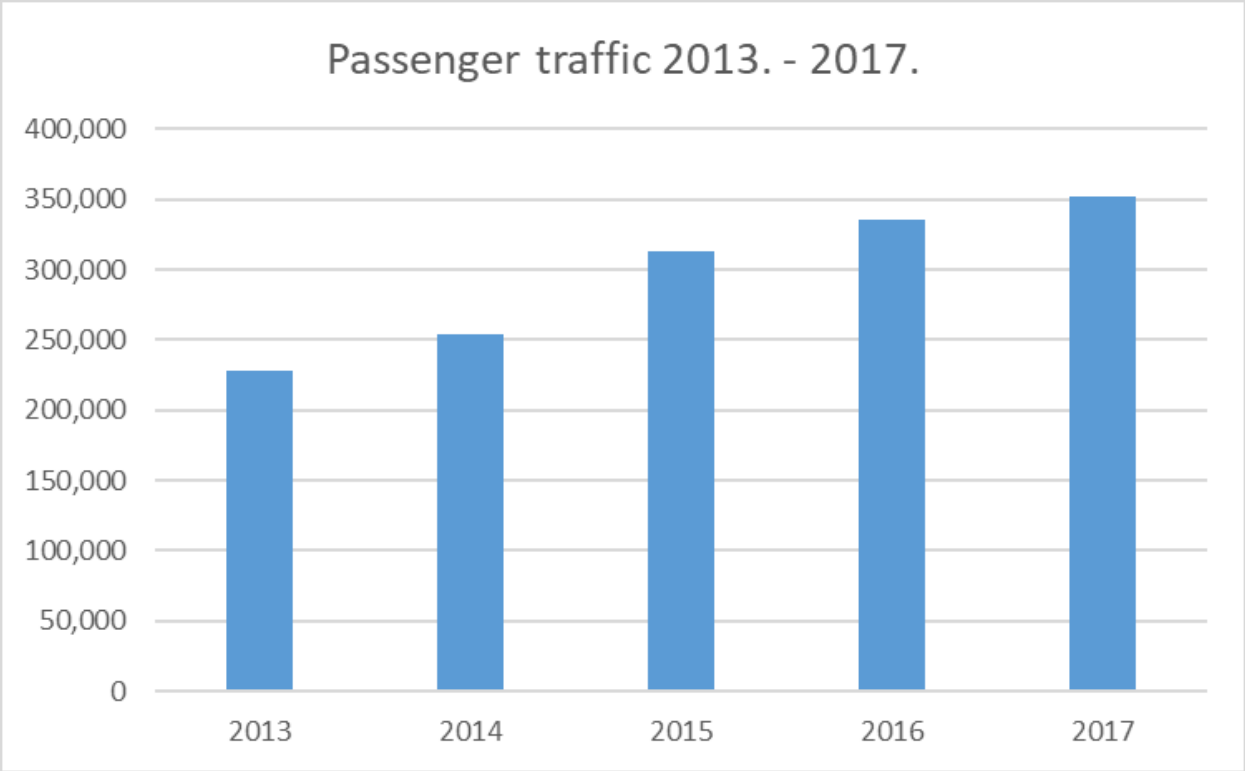


Figure 9 - Passenger traffic in the Port of Ploče 2013-2017

4.2 Vessel traffic statistics

	2013	2014	2015	2016	2017
Vessels overall	423	382	379	366	419
Container vessels	98	94	95	92	92
General cargo vessels	111	110	88	81	66
Dry bulk vessels	125	114	108	94	143
Liquid cargo vessels	89	64	88	99	118

Table 10 - Vessel traffic statistics in the Port of Ploče 2013-2017

Unfortunately, regarding vessel traffic statistics, there is no more detailed data currently available.

4.3 Other related data

VTS center is operational 24/7, every day in year, and referring to it is mandatory for all vessels of 500 GT and above entering the VTS area in transit, anchoring in the roads, or heading to (or departing from) the port of Ploče.

VTS center provides:

a) information services:

- traffic (ship positions, names and routes);
- weather (meteorological and hydrological conditions, warnings);
- general information (procedures, radio frequencies, buoy or light failures, SAR or decontamination operations, floating objects that might be a threat to navigation);

b) traffic organization services:

- in case of relevant traffic;
- in presence of vessels that could affect the safe passage of other vessels (like ships restricted in their ability to maneuver or carrying dangerous goods).

c) navigational assistance service:

- advice in case of heavy weather or of an engine/system failure on board.

The languages to be used within the VTS area are Italian and Croatian, and reports to VTS concern:

- first contact (no less than 5 NM off the outer VTS area);
- entry (entering the VTS area);
- anchorage report (actual timetable of the anchor lowering and heaving up);
- pilot report (when the pilot has boarded and/or disembarked);
- berthing/unberthing report (vessels, on entering/departing from port of Ploče);
- exit report (on leaving the VTS Area);
- accident report.

5. Natural hinterland and Corridor Vc

Determination of the gravitational zone of the port of Ploče means to define the size and the border areas in the port's hinterland. For the manufactured goods intended for overseas export or imported goods intended for consumption in port's hinterland area, the port of Ploče represents connection point between hinterland area and sea transport.

Gravitational area of the port is a variable size depending on many factors such as: geo-traffic position of the port, traffic flows, transport capacities (traffic infrastructure and superstructure), the extension and the quality of the traffic net (railroads, roads, navigable routes, air traffic net), the application degree of modern transportation technologies, costs of port's services and total cost of the traffic service, the size and the degree of the economic development of the territory gravitated towards the use of a specific traffic route, the presence of competition on the traffic service market, traffic politics, rate politics and many other factors.

In relation to different economic, political and other factors which are unpredictable, data about actual structure of traffic flows according main transit partners is the most advisable basis for analyzing the gravitational area and forecasting the transport demand in the port and traffic route. Because of that, directions and dynamics of traffic flows represent the main indicator for transport route competitiveness on transport service market and the main indicator for gravitational area of the port.

According above-mentioned theoretical principles, identification of the port of Ploče gravitational area for cargo and passenger traffic will be carried out from the following aspects:

- transport supply,
- transport demand,
- transport environment.

Transport offer analysis will include analysis of capacities in port of Ploče together with infra and superstructure at the terminals, appropriate rail and road infrastructure at the Corridor Vc as backbone of the hinterland connection, transport costs and service quality and influence of new terminals on the port competitiveness.

Main interest gravitational area or transport market for port of Ploče is Bosnia & Herzegovina, which is origin for more than 90% of container cargo in transit. Although Bosnia & Herzegovina represents natural and closest hinterland area, the potential hinterland area includes Serbia and Montenegro, as well as territories of Hungary and Eastern European countries. Identification of the gravitational area will lead to the determination of main partners of the port of Ploče as well as identification of potential transit partners in wider area.

Competitive transport environment include identification and comparison of the closest competitive ports to port of Ploče and their gravitational area. The closest ports to port of Ploče with overlapped hinterland area for containers could be foreseen the following ports: Split, Bar, Rijeka and Koper.

4.1 Geographical situation

Corridor Vc is a multi-country corridor, traversing Croatia, Bosnia and Herzegovina and up to Hungary. It thus passes through the commercial centers of Sarajevo and Mostar in BiH, Osijek being the economic center of Slavonia and Budapest in Hungary. The corridor connects the Adriatic Port of Ploče with Sava ports, as well as the Danube.

Figure 10 - Geographical Position of Corridor Vc

The Corridor Vc crosses the Corridor X close to the Croatia/BiH border at Šamac, which in turn provides connections with the Serbian capital of Belgrade to the East and the Region of Zagreb to the West. In Budapest, the Corridor Vc joins the other branches of Corridor V, leading to Kosice (Slovakia) and Lvov (Ukraine), as well as Corridor IV and Corridor VII (the Danube).

4.2 Corridor Vc in the realm of EU-policy

The ten Pan-European transport corridors were defined at the second Pan-European transport Conference in Crete, March 1994, as routes in Central and Eastern Europe that required major investment over the next ten to fifteen years. Additions were made at the third conference in Helsinki in 1997. Therefore, these corridors are sometimes referred to as the "Crete corridors" or "Helsinki corridors", regardless of their geographical locations. A tenth corridor was proposed after the end of hostilities between the states of the former Yugoslavia.

These development corridors are distinct from the Trans-European transport networks, which is an EU project including all major established routes in the EU, although there are proposals to combine the two systems, since most of the involved countries now are members of the EU. The corridors variously encompass road, rail and waterway routes

I	(North-South) Helsinki - Tallinn - Riga - Kaunas and Klaipėda - Warsaw and Gdańsk • Branch A (Via/Rail Hanseatica) - St. Petersburg to Riga to Kaliningrad to Gdańsk to Lübeck • Branch B (Via Baltica/E 67) - Helsinki to Warsaw.
II	(East-West) Berlin - Poznań - Warsaw - Brest - Minsk - Smolensk - Moscow - Nizhny Novgorod
III	Brussels - Aachen - Cologne - Dresden - Wrocław - Katowice - Kraków - Lviv - Kiev • Branch A - Berlin - Wrocław
IV	Dresden/Nuremberg - Prague - Vienna - Bratislava - Győr - Budapest - Arad - Bucharest - Constanța / Craiova - Sofia - Thessaloniki / Plovdiv - Istanbul.
V	(East-West) Venice - Trieste/Koper - Ljubljana - Maribor - Budapest - Uzhhorod - Lviv - Kiev. 1,600 km (994 mi) long. • Branch A - Bratislava - Žilina - Košice - Uzhhorod • Branch B - Rijeka - Zagreb - Budapest • **Branch C - Ploče - Sarajevo - Osijek - Budapest**
VI	(North-South) Gdańsk - Katowice - Žilina, with a western branch Katowice-Brno.
VII	(The Danube River) (Northwest-Southeast) - 2,300 km (1,429 mi) long.
VIII	Durrës - Elbasan - Skopje - Sofia - Plovdiv - Burgas - Varna. 1,500 km (932 mi) long.
IX	Helsinki - Vyborg - St. Petersburg - Pskov - Gomel - Kiev - Liubashivka - Chișinău - Bucharest - Dimitrovgrad - Alexandroupolis. 3,400 km (2,113 mi) long. Major sub-alignment: St. Petersburg - Moscow - Kiev. • Branch A - Klaipėda - Vilnius - Minsk - Gomel • Branch B - Kaliningrad - Vilnius - Minsk - Gomel • Branch C - Liubashivka - Rozdilna - Odessa
X	Salzburg - Ljubljana - Zagreb - Beograd - Niš - Skopje - Veles - Thessaloniki. 2,300 km (1,429 mi) long. ▪ Branch A: Graz - Maribor - Zagreb ▪ Branch B: Budapest - Novi Sad - Belgrade ▪ Branch C: Niš - Sofia - Plovdiv - Dimitrovgrad - Istanbul via Corridor IV ▪ Branch D: Veles - Prilep - Bitola - Florina - Igoumenitsa

Table 11 - Pan-European transport corridors

The Trans-European Transport Networks (TEN-T) are a planned set of road, rail, air and water transport networks in the EU. The TEN-T networks are part of a wider system of Trans-European Networks (TENs), including a telecommunications network (eTEN) and a proposed energy network (TEN-E or Ten-Energy). The EC adopted the first action plans on trans-European networks in 1990.

TEN-T envisages coordinated improvements to primary roads, railways, inland waterways, airports, seaports, inland ports and traffic management systems, providing integrated and intermodal long-distance, high-speed routes. A decision to adopt TEN-T was made by the European Parliament and Council in July 1996. The EU works to promote the networks by a combination of leadership, coordination, issuance of guidelines and funding aspects of development.

These projects are technically and financially managed by the Trans-European Transport Network Executive Agency (TEN-T EA), which was established for this purpose by the EU in October 2006.

Figure 11 - TEN-T extended network to specific third countries

In June 2015, the WB6 Transport Ministers met with the EU Transport Commissioner, Violeta Bulc, at the TEN-T Days in Riga, and tentatively identified three core network corridors to be extended for the Western Balkans as well as priority projects along sections of these corridors for possible EU funding over the next six years.

While the present report was under review, the extension of the three core network corridors was finally decided at the West Balkans 6 Vienna Summit on 27th of August 2015. Among those corridors is the Mediterranean corridor – now consisting of a new branch from Zagreb, via Slavonski Brod and through BiH to Ploče (as well as to Belgrade), and a branch from Rijeka to Ploče and leading further on to Igoumenitsa in Greece.

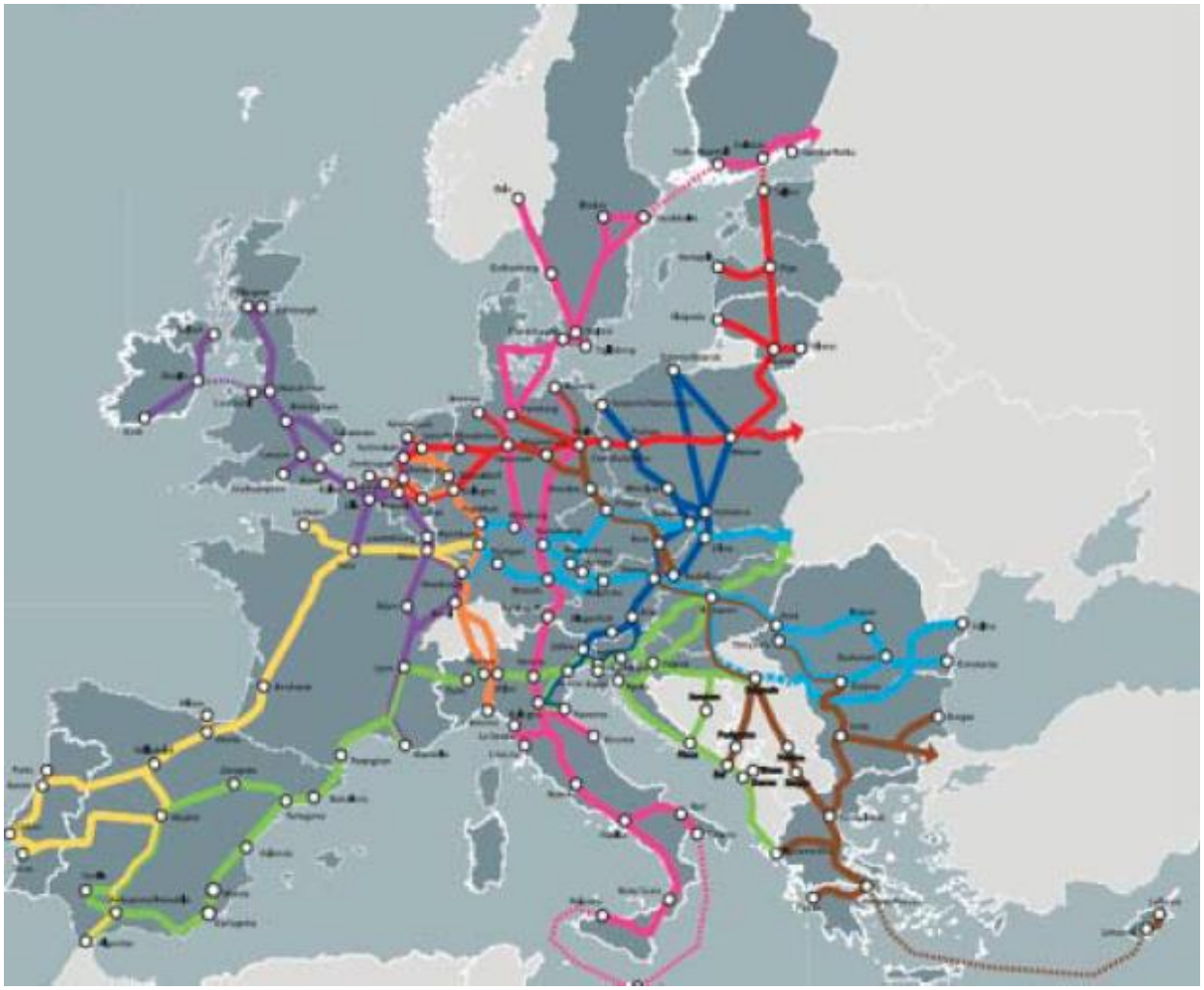


Figure 12 - Extended TEN-T core network

A further new branch of the Orient/East-Med Corridor meets the Ploče – Slavonski Brod section of the Mediterranean Corridor at Slavonski Brod and leads to Budapest. Thus, the Pan-European Corridor Vc is integrated into the TEN-T core network in its entirety. The previous figure shows the new TEN-T network, covering as well the Pan-European Corridor Vc from Ploče to Budapest. On the basis of the Ministerial Conclusions released upon the 8th AMM held in Zagreb, in December 2012, a new approach to identify improvement on infrastructure and services on long distance and cross-border corridors was recommended, namely the Flagship initiative.

The objective of this initiative is the identification of physical and non-physical barriers for selected multimodal axes (Corridors/Routes) from the SEETO Comprehensive Network, and the development and analysis of plausible remedial measures for reducing travel times and transport costs. From those measures, implementation should be sought for the ones with the highest cost-benefit ratio.

On the 38th SC meeting (3-4th October 2013) the following five flagship axes were selected for analysis:

- Corridor X (highest traffic flows + connectivity Port of Thessaloniki and Belgrade),
- Corridor Vc (connectivity Port of Ploče and Sava river),
- Corridor VIII + Route 7 (connectivity Port of Durres, Corridor X and Black Sea),
- Route 4 (connectivity Port of Bar, Corridor X, Danube and Corridor IV),
- Danube river (already European corridor).

Figure 13 - Map of Flagship axes

Conclusion from the ranking of SEETO flagship corridors shows two top priority routes/corridors according the final report of the SEETO study Support to the Implementation of the Strategic Work Program of the South East Europe Transport Observatory (SEETO) – Technical Assistance dated April 2015:

- Route 4 (due to port of Bar) Bar and Corridor Vc (due to port of Ploče) are the top two priorities.
- Corridors Vc (Ploče) and Vd (Bar) between each other and with Rijeka, Koper, Trieste and Monfalcone for Serbia and Hungary.
- Corridor Vc is constructed to be a landbridge between the Adriatic Sea, Sava River and Danube River (in competition with the inner Croatian corridor to-be-established between Rijeka and Vukovar). It furthermore links the Hungarian economic center of Budapest with another Adriatic port (in competition with Rijeka and Koper) and the industrial centers of Northern Bosnia and Herzegovina.

6. Border crossings

Any progress in cross-border transport depends on the legal and institutional framework. Without a legal basis and a common understanding of involved entities, be it in the form of laws, administrative instructions, regulations or subsequent agreements with customs authorities, border police authorities, phytosanitary authorities and infrastructure managers at the border points, no improvement can be expected.

A sensible basis for a legal and institutional basis is deemed to be EU legislation and the subsequent outflowing procedures observed by the institutions.

According to the information contained in the annual country reports prepared by the EU delegations in the SEETO participant countries and published on the EU website, all countries have aligned their transport legislation, in particular the rail, inland waterways and port legislation.

However, in rail not all SEETO participants have yet adopted the “recast” directive (Directive 2012/34/EU) - as it is the case in most EU member states.

From a formal point of view, the legal framework for rail is set but it is a question of implementation of national laws and a question of political willingness combined with an intensive monitoring by the EU.

5.1 Road border crossings

Concerning the roads, the SEETO Participants already adhere to international conventions such as TIR and CMR reaching far beyond the EU and its neighbors. Trade facilitation is far more advanced than on the rail track. Road formalities at SEETO BCPs for international goods transport are subject to well-functioning international border procedures (TIR/CMR) where mostly customs are involved.

With respect to transport operation by lorry, there are no major obstacles or restrictions from a legal and/or institutional point of view since the technical aspects of the lorry are harmonized, at least European-wide and lorry drivers have freer access to vehicles and roads than train drivers. The service quality is impeded since controlled areas at the border have limited parking facility for trucks while the documentation is processed, and trucks are either queuing on the access road to the controlled area, making it difficult to separate flows for priority trucks (for instance tanker trucks), or are directed to a waiting area until the time they can be admitted to the controlled areas (when the documentation is ready, or when it is their turn).

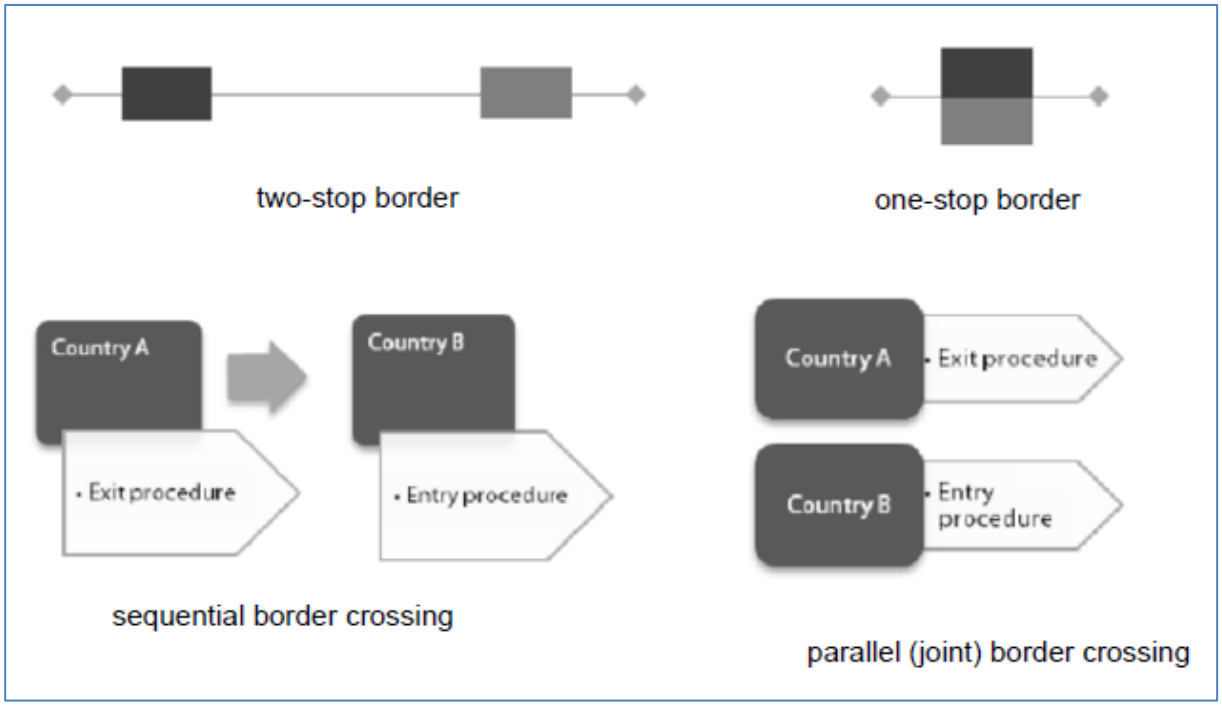


Figure 14 - Schematic depiction on organizational types of border crossings

Apart from questions of security, no major access restrictions to the roads could be observed at the border crossing points visited. The only relevant physical restriction is the parking/waiting space for trucks and busses which is rarely due to administrative (non-physical) barriers.

The lack of parking space and the waiting time at the borders is rather the result of the success of international road transport in the SEETO region to the detriment of international rail transport that has not managed yet to efficiently organize its border crossing.

To show the relative facility of international road transport, below an example applicable in the region:

TIR Transport starting from a third country and involving a non-Community (SEETO) country during the journey.

The truck stops for some minutes at the Serbian borders of entry and exit.

The field missions have shown that waiting times on the road BCPs are mainly subject to lack of road infrastructure while waiting times at rail BCPs are subject to cumbersome procedures and lack of coordination among the railway organizations on both side of the border.

The road is already much more integrated regionally and with EU than railways!

No.	BCPs	NCTS (yes/no)	SEED(yes/no)
1	SRB-CRO: Šid (rail)	no	no
2	SRB-CRO: Batrovci (road)	yes	no
3	SRB-HU: Subotica (rail)	no	no
4	SRB-HU: Horgos (road)	yes	no
5	BIH-CRO: Brod (road)	yes	no
6	BIH: Samac (port)	no	no
7	BIH-CRO: Sl. Samac (rail)	no	no
8	BIH-CRO: Samac (road)	yes	no
9	BIH-CRO: Samac (rail)	no	no
10	BIH-CRO:Capljina (rail)	no	no
11	BIH-CRO: Biaca (road)	yes	no
12	CRO - BIH: Biaca (road)	yes	no
13	BIH: Ploče (port)	no	no
14	SLO: Koper (port)	yes	no
15	CRO: Rijeka (port)	yes	no
16	MNE: Bar (port)	no	yes
17	MNE-SRB: Bijelo Polje (rail)	no	no
18	MNE-SRB: Dobrakovo (road)	no	yes
19	SRB-MNE: Brodarevo (road)	no	yes
20	SRB-MNE: Prijepolje (rail)	no	no

Figure 15 - Rail and road border crossings and implementation of NCTS and SEED

NCTS (computerized transit procedure management system within the EU) is used only on road crossings connecting the SEETO region with EU member states. SEED-is used on road crossings inside the SEETO region.

5.2 Rail border crossings

The major bottleneck and service quality obstacle at the borders are to be found in the rail sector.

With respect to this core challenge, SEETO has published a model BCA14, an agreement in full conformity with Directive 2012/34/EU. This model Border crossing agreement includes sub-agreements for:

- Framework Border Crossing Agreement (BCA),
- Framework Border Police Agreement (BPA),
- Agreement between Infrastructure Managers on the Interconnection of Networks,
- Agreement among Railway Undertakings concerning the Transfer of Wagons and Traction,
- Regional Agreement for the Mutual Recognition of Train Driver Certificates,
- Language tests.

The Directorate General MOVE has also developed a “checklist on the verification of the compliance of the cross-border agreements with the recast of Directive 2012/34”. These have served as basis for assessing the existing border crossing agreements.

Regarding the rail border crossings between Croatia and Bosnia and Herzegovina, the current agreement in force is the “Agreement between the Republic of Croatia and the Republic of Bosnia and Herzegovina on the regulation of border railway transport” dating from the year 2000.

A further problem at rail border crossings is the non-applied or intelligently deferred market opening.

There is no open access for private railway undertakings to run on the national networks or between the national networks although the relevant railway laws - in conformity with the EU legislation - stipulate it. “Private railway undertaking” also applies to the national railway company of the neighboring state once operating on the “own” network.

This lack of implementing the national railway laws and the new BCAs, intentionally or unintentionally, leads to the fact that there is no open access in whatsoever form in the region.

The Border Crossing Metković – Čapljina plays a particular role for the Port of Ploče, since it is only 25 km away from the port. The crossing has following characteristics:

General

- No international passenger train traffic any longer, only 2 local trains per 24 h to/from Sarajevo/Mostar with two passenger cars.

- Freight traffic with Luka Ploče: 2 freight trains per direction, per day on the average.
- In 2008. it used to be 2 pairs of local passenger trains Ploče-Metković and 2 pairs of international trains Ploče-Zagreb-via BiH and Ploče-Sarajevo and 10-15 freight trains per 24 hours.

Rail

- Change of traction, and train drivers is cumbersome. Mainly due to the lack of traction. It is as well one of the major reasons for long idling times at the border.
- Repair depot of the BiH Federal Railways at the freight section of the station with the possibility to separate trains for various reasons, be it customs or operational reasons.

Technology

- Freight trains are announced 6 hours before they arrive from both sides.
- Sometimes the trains stay at Luka Ploče station ready for departure for 5,5 h before they run the 25 km section in 30 min.
- According to freight station at Ploče, they make a guess when the train is ready for departure. 30 minutes on the average for customs and border police procedures, it depends on the complexity of goods and on the length of the train.

Border authorities

- There is a protocol between the BiH and Croatia border police to enter the respective territories but first they have to telephone, however, there are regular joint patrols and controls on both sides of the territory according to the protocol. Regarding the rail border crossing, however, double work is sustained at both sides of the border.

Main problems are:

- No Border crossing agreement according to SEETO model.
- Complicated procedures for a section of only 25km by rail since no pre-aviso from the port or declaration by BiH customs in the port.
- Lacking cooperation between the incumbent state-owned railway companies in Croatia, BiH and Hungary (although they officially claim good cooperation).
- In fact, double work since no joint procedural systems in the commercial and operational dispatching (e.g. One-stop-shop) are in place.

- No electronic exchange of data among railways, customs, other border authorities and the port. All is paper work.

As a result:

- Long procedures and delays are commonplace.
- No competition in the rail sector on the Croatia and BiH side, with only one incumbent operator respectively.
- No open access. The BiH rail company cannot enter the port and HŽ Cargo cannot enter BiH.

7. Identification of Non-physical bottlenecks

6.1 Non-physical bottlenecks on rail network

Since 2009., the opening of the rail borders has got stuck halfway.

- The border crossing agreements in force are not in conformity with EU legislation.
- There does not exist any open access for private railway undertakings to run on the national networks or between the national networks of the SEETO Participants although the relevant railway laws - in conformity with the EU legislation - stipulate it.
- The lack of implementing the national railway laws and the new BCAs, intentionally or unintentionally, leads to the fact that there is no open access in whatsoever form in the region.

The border crossing points for rail are in a worse state than road border crossings, when applying the same criteria of assessment.

The rail-bound logistics centers along the corridors, in particular those run by the state-owned railway companies and the Sava ports do not have the service qualities for modern supply-chain-driven transport.

6.2 Non-physical bottlenecks on road network

Major non-physical barriers on the corridor for road are still the border crossings. However, due to TIR, NCTS and MNC, the actual border crossing procedures are much more efficient, than those at rail border crossing points.

Normally, the procedures itself last no longer than a couple of minutes.

Major bottleneck is the physical capacity of road border crossing points due to the enormous increase in road freight and road passenger transport and the lacking number of parking space related to that.

6.3 Non-physical bottlenecks within the port

Major non-physical bottleneck within the port area is lack of electronic exchange of documents. Although the Port Authority has developed and introduced the port community system (PCS), which should gather all the information from all stakeholders (forwarding agencies, ship agencies, border police, customs office, phytosanitary, stevedores…), it's use is still limited and it proves to be a significant bottleneck, which impacts costs and transit time of goods on the whole corridor.

Other bottlenecks are:

- non-existence of joint systematic promotion of the port itself and the corridor as a whole;
- non-existence of systematic „bottleneck exercise";
- non-existence of IT route planner;
- partial Quality Management implemented;
- vehicle tracking inside the port is not appropriate;
- monopoly of the stevedore's company.

8. Identification of physical bottlenecks on the corridor

7.1 Physical bottlenecks on rail network

Corridor Vc is, with the exception of an approximately 130 km long section between Strizivojna Vrpolje in HR and Pecs in HU, in its entire length electrified: AC 25 Kv, 50 HŽ.

The major obstacles for are to be found on the BiH side, as is further elaborated in the following chapter.

The below figure shows the current capacity constraints on Corridor Vc. The reason that there are no major constraints lies in the fact that the transport volumes are relatively low.

Figure 16 - Rail sections with current capacity constraints

The total length of railway lines in Bosnia and Herzegovina (BiH) is 1030,389 km, almost all single tracked. In the Federation of Bosnia and Herzegovina 587,15 km of the net length are located (57,0%) and in the Republic of Srpska 416,34 km (40,4%). In District Brčko there are 26,901 km (2,6%). The analysis of the infrastructure identified some restrictions in the infrastructure and in the operation, but in general the existing situation is sufficient for coping with the needs of operation at present both in capacity and safety in consideration of the Investment Plan 2005 – 2009, which is in progress right now.

The present capacity is limited in respect of speeds and safety caused by insufficient infrastructure by:

- Alignment due to topography,

- Gradients,
- Single track in sections of fairly high line load,
- Insufficient track condition,
- Incomplete signaling system,
- Incomplete safety system for level crossings,
- Length of the tracks and sidings in the stations,
- Bottlenecks caused by missing direct connections,
- Station capacities are partly not sufficient,
- Missing safety system for Industrial sidings.

Additional to the capacity restrictions, the travel time is also an indicator to get more traffic to the railway. The main hampering factors for a higher speed are:

- Track lay-out due to the landscape and the topography,
- Single track sections,
- Incomplete signaling system,
- Condition of superstructure,
- Radii not sufficient due to the alignment,
- Gradients not adequate for higher speed,
- Ramps for cants are too short in some radii and have to be enlarged,
- Turnouts at all merging points of lines speed restricting in a not acceptable way.

The main restrictions caused by operation and organization factors are:

- Maximum length of the trains 550m,
- Maximum High speed of 70km/h,
- Change of locomotives,
- Communication deficiencies,
- Maintenance organization,
- Border procedures.

7.2 Physical bottlenecks on road network

The road network in Bosnia and Herzegovina covers more than 8,000 km, more than 1,000 km of which are European routes. Most of this network has been designed to accommodate a two-way single carriageway with a maximum speed of 80kph. Traffic lane width varied from 3.50 to 3.75m, and road shoulders from 0.5 to 1m wide. As average daily traffic volumes grew to over 9,700 vehicles, with a corresponding increase in freight volumes, Bosnia and Herzegovina embarked on a motorway construction program in cooperation with its neighbors. It has been actively supported by the European Union and its partners, particularly under the Western Balkans Investment Framework.

Under the newly extended TEN-T Core Network a first concrete measure will to upgrade the road connection between Svilaj – Odžak.

The Svilaj – Odžak section is part of the motorway designed and partially built by Bosnia and Herzegovina along the Mediterranean Corridor Vc to Croatia. The route will accommodate 2x2 traffic lanes and speeds of 120kph. Construction works are ongoing for this section. The new bridge over the Sava and the border crossing facilities funded under this project will allow even increased traffic volumes to flow smoothly. Relying on existing infrastructure would undoubtedly have resulted in serious bottlenecks.

Figure 17 - Road sections with current bottlenecks

In terms of bottlenecks, the only relevant physical restriction is the parking/waiting space for lorries and busses which is mostly due to administrative (non-physical) barriers.

The lack of parking space and the waiting time at the borders is rather the result of the success of international road transport in the SEETO region to the detriment of international rail transport that has not managed yet to efficiently organize its border crossing.

7.3 Physical bottlenecks within the port

It is considered that the major physical bottleneck within the port is the insufficient length of quays to accommodate large ships, especially on container terminal and on liquid cargo terminal. With development plans for new liquid cargo berth already ongoing, it is expected that this physical bottleneck will be annulled by 2020, when the construction of new jetty is scheduled to be completed.

Container terminal quay is 280 meters long and it is not able to accommodate mother vessels carrying 5000 TEU and more. Second phase of construction of container terminal should overcome this obstacle, but in order to commence construction, there should be enough throughput of containers, which is currently low (around 21.500 TEU's in 2015, expected to be 23.000 TEU's in 2016).

In terms of passenger terminal, major bottleneck is non adequate width of RO-RO ramps, which results in inability of simultaneous operating of ferry line Ploče – Pelješac peninsula and possible ferry line Ploče – Italy. This bottleneck is planned to be removed by extending the width of one RO-RO ramp so it could accommodate bigger ferries.

Also, the passenger terminal suffers from congestion in summer months, but that bottleneck is due to spatial restrictions and it can't be overcoming. It is expected that a bridge connecting Pelješac peninsula with mainland should be completed in next 5 years and it should remove this bottleneck.

Other physical bottlenecks within the port are:

- There is a road and pedestrian crossing on the railway;
- Road and railway crossings but railway has priority;
- Parking spaces at terminal are not adequately signposted;
- non-existence of areas adequately arranged, with different areas for waiting and pre-embarkation and the interior traffic (will be done till end of 2015);
- not existence of dedicated Ro-Ro passenger terminal.

9. Local stakeholders identification of bottlenecks

Port of Ploče Authority has created a questionnaire for local port stakeholders with aim to address the bottlenecks and drawbacks on the Trans-European Transport Corridor Vc in connection with its starting/ending point at the Port of Ploče. Its aim is to explore the current situation of the Port of Ploče and the Corridor Vc from the angle of private stakeholders and discuss their requirements towards the Port of Ploče and the Corridor Vc.

The questionnaire was delivered to total of 20 stakeholders, including major stevedoring company Luka Ploče d.d., forwarding agencies, maritime agencies, rail cargo operators and other local stakeholders. It was answered and delivered back to Port Authority, who systematized the answers and created a prioritized bottlenecks list.

With this questionnaire, the most important barriers, physical and non-physical, as well as the requirements of the private stakeholders towards a more operable, reliable, customer friendly and economically attractive port, respectively hinterland corridor, should be identified.

The below table shows the results of the questionnaires after having been weighted.

Bottleneck priority	**Bottlenecks according to priority assigned by private stakeholders** - starting with the most pressing
1	Time-consuming change of locomotives and missing traction
2	Long delays at borders
3	Missing institutional infrastructure and legal framework for multimodal logistic chains
4	Lacking cooperation between port and transport companies - as well in order to offer better services to common customers
5	Long and complicated customs procedures due to the lack of electronic information transmission
6	Previous investments often dedicated to rehabilitation and track overhaul instead of upgrading
7	Delays within the port because of uncoordinated processes between different organizations

8	Long idling times for good in the port until they can leave by train; unreliable rail services
9	Missing cooperation between incumbent railways
10	Missing independent multimodal regulator (rail, road, inland waterways) to ensure non-discriminatory and fair practices
11	Physical obstacles (such as cants not adequate for higher speed, incomplete signalling, insufficient track condition, alignment due to topography, single railway tracks)
12	Uncoordinated office hours of customs, railways and stevedoring
13	Double customs clearance at port for goods arriving from other EU member States for import/export to/from BiH
14	Length of quay not sufficient to accommodate large ships
15	Length of the tracks at container terminal too short

Table 12 - Bottlenecks according to priority assigned by private stakeholders

The results from the questionnaires show, that the stakeholders mostly considers non-physical barriers as the greatest obstacles to their businesses - and as such, to the development of the Corridor Vc and the Port of Ploče.

On top of the prioritization, the participants also named the following points to be barriers:

- Terminals in Port of Ploče are incapable when it comes to undertake unloading while it is raining,
- Without authorization of railways, ships are being manipulatively bargained between the user and Port of Ploče,
- Problem of goods storage in port,
- Problem of wagons detention due to immediate ship loading.

10. Overview and analysis of the existing traffic flows between Italian- Croatian ports

In 2016. there were 135 cargo vessels that sailed between Ploče and Italy, 63 that sailed from Italy to Ploče and 72 that sailed from Ploče to Italy. Most of those vessels were general cargo vessels (feeder container ships). Other significant connections were dry bulk vessels, mostly because of transshipment of dry bulk cargo like coal.

2016				
	Italy - Ploče		Ploče - Italy	
	vessels	cargo (t)	vessels	cargo (t)
liquid cargo	3	43932	4	55773
dry bulk cargo	20	119840	15	122822
general cargo	40	115091	53	203531
total	63	278863	72	382126

Table 13 - Traffic flows between Port of Ploče and Italy in 2016

In 2017. there were 162 cargo vessels that sailed between Ploče and Italy, 95 that sailed from Italy to Ploče and 67 that sailed from Ploče to Italy.

2017				
	Italy - Ploče		Ploče - Italy	
	vessels	cargo (t)	vessels	cargo (t)
liquid cargo	24	214125	7	29295
dry bulk cargo	29	169300	1	4437
general cargo	42	98600	59	179567
total	95	482025	67	213299

Table 14 - Traffic flows between Port of Ploče and Italy in 2017

As for as passenger traffic is concerned, there were no traffic flows between port of Ploče and Italy, although in 2018. there is a new pilot line established between Ploče and Termoli, Italy, which could generate some passenger traffic (although not substantial).

11. Analysis on potential market flows and projection of future traffic flows between Italian-Croatian ports

As a logistic node, port of Ploče is situated on the eastern coast of the Adriatic Sea and because of its location it is of great importance for the economy of the neighboring Bosnia and Herzegovina, whose state border is only 25 km from the port of Ploče.

It is located in a bay that encloses the Pelješac peninsula on the south and southwest sides, thus representing a natural breakwater. Luka Ploče is directly connected with its hinterland in Bosnia and Herzegovina, further to the north-eastern part of Croatia, and with Central Europe the railway line and the roadway (E-73) stretching along the line C (Budapest - Osijek - Sarajevo-Ploče) Of the Fifth Pan-European Corridor (Venice - Trieste - Budapest - Uzgorod - Lvov). This roadway is also one of the most important branches of the TEM / TER project and in a broader sense connects the European North (Baltic) with the Adriatic and is of vital importance in economic connections and the traffic of people and goods.

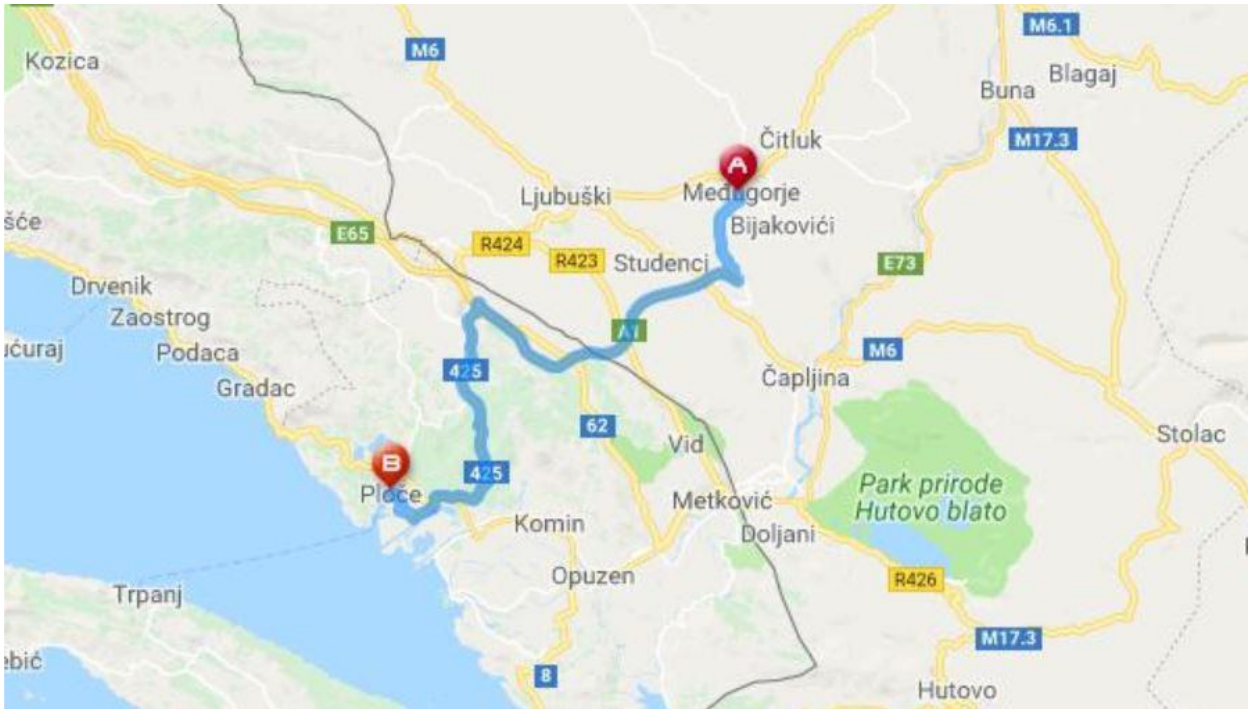


Figure 18 - Connection between Ploče and Međugorje, B&H

Since Međugorje, Bosnia and Herzegovina, a major destination for Italian tourists, is located only 40 km from port of Ploče, we should focus on this market. According to statistical data from B&H,

there was 1 million of tourists in Međugorje in 2017., and almost all of them arrived via road, with Italian tourists being the vast majority.

This situation was closely monitored, and a result is a permanent catamaran line between Ploče and Termoli, Italy, which should be established to provide fast connection between central and southern Italy and Međugorje.

Figure 19 - Connection between Ploče and Termoli, Italy

The line should be operated by a 36 meter long catamaran, with capacity of 330 passengers, with projected duration of voyage at 4 hours and 45 minutes, meaning that transit time from Termoli to Ploče is decreased by almost 10 hours.

Since there is an existing ferry line between Split and Ancona, it is not likely that another ferry line between Ploče and central Italy will be established so we will not consider this possibility.

12. Potential undesirable effects and points of congestion

It could be said that for the current cargo flow, Port of Ploče has satisfactory infrastructure. The problem with congestion on the road can be seen only in summer months with the influx of tourist. However, since city of Ploče is not a great touristic destination, congestion is not a major problem in city itself, but it can be a major problem on the motorway A1 and the surrounding roads and border crossings.

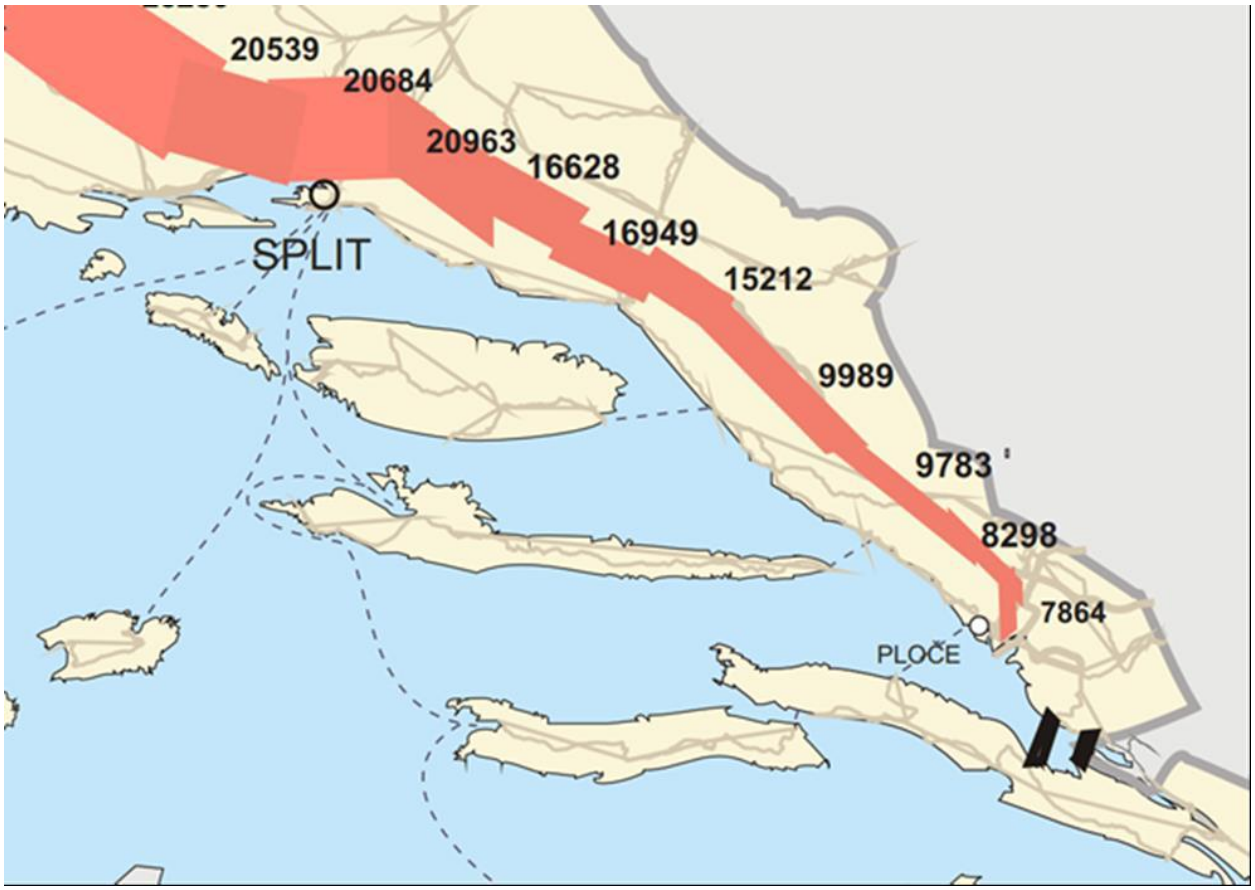


Figure 20 - Congestion on motorway A1 near port of Ploče

Port of Ploče has a connection to a highway A1 that is connecting capital with the south of the country. It is also part of the corridor Vc that stretches from Budapest and includes the road

connection from Hungarian border through Osijek, Sarajevo and Mostar to Metković and Ploče (road E65). The road connection is very good, and with the building of new entrance terminal, there is a direct access from main port gate to highway.

The problem with congestion mostly manifested at state border with Bosnia and Herzegovina, since Port of Ploče is major transit port for Bosnia and Herzegovina. Picture below shows main border crossings in that area:

Figure 21 - Border crossings near port of Ploče

It could be said that port of Ploče has a good infrastructure, especially if we took into consideration soon to be new entrance terminal, that will be directly connected with highway network. Railway infrastructure is also in good condition in the port, and the only problem is the connection and cooperation between two countries – Croatia and Bosnia and Herzegovina.

The main problem that port of Ploče now consider is lack of information exchange. At the moment, there is still paper information exchange between actors. Also, main problem is information exchange from the seaside – between ships and port. Because of that problem, in the last few years, there were few accidents where ships made a collision with the terminal and made a huge

damage to the operation of the port. Because of that, main focus of the port should be in informatization of operations and information exchange.

13. SWOT Analysis

		POWER OF INFLUENCE	
		LOW	**HIGH**
INTEREST	**LOW**	<u>Marginal Stakeholders</u> 1. Croatian Railways 2. Croatian Motorways 3. ARPA Agency of the Republic of Croatia 4. International Maritime Organization- IMO 5. Marine Environment Protection Committee - MEPC	<u>Relevant Stakeholders</u> 1. Town of Ploce - Physical Planning Department 2. Dubrovnik-Neretva County - Institute for Regional Planning 3. Shipping companies 4. Cruise companies
	HIGH	<u>Operative Stakeholders</u> 1. Terminal Operators 2. Pilot Service of port of Ploce 3. Tows service of port of Ploce 4. Mooring services of port of Ploce 5. Shipping agencies 6. Forwarding agencies	<u>Key Stakeholders</u> 1. Croatian Ministry of Sea, Transport and Infrastructure 2. Hydrographic Institute of the Republic of Croatia-Split 3. Plovput d.o.o. - Split - A state-owned enterprise based in Split, Croatia with the main purpose to maintain Aids to Navigation and maritime radio-traffic in Croatian part of the Adriatic 4. Harbour Master's Office of Ploce 5. Croatian Association of Port Authorities

Table 15 CLASSIFICATION OF THE STAKEHOLDERS

(SOURCE: PORT OF PLOCE AUTHORITY)

STRENGTHS

- Geostrategic and traffic position which enables a quality maritime connection both with the cities on the Adriatic Coast and in Italy and with the ports in the entire world. It is directly connected with its hinterland in Bosnia and Herzegovina and also with the North-East of Croatia, as well as with Central Europe by railway and by road (E-73), which stretches along the route of Corridor Vc (Budapest-Osijek-Sarajevo-Ploče). The Port of Ploče is also located next to the motorway (E-65 - the quickest connection between the port of Ploče and Zagreb), the state road (D8) that stretches from Trieste via Rijeka and Split to the extreme South point in this part of Europe.
- Terminal infrastructure
- Port Community System
- Level of security
- Competitive prices
- Wide gravitational area
- Characteristics of the port area suitable for berthing, performance of port operations, and the organization of intermodal transport and connections with the hinterland
- Specialized terminals

WEAKNESSES

- Port loading and storage capacities
- Limited capacity and flow of rail traffic
- Underdeveloped multimodal transport
- Criteria for determining justification, priority and approval for major infrastructures and other development projects are not clearly defined
- Revenues per square meter of concession areas
- Lack of long-term and strategic plans
- Lack of response capacity in the event of major contamination and other major emergencies
- Operations of port authorities are often not harmonized and coordinated
- Lack of financial resources for funding large strategic projects

OPPORTUNITIES

- Create more favorable conditions for private investments in the construction of port infrastructure and specialized port terminals through various forms of public-private partnership

- Encourage the use of renewable energy
- Encourage the use of innovative port solutions to prevent environmental pollution
- Attract high-tariff cargo in ports
- Development of the port as a logistics hub for the wider hinterland
- Integration with national AIS / CIMIS system
- International cooperation and partnerships in the wider European area
- Development of a hub for foreign trade for Central European countries that do not have access to the sea
- Incensement in traffic demand by creating long-term partnerships
- Partnerships between all stakeholders within the intermodal route – Joint marketing appearances of all stakeholders with a comprehensive package of services controlled price and quality
- Increasing the competitiveness of the port and customer satisfaction through better organization of the port system and management of the quality of services
- Introducing a system of education and certification of port workers in order to raise the level of security, flow and quality of services
- Harmonization and development of other infrastructures (roads and railroads)
- EU accession of neighboring countries
- Opportunities from European funds
- Designing and implementing modern technologies
- Modernization and development of port infrastructure and superstructure
- Short sea shipping between Italy and Croatia (Motorways of the Sea)
- Environmentally friendly solutions for maritime transport and maritime transport infrastructure
- Completion of Corridor Vc

THREATS

- Inconsistency of investment and market demand
- Lack of standardizing services
- Reduction of the national co-financing
- Lack of coordination and cooperation with operators and service operators within the intermodal transport corridor
- Inadequate marketing mix
- Lack of mechanisms for managing and directing the behavior of port operators
- Inability to meet safety standards

- The lack of improvement of the system in terms of competence, professionalism, organization, responsibilities and information flows
- Weak economic growth in the Eurozone
- Competition between the ports of the northern European passage and the transshipment ports of the Mediterranean hub
- Cyber security issues
- Strong impact of potential marine pollution on economic development and sustainability
- The risk of an increase in marine casualties with a negative impact on the environment

14. Analysis of IT Systems

Port of Ploče Authorithy has implemented a Port community system designed to support processes and stakeholders involved in cargo, vessel, truck announcing and other forwarder to port related operations. At present time there are two IT systems in use at port of Ploče community. A new PCS system and the system ECCOS used for recording persons accessing port area through Luka Ploče main gate.

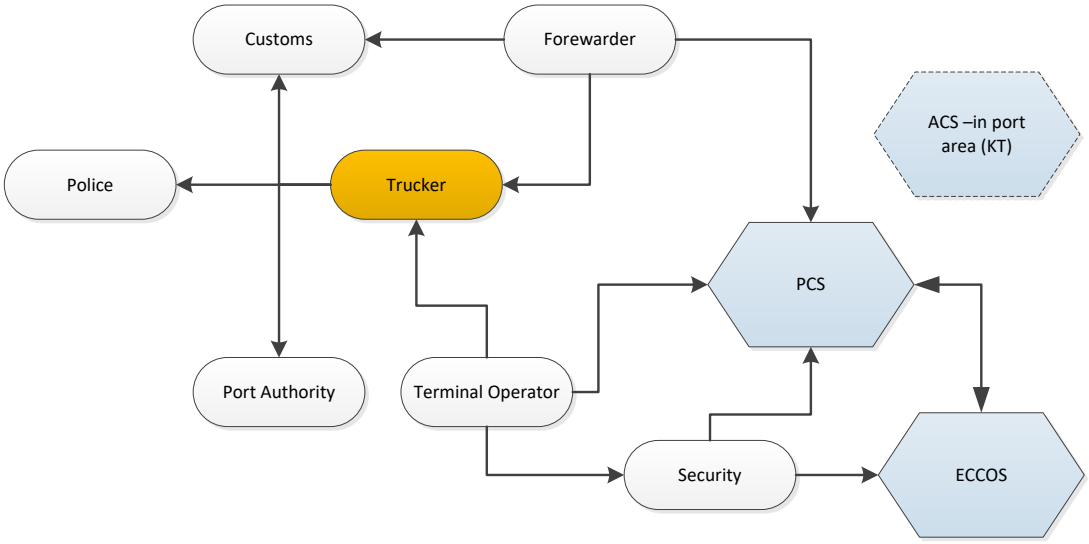


Diagram 1: System overview and stakeholders interactions

As listed in table below, there are several stakeholders that have active role in processes connected to truck announcing procedures. However, there is a third system on port area in function of monitoring and video surveillance.

13.1 Involved parties and roles

On the basis of the common agreement between the project partners about the list of the processes which should be considered, the Port of Ploce Authority listed all stakeholders in the port community , divided them into the groups on the basis of the core business activity and then

selected minimum one and in some processes even more representatives who were interviewed. The crucial criteria for the selection was the level of the involvement in relevant processes, then the size and volume of the activities, as well as the readiness to cooperate in the interview.

List of the stakeholders which are identified:

Terminal operators	Forwarding agents	Public institutions	Port Security
1. Luka Ploče d. d. **2. Adriatic Tank Terminal d.o.o. Ploče** **3. NTF d.o.o. Ploče** **4. Top Logistics d.o.o**	1. INA d.d. 2. Trans integral d.o.o. 3. Jadroagent d.d. Ploče 4. Adriatic Tank Terminal d.o.o. Ploče 5. Luka Šped d.o.o. 6. Ploče Šped d.o.o. 7. Petra Marina d.o.o	1. Port of Ploce Authority 2. Customs	1. Port security d.o.o.

Table 16 - PCS List of the stakeholders which are identified

13.2 IT system in use

During analysis Port of Ploče Authority had two IT systems in use. The system for persons and vehicles access control into port of Ploče area, Technical security system and newly build, but not yet fully implemented IT system for broader port community, Port Community System Ploče.

13.2.1 PCS (Port Community System

Port Community System is a centralized and automated system for exchanging of information and documentation between organizations and marine transport authorities. It is based on data exchange automation opportunities and the known international standards and requirements of the port's electronic interaction between the related organizations, systems and customers, transportation terminals, railway and customs administration. Part of PCS system is aimed at covering truck announcements. PCS as main system for all parties involved in port community has been planned to interact and exchange messages regarding truck announcements with Technical Security system used by Port Security.

Constructing modern port terminals, while maintaining the existing level of communication between the parties in the “port community” that is characterized by frequent untimely submission of information, the number of paper documents in which one information is entered several times, the lack of coordination and long duration of the procedures, could not result in full improvement of the efficiency and competitiveness of the port and the overall transport route. Therefore, Port of Ploče Authority decided to start activities on development of the PCS system of the port of Ploce.

The objective of the PCS is to develop a centralized, web-based and intelligent electronic message switching facility between the all port community members. Through a web-based application all port stakeholders will be able to access to all relevant information in secure fashion. This would provide a single source and an integrated standardized process for data exchange with links to the systems of port stakeholders.

This integration and data exchange will show that different information systems in different port organizations can exchange data efficiently and provide benefit to whole port community.

Key drivers for the establishment of Port Community Systems were, on the one hand, the need for a standardized communication platform in order to improve the systems in terms of punctuality, reliability or costs and, on the other hand, the need to increase competitive position among ports.

A good collaboration with the key authorities, as well as with stakeholders, potential customers and local trade associations, was critical in the setting up of the respective PCS which were – and still are – implemented by means of special training and workshops with the end users.

While target market areas differ widely in terms of existing IT infrastructure and use of functionality, it is arguable that where little or no automated processes are in place either at frontier, port or fiscal and regulatory level, the PCS is ideally placed to form the foundation or backbone of the Single Window vision.

Figure 22 - PPA Port Community System

PCS is a centralized and automated system for exchanging of information and documentation between organizations and marine transport authorities. It is based on data exchange automation opportunities and the known international standards and requirements of the port's electronic interaction between the related organizations, systems and customers, transportation terminals, railway and customs administration. Part of PCS system is aimed at covering truck announcements. Although the functionalities for truck announcement process are developed there is no agreement yet who will prepare the announcement. PCS as main system for all parties involved in port community has been planned to interact and exchange messages regarding truck announcements with Technical Security System.

After user login, the main screen appears:

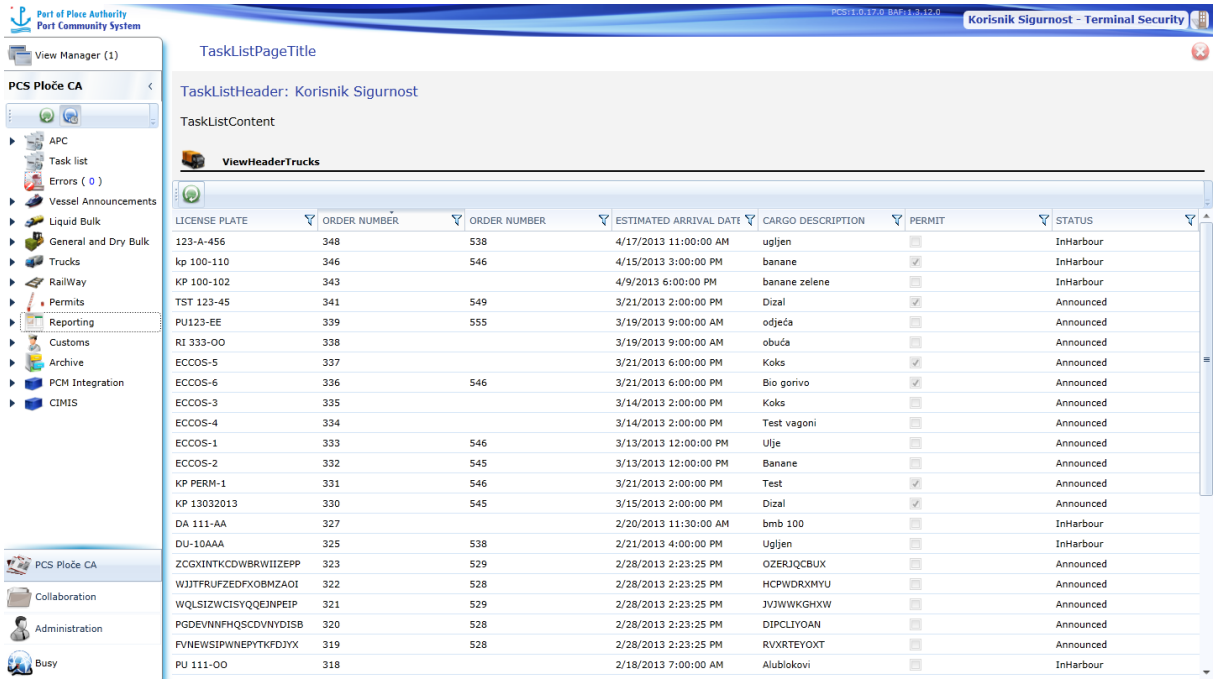


Figure 23 - PCS screen example #1

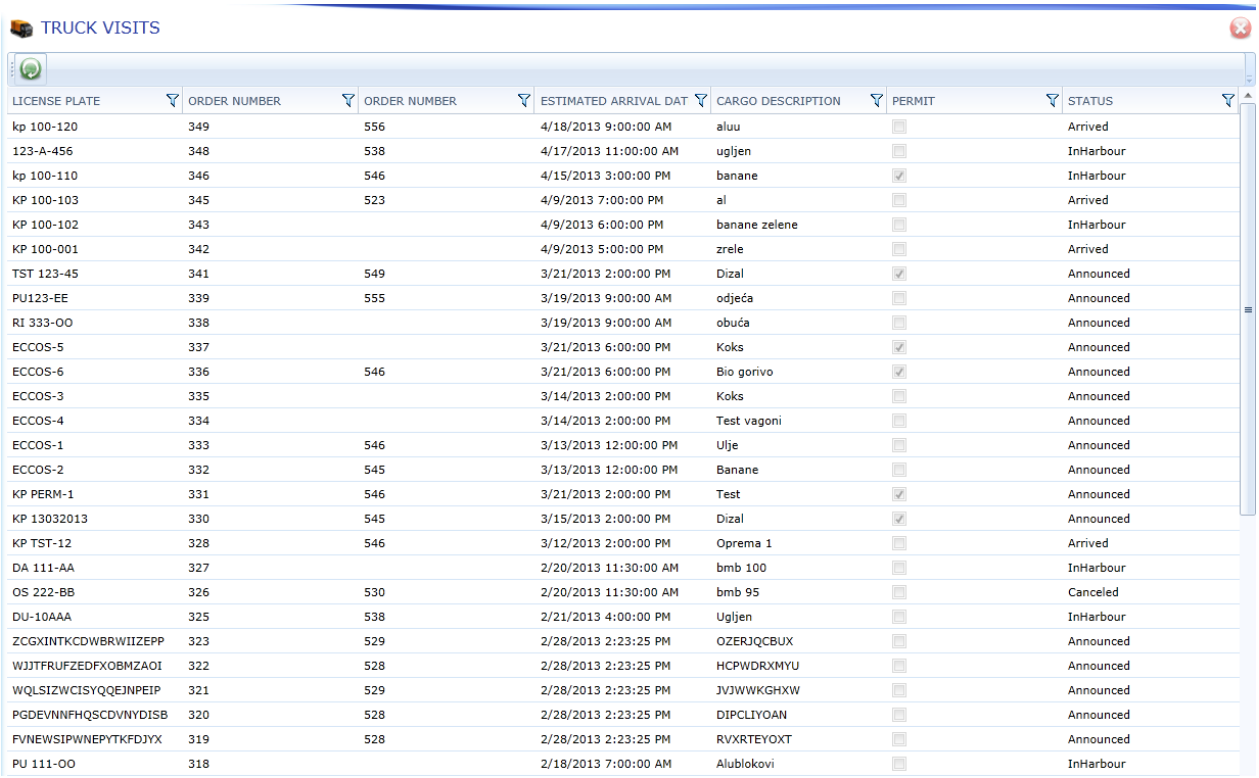
In PCS Menu there are different modules. Modules are APC, Vessel announcement, Liquid Bulk, General and Dry Bulk, Trucks, Railway, Permits, Reporting, Customs, Archive, PCM Integration, CIMIS.

Module APC is used to input data in IMO files.

Vessel announcement module enables working with vessel announcements, meaning that all action about vessel´s arrival and departure can be done by Vessel announcement module.

Liquid Bulk, General and Dry Bulk module enables working with dispositions (work orders). These modules also enable warehouse documents saving.

Trucks module enables working with truck announcements.



LICENSE PLATE	ORDER NUMBER	ORDER NUMBER	ESTIMATED ARRIVAL DAT	CARGO DESCRIPTION	PERMIT	STATUS
kp 100-120	349	556	4/18/2013 9:00:00 AM	aluu	☐	Arrived
123-A-456	348	538	4/17/2013 11:00:00 AM	ugljen	☐	InHarbour
kp 100-110	346	546	4/15/2013 3:00:00 PM	banane	☑	InHarbour
KP 100-103	345	523	4/9/2013 7:00:00 PM	al	☐	Arrived
KP 100-102	343		4/9/2013 6:00:00 PM	banane zelene	☐	InHarbour
KP 100-001	342		4/9/2013 5:00:00 PM	zrele	☐	Arrived
TST 123-45	341	549	3/21/2013 2:00:00 PM	Dizal	☑	Announced
PU123-EE	339	555	3/19/2013 9:00:00 AM	odjeća	☐	Announced
RI 333-OO	338		3/19/2013 9:00:00 AM	obuća	☐	Announced
ECCOS-5	337		3/21/2013 6:00:00 PM	Koks	☑	Announced
ECCOS-6	336	546	3/21/2013 6:00:00 PM	Bio gorivo	☑	Announced
ECCOS-3	335		3/14/2013 2:00:00 PM	Koks	☐	Announced
ECCOS-4	334		3/14/2013 2:00:00 PM	Test vagoni	☐	Announced
ECCOS-1	333	546	3/13/2013 12:00:00 PM	Ulje	☐	Announced
ECCOS-2	332	545	3/13/2013 12:00:00 PM	Banane	☐	Announced
KP PERM-1	331	546	3/21/2013 2:00:00 PM	Test	☑	Announced
KP 13032013	330	545	3/15/2013 2:00:00 PM	Dizal	☑	Announced
KP TST-12	328	546	3/12/2013 2:00:00 PM	Oprema 1	☐	Arrived
DA 111-AA	327		2/20/2013 11:30:00 AM	bmb 100	☐	InHarbour
OS 222-BB	326	530	2/20/2013 11:30:00 AM	bmb 95	☐	Canceled
DU-10AAA	325	538	2/21/2013 4:00:00 PM	Ugljen	☐	InHarbour
ZCGXINTKCDWBRWIIZEPP	323	529	2/28/2013 2:23:25 PM	OZERJQCBUX	☐	Announced
WJJTFRUFZEDFXOBMZAOI	322	528	2/28/2013 2:23:25 PM	HCPWDRXMYU	☐	Announced
WQLSIZWCISYQQEJNPEIP	321	529	2/28/2013 2:23:25 PM	JVJWWKGHXW	☐	Announced
PGDEVNNFHQSCDVNYDISB	320	528	2/28/2013 2:23:25 PM	DIPCLIYOAN	☐	Announced
FVNEWSIPWNEPYTKFDJYX	319	528	2/28/2013 2:23:25 PM	RVXRTEYOXT	☐	Announced
PU 111-OO	318		2/18/2013 7:00:00 AM	Alublokovi	☐	InHarbour

Figure 24 - PCS Truck visit screen

If user selects one of the truck announcements, selected truck announcement screen will appear.

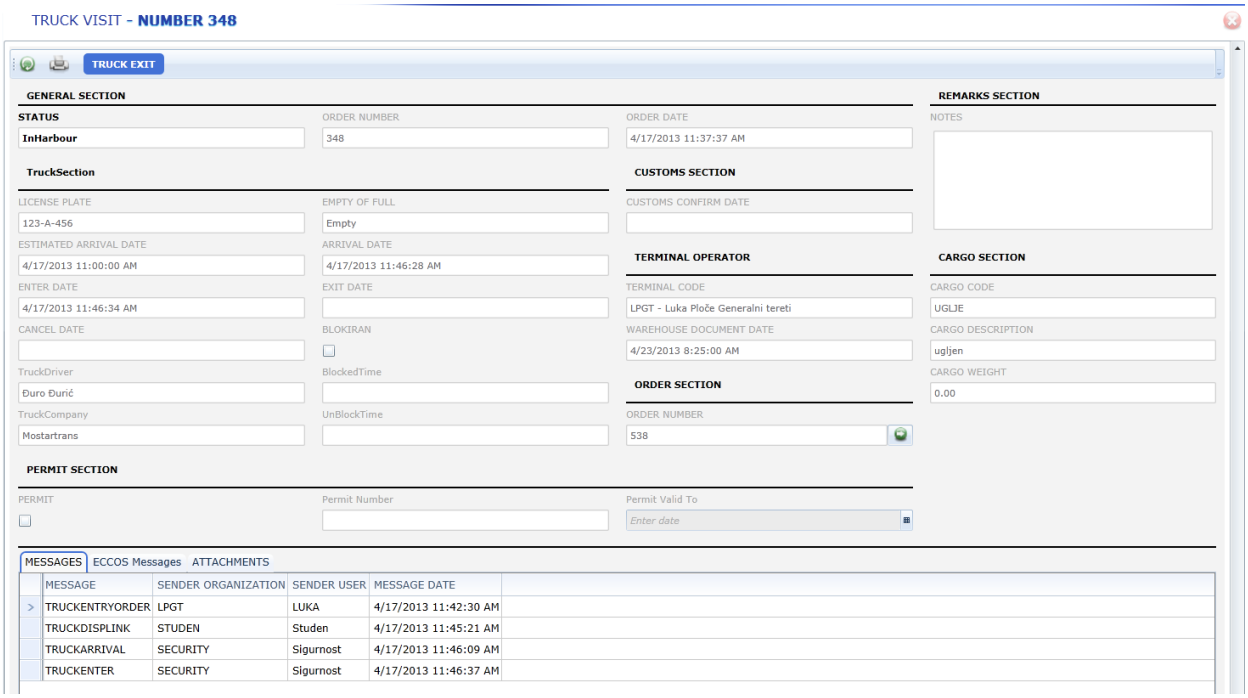


Figure 25 - Detailes of the truck visit screen PCS

Truck announcement screen contains all necessary information about truck.

Railway module enables working with wagon announcements.

Permits module enables working with vehicle permits. Vehicle permits can be issued, modified, printed and saved.

Reporting module is used to save or print different reports, such as Customs report, Cargo report, Vessel report.

Customs module enables customs to search different documents, such as warehouse documents, No obstacles documents, etc.

PCM module is used for all action regarding containers.

CIMIS module is connected with the Croatian Ministry of maritime affairs, transport and infrastructure.

13.2.2 Technical Security System

System used by the Port security company to record and control all persons entering and exiting the port area. Port security officer is manually entering data into system. Each person entering the port area has to be recorder in system. In case person is entering with vehicle the license plates and company names are added to driver data.

Port security officer is able to search through history and is able to monitor how many vehicles are present on port area. However, there is no toll to monitor or to keep track of where those vehicles are. Through system the officer is able only to see when each vehicle or person has entered through main gate and when each vehicle or person has exited through main gate. There is no option to keep a record when a vehicle has arrived at external or internal parking, neither when a vehicle has arrived at dedicates quay or port terminal.

In conclusion, system provides limited report options to port security offices that are in charge of providing security. Based on different interviews the officer did not express any concerns regarding different report as there is no need to issue any truck or persons visits reports, congestion reports or to keep statistics about vehicles and pedestrians entering the port area.

13.3 Identification of the main changes and improvements

13.3.1 General Procedure Requirement

a. **Automation procedures and information exchange**:
   - All data will be entered only once into the system;
   - Implementation of recognition systems (truck plate recognition, driver licence recognition...);
   - Automation of ramp (automatic rise, block...).

b. **Information/data exchange** between different information systems has to be made where reasonable. With information exchange between AGS and PCS can improve process execution, data reliability and single entry of data.

c. **External park lots** - there will be a quick enter process on the external entrance gate; when the truck arrives at the external entrance gate, plate recognition system will recognize truck plates; driver takes the PIN 1 barcode list or show RFID device, and the gate will open. If plate recognition system will not recognize truck plate, entrance

procedure is same (truck driver always takes the PIN 1 barcode list) and the gate opens. Daily entrance vehicle permits will be payed at the kiosk. After the driver documents are scanned, and all other documents for entering are prepared, driver will pay the vehicle daily permit by inserting the PIN1 into Kiosk. The truck driver will pay the parking fee only if the truck is parked more than 3 hours in the external parking lot. The parking fee will also be paid at the kiosk by inserting the PIN1. PIN1 barcode ticket or RFID card will "carry" all the data about truck, driver, vehicle permit, and driver ID.

d. **Entrance/exit point** – officers order at port entrance is police, customs, port security. At the port entrance point there are plate recognition system and video surveillance.

e. **Tracking truck all-over the port area** – at the entrance truck driver receive RFID device and all trucks will be tracked inside the port area using plate recognition system and RFID devices.

13.3.2 Renewed process (use cases)

The information collected prior to the arrival of the vehicle at the port and during the completion of its job inside the port is used to provide the customs police with as many details as possible regarding the goods in transit and supporting documents (especially customs documents). The customs police can make any additional checks on the basis of this information rather than on the basis of further paper documents the truck driver can exhibit.

Alongside the "logistic" checks to establish the feasibility of vehicle jobs, the port entrances also have to perform security checks. The integration of these two processes and of their supporting systems improves reciprocal efficiency and effectiveness and speeds up vehicle transit operations.

All truck and goods entry or exit from harbour must be preceded with approved announcement, declaring:

- The plate number of the incoming/exiting vehicle
- The driver's identity (name, surname)
- The terminal operator at which loading or unloading operations are to be performed
- The type of operation to perform and details of the goods being transported

Conditions for a truck to enter a port area are:

- **A truck must have an announcement**
- **A truck must pay an entry permit (daily, half-annual or annual)**
- **A truck must have a terminal confirmation for entrance**

The following figure summarizes the operative moments at the port gate supported by Automatic Gate System and the events that determine the information exchange inside the port areas.

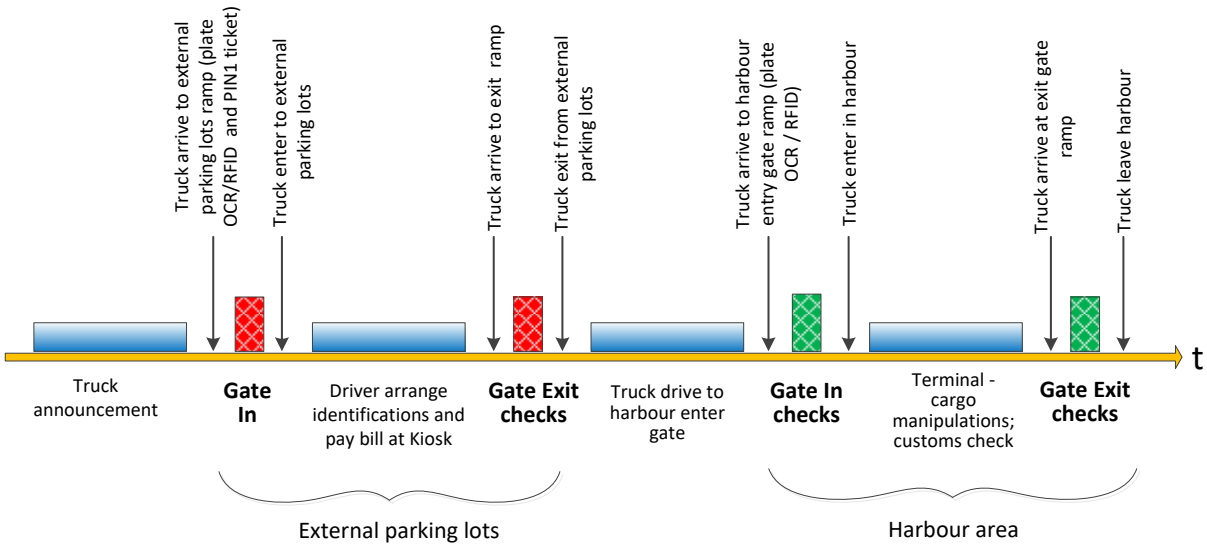


Figure 26 - Entrance and exit process

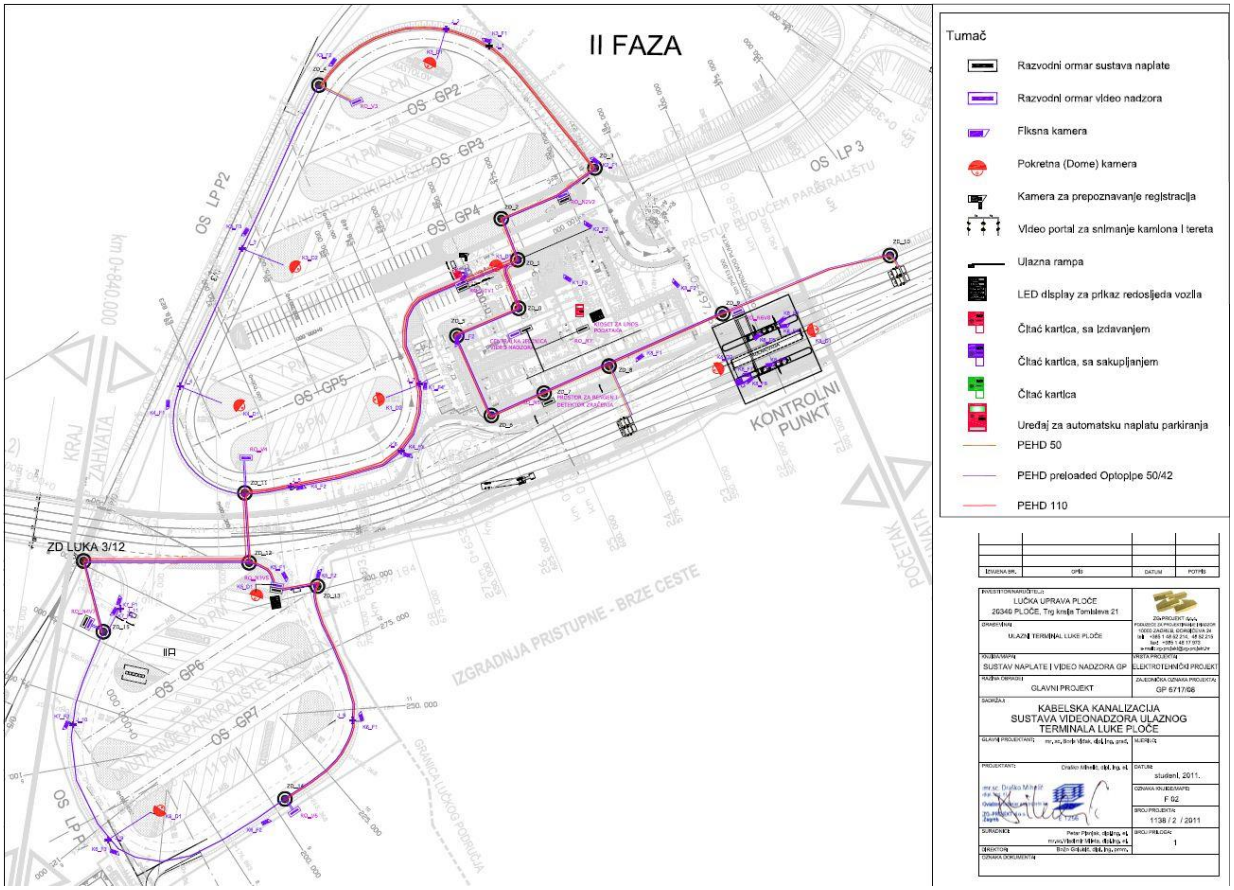


Figure 27 - New entrance technological schema

13.4 External parking lots

13.4.1 Arrival and entrance to external parking lots

Process requirements for entrance at external parking lots is that the truck entrance must be as quick as possible. Minimal identification data have to be collected at entry gate. The truck arrives at the entry gate (an entry barrier on external parking lots).

13.4.2 Identifying the vehicle

When the truck arrives in front of entry barrier of external parking lots the induction loop under truck activate the ANPR and ADR system.

The ANPR camera takes a snapshot of the truck plate. The information system recognises the truck plate number and sends it to AGS system. If the truck announcement exists for the scanned truck plate number, plate data are combined with the truck announcement in AGS system.

At the same time the ADR system recognises dangerous cargo code and send information to AGS system. In case the truck driver already has a temporary RFID device (annually or half annual entry permit) there is no need for PIN1 ticket. The driver just reads his RFID card (instead of take PIN1 ticket) and RFID data are joined in truck announcement, plate data and ADR data. Semaphore green light will be turned on, gates will open, truck enters on external parking lots.

If there is some problems and green light not lights (lights red light), the driver can use the Intercom device for communicating with Info desk. For example, when maximum allowed dangerous cargo on parking is reached, truck enters with dangerous cargo is not allowed.

When a visitor approaches to external parking gate, OCR system will take a snapshot of vehicle plates. After successfully recognition process on semaphore lights green light.

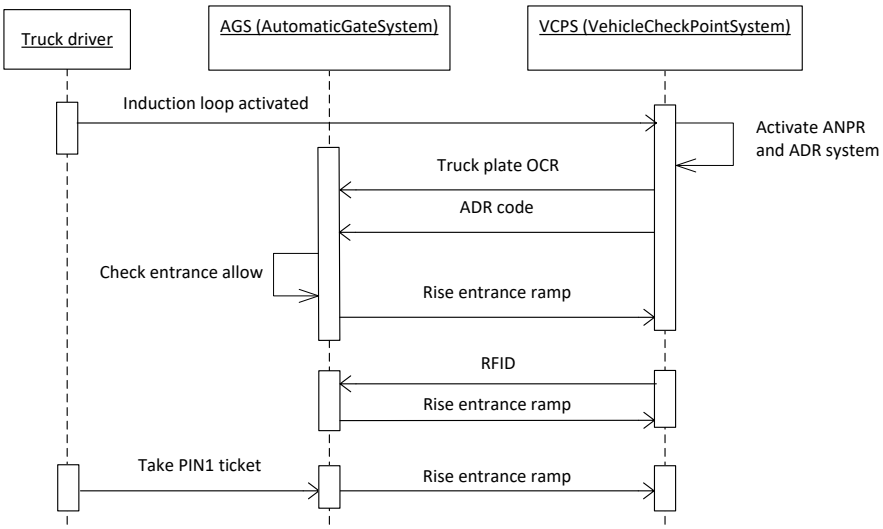


Figure 28 - Entrance procedure on external parking lots - sequence diagram

13.4.3 Identifying the truck driver and visitor

Truck driver goes to the Kiosk. Put the PIN1 ticket or temporary RFID card into the kiosk slot and choose if he is a truck driver or a visitor.

If a truck has a half-annual or annual permit, driver puts an RFID card into the kiosk slot, and proceeds with identifying procedure.

In case the truck plate was not correctly recognised at the entry gate, the driver has to manually input or correct the plate number. Plate number data inserted by the driver is then combined with the truck announcement and linked to PIN1 ticket ID (or to temporary RFID card).

13.4.4 Pay the parking fee and daily truck entry permit

Once there is a valid announcement and the driver checked, the driver can pay daily entry permit for the vehicle at a Kiosk. On the screen, choose entry permit options. A daily permit fee can be paid at Kiosk with credit card or cash.

If the truck driver uses valid temporary permit (RFID card) at Kiosk the system show entry permit expires date.

If the truck is parked more than three hour on external lots also parking fee has to be paid.

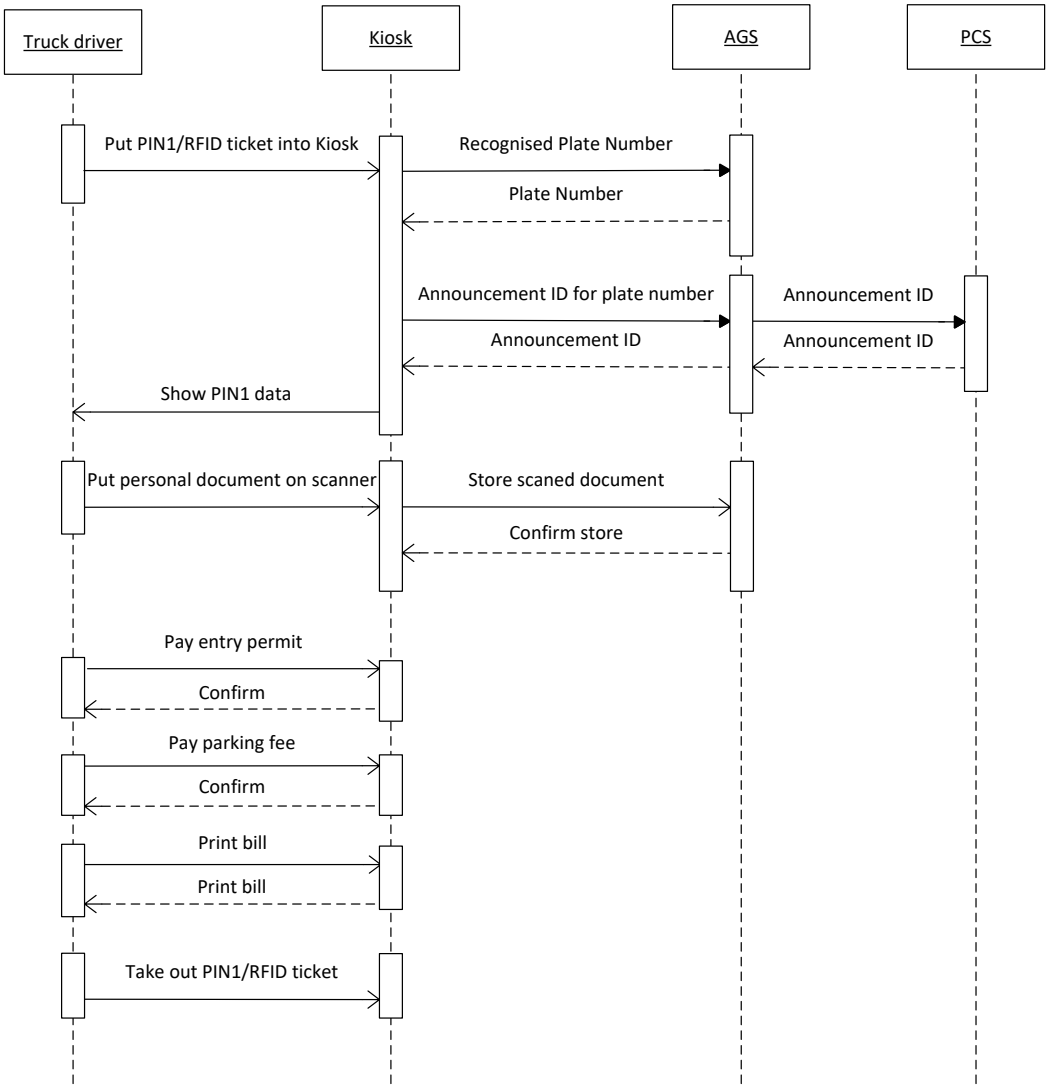


Figure 29 - Identifying driver, vehicle and bill procedures – sequence diagram

13.4.5 Arrange other documents

Before exiting the external parking, lots and enter in harbor driver has to arrange all necessary documents (customs check disposition...).

The driver can watch his status on the Info panel, which is located in the building of truck terminal and on external parking lots.

An example of the Info panel is on the picture below.

Truck	Terminal	Time	Announcement	Operater	Driver	Entry permit	Parking	Entrance
CE94U67	NTF	23.4.2013 9:40	●	●	●	●	● 3:50	●
ST097ST	LPT	23.4.2013 10:40	●	●	●	●	● 1:30	●
DU769GH	NTF	23.4.2013 10:40	●	●	●	●	● 2:50	●

Figure 30 - Info panel

Note: If “Parking” red light is on, truck´s queue will not change. If a truck is on the top of the list, truck can enter first, but Parking red light is a piece of information for driver, meaning that parking must be paid before exit of external parking lots.

Truck	Terminal	Time	STATUS
CE94U67	NTF	23.4.2013 9:40	ENTRANCE
ST097ST	LPT	23.4.2013 10:40	WAITING
DU769GH	NTF	23.4.2013 10:40	WAITING

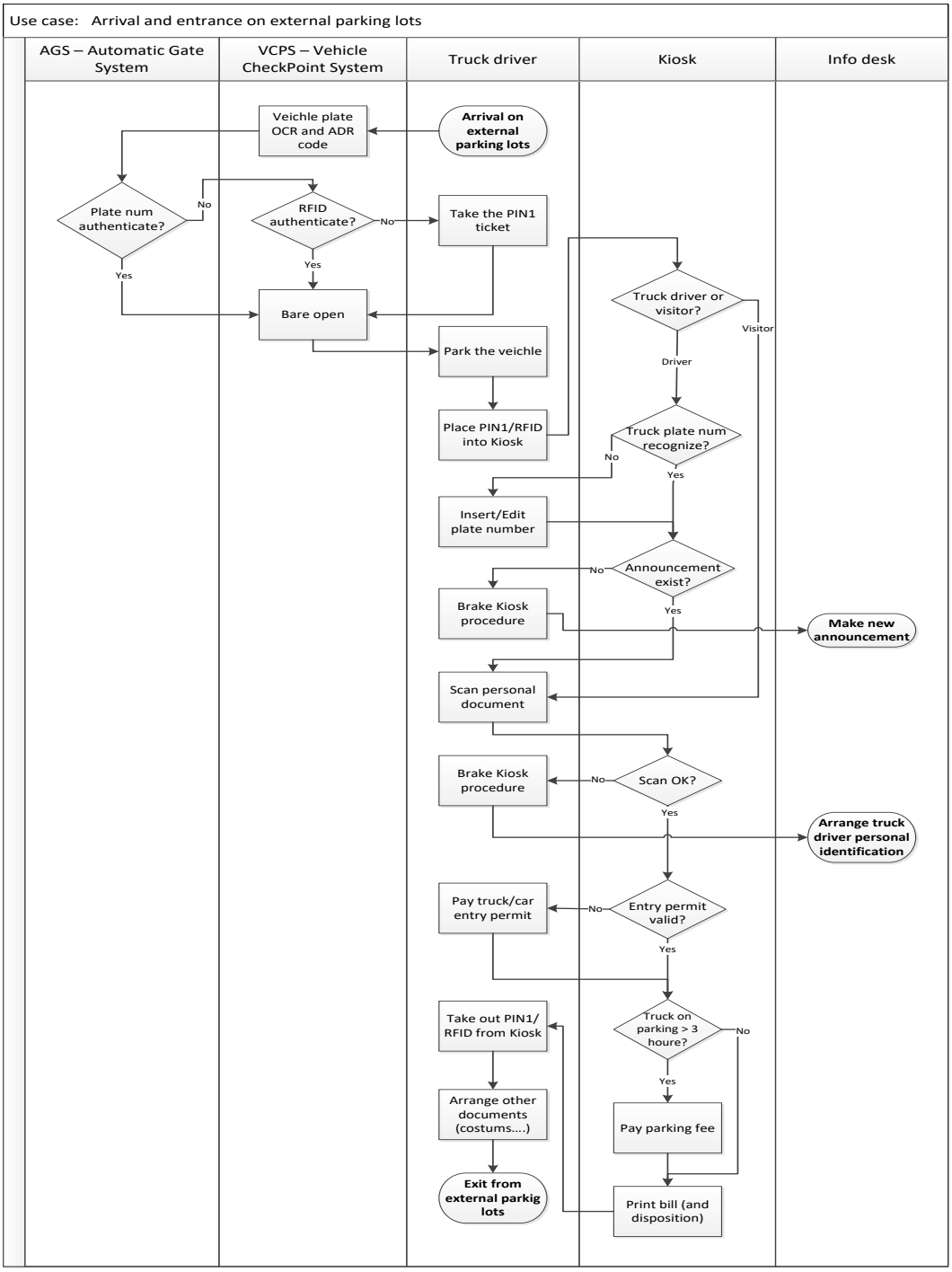


Figure 31 - Entrance at external parking lots – process chart

13.4.6 Exit from external parking lots

When all conditions are fulfilled and truck is for entering in harbor, the truck approaches the exit ramp from parking.

When the truck arrives in front of exit barrier the induction loop under truck activate the ANPR system and truck plate are once more read by OCR.

If the truck has a daily permit, driver reads the PIN1 ticket barcode and if parking fee is arranged semaphore green light is on and gates open.

If the truck has a temporary permit (half-annual or annual), the driver reads an RFID card, semaphore green light is on and gates open.

If there is some problems and green light not lights (lights red light), the driver can use the Intercom device for communicating with Info desk.

Parking building employees (ship agents, forwarders, custom officers, LUP officers…) exit the external parking lots with their RFID device.

Visitors exit the external parking lots with PIN1 ticket given at the entrance. When a visitors' car arrives in front of exit barrier, the induction loop under vehicle activates the ANPR system, vehicle plates are read by OCR. Driver of the visitor's vehicle reads the PIN1 ticket and if parking fee is arranged semaphore green light is on, the gate opens.

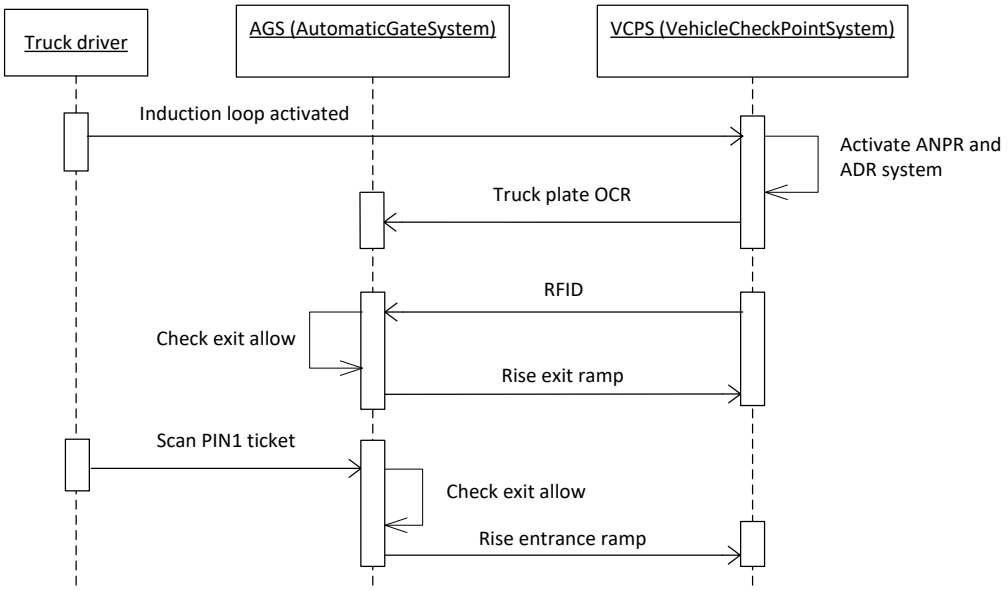


Figure 32 - Exit procedure from external parking lots - sequence diagram

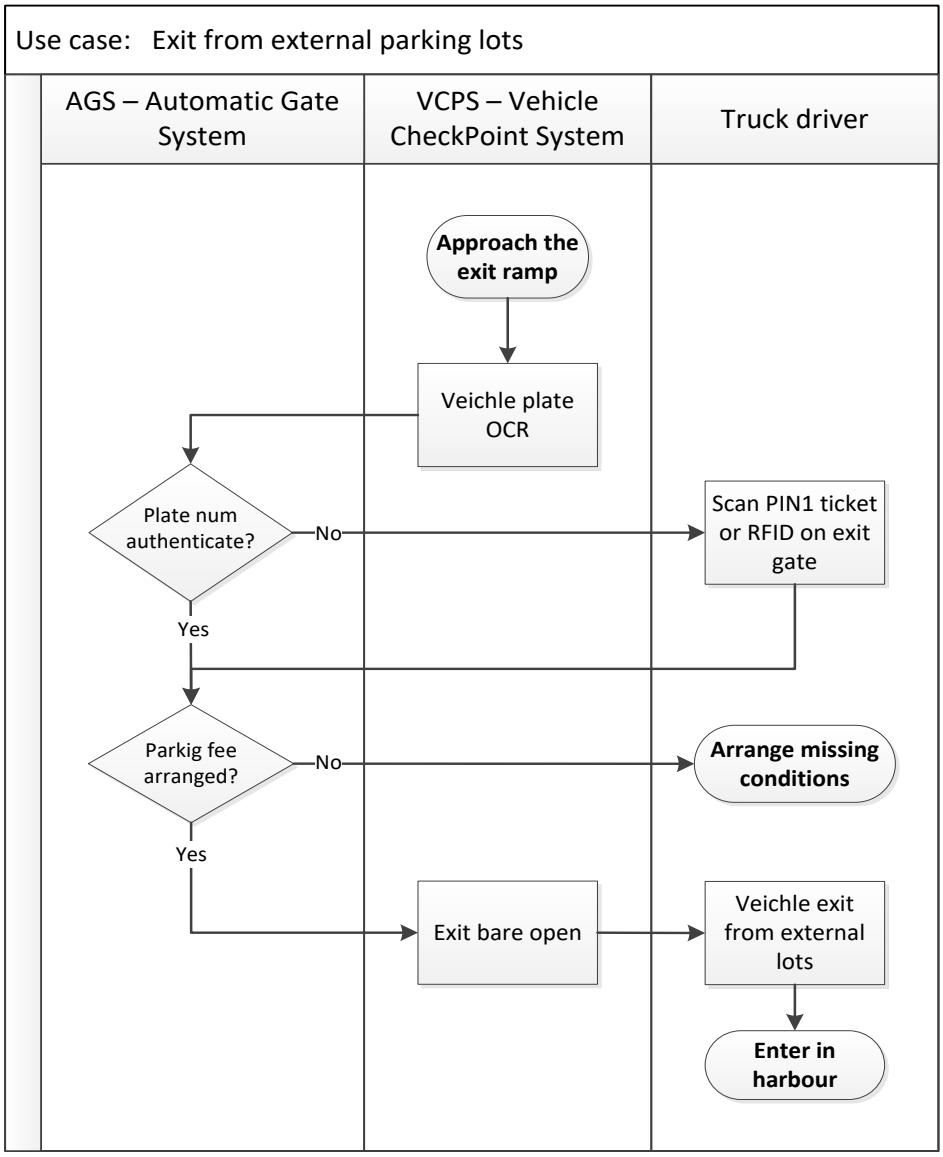


Figure 33 - Exit from external parking lots – process chart

13.4.7 Vehicles entering in the harbour

Between external parking lots and port entry point, there will be a **Video portal** for the truck all side pictures. Video portal will be placed on both truck entry lanes. At the top of video portal will be placed **Info semaphore**, which indicate if the lane is open or close (red cross or green light). When a truck passes the induction loop, snapshots of truck plates (front and rear) and truck front, back, top and side are taken. Also, an ADR label of dangerous cargo is recorded. All pictures and ADR label is stored in an information system under truck plate number (and pin to PIN1 ticket label).

Note: When truck pass Video portal driving speed is limited at 30 km/h. At the front of Video portal can be placed traffic sign for limited speed. When the truck arrives at Video portal and the OCR plate number is made, employers at entry gate are alerted of truck arrival and all information and picture of the scanned truck plate are available. Between video portal and entry gate the truck entry order (truck overtaking) or drive lane must not be modified.

Truck stop before the first entry gate ramp and driver is first checked by Port Police (valid driver licence, passport...). If there is no problem policeman rise first ramp and truck can proceed and stop at the second ramp. Then Custom check truck cargo and if allowed truck entrance in port acknowledge the approval in the PCS system (Block/Unblock message). The driver gives a PIN1 ticket to the Port Security employee. Using barcode reader and AGS information system he checks out if all requirements are fulfilled. If all conditions are satisfied Security employee paired PIN1 ticket ID with the new RFID card ID.

Port Security employee retrieves PIN1 ticket and gives the RFID device to the driver.

Note: If truck driver already has an RFID card (temporary entry permit) the Security officer checks the RFID data.

Then Port Security officer opens the gate, and the truck enters the port area.

Immediately after the entrance in port area the radiation detection device will scan the truck (radiation detection device is installed immediately after port entrance). Radiation detection device is not connected to information system and in case of detection of the radiation red lamp will flash and audio signal will be emitted.

If any problem arise and truck not have permission to enter the harbour area the Security employer rise entry ramp and allow the truck controlled turns and immediately leave the port area.

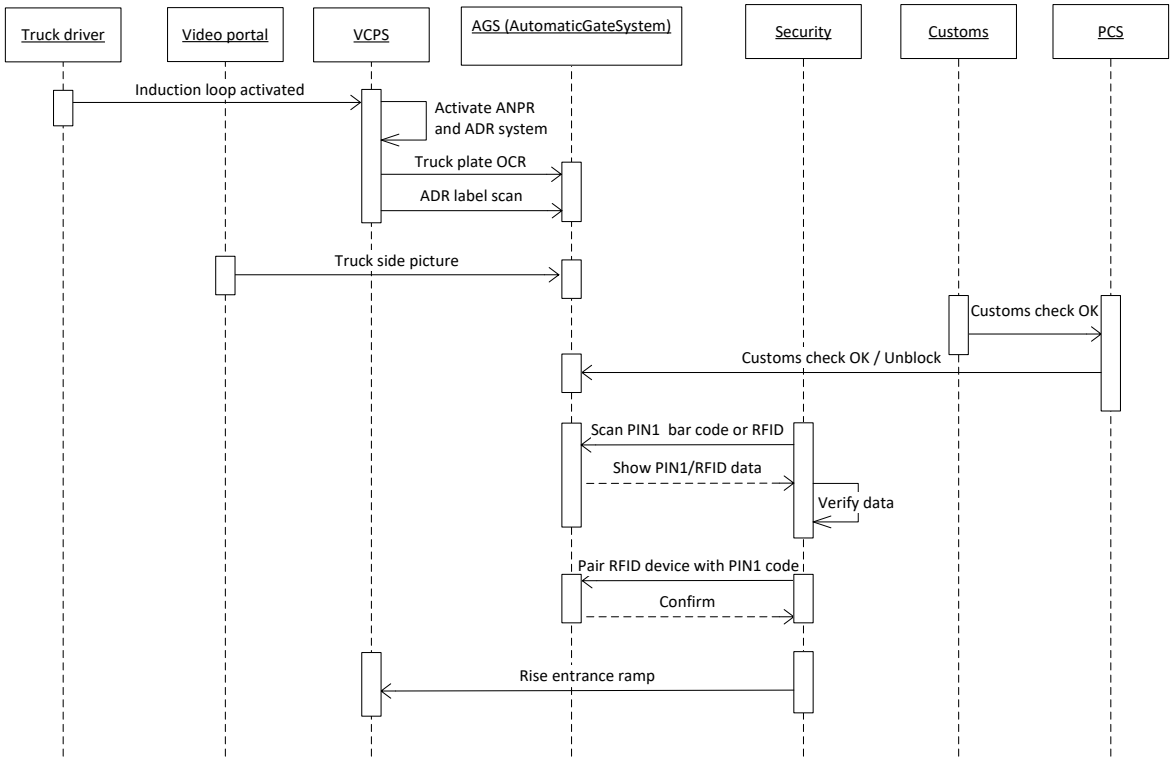


Figure 34 - Entrance procedure in harbour area - sequence diagram

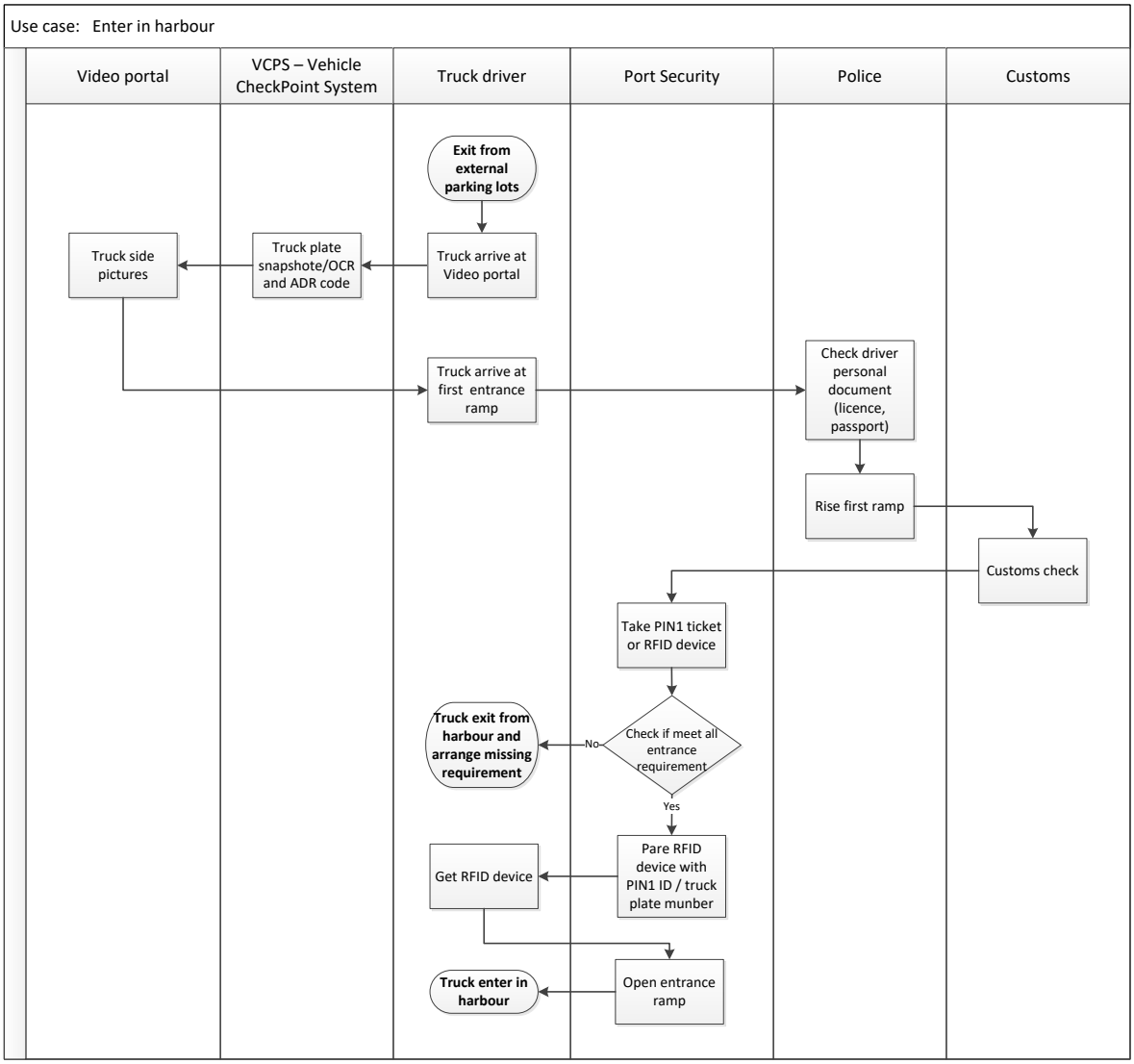


Figure 35 - Enter in harbour – process chart

13.4.8 Arrival on harbour exit point and exit procedures

In harbor area are made cargo manipulations (load or unload cargo). After manipulations ended truck has to leave harbor area. If Custom check or other exit procedures are needed truck must stop on internal parking lots. Trucks approach the internal parking lots ramp and when overpass the induction loop OCR of truck plate is taken. Using RFID card raises the entrance ramp.

After arranging exit documents and custom check the truck leaves the internal parking.

Truck approaches the exit ramp from internal parking lots and when overpasses the induction loop, OCR of track plate is taken and using RFID device raise exit ramp.

If there is some problems green light not lights (lights red light) and ramp does not rise, the driver can use the Intercom device for communicating with Port Security. It here is some problems truck driver can arrange it while staying on internal parking, so the possible traffic congestion at the exit harbor gate is minimized.

Before the truck reaches the port exit gate it has to pass through **Video portal**. Video portal will be placed on both truck exit lanes.

At the top of video portal will be placed **Info semaphore**, which indicate if the lane is open or close (red cross or green light).

When a truck passes the induction loop, snapshots of truck plate and truck front, back, top and side are taken. Also, an ADR label of dangerous cargo is recorded. All pictures and ADR label is stored in the AGS system under truck plate number (and pin to RFID card label).

Note: When truck pass Video portal driving speed is limited at 30 km/h. At the front of Video portal can be placed traffic sign for limited speed

When the truck arrives at Video portal and the OCR number plate is taken, employers at exit gate are alerted of truck arrival and all information and picture of the scanned truck plate are available. Between video portal and entry gate the truck entry order (truck overtaking) or drive lane must not be modified.

The radiation detection device will scan the truck before the exit port area (detection device is installed immediately before the port exit). Radiation detection device is not connected to information system and in case of detection of the radiation red lamp will flash and audio signal will be emitted.

Then the truck reaches the exit gate.

If the truck plate number is not correctly recognized truck driver has to put an RFID card near an exit gate reader. If all exit conditions are met green light lights. If there is any unfulfilled requirement and green light not lights (lights red light), the driver can use the Intercom device for communicating with Port Security.

For temporary and permanent permit (port employers, annual permit...) exit gate bar rises when green light lights.

For daily entrance permit truck driver has to drop an RFID card in exit gate box and exit gate bar rises. The truck can leave harbor area.

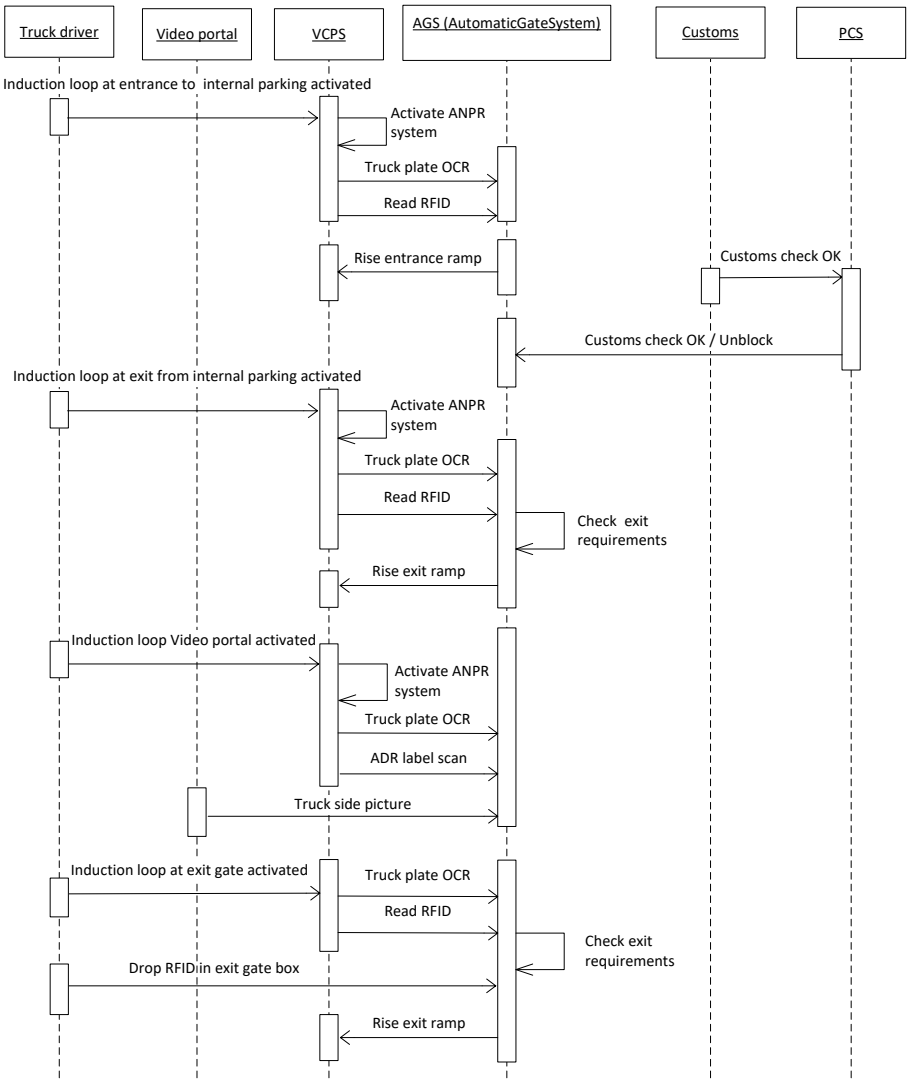


Figure 36 - Exit procedure from harbor area - sequence diagram

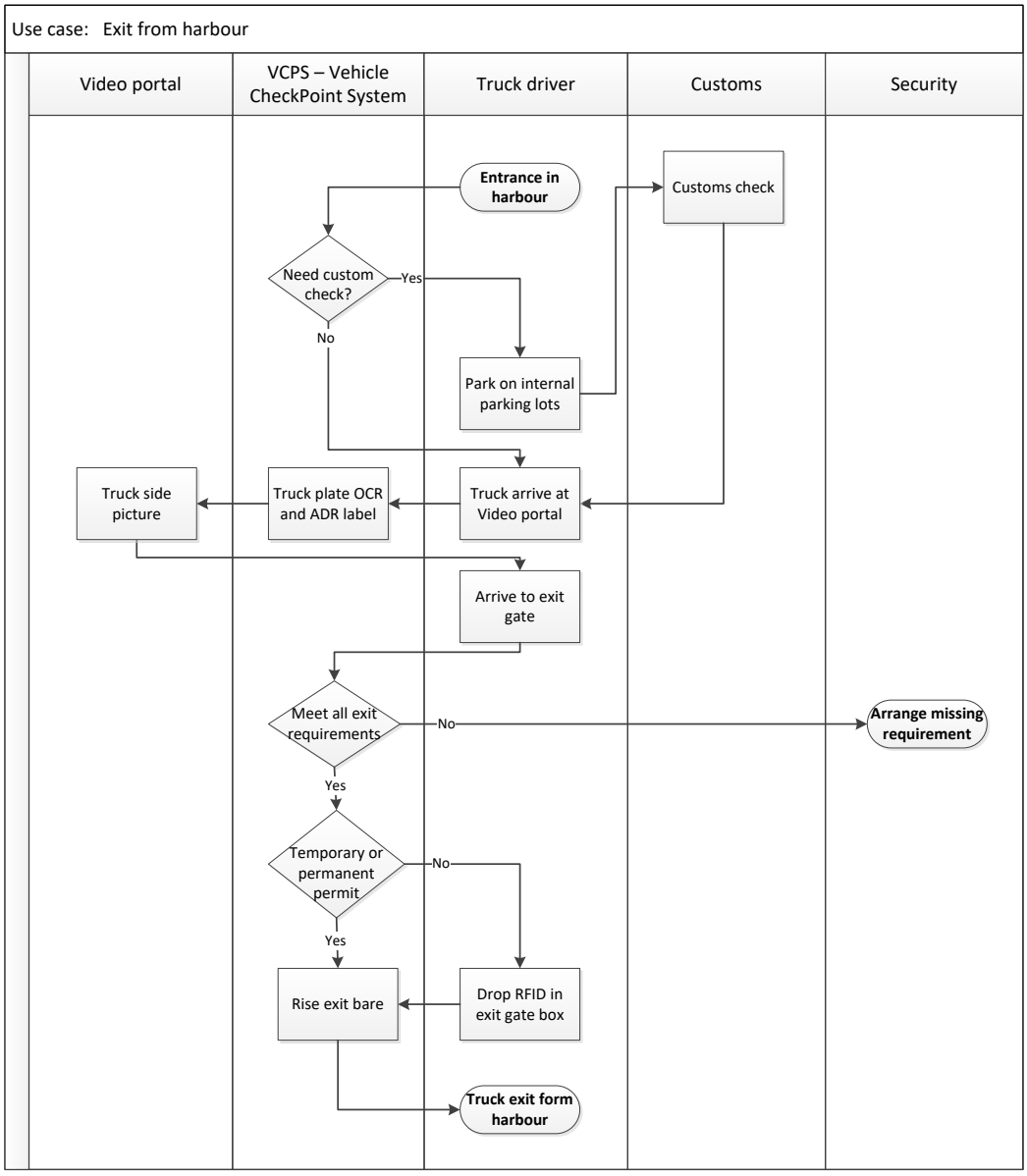


Figure 37 - Exit from harbour – process chart

13.5 Suggestions summary:

- Vehicle permits are no longer printed, that is physically no longer exist.
- Permits for persons no longer printed, that is physically no longer exist.
- Parking on external parking lots is not paid for the first 3 hours.

13.6 Definition of gate in/out scenario for solving bottlenecks

13.6.1 Automatic Gate System (AGS)

The AGS system manages the security of the transits through the port gates with different managing levels:

- It controls permissions at the field devices in the port gates: barriers, traffic lights, bar code, RFID readers;
- Is connected with Kiosk and Event display to provide and get necessary data;
- Collects the data of the users and vehicles to which an access license is issued and the authorization levels;
- Exchange data with other IS systems (PCS, VCPS...)
- Exchange data with other platforms (Port Community. TOS, Maritime window)

Actually, is in the use VCPS system, which provides basic functionality for entrance control (licence plate recognition, RFID or automatic gate bare is in use).

The AGS system manages the security of the transits through the main port gates with different managing levels:

a) it controls permissions at the field devices in the port gates: barriers, traffic lights, bar code, RFID readers;

b) is connected with Kiosk and Event display to provide and get necessary data;

c) Collects the data of the users and vehicles to which an access license is issued and the authorization levels;

d) Exchange data with other IS systems (PCS, VCPS...)

Existing surveillance information system and VCPS system have to be evaluated if they meet new operability and extension requirements.

Automatic Gate System controls entrance on port and based on results of processes exchange information with other platforms in port community

13.6.2 Interaction with Other information systems and platforms

VCPS and AGS must be integrated with other information systems in Luka Ploče where is reasonable. With information exchange between AGS and other IS can improve process execution, data reliability and single entry of data.

The AGS system must be integrated with PCS system. PCS system is in use basically for port business documents storage and process handling. Integration between AGS and PCS must be established for truck announcement, dispositions and customs approval. Truck announcement, dispositions and customs approval will be handled in PCS system, AGS system will only read data from PCS. Key identification element will be truck plate number.

Integration between code lists will be made according to the principle that PCS code list is principal and all new entry and update has to be made in PCS system. Only code lists, which are unique to AGS system will be arranged in AGS system.

Integration is made with Web services technology and SOA architecture.

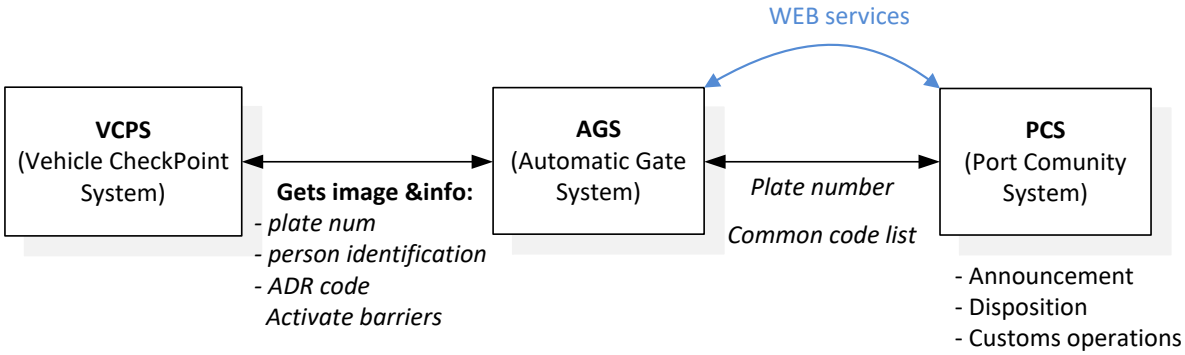


Figure 38 - AGS interaction with other information systems

13.6.3 Integrating AGS and PCS

The table below shows connection between AGS and PCS

Task	AGS		PCS	PCS Status	Executed by
Truck announcement	O	←	X	Announced	Terminal operator, Forwarder or Cargo Agent
Truck announcement update (only LicesePlate, TruckDriver and TruckCompany)	X	→	O	Announced	Terminal operator, Forwader
Entrance in external parking lots	X	→	O	Announced --> Arrived	
Exit from external parkin lots	X				
Arrival on Gate In	X				
Customs check	O	←	X	Block / Unblock	Customs
Entrance in harbour	X	→	O	Arrived --> InHarbour	Port Security
Customs check	O	←	X	Block / Unblock	Customs
Arrival on Gate Out	X				
Exit from harbour	X	→	O	InHarbour --> Departed	Port Security

Legende:
X - primary input
O - replicate by system

Figure 39 - Integration between AG Sand PCS – Message flows

A Truck Announcement message is made in the PCS and is sent to the AGS. The truck announcement has **Announce** status since the vehicle has not yet arrived at the external parking lot. Truck Announcement messages can be updated by the AGS system (Licence plate, Truck Driver, Truck Company, other relevant data), however, when updated, the truck announcement does not change the status. When the truck enters at external parking lots, AGS will send a message to PCS and the status of the truck announcement is changed to **Arrive**. When the truck comes in front of the port entrance, customs may block the truck (when documents are cleared, customs will unblock the ruck and the driver will be able to enter the port area). Both messages (**Block/ Unblock**) will be sent from PCS to AGS. When truck enters in the port area, the AGS will send a message to the PCS. The truck announcement in the PCS will change from Arrived to In Harbour. Upon exit, customs may block the truck. After the customs check is performed, the truck driver will be unblocked. Both messages (block/unblock) will be sent from the PCS to the AGS. When the truck exits the port area, the AGS will send a message to the PCS, and the announcement status in the PCS will change to **Departed**.

13.6.4 Example of PCS message specification

1. *Truck announcement*

TruckAnnouncementId	integer
OrderNumber	string
OrderDate	DateTime
TerminalOperator	string
EstimatedArrivalDate	DateTime
LicensePlate	string
TruckDriver	string
TruckCompany	string
EmptyOrFull	WSEmptyOrFull
DispositionCode	string
CargoCode	string
CargoText	string
CargoWeight	Nullable<decimal>
PermitNumber	string
PermitValidTo	DateTime (nullable)
HasPermit	Boolean

This message is made in the PCS system and is sent to the AGS system before a truck arrives. This message can be updated in the PCS system. All updates are sent to the AGS system. Updates are allowed until a truck arrives at the external parking gate.

2. *Truck Arrival*

TruckAnnouncementId	integer
LicensePlate	string
TruckDriver	string
ArrivalTime	DateTime

This message is made in AGS system and is sent to PCS system. When a truck arrives at external parking lots enter the gate, the AGS sends the message to the PCS system. This message can be updated in AGS system. All updates are sent to PCS system.

3. *Customs Block*

TruckAnnouncementId	integer
LicensePlate	string
BlockTime	DateTime

If full truck is entering port area, or full truck is exiting the port area, at port area check point, custom will block truck.This message is made in the PCS system, and is sent to the AGS system.

4. *Customs UnBlock*

TruckAnnouncementId	integer
LicensePlate	string
UnBlockTime	DateTime

When customs clearance is done, the UnBlock message sent from the PCS to the AGS system.

5. *Truck Enter*

TruckAnnouncementId	integer
LicensePlate	string
EnterTime	DateTime

This message is made in the AGS system and is sent to the PCS system. When a truck passes police control and checks, security officer checks truck data. After security checks, security officer opens port area entrance gate, and message Truck enter is made.

6. *Truck Exit*

TruckAnnouncementId	integer
TruckLicensePlate	string
ExitTime	DateTime

After all exit checks, truck approaches the port area exit gate. Truck driver opens exit gate, and message the Truck Exit is made. The truck exit message is mad at AGS system and is sent to PCS system.

If the Video portal has a power failure it will be not possible to capture licence plate number, vehicle pictures and other video material. We assume that this is not critical procedures and all data shall be entered later into the AGS system.

At the entrance in the harbour area Port Security officer checks paper form and manually raises entrance ramp.

At the internal parking lot customs officer shall manually raise and lower the exit ramp.

At the exit gate from harbour a Port Security Officer takes paper form from the truck driver, fills the exit hour and raises the exit ramp. All collected paper forms will be taken to the Info desk, so the Info desk employee is able to enter data in an information system.

In special case, when truck enters regularly with the daily RFID card, Security take the RFID card and raises the exit ramp. If information system works normally Security scans the RFID card and fills in the truck exit date.

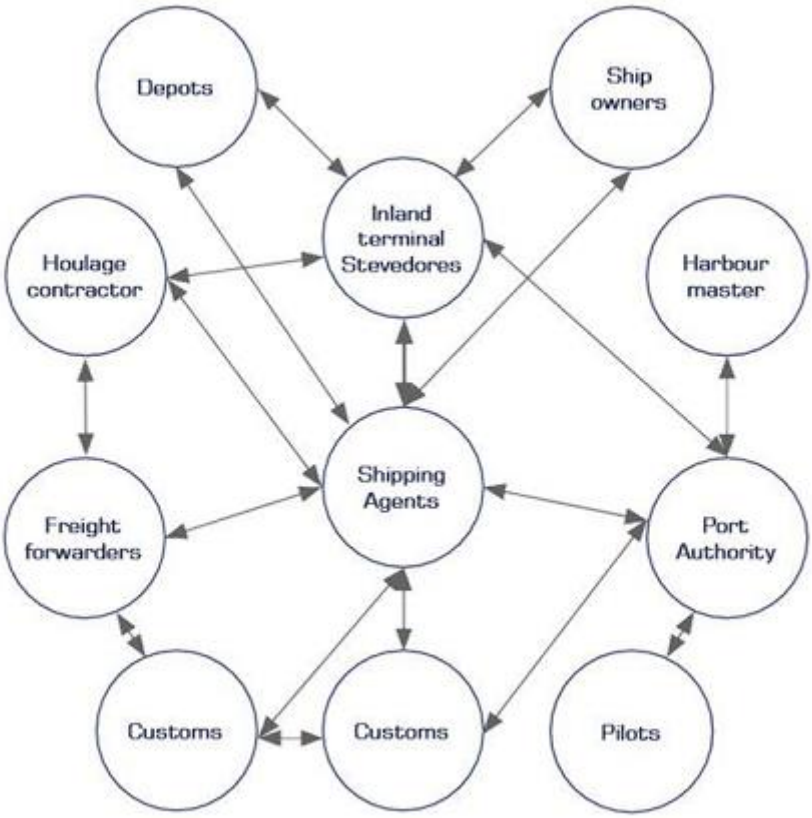
13.7 Port Community System

There is no use of unified port system with ability to exchange all relevant information between port stakeholders and between ports.

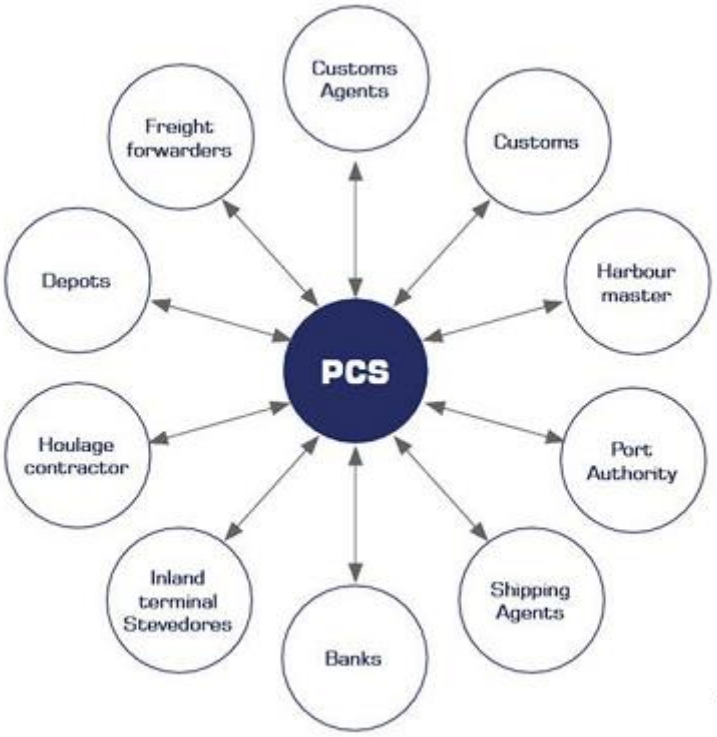
A Port Community System (PCS) is a neutral and open electronic platform enabling intelligent and secure exchange of information between public and private stakeholders in order to improve the competitive position of the sea and air ports communities; Use of Port Community System optimizes, manages and automates port and logistics processes through a single submission of data, connecting transport and logistics chains. PCS is an electronic platform that connects the multiple systems operated by many different organizations that make up a seaport community. PCS is used to standardize message exchange among port community members and centralize all port community information as much as possible.

13.7.1 Why Port Community System?

In ports without the PCS every port community member (company) sends its information to any other member, who wants or needs the information. The information is sent through fax, email, Electronic Data Interchange (EDI), ordinary mail and telephone. This way every port community member has its own bi-directional lines and sends the same information to all those members who need it (Picture bellow)



When a PCS is used, port community members sends their information to a central system where other involved members get the information they need, either through searching up in the system or the system itself sends the requested information to the eligible member. PCS improves the communication efficiency and effectiveness in the port (picture bellow). Port Community Systems can also be used for inland shipping, intermodal ports, or other kind of transport, so it does not concern only sea born transport.



It is very important for ports and port communities to implement solutions which will improve their competitiveness. The PCS is such a solution.

It is expected that PCS will give the following benefits to the stakeholders:

- A single source of information, integrated and standardized platform for meeting the requirements of all members of port community;
- Provides an e-commerce platform;
- Provide adequate, accurate and timely information;
- Speeds the response time of stakeholders to their customers;
- Improve track and trace efficiency;
- Provide shipment/service visibility;
- Generate alerts about delays or problems;

- Enable moving towards similar procedures across all communities;
- Provide opportunities for re-engineering and adopting best practices;
- Easily accessible and secure;
- Easy to learn, operate and support;
- Reduce the usage of paper documents and forms;
- Automation of business workflows and processes;
- Enhanced data security through access management;
- Increased transparency;
- Better information quality;

13.7.2 Modularity of PCS system

A PCS is a modular system with functionality designed to provide all the various sectors and players within a port community environment with tools specific to them, thus delivering a tightly integrated system. Developed for port users by port users, a PCS encompasses exports, imports, transshipments, consolidations, hazardous cargo and maritime statistics reporting. PCS provide a huge range of services and key features:

- Easy, fast and efficient EDI information exchange, re-use and centralization, available 24/7/365;
- Customs declarations;
- Electronic handling of all information regarding import and export of containerized, general and bulk cargo;
- Status information and control, tracking and tracing through the whole logistics chain;
- Processing of dangerous goods;
- Processing of maritime and other statistics;

Members of the Port Community:

- Carriers,
- Customs,
- Environment Agency,
- Fire Brigade,
- Forestry Commission,
- Forwarding agents,
- Hauling companies,
- Importers & Exporters,
- Freight services,
- IT systems,
- Maritime Police,
- Packers,
- Plant Health,
- Port Authorities,
- Port Health,
- Port State Control,
- Quay operators,
- Railway operators,
- Ship operators,
- Ship owners,
- Shipping agents,
- Shipping Lines,
- Statistics Service,
- Stevedores
- Terminals,
- Veterinary Office,
- Warehouse,
- Pilots,

PCS in different ports are not the same, as the PCS"s functionality depends on the local characteristics of the port. The PCS is determined by the operation of a port and this is determined by the location of the port and its surrounding. Furthermore, the functionality of a PCS depends on the initiators of the system as they have a large influence on the development of the system. In short, a PCS can be described as a central point for an organization to deliver or receive information. In smaller port communities, PCS tend to serve as extensions to the in-house systems of major players, offering company-specific applications. In large ports, however, they have a more neutral role as a true information broker.

Regardless of the size of the port it is very important that members of the port community agree on the systems requirements. A true sense of community and a general feeling of involvement need to be established. Different prerequisites and interests of e.g. major multi-national companies and one-person service providers need to be overcome. The success of a PCS can only be maximized if all member groups of the port community realize benefits and thus share information. A PCS also should not duplicate functions that are already existent in other systems, but rather focus on general operational processes. It is also very important that sensitive information in the PCS is safeguarded.

13.7.3 Improvements by using PCS system

PCS can improve many parts of the processes in the port:

- Reporting to authorities is simplified. Information is distributed to the respective authorities in compliance with effective directives (very important because supply chain performance is increasingly driven by governmental regulations);
- Coordination of operations is enhanced at the physical, information, and financial layer. This means that cooperating and competing firms are bound together. PCSs

enhance the efficiency and effectiveness of interactions between port community members and thus help to reduce processing costs by providing a central information network which increases visibility and data quality;

- better data quality:
- The intrinsic category of data quality is related to data accuracy, objectivity, and reputation. PCSs enhance the accuracy of information by checking for input mistakes.
- Data accessibility is enhanced by centralizing community information as much as possible. The structured approach of information exchange via PCSs is better than information exchange through informal information channels. Information is detached from personal communication and thus made available on a 24/7 basis. PCSs also ensure data security by managing access rights and tracing unauthorized access attempts. Information is only made available to authorized members of the port community.
- The contextual category of data quality comprises the dimensions of data relevancy, timeliness, completeness, and data complexity. Besides assuring accuracy, input validations performed by PCSs also enhance data relevancy and completeness. PCSs also help to reduce data complexity by capturing information once and reusing it for different applications, so the need to re-type data can be avoided ("single submission"). Information also becomes more transparent because changes can be traced back to individual organizations or users. Regarding data processing, PCSs can enhance the automation of core workflows and processes based on captured information.
- Representational data quality. Its main dimensions are data interpretability, ease of understanding, concise presentation, and consistent representation. PCSs standardize the message exchange among port community members. All companies involved use the same language in terms of data formats and transmitting services.
- Possibility to launch alert messages/status reports;
- Possibility to implement collaborative planning;
- Higher efficiency and speed regarding port processes for all parties involved;

- Reduction of paperwork. In this way, PCSs contribute to sustainable transport logistics and support the ambitions to meet global carbon reduction requirements.

Using electronic data exchange, the PCS is an effective real-time information system; fast, focused, flexible and multi-faceted, it aims to improve efficiency at all stages of the process of manifesting, through vessel discharge and loading, Customs clearance, port health formalities and delivery in and out of the terminal. PCS offers also improved security, cost reduction and potentially more competitiveness for each user.

13.7.4 PCS architecture

The port community is a large community with many stakeholders, and variety of IT systems in place, supporting different administrative and business functions. The Port Community System (PCS) aims at connecting them together, by establishing a unified platform for exchanging information, taking into consideration strict security standards.

An outline of the PCS architecture, according to the best practices, is given below.

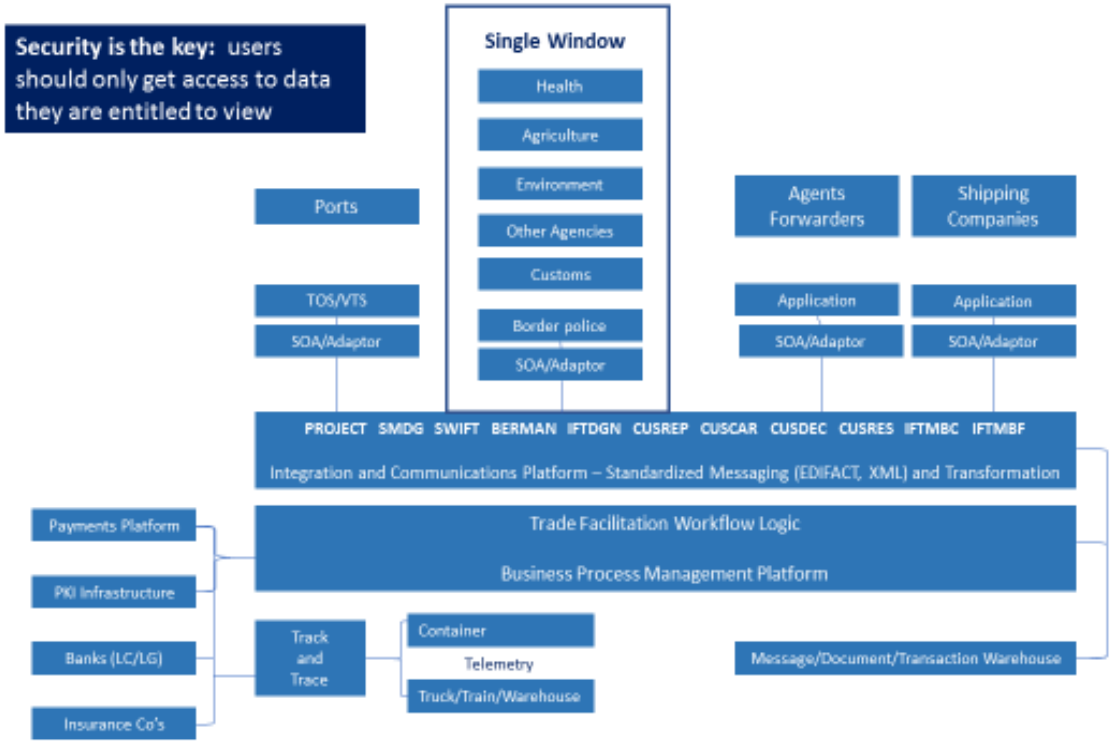


Figure 40 - PCS architecture - best practice

13.7.4.1 PCS architectural models

The PCS architectural solution can be implemented as one of the 3 e-collaboration models, or their combination:

- **Bilateral Information Model (BIM).** In this model, information is exchanged directly between the different actors on a bilateral basis.
- **Centralized Information Model (CIM).** In this model, data is stored at a central information service provider. Information can be retrieved from this central information service provider by trading partners that have the right to do so.

- **Decentralized Information Model (DIM).** In this model, data is stored and controlled by each individual party. A broker service can help in retrieving the information from the right source.

13.7.4.2 Recent PCS model developments

In addition to the information models mentioned above, Srour et al. (2007) introduced a modular distributed plug & play architecture which purpose is to offer actors a simple way to integrate themselves as a part of the network without months of hard integration work. This can be implemented by using Web Services technologies that make it possible to form interoperable *machine-to-machine* interaction over a network (W3C 2004). These kinds of PCSs have not been truly established yet but a collection of initiatives and plans that focus on realizing fast connect capabilities within a supply chain are under development (Srour et al. 2007).

13.8 CIMIS (MNSW)

CIMIS is the unique MSW (Maritime Single Window) system that implements all national level processes related to the administrative aspect and aspect of navigation safety. The role of the CIMIS system is to manage, store, and provide master data (MDMs) such as ship code (NIB and IMO numbers), ports, berths, anchors, agents, shipping, and so on. Croatian Ministry of the Sea, Transport and Infrastructure (MMPI) has developed advanced IT platform CIMIS (Croatian Integrated Maritime Information System) in order to enhance electronic delivery and exchange of data about ships, cargo and passengers in official administrative procedures related to ship's announcement, arrival and departure.

15. Conclusion

Port of Ploče is one of Croatian biggest ports. It is located near the mouth of the Neretva river on the Adriatic Sea coast. As of 2018, it ranked as the second largest cargo port in Croatia — after the Port of Rijeka — with a cargo throughput of 3.3 million tons, consisting mostly of liquid and dry bulk cargo. Based on the analysis it is determined that almost all parameters within road network meet ports requirements.

The port of Ploče is the first/last node of the supply chain on the southern part of Corridor Vc. The investments in the bulk terminal, the container terminal and other areas have improved the port's physical capacity and efficiency. However, it cannot be considered independently from the corridor itself where 90 percent or more of the traffic is carried on Corridor Vc. From customers' perspective, where the time is spent on the corridor, whether in actual transportation time or handling and processing at a port/border/marshalling yard, is irrelevant. What matters is the ability of the corridor to deliver reliable and price-competitive logistics services in a seamless manner.

Since the inception of the Trade and Transport Integration Project in 2006, there have been economic disruptions, market changes, containerization has become important, but rail infrastructure in Bosnia and Herzegovina (BiH) still has important bottlenecks, in particular for container transport, and the rail market, in particular access to the network by third parties is not yet possible in BiH and has not been experienced in the Croatian part, although it is legally possible. In 2013, Croatia entered the European Union, resulting in new customs challenges for trade with non-EU member state such as BiH at border crossing points for road and rail. Therefore, a paper updating the trade and transport issues would be helpful in identifying issues to be address in the realization of the project development objective.

Although it is difficult to regulate and coordinate processes between Croatia and BiH, even more because Croatia is an EU member state and BiH is not, Port of Ploče Authority should aim to achieve even bigger lever of coordination and cooperation, in order to promote the Corridor Vc and remove as many bottlenecks as possible.

Existin cargo traffic flows between port of Ploče and Italy are significant, there are big possibilities for improvement of passenger traffic flows. The main opportunity is to establish a permanent direct fast line between Termoli and Ploče, which can be tenable because of more than 500 thousand tourists visiting Međugorje from Italy every year. Decreasing transit time from 14 hours to 4 hours and 45 minutes and decreasing costs of travel could provide that a direct fast line between Termoli and Ploče becomes permanent.

After the new entrance terminal has been built, the flow capacity of cargo traffic meets all requirements and can be evaluated as extremely good. With direct access to highway, port of Ploče is able to attract more cargo in transit.

Cargo traffic flows between port of Ploče and Italy can also be improved and increased without possibility of congestion, especially since new container, dry bulk and entrance terminals have been built within the port.

As for the possible undesirable effects of developing new traffic, no possible congestion is expected.