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MEASURES TAKEN BY THE PORT OF HAMBURG TO IMPROVE ITS ACCESSIBILITY AS AN IMPORTANT FACTOR INFLUENCING PORT'S COMPETITIVE POSITION

Abstract

Port's seaside accessibility is one of the two most important factors influencing decisions of shipping lines for choosing or rejection the use of the port. The landside accessibility is connected to level of service which the port can offer in hinterland traffic. Both factors together have an enormous impact on port's competitive position on the market. The paper contains overview of problems of ensuring accessibility of the port of Hamburg for container ships as well as rail or road transportation in order to maintain the current high role of Hamburg in container traffic to and from the Northern Europe.

Keywords: container transportation, port's accessibility, port of Hamburg

Introduction

Ports are important nodes of transport and logistical infrastructure with a broad functional spectrum (Fechner, 2010). From a perspective of economic geography they could be described as a place where terminal operators decide on allocating their services or routines (Leal et al., 2011), of which consequence is selected technology and specialization. In case of container ports the chosen handling technology is based on standard of ISO containers as means of transport.

Being nodes in a transportation network connecting land and sea, ports handle seaborne cargo destined for their hinterland. The port's hinterland is geographic land area from which their respective trade originates. In Europe, due to development of the common market and relatively small distances, ports have unquestionable position on a relatively small part of their hinterland and usually

have to compete against other ports, as vast regions can be obtained via alternative routes and alternative ports.

Accessibility may have various meanings and usually is defined as the ease of reaching goods, services, activities and destinations. In this article it is understood as accessibility to the destination i.e. relative ease of reaching a particular location (Litman, 2017).

Accessibility could be regarded as scarce resource due to the limitation of expanding its transportation infrastructure. As such may limit port's development and consequently its market position. This paper focuses on measures taken in Hamburg to improve accessibility for seaborne (first chapter) and land (second chapter) traffic.

1. Importance of accessibility as a reason for a shipping line for choosing a container port

Technology itself cannot be regarded as a sole success factor for a container port; otherwise, newly constructed port terminals furnished with state-of-the-art handling equipment would be immediately much better positioned against older terminals, which is not true. In fact, construction of new port facilities in UK (London Gateway), Germany (Wilhelmshaven) or Poland (Gdansk) proves that it is not easy to change existing transportation patterns and usually requires some trigger to boost handling (e.g. certain malfunction of operations in existing "old" facilities including strike of stevedores or serious accident) and strong advantages to support further development. On the other hand, higher operational costs are in fact no obstacle for successful development of seaborne traffic in selected ports. An interesting insight into decisions behind choosing or rejecting the use of a port by shipping lines gives a query carried out by Global Shipping among shipping lines in 2010 in Hamburg (Hypovereinsbank, 2010). According to it, there are only two basic reasons for choosing/rejection the use of a port i.e. too low cargo availability and unfavourable accessibility.

Cargo availability is derived mainly from existing flow of goods which can be routed via selected port and depends on proximity to the market and availability of GDP. In North Europe the highest purchasing power and created value added have densely populated regions of Belgium, the Netherlands and North Rhine-Westphalia as well as Baden-Würtemberg and Bavaria in Germany, which thus support the gateway function of big ports of the North Sea (Wedemeier, 2015). Cargo availability can be further developed by improvement of rail and road infrastructure and adding a hub function – both allowing steaming additional cargo flows to/from more distant regions including Central Europe and the Baltic Sea. However, ports have limited influence on development of major transport corridors (which lies within remit of respective governments or European Commission) or decision of shipping lines of routing transhipment containers (except from applying discounts in their tariffs), therefore the focus of ports authorities is mainly on improvement of own infrastructure and accessibility by sea and by land.

2. Market position Hamburg's and requirements towards its transportation infrastructure

Hamburg is currently the third biggest container port in Europe. In 2016 it handled 138.2 million tons of total cargo, including 91.7 million tons of containerized cargo. Container handlings reached 8.9 million TEU i.e. slightly more (+1.0%) than in former year. The modal split in hinterland traffic shows dominant role of road transportation representing 55.6% of total volume and increasing importance of rail at 42.3% in 2016. Inland waterways transportation carried 2.1% of the containerized hinterland traffic.

Being a seaport, Hamburg needs to comply with requirements of shipping lines. Recent development in container shipping shows steep rise of average size of a container vessel – compound annual growth rate of their capacity was less than 2% between 2001 and 2009 and rose to 18% between 2010 and 2015[1]. The number of the biggest container ships (ULCS – Ultra Large Container Ships) calling Hamburg in 2016 rose by 60% to 240[2] and declined in most other ships classes (with exception of size class 2000–3999 TEU i.e. increased size of feeder ships). The bigger ships require adjustment of fairway channel due to their increased dimensions including draft and beam as well as bigger turning circle within the port due to increased ship's length (LOA). In April 2017 Korean shipyard Daewoo Shipbuilding & Marine Engineering delivered to Maersk Line the biggest container ship (Madrid Maersk), which is 399 m long (LOA), 59 m wide and has maximal draft of 16.5 m. Many ports including almost all Baltic ports are not capable of handling such big vessels. Hamburg can accept them, nevertheless not without some restrictions.

Being a sea port, Hamburg is located ca. 130 km from the coastline upwards the river Elbe. Sea-going ships approaching Hamburg have to take pilot onboard at the district boundary marked by buoy Elbe 1 on the North Sea some 145 km (76 NM) from the port (pilotage is compulsory for all ships longer than 9 m or wider than 13 m). The fairway channel on approximately half of that distance between buoy Elbe 1 and Brunsbüttel is wide and deep, however, upwards from Brunsbüttel it is becoming more demanding for navigation. The maximal ship's draft is 12.5 m independent of tide, however, when using tide, it increases to 14.8 m for incoming ships and 13.5 m for outgoing ships. In praxis, Hamburg handles all container ships, including the biggest ones, as they are never fully loaded (Hamburg is never the first or last port of call), provided they use tide windows whenever it is necessary and possible.

3. Seaside accessibility

In order to keep up the pace with growing development of ships' size, Port of Hamburg Authority together with city of Hamburg launched in 2002 a project of adjustment of the navigation channel on the Lower and Outer Elbe. Dredging

[1] Own calculation based on data from Drewry.

[2] Source: Hafen Hamburg Marketing.

should upgrade navigation conditions in terms of both draft as well as width of the channel to allow for maneuvering of bigger vessels:

Incoming ship irrespective of the tide: max. 13.50 m draft*,
Outgoing ship irrespective of the tide: max. 13.50 m draft*,
Incoming ship depending on tide: max. 15.60 m draft*,
– Outgoing ship depending on tide: max. 14.50 m draft*.
* in seawater

The project requires that the navigation channel in the German Bight is to be deepened from 16.98 to 19 m, the riverbed on a major section between Brunsbüttel and Hamburg to be deepened to 17.3 m and within the port of Hamburg from the junction of the North and South Elbe to Container Terminal Altenwerder from 16.70 to 17.40 m.

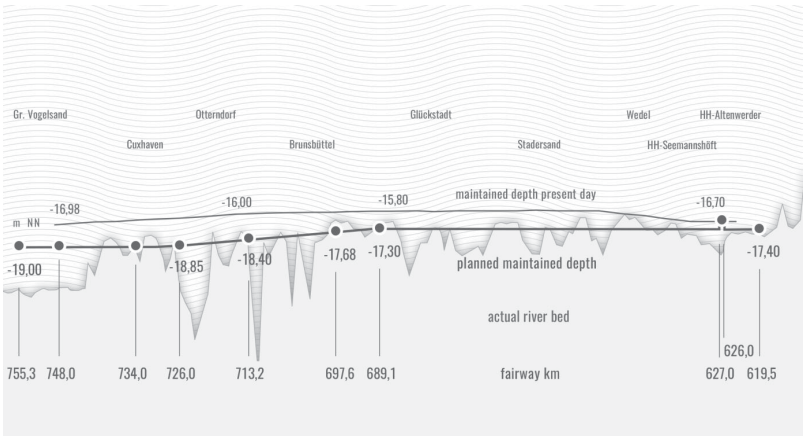

Figure 1. Current state and planned adjustment of the navigation channel
Source: (HHM, 2016)

Even though the channel is currently at least 300 wide, it allows for ships' encounter only when their combined beam does not exceed 90 m. To overcome this restriction, the channel's width shall be enhanced to at least 320 m and the section between Wedel and Wittenbergen to 385 m. There are some other measures planned or carried out recently within the port to improve its accessibility for sea-going ships including enlargement of a turning circle at the top of Tollerort Terminal (now ready for 400 m long ships) completed in February 2017 and future and extension of a turning circle at Waltershof from 480 to 600 m following construction works at Petroleumhafen.

The major problem of any construction project on the river Elbe is the complexity of proceeding on the granting of construction permission, restrictive legal rules set by Water Framework Directive as well as resistance of local citizens and environmental protection organizations. The project of adjustment of the navigation channel on the Lower and Outer Elbe has been launched in 2002 and will not have been completed by end of 2017 or even 2018. On February 9th the Federal Administrative Court in Leipzig has made its judgement on claims

against granting the construction permission. The court pointed out two serious flows in the permission leading to infringement of Flora-Fauna-Habitat Directive including not sufficient protection of the plant species "Hemlock Water Dropwort" and non-coherent planning decisions in respect of Natura 2000 areas, but ruled out all other claims. As the result the draft of construction permission has to be amended which will take additional time, nevertheless the investment itself is now certain to be carried out.

Having restrictions in ships' navigation, the port of Hamburg invests into specially designed IT tools supporting optimization of ships' movements on port's approach and departure as well as berth planning. The optimization process is based on assigning to ships time windows according to required services and berths as well as hydro navigational conditions in the fairway channel and within the port water areas. In Hamburg there are two different systems supporting decision-making of ship's management focused at improving port's accessibility.

The first of them is Port River Information System Elbe (PRISE) which collects information on ships' position from as early as German Bight (basing on AIS – Automatic Identification System) up to the port of Hamburg. It gathers notifications from ships, pilots, terminals, tugboats, mooring companies as well as information from the Harbour Master Office and the German Federal Maritime and Hydrographic Agency (BSH) to ensure swift communication allowing for ship's fitting into the pre-assigned time frame and eliminating conflicts leading to potentially dangerous situations or delay. Controlling ships' movements on port's approach allows for better utilization of limited capacity of navigational waters which varies significantly according to tide and water gauge. It also acts as single windows for shipping lines which need to contact only one office instead of numerous companies and institutions.

A similar establishment is Hamburg Vessel Coordination Center GmbH, a joint venture of two container terminal operators i.e. HHLA and Eurogate. HVCC offers to ships free of charge coordination services for their arrival in the Port of Hamburg, but also departure after handling at terminals thus allowing for avoidance of time waste thanks to optimization of time frames assigned to ships. HVCC is divided into two separate divisions i.e. Nautical Terminal Coordination handling ocean going container vessels (including mega-ships) and Feeder Logistics Center (FLC). Correct information allows ships to maintain the most economic speed to arrive at the border of pilotage district (Elbe 1), optimally plan their berthing and operations at a terminal in Hamburg. It also has an impact on Vessel Traffic Service Centre through reduced burden due to the optimize traffic on the Elbe.

The same applies to feeder ships which additionally benefit from optimization and control of their rotation within the port due to necessary shifting to various container terminals. Feeder ships usually have to discharge and load boxes on different terminals and non-optimized sequence may comprise more than a dozen shifting within the port which leads to delays for ships waiting to get free berth and terminals wasting too much time on mooring operations. FLC checks terminals' work programs and berth availability and coordinates pilots, tugs and linesmen, which ensures that utilization of terminals and feeder ships is optimized.

4. Land accessibility

Rail transportation plays increasingly important role in container haulage. The share of rail in modal split of Hamburg's hinterland transportation was as high as 42.3% which amounts to 2.36 million TEU and rises steadily. Even in years of poorer port's performance when overall container throughput declined, the volume of containers carried by rail increased.

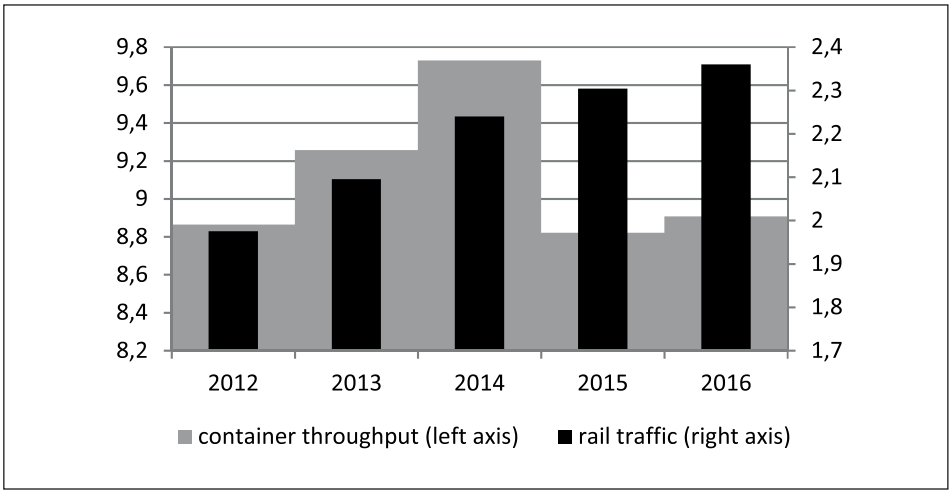

Figure 2. Port of Hamburg's rail traffic vs. container throughput
Source: (own elaboration based on data available at: HHM, 2017)

Road transportation is regarded as necessary due to its flexibility, speed and versatility and is unbeatable on short distances. Nevertheless, it is the rail which prevails on long distances due to its lower external costs and high capacity. Development of road and rail traffic in relation with port's hinterland relies heavily on development of roads and rail tracks outside Hamburg. The city of Hamburg is one of sixteen federal states of Germany, therefore can influence the federal policy regarding investments in transportation infrastructure through proposals and lobbying for infrastructural projects to be included in the Federal Transport Infrastructure Plan (the newest plan until year 2030 was passed by the German Government in August 2016), which is updated every 10 to 15 years. However, this influence is limited which means that needs of the port of Hamburg do not have priority over other needs and the process of preparing new infrastructural investments is very long and takes decades, not years.

On the other hand, in the city of Hamburg land area is very scarce resource, therefore development of new infrastructure here is also very difficult. A good example could be the Hafenquerspange (Port link road) i.e. the East-West highway road connection through the area of the port of Hamburg, which has been planned since 1980s whereas originals plans date back from as early as 1940s. It has not been constructed until nowadays and will not be ready in the middle-term because

of many reasons including doubts whether it can solve traffic jams created by local traffic or rather induce additional supra-regional or national traffic.

To cope with increasing traffic, Hamburg decided to focus on creating smart infrastructure allowing for improved traffic flow control as well as better infrastructure management in respect of maintenance. A project dedicated to this task is smartPORT logistics, which is one of two pillars of a broader project portfolio smartPORT Hamburg. smartPORT logistics enhances port's accessibility by increasing mobility (level of service) and reducing time delay.

Hamburg is an essential rail hub – it acts as origin or destination of ca. 12% of total German rail freight. High traffic volume (ca. 200 trains or over 5000 rail wagons) make it the busiest railway seaport in Europe. The importance of the problem of traffic control results from high density of roads and rail tracks on a relatively small port area as well as of traffic itself. Rail infrastructure consists of 300 km rail tracks, over 800 shunting switches as well as 135 private sidings extending railway network by additional 160 km. Interlacing of road, rail and water traffic is a significant issue and can lead to conflicts on traffic priority. Whenever possible, HPA plans the infrastructure so that different transport modes are separated from each other, which applies mainly to road and rail transport infrastructure. In case of intersections of rail tracks or road with waterways, the bridges are constructed in the way which is most appropriate inclusive high bridges allowing ships passing underneath as well as moveable bridges. The latter solution, despite obvious disadvantage of interrupting land traffic to make passage for ships open, puts no restriction on ship's height which is increasing faster than the infrastructure gets outdated. Examples of movable bridges of utmost importance for the port are Rethe bascule bridge or Kattwyk vertical lift bridge, belonging to the biggest one in the world.

Intelligent infrastructure can address a handful of problems including:

– Maintenance issues,
– Identification of vehicles,
– Traffic predictability,
– Lowering energy consumption,
– Improving planning ability of truckers/transportation managers.

To make infrastructure intelligent, smartPORT logistics is applying 5 IT-megatrends including internet of things, big data, cloud computing, social networks and mobile applications for collection and analysis of data on current state of the whole transportation infrastructure as well as real-time traffic. The real-time picture of infrastructure and traffic can be conveyed to end-users through various channels inclusive mobile applications to allow decision-making and route planning.

Maintenance issues are most important for rail infrastructure where, in practice, they equal to switching from preventing to predictive maintenance, which is much more effective, by equipping critical elements of rail infrastructure inclusive switches with intelligent sensors reporting on their performance in real time and sending data allowing estimation of infrastructure's wearout. Potential failure may lead to serious consequences in the entire rail network of the port railway and could

even cause collapse of the whole system, therefore preventing such incidents is of utmost importance for port accessibility and level of service.

Identification of rail cars and locomotives helps to manage the traffic and is achieved by implementation of LED cameras in pivotal points of the rail infrastructure which are able to read rail cars' or containers identification numbers as well as dangerous goods labelling etc. These data supplement the data registered in IT platform transPORT-rail which connects all actors responsible for operating trains within the remit of Hamburg's port railways.

Evaluation of road transportation as basis for decision-making of dispatchers and truckers is even more problematic as in case of rail traffic. The main difference is connected to the fact that rail transportation has to be pre-booked and scheduled in advance whereas road transportation doesn't have to and decisions are being taken by hundreds of truckers independently. When they decide to take the same road in the same time, a traffic jam may be created unless they are informed of better alternatives. The Port Road Management Centre produces hints for most advantageous decisions regarding routing of trucks. To be able to do that it has to analyse current situation first. The roads have been equipped with different kinds of sensors including video detection, Bluetooth, inductive loops to provide reliable real time traffic information to PRMC. PRMC improves traffic flow through:

– providing real-time traffic information via mobile apps and electronic message signs in crucial road points within the port (so called EVE),
– management of incidents,
– management of parking areas as well as pregate car parks,
– establishing a traffic information center (DIVA).

In the future the Port Road Management Centre shall be combined with similar centers for other means of transport including rail, ships and barges. Thus, the decision makers may get a comprehensive information on traffic situation (Port Monitor) and potential threads to reliability of transportation services from a single source, enabling them to plan deliveries better in a timely manner.

In a more distant future the port management will implement a solution to the whole logistics chain using Hamburg as one of its nodes. It shall compile all possible information from partner ports/terminals/carriers on potential threads which may lead to delay. Such information could be consequently used for choosing alternative transportation solutions to avoid those threads to allow for on time delivery. The first step towards such a system has been made when eight global ports including Hamburg decided in April 2016 to create ChainPORT – a common platform for exchange of information relevant for transportation of containers.

Conclusions

The port of Hamburg takes great effort to improve its accessibility, especially from the sea side which directly influences its market position. Shipping lines require that navigational channel, port water infrastructure including turning circle, port basins etc. as well as land infrastructure (quay walls, handling equipment etc.)

are able to handle the biggest container vessels. Very fast development of container fleet especially in respect of vessels' size must be accompanied by appropriate development of ports' accessibility or the future port's market position may be inflicted.

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