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Conflicts and Reconciliation at the Port-City Interface in Contemporary European Cities

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Abstract

Since ports were first created in coastal and riverbank cities, they have remained an integral part of many cities. As maritime trade developed and required more space and infrastructure, ports have gradually become more specialized for maritime purposes. Since the more recent advent of containerization and globalization, port-city relations have become increasingly complex. Therefore, it is important to investigate methods to resolve the conflicts in port-city interfaces. This paper demonstrates an in-depth research study of the approaches taken by major European ports to reconcile port-city conflicts and provides insight and guidance for port authorities on this issue.

Keywords: port-city interface, conflicts and reconciliation, contemporary Europe

1. Introduction

1.1 The Importance of the Problems at the Port-City Interface

The relationships between ports and their cities have gradually changed throughout urban history. Ports first appeared on riverbanks and in bay areas around 4500 years ago, becoming an integral part of cities. Ports generated profits for the development of the cities through trade, while cities in turn provided ports with the necessary infrastructure for maritime activities. However, as the world began to be increasingly interconnected, ports have gradually become more specialized for maritime purposes, and there has been a spatial and functional breakup between ports and the cities to which they originally belonged.

Since the advent of containerization in the 19th century and globalization in the late 20th century, the relationship between ports and cities has become increasingly complex. Containerization requires ports to have direct access to intermodal transportation hubs, while globalization favors ports with strong economic ties to their host cities. Ports are still highly specialized, while new logistic and economic connections have begun to emerge between ports and cities. Therefore, it is of great importance to investigate the functional conflicts between ports and cities at the port-city interface and look for approaches to reconcile those conflicts. What types of conflicts do contemporary European ports face at the port-city interface? What types of approaches do the port authorities take to reconcile such conflicts? By examining existing approaches taken by European port authorities to settle port-city interface conflicts, this paper will provide useful insights for future port planners.

2. Method

2.1 General Viewpoint and Research Method Breakdown

The main argument of this paper is that the conflicts at the port-city interface are reconcilable, and that multiple approaches to reform the infrastructure and regulation at the port-city interface can be taken to improve the relationship between the port and its city. Above all, authorities should maintain a healthy and appropriate spatial, functional and perceptual distance between the two. This paper will first review several proposed theories and models of port-city interfaces, and then clarify the importance of researching possible solutions for conflicts between ports and cities. The paper will then examine different types of potential approaches to resolve varying types of conflicts, and list existing strategies used by major European ports to substantiate the points. By reviewing these strategies, this paper will provide an organized series of examples for future port planners to refer to.

2.2 Reviewing the Theories of the Port-City Interface

In order to better understand the roots of conflicts at port-city interfaces, it is necessary to first have a firm understanding of the development of a port-city interface, which is a necessary part of the port development itself. A review of both historical facts about port development and established theories on port development are required. This section of the paper will mainly focus on established theories. as they are the best summaries of the port development patterns that can be observed in historical examples.

Extensive explorations on theories of port development have been done by James Bird (1963), Daniel Olivier and Brian Slack (2006) and many other scholars. In his report at the 2007 ENHR Conference at Rotterdam, Tom Daamen (2007) gave a comprehensive summary and explanation of the established theories, so this section will largely follow the summary in Daamen's work.

2.2.1 Bird's Theory on Port Development

After examining the development paths of major British seaports, Bird (1963) proposed his *Anyport* model to summarize patterns in port development. In his *Anyport* model, Bird views the spatial development of ports as a series of chronological phases (Bird, 1963). As shown in Figure 1, Bird's model demonstrates 6 phases of the spatial transition of ports. Bird points out that each phase has its unique physical layout of port facilities and functions, due to the technological changes in the shipping industry and cargo maneuver processes, such as the technological leap from bulk cargo to containerized cargo. The advances in maritime trade set the pace for port development, while new challenges keep emerging for port planners (Bird, 1963).

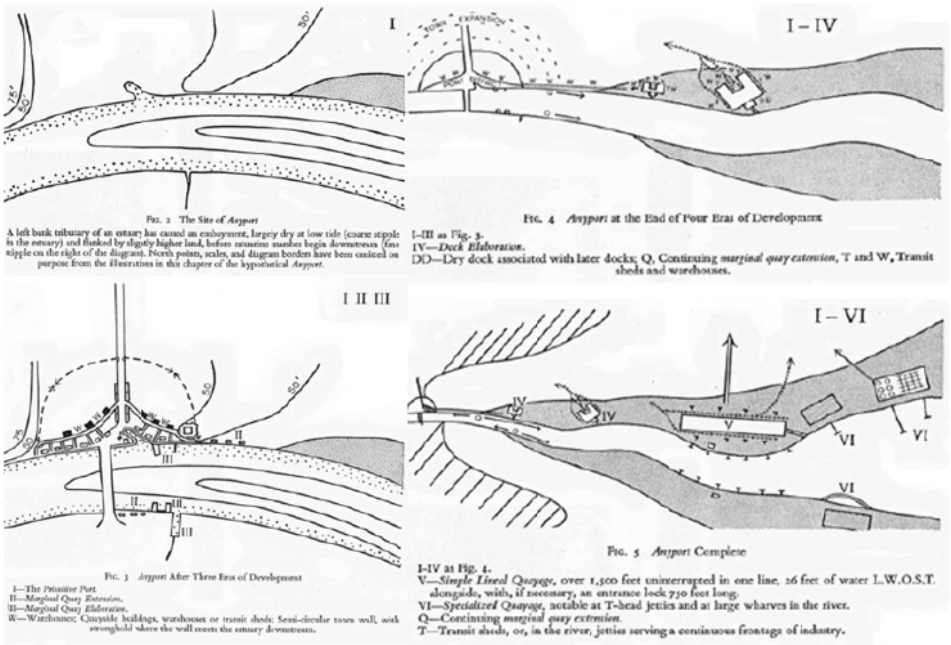


Fig. 2 The Site of *Anyport*
A left bank tributary of an estuary has caused an embayment, largely dry at low tide (coarse stipple in the estuary) and flanked by slightly higher land, before estuarine marshes begin downstream (fine stipple on the right of the diagram). North point, scales, and diagram borders have been omitted on purpose from the illustrations in this chapter of the hypothetical *Anyport*.

Fig. 4 *Anyport* at the End of Four Eras of Development
I–III as Fig. 3.
IV—*Dock Elaboration.*
DO—Dry dock associated with later docks; Q, Continuing *marginal quay extension*, T and W, Transit sheds and warehouses.

Fig. 3 *Anyport* After Three Eras of Development
I—The *Primitive Port.*
II—*Marginal Quay Extension.*
III—*Marginal Quay Elaboration.*
W—Warehouses; Quayside buildings, warehouses or transit sheds; Semi-circular town wall, with stronghold where the wall meets the estuary downstream.

Fig. 5 *Anyport* Complete
I–IV as Fig. 4.
V—*Single Lineal Quayage*, over 1,500 feet uninterrupted in one line, 26 feet of water L.W.O.S.T. alongside, with, if necessary, an entrance lock 750 feet long.
VI—*Specialized Quayage*, notable at T-head jetties and at large wharves in the river.
Q—Continuing *marginal quay extension.*
T—Transit sheds, or, in the river, jetties serving a continuous frontage of industry.

Figure 1. Bird's *Anyport* Model (Bird, 1963)

The major trends in port development, demonstrated in Bird's model, show that continued specialization of port activities pushed the core port area out of the urban center and forced port infrastructures to move downstream. This spatial separation of the port area and its urban center largely influenced the port-city interface, which will be discussed in the second half of this section.

2.2.2 Hayuth's Theory on Port-City Interface Transition

Yehuda Hayuth was the first theorist to introduce the concept of port-city interface in 1982. He observed that, due to the advent of containerization and new cargo handling techniques, the land-usage of ports had changed drastically, and many once-favorable port sites were no longer seen as competitive.

For example, the port of San Francisco once thrived as it proved to be a good site for conventional finger piers—piers built with multiple branches to maximize waterfront length. However, as containerization required more space for cargo handling and more direct access to inland transportation, San Francisco simply no longer

had the suitable topography and urban structure for container maneuver. San Francisco gradually lost in its competition with the port of Oakland, a rising port opposite San Francisco with abundant areas for cargo handling and convenient access to inland distribution (Hayuth, 1982).

As the San Francisco-Oakland example demonstrates, in the search for more suitable sites for cargo handling and ship docking, port facilities were forced to move out from the center to the fringes of the urban area. Such moves weakened both spatial and functional connections between the port and the city (Hayuth, 1982).

2.2.3 Hoyle's Model of New Port-City Relationship

As globalization and intermodal transport thrived in the late 20th century, the port-city relationship could no longer be viewed as simply separate. Globalization strengthened the economic ties between port cities worldwide, and thus required ports to renew economic ties with their urban financial centers. On the other hand, the advent of intermodal transportation favored ports with direct access to inland distribution centers. Both factors encouraged port authorities to consider modifying their relationships with urban financial and logistics centers. To better depict the nuanced relationship between the port and the city, B.S. Hoyle (1989) visualized the port-city linkage with a symbolic outline (Figure 2).

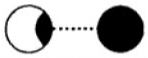
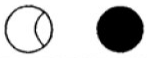
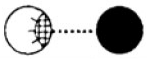
STAGE	SYMBOL ○ City ● Port	PERIOD	CHARACTERISTICS
I Primitive port/city		Ancient/medieval to 19th century	Close spatial and functional association between city and port.
II Expanding port/city		19th - early 20th century	Rapid commercial/industrial growth forces port to develop beyond city confines, with linear quays and break-bulk industries.
III Modern industrial port/city		mid - 20th century	Industrial growth (especially oil refining) and introduction of containers/ro-ro require separation/space.
IV Retreat from the waterfront		1960 s - 1980 s	Changes in maritime technology induce growth of separate maritime industrial development areas.
V Redevelopment of waterfront		1970 s - 1990 s	Large-scale modern port consumes large areas of land/water space; urban renewal of original core.
VI Renewal of port/city links		1980 s - 2000+	Globalization and intermodalism transform port roles; port-city associations renewed; urban redevelopment enhances port-city integration.

Figure 2. Figure from Hoyle (2000) based on the port-city relationship model from Hoyle (1989)

Hoyle's model is also divided into six phases. The first four phases, labeled I through IV, represent Hayuth's idea of separation. However, Hayuth did not capture the fifth stage of the transition, which is the return of urban functions to the original port center. This urban encroachment of what used to be the core area of the port seemed to push the functional port area further downstream (Daamen 2007), but as urban and port functions began to coexist in this newly emerging area of port-city interface, such urban permeation actually showed the possibility of a reconciliation between the port and the city. It also anticipated new links between city and port under the influence of globalization and intermodal transportation, as described in stage VI. This revitalization of port-city linkage can be seen as a break from the history of port-city relationships throughout most of the 20th century and called for further research on port-city interfaces.

2.3 Reconciliation Approaches Taken by European Port Authorities

In order to adjust to contemporary port-city relationships and face the challenges present at any port-city interface, major European ports such as A Coruña, Bremerhaven, Hamburg, Helsinki, Algeciras, Amsterdam have sought solutions to settle various types of conflicts.

In this section, different types of approaches used by contemporary European port authorities will be examined and their effects will be analyzed, in order for port authorities to pick better solutions and for researchers to better understand conflicts in the future. Approaches taken to encounter environmental and functional conflicts will be listed.

Current data on port authorities and their approaches to conflicts comes from the official websites of European port authorities. Thanks to the case studies done by the International Association of Ports and Harbors (IAPH)

and the Hamburg Port Authority (HPA) at IAPH Hamburg in 2015, resources for this section became much more accessible.

2.3.1 Existing Approaches to Reconcile Environmental Conflicts at the Port-City Interface

As a commercial and industrial hub of the host city, ports are a major source of pollution—including noise pollution and air pollution. Unregulated pollution not only damages the existing ecosystem at the port site, but it also undermines the port-city relationship by lowering the quality of life for port employees and residents who live near the port-city interface.

In order to reconcile environmental conflicts between the port and the city, European ports have adopted both infrastructural and regulatory approaches to reducing pollution or limiting its influence. Some are common approaches, but others are unique to the host port city. Common approaches include rewarding or compensating users of clean fuel such as liquified natural gas (LNG) and using shoreside power systems to reduce emissions from ship engines (Hamburg Port Authority n.d.). Although these approaches do reduce negative environmental effects on a global scale, they have less of an effect on the environmental conflicts in the port-city interface locally, as most of the fuel usage of container ships comes from sea voyages.

2.3.1.1 Infrastructural Approaches

In order to mitigate the negative effects of pollution on urban areas in the port-city interface, European ports and their host cities have built new port infrastructures. Some of the approaches reduce the pollution source itself, while others attempt to minimize its influence on the urban population and functions.

2.3.1.1.1 Case Study: The Coal Terminal Facility Medusa in A Coruña

The Centenario Wharf of the Spanish port A Coruña was originally built for the unloading of dry bulk and general goods before a coal terminal function was added, and it is therefore located in the inner port area close to the urban center (IAPH, 2015). As the open storage of coal may result in air pollution in nearby areas, it is important to reduce the potential pollution that coal unloading and storage at the terminal might bring to the urban population.

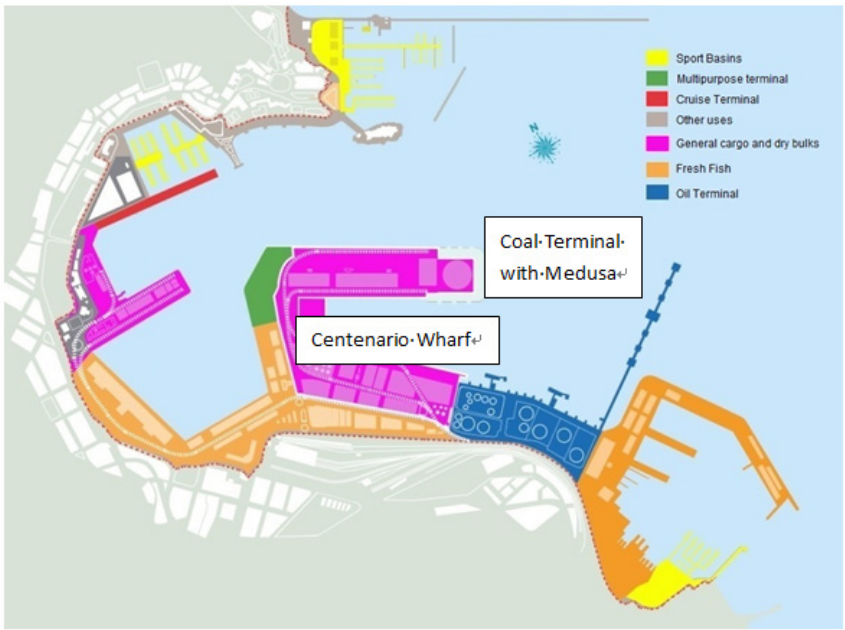


Figure 3. Location of A Coruña´s Centenario Wharf and Medusa Terminal in the inner port of A Coruña (Port Authority of A Coruña, n.d.)

To solve the pollution problem at the port-city interface at A Coruña, a special facility called Medusa was built over the coal terminal on the Centenario Wharf, thus reducing the air pollution caused by air-borne coal particles (IAPH, 2015).

Figure 4&5 Exterior view of coal terminal facility Medusa (Port Authority of A Coruña, n.d.)

Resembling a huge, light blue jellyfish (which "Medusa" means in Spanish), Medusa floats on the urban waterfront. The facility not only reduces air pollution but also increases the overall architectural value of the port, resolving mainly environmental issues but also aesthetic conflicts between urban area and the port area.

2.3.1.1.2 Case Study: Soundproof Glass Panels at Bremerhaven and Hafencity Hamburg

Noises generated by cargo handling and ship docking can greatly influence the quality of life in the urban residential areas near the port. To solve the noise pollution between port and city areas, European ports have applied both infrastructural and regulatory approaches. This section will focus on infrastructural approaches taken by the German ports Bremerhaven and Hamburg.

Hamburg and Bremen/Bremerhaven are the two biggest ports in Germany, and are also both important maritime trading hubs in Northern Europe. Both ports are adjacent to the host city's urban residential areas, so reducing the noise from port operation and minimizing the port's negative effect on urban life quality are important conflicts to resolve in both cases.

In 2007, Bremerhaven's container terminals underwent a large-scale expansion, and the new CT 4 terminal was built next to the residential district Weddewarden (IAPH, 2015). The noise-producing port facilities can be as close to the residential community as 250 meters. To lessen the negative effect of the noise, the residential buildings in Weddewarden were improved with noise-absorbent surfaces—windows, doors and roofs—to minimize the port's influence on the daily life of the community's residents (IAPH, 2015).

The Hafencity of Hamburg is a former port area developed for partial urban usage. Since the region is adjacent to

a busy cargo handling area where regulatory noise caps do not apply, the noise in the residential areas can reach up to 70dB (IAPH, 2015), which is as loud as a loud conversation happening 3-5 feet away. In order to solve the increasing conflict between urban life and port usage in this transitional port-city interface, the Hamburg port authority installed specially-designed soundproof windows in all the residential and commercial buildings to keep the noise low even when the windows are not completely shut (IAPH, 2015).

The infrastructural approaches taken by the ports of Bremerhaven and the Hafencity in Hamburg demonstrate the possibility to reconcile sharp conflicts between urban and port functions within a narrow transitional interface, as both ports are directly next to the residential areas. This type of passive noise protection does not strengthen the city-port tie, but rather further separates them functionally by adding a physical barrier between separate spheres of functions and therefore reduce the potential interactions between the two. However, such protection does enable port and city infrastructures to simply coexist, and is efficient, as no extra transitional space is needed at the port-city interface.

2.3.1.2 Regulatory Approaches in European Ports

Besides constructing new infrastructure, European ports have also experimented with new regulations to mitigate the conflicts at port-city interfaces, notably on the aspect of noise control.

2.3.1.2.1 Case Study: Flexible Noise Cap Regulations in Hafencity, Hamburg

In addition to the above-mentioned soundproof windows that were implemented as a solution to the noise problem at Hafencity Hamburg, the port official also divided the Hafencity into different districts with different noise amplification limits based on the usage and location of the district (IAPH, 2015). The divisions are illustrated in Figure 6.

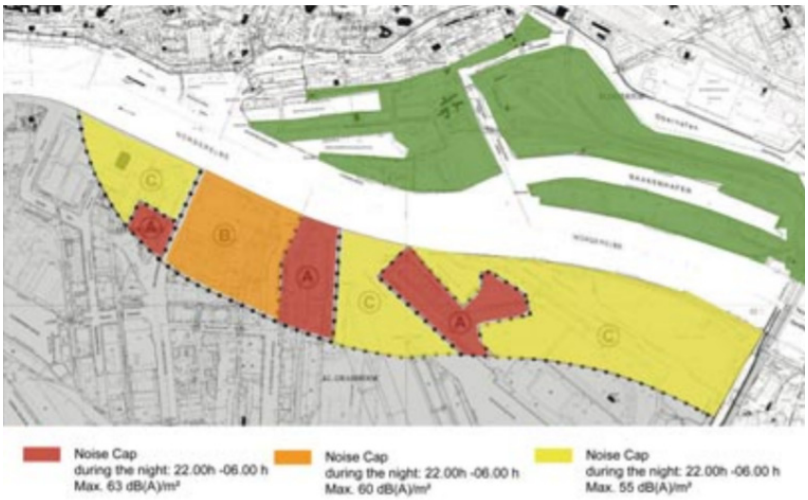


Figure 6. Noise cap planning of Hafencity, Hamburg (IAPH, 2015)

In the districts closest to the functional center of the port areas, the upper limit for noise levels are set to be 63dB. As urban functions took over part of other areas, the noise cap was lowered to 55dB (IAPH, 2015)

In contrast to the implementation of one consistent noise cap for all districts, this flexible noise cap system in Hafencity, Hamburg respects both urban and maritime interests at the transitioning port-city interface. Such a system promotes the coexistence and reconnection of the port and the city.

2.3.2 Reconciling Functional Disparity Between the Port and the City

As ports have become increasingly specialized for maritime purposes, there has been a functional break between the port and the city, in addition to the spatial separation proposed in the established theories mentioned above. This functional break does not simply mean that the port has taken away part of the city's industrial and commercial functions. While that is true, other crucial functions of the city—cultural and recreational aspects—have been missing from the highly specialized port area. These missing functions further separate the port from the city, especially through influencing urban residents' perception of the port. To mitigate these huge

functional conflicts between the port and the city, European ports have mainly applied infrastructural approaches to satisfy the demand for various urban functions that are missing from the port. In so doing, European port authorities are able to recover the functional tie between the port and city in an era of port-city reconnection.

2.3.2.1 Case Study: Parque del Centenario in Algeciras, Spain and the Golf Course in Helsinki, Finland

Algeciras is Spain's biggest seaport, located at the entrance to the Mediterranean Sea. As the port expands along the coastline of the Bay of Algeciras, the port-city interface of Algeciras is also undergoing gradual change. Multiple green buffer zones have been built at the port-city interface, but the biggest one is built on the site of a former military base, and is called Parque del Centenario, or "Centurial Park" (IAPH, 2015).

Figure 6. El Parque Centenario has a great view of the urban waterfront (APBA, 2009)

Parque del Centenario comprises a total size of approximately 100,000 square meters, which is approximately equal to that of 19 full-sized football fields. The park offers a view of the Bay of Algeciras, including the operating port areas. While its recreational function satisfies urban residents' demands for leisure, the park also serves as a noise barrier between the port and the urban residential areas, further improving the quality of life at the port-city interface (APBA, 2009).

Similar approaches have been taken by the port authority of Helsinki, Finland. Around the newly expanded port district of Vuosaari, where most of the container ships dock, several patches of green areas have been built to serve as a noise buffer zone. The park located to the southwest of the port area is unique: it is designed as a golf course (IAPH, 2015).

Compared to the soundproof infrastructures used by the port authorities in Hamburg and Bremerhaven, these types of noise buffering approaches require more space at the port-city interface. However, the parks built in Algeciras and Helsinki more effectively strengthen the tie between the city and the port, by adapting to recreational functions and changing residents' perception of the port through providing a panorama of the port area.

Figure 7. Vuosaari buffer plan (IAPH, 2015)

2.3.2.2 Case Study: The Hafentheater in Hamburg and the Science Center "Nemo" in Amsterdam

In the 1990s, a music tent that could hold 1,000 audiences was built on an unused port area in Hamburg, right in between several dockyards of the port (IAPH, 2015). It is located directly opposite the famous tourist attraction "St. Pauli Landungsbrücken," and harbor ferries take tourists to and from musicals and concerts. Although it was originally constructed for temporary usage, nowadays there is discussion about making it a permanent music hall (IAPH, 2015). Surely the Hafentheater will continue to be a cultural hub in the port area of Hamburg, bringing urban cultural functions to the port and changing residents' and tourists' perceptions of it.

Figyre 8. Hafentheater in Hamburg, with container cranes looming in the back (Stage Entertainment, n.d.)

In Amsterdam in the Netherlands, a submarine-shaped building stands at the entrance of the port area. It is the science center "Nemo," named after the legendary captain of the submarine Nautilus from the science-fiction

book *Twenty Thousand Leagues under the Sea* (IAPH, 2015).

Figure 9. Science Center "Nemo" on the waterfront in Amsterdam (IAPH, 2015).

"Nemo" was not built next to any operating port facility, but rather on a waterfront abandoned by the port decades ago during the era of port-city separation. In the process of urban renewal of former port areas, the science center "Nemo" not only provides residents with an educational and cultural experience, but also respects the port's maritime traditions in its architecture and positioning.

Both the Hafentheater and "Nemo" are successful examples of reconciling functional conflicts at the port-city interface, as they bring cultural aspects of the urban center into port areas, and successfully influence people's perception of the port as a whole.

3. Results and Discussion

Part I of the paper reviewed theories on ports and port-city interfaces in urban centers. These theories reveal the historical trends of port-city relationships: ports and their host cities have grown increasingly separated in terms of location and functionality, while processes of globalization and intermodal transportation continue to hold the port and the city together.

Part II of the paper examines examples of the approaches taken by major European ports to settle conflicts that emerge in port-city interfaces. Their unique effects in ports in Germany, Spain, Finland and Holland were analyzed and explained. The existing approaches prove that environmental and functional conflicts at port-city interfaces are reconcilable, and that multiple approaches can be taken according to the unique setting of the port and the host city. They also reveal general patterns of port-city relationship management. When the port and the city have spatial overlay at the interface, and where the ports are functionally irrelevant, European port authorities attempted to reduce the negative effects of the port on the nearby urban area (as in examples of Bremerhaven and Hamburg). When the port is spatially segregated from the city, European port authorities utilized the extra space as a buffer zone between the port and the city, while building infrastructure in the buffer zone to keep the port and the city functionally connected, but spatially separated (as in the examples of Helsinki and Algeciras).

Clearly, it is important to achieve a functional and spatial balance between the port and the city, so that their individual interests do not clash at the port-city interface, while the two still act efficiently and effectively as a whole. The planning strategy of the port-city interface is therefore never carried out in a singular manner, by simply segregating or merging the two. Just as Hoyle (1998)'s model suggested, the port-city relationship is becoming increasingly complex as new links continue to emerge. Maintaining a healthy and appropriate spatial,

functional and perceptual distance between the port and the city through infrastructural and regulatory approaches is crucial to settling the conflicts at any port-city interface.

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