The Dry Port Concept – Connecting Seaports with their Hinterland by Rail

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Abstract

The dry port concept is based on a seaport directly connected with inland intermodal terminals where goods in intermodal loading units can be turned in as if directly to the seaport. Between the seaport and the inland terminals, here denoted dry ports, relatively large goods’ flows are being concentrated, giving room for other traffic modes than road. The hypothesis behind the article is that a consciously applied dry port concept can shift freight volumes from road to more energy efficient traffic modes that are less harmful to the environment, relieve seaport cities from some congestion, make goods handling more efficient and facilitate improved logistics solutions for shippers in the port’s hinterland. The main purpose of the article is to present the theory behind the dry port concept and to define three dry port categories; distant, mid-range and close. For each category the benefits are defined from the perspectives of involved actors such as seaports, rail and road operators, shipping lines, shippers, local authorities and the society as a whole. In addition, existing applications of the dry port concept are presented regardless of whether these are officially denoted dry ports. The article takes a logistic, technological, economic as well as environmental perspective, and is focused on how the new transport networks could be designed and also what can be learned from this by authorities and companies that plan to use or operate similar transport systems.

1 Introduction

Since it appeared in a large scale in the 1960’s, the container shipping industry has improved its performance at an impressive pace. Today it is the backbone of globalisation estimated to account for 13% of seaborne trade in volume and 49% of value (Cullinane and Khanna, 2000). Its importance for the ongoing space/time collapse is less referred to achievements in the speed dimension than in the cost ditto (Rodrigue, 1999). The maritime part of the intermodal transport chains has employed ever larger ships to cope with increasing transport demand and for facilitating potentially lower unit costs as discussed by Cullinane and Khanna (2000). The latest vessels on order will cross the 10 000 TEU barrier (Roach, 2004) but to fully realise the economies of scale, progress in ports and hinterland operations must match.

Larger ships and larger flows of containers severely strain seaport operations (see, e.g., Mourão et al., 2002). As an example, the container throughput in the ports of the Chinese special economic zone Shenzhen are estimated to rise by 2-3 million TEU/year the coming...
years (World Cargo News, 2004/a and Woodbridge, 2004/a). Port capacity can be increased by physically expanding existing ones or establishing new ports (McCalla, 1999), but this is in the long run and at considerable costs and endeavours (Pellegram, 2001 and The TT Club, 1996). Other options include adding conventional equipment or improving the productivity by new forms of technology as analysed by Ballis et al. (1997), work organisation as suggested by Paixão and Marlow (2003) or by information systems such as elaborated by Henesey (2004).

Also the transport services to the ports’ hinterland, defined by van Klink and van den Berg (1998) as the “the interior region served by the port”, are strained by the increasing flows. According to the European Commission (2000), the volume of European hinterland transport related to trans-ocean maritime transport will increase by 140% to 2010. Besides the introduction of 240 TEU double-stack trains in the US, productivity in the land part of the transport chains has generally not followed the progress at sea. As an example of the consequences, the 150 km road leg from Gnosjö to Göteborg is roughly as expensive to the shipper as is the sea leg between Göteborg and China (Ireståhl, 2004). Nevertheless, double-stack services are now being developed in China (Cheng, 2004) and are discussed in Sweden and the Netherlands. Except for the US west coast ports, road is still the dominating traffic mode involving external effects such as emissions, noise, road accidents and congestion in the seaport cities and further inland. Increasingly, transport policies at different levels (see, e.g., European Commission, 2001/a) advocate rail and barge as being more sustainable traffic modes.

The hypothesis behind this article is that the problems related to increased container flows are best approached from a joint seaport and hinterland perspective. The idea of dry ports is certainly not new, and the notion of ports’ role and spatial coverage is dealt with, e.g., by Heaver et al., 2000 and 2001, Notteboom (2002), Notteboom and Winkelmans (2001), Robinson (2002) and van Klink and van den Berg (1998). In addition, the tradition of land-bridges, mini-bridges and micro-bridges has a long history in the US (see, e.g., Coyle et al., 2000, pp. 244-245 and Muller, 1999). Previously, however, it has not generally been seen as a tool for consciously solving problems of a multitude of actors with somewhat contradictory goals. Hence, it is here argued that a well applied dry port concept can shift freight volumes from road to more energy efficient traffic modes that are less harmful to the environment, relieve seaport cities from some congestion, make goods handling more efficient in seaports and facilitate improved logistics solutions for shippers in the port’s hinterland.

The main purpose of the article is to present the theory behind the dry port concept and to define three dry port categories; close, mid-range and distant. For each category the benefits are defined from the perspectives of involved actors such as seaports, rail and road operators, shipping lines, shippers, local authorities and the society as a whole. The article takes a logistic, technological, economic as well as environmental perspective. It is focused on how the new transport networks could be designed and also what can be learned from this by authorities and companies that plan to use or operate similar transport systems.

After a theoretical part regarding the role of terminals in freight transport networks, the dry port concept is presented. In addition, examples of applications of the dry port concept are presented regardless of whether these are officially denoted dry ports. The research is financed by the Swedish Agency for Innovation Systems (Vinnova) and the CN 70 foundation.
2 Freight transport networks

Freight transport systems are characterised by sequential transfers of goods between points of origin and destinations, generally defined as nodes. Activities, such as consolidation, sorting, storage and transhipment between vehicles and traffic modes, are carried out in nodes. The globalisation of supply chains implies that it is often attractive for shippers to outsource value adding services such as customisation, packaging or sequencing to logistics service providers at strategically placed nodes (Cheung et al., 2003, Notteboom and Winkelmans, 2001, Paixão and Marlow, 2003 and Robinson, 2002).

A node can be defined as a source, a sink or a transhipment node, depending on the transport assignment. Links represent transport and transfer activities connecting nodes, and together with the nodes the links compose the transportation network. By connecting all sources and sinks with a sufficient number of transhipment nodes, a network can be defined as shown in Figure 1. By restricting the view to the demand for a single transport assignment without considering the actual path, a transport relation can be defined by connecting the source and the sink directly, i.e. short-circuiting the network.

![Figure 1: A transport network model and a transport relation.](image)

Links and nodes are abstract terms used for modelling. In the real system, links are served by vehicles and vessels using infrastructure. For the physical unit corresponding to transhipment nodes, the word terminal is used although the traffic mode specific terms airport, seaport and station are more common in colloquial speech. Transhipment nodes with a central role in a network are, varyingly and often inconsistently, called hub, dock, gateway, turntable etc. in the transport industry.

To straighten up the terminology a gateway is here defined as a link between different networks, while Fleming and Hayuth (1994) restrict the meaning to nodal points transhipping between intercontinental transport flows and continental axes. Figure 2 shows how gateways can be classified as receiving or dispatching nodes in a network. These types of nodes differ from sources and sinks in the sense that transport assignments do not origin or end in gateways, but merely use these as interfaces towards other networks.
In an *intermodal gateway*, networks based on different traffic modes are linked, while *intramodal gateways* link networks using the same traffic mode. Traditional examples of intermodal gateways are seaports, airports and intermodal road-rail terminals. Intramodal gateways include consolidation terminals where lorries operating long-distances and pick-up and delivery routes respectively are coordinated and seaports offering transhipment between trans-ocean container vessels and feeder vessels or barges. International rail services is still commonly operated by use of intramodal gateways compensating for incompatible legislation, electric power supply systems, signalling systems, loading profiles and sometimes also rail gauge between neighbouring countries.
An **intermodal road-rail terminal** can simply be described as a place equipped for the transshipment and storage of intermodal loading units (ILUs) between road and rail. There are intermodal terminals in a great variety of shapes and sizes (see, e.g., Woxenius, 1998) and a number of value-added services such as stuffing and stripping, storing and repair of ILUs might be offered. As suggested by Höltgen (1995), intermodal terminals can be classified according to some basic functional criteria like transport modes, transhipment techniques, network position or geographical location. Nevertheless, the transhipment between traffic modes is the characterising activity.

A specific class of terminals has evolved around the need for connecting inland conurbations with seaports. Depending on the role and the offered services, the transport industry operates this kind of terminals under different names. From a legal point of view, it is of particular importance if customs services are provided. The UN Economic Commission for Europe (UN ECE, 1998) defines an **Inland Clearance Depot** as:

A common-user inland facility, other than a port or an airport, with public authority status, equipped with fixed installation and offering services for handling and temporary storage of any kind of goods (including container) carried under Custom transit by any applicable mode of inland surface transport, placed under Customs control and with Customs and other agencies competent to clear goods for home use, warehousing, temporary admission, re-export, temporary storage for onward transit and outright export.

Hence, the function corresponds to a classic free port. UN ECE states that the definition also applies to synonyms like Dry Port and Inland Clearance Terminal.

India introduced **Inland Container Depots** (ICDs) in 1983 and the Indian Customs (2004) bases its definition of an ICD on the UN ECE definition above, but restricts it to containers. India also uses the term **Container Freight Station** (CFS), which differs from an ICD since containers are stuffed and stripped there. Hence, an ICD is a consolidation node for containers whereas a CFS aggregates individual consignments into containers. A CFS function might be added to an ICD. ICDs are normally located outside the port towns but there are no site restrictions regarding CFSs. CONCOR, the intermodal branch of Indian Railways, currently operates 41 ICDs and plans for further 13 (Indian Railways, 2004). The ICD Tughlakabad in Delhi alone handled some 500 000 TEU in 2003 (Thorby, 2004).

In Europe there has been a focus on business areas offering a wide range of logistics services. In a survey, Cardebring and Warnecke (1995) define an **Intermodal Freight Centre** as:

A concentration of economically independent companies working in freight transport and supplementing services on a designated area where a change of transport ILUs between transport modes can take place.

An **Inland Freight Terminal** is, according to UN ECE (1998), “any facility, other than a port or an airport, operated on a common-user basis, at which cargo in international trade is received or dispatched”. According to The US National Association of Development Organizations (2002), an **Inland Port** is located inland, generally far from seaport terminals. They supply regions with an intermodal terminal or a merging point for different traffic modes involved in distributing merchandise that comes from ports. The term dry port is used synonymously. The Port of Marseilles uses the term **Advanced Port** for a site possessing certain features that allow it to be considered as a genuine port located inland. In order to obtain the Advanced Port label, the site must offer the following characteristics (Port of Marseilles, 2004):

- it must be at least bimodal (rail-road, river-road, etc.),
- it must allow freight to be prepared for "mass" transport for integration on one or more means of
transport, with numerous and comprehensive services (storage and repair areas, warehousing, etc.)
- it must be possible to carry out all administrative and customs formalities using high-performance
data processing systems,
- its services must be available to all professionals (public service concept).

Related to seaports, “advanced” refers to the advanced location rather than to the advanced
level of service as these services are generally provided by seaports. Finally, according to
the European Commission (2001/b, p. 59), a dry port is simply “an inland terminal which
is directly linked to a maritime port”. Since this definition is rather broad in its meaning, all
above mentioned terminal facilities might use the notion dry port due to their links to sea-
ports. Therefore, a more operational and precise definition of the dry port concept is pro-
vided in the next section.

3 The dry port concept

As mentioned, the steeply rising container flows have resulted in crowded terminals, con-
gestion and prolonged dwell times for containers. An option for relieving the main ports
from such congestion on the land side is to shift from routes where the trans-ocean vessels
call a few ports at each continent to call a single hub port while feeder vessels connect to
many smaller ports (Baird, 2002/a). The individual main ports, however, try to attract as
much flows as is economically feasible and, as elaborated by van Klink and van den Berg
(1998), the size and shape of a port’s hinterland is not statically or legally determined but
varies dynamically due to developments in technology, economy and society.

Among others, Heaver et al., 2000, Notteboom (2000 and 2002) and Notteboom and
Winkelmans (2001), state that many seaports as well as shipping lines integrate vertically
to control also hinterland transport. In Europe, for instance, deregulation in the rail sector
has made it legal for Maersk-Sealand and P&O Nedlloyd to start European Rail Shuttle
and for Hamburger Hafen- und Lagerhaus (HHLA) to buy half of the German intermodal
operator Transfracht (Woxenius and Bärthel, 2002). The vertical integration must be done
cautiously and respect anti-trust legislation since slot-sharing alliances and conferences are
allowed at sea but have been disputed by competition authorities (Slack et al., 2002), even
in court by the European Commission. With new port networks emerging (Notteboom,
2002 and Woxenius, 2003) and different actors integrating vertically, the competitive
situation needs continuous attention by port operators (Heaver et al., 2001 and Notteboom
and Winkelmans, 2001).

Conventional hinterland transport is based upon numerous links by road and a few by
rail as shown in Figure 4 with an example of ten shippers outside the seaport city. Rail
transport is generally limited to serving major conurbations at rather far distances from the
port and the interface towards containers arriving by rail is comparable to that of those
arriving by road.
The intermodal transport market in Europe is often divided between maritime and continental services (see, e.g., Rutten, 1998), of which the former relates to seaport traffic and the latter to the road-rail-road combination. Operators such as CNC, ICF and Transfracht distinguish operations, or at least market offers, and report their flows correspondingly.

The traditional division of labour in the industry together with monopolies or other regulation is now loosened. In addition to rail shuttles, ports have also shown interest in starting inland terminals in order to control and optimise a larger part of the intermodal transport chain. The importance of well functioned inland terminals is stated by van Klink (2000, p. 134):

Another way in which ports can exploit know-how in order to pursue their strategic goals is to participate in the development of a network of inland terminals within Europe. Developing and rationalizing intermodal transport operations places great demands on the structure and operation of inland terminals. By investing in inland terminals and participating in their operation, a sea port can establish itself in inland regions. Inland terminals may be considered as “extended gates” for sea ports, through which transport flows can be better controlled and adjusted to match conditions in the port itself. In this way, inland terminals can help to improve land access to ports in both physical and psychological terms.

According to Zimmer (1996) an ideal terminal is not a certain physical configuration of pavement and tracks, but an organisation of services integrated with a physical plant that meets the business needs of a specific marketplace. These physical plants may take many forms, which are influenced by the characteristics of the landscape, their proximity to the seaport or major industrial complex, their location relative to the main rail infrastructure, and their distance from the country’s highway network. This conscious and strategic development of intermodal terminals in the hinterland is approaching what we denote dry ports. Based on earlier own research on the terminal facilities using the dry port notion, the following definition was formed by Leveque and Roso (2001):

A dry port is an inland intermodal terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardised units as if directly to a seaport.

Apart from the basic service, transhipment, that a conventional inland terminal provides; services like storage, consolidation, depot-storage of empty containers, maintenance and repair for containers, custom clearance, etc. should be available at full-service dry ports.
The quality of access to a dry port and the quality of the road/rail/waterway interface determines the quality of terminal performance therefore it is necessary to have scheduled, reliable, transport by high capacity means to and from the seaport. Thus, dry ports are used much more consciously than inland terminals with the aim to improve the situation caused by increased container flows, focus on security and control by use of information and communication systems. The real difference is that the gates of the port are extended as described by van Klink above and that the shipper or forwarder see the dry port as an adequate interface towards the port and the shipping lines. Hence, the dry port concept goes beyond just using the rail and barge modes for high capacity transportation in the hinterland.

The dry ports are mostly located interior from the coast, thus the name dry port, but it does not exclude cities with sea access. In the case of Sweden, Göteborg is the main port and the concentration of flows with a high frequency together with the fact that calling Ports of Stockholm implies a significant detour around southern Sweden, means that most containers are moved by rail across Sweden. Between the seaport and the dry ports, relatively large goods’ flows are being concentrated, giving room for other traffic modes than road. For a fully developed dry port concept the seaport or shipping companies control the rail or barge operations, but it does not mean that the terminal itself must be dedicated to serving only one port and it can also be part of a network for continental services.

3.1 Distant dry ports

Based upon the function of a dry port, they can be categorised as distant, mid-range and close dry ports. A distant dry port is the most conventional of the three and has the longest history. The main reason for implementing it is simply that the distance and the size of the flow make rail or barge viable from a strict cost perspective. Figure 5 shows a seaport and its hinterland with the implementation of a distant dry port.

![Figure 5: A seaport with a distant dry port.](image)

Compared to conventional rail shuttles to and from ports, the difference is mainly referred to the functions offered at the distant dry port and the moved interface towards shippers. The more structured approach increases the competitiveness of rail against road and the shippers 3, 6 and 7 are now served by the dry port. Parts of the benefits of distant dry ports
relate to the modal shift from road to rail that results in reduced congestion at the seaport gates and its surroundings, one train can substitute some 40 lorries in Europe and more than 100 in the US, and reduced external effects along the route. The main reason for the seaport to engage in a distant dry port, however, is that a wider hinterland can be secured by offering shippers low cost and high quality services.

Hence, the main benefit is attributed to seaports and the shippers using it. van Klink (2000, p. 127) states that the pressures for good inland accessibility come from various, interrelated, directions like the growth of containerised transport, resulting in congestion in the ports themselves and on the routes to the hinterland. In addition, shippers and carriers increasingly rate ports on their accessibility, for example the frequency of inland transport services and transit times, or because of society’s demand for more environmentally friendly transport. To benefit from the opening up of new markets, ports need to improve their access to areas outside their traditional hinterland. Mourão et al. (2002) agree and argue that ports compete not only in terms of transhipment efficiency and tariffs, but also in terms of speed and reliability of shipments to destinations on the continent. That competition requires seaports to focus on transport links, on the demand for services in its traditional hinterland and also on development in areas outside their immediate market. A good example, according to van Klink, (2000, p. 132), is the introduction of a block train service between Rotterdam and Barcelona, which makes it possible for time-critical products from Asia, destined for North-West Europe, to be transhipped in Barcelona and transported over the final leg of the transport chain by rail instead of doubling the Iberian Peninsula.

Rail operators obviously benefit from distant dry ports because it increases the scale of their business. This is particularly important for rail transport depending on economies of scale and can make continental services, for instance between the inland conurbation and the seaport city, viable although ports are reluctant to bring in ILUs not relating to shipping. At least, the fixed costs of the intermodal terminal itself can be distributed between more transhipments when adding the dry port flows. Road transport operators are not benefiting from this configuration directly since the aim is to move transport of containers from road to rail, but they are still involved in the intermodal transport chains. As they are not particularly paid for waiting in congestion or at crowded gates at the port, they can serve the dry port surroundings with shorter hauls with better total revenues.

From the shippers’ perspective, a well implemented distant dry port offers a greater range of logistics services in the dry port area. For environmentally conscious shippers it brings a possibility of using rail instead of road and thus decrease the environmental impact of their products. The seaport city benefits from decreased road traffic saturating the streets and decreasing the quality of life for the citizens. Less traffic might also leave valuable area around the city centre for other purposes than traffic.

One example of a distant dry port is Isaka Dry Port in Tanzania, which used to be a conventional intermodal terminal (Tanzania Railways Corporation, 2004):

Isaka Dry Port is an inland container terminal, which acquired the Dry Port status in 1999. The conversion of Isaka into a Dry Port means that all the customs documentation may be done at Isaka instead of Dar es Salaam Port. Importers can now accomplish all the necessary documentation and take delivery of their cargo at Isaka. (...) Isaka provides a convenient interface for traffic to Rwanda and North Eastern Democratic Republic of Congo.

According to Mande (2000), the Isaka facility is very profitable because of the increasing exchange of containers that is done with neighbouring land-locked countries such as Rwanda and Burundi. Before the conversion, shippers had to do custom and port clearance
directly in the seaport of Dar es Salaam some 800 km away. Instead of a week it now takes only two days to send a container to the seaport.

### 3.2 Mid-range dry ports

Besides the price-quality ratio of competing traffic modes, the competitiveness of intermodal road-rail transport depends on geographical and demographical conditions. Continental services are generally competitive at distances above 500 km (see, e.g. van Klink and van den Berg, 1998) while maritime services can compete on slightly shorter distances (Rutten, 1998) due to the concentration of flows, less tight demands for transport time and frequency and that one transhipment is required also for the combination road-sea (Woxenius and Bärthel, 2002). A mid-range dry port is consequently situated within a distance from the port generally covered by road transport as shown in Figure 6.

![Figure 6: A seaport with a mid-range dry port.](image)

Here shipper 2, 3 and 9 are served directly by the dry port while shippers 7 and 8 are served by a closer conventional intermodal terminal. The mid-range dry port here serves as a consolidation point for different rail services, implying that administration and technical equipment specific for sea transport, for example x-ray scanners needed for security and customs inspections, are just needed in one terminal. The high frequency achieved by consolidating flows together with the relatively short distance facilitates loading of containers for one container vessel in dedicated trains. Hence the dry port can serve as a buffer relieving the seaport’s stacking areas. If this is a severe constraint, shippers with comparable distance to the seaport and the dry port (e.g., shipper 9) can then be directed to the dry port if it is made cost neutral to them. In other dimensions, the benefits are similar to those of a distant dry port.

The Virginia Inland Port (VIP) is an example of a mid-range dry port that moves the interface between lorry and rail for the transport of containers to and from the Port of Virginia, mainly their terminals in Hampton Roads. The VIP is located at Front Royal some 330 km from Hampton Roads and serves as a “US customs designated port of entry” where the full range of customs services is available to shippers. It has been consciously developed in order to increase the hinterland of the Port of Virginia (Bray, 1996) serving the Ohio valley in competition with Port of Baltimore (Woodbridge, 2004/b). The VIP has
attracted investments of some 100 MUSD in distributions centres for Home Depot and Sysco securing import container flows for the seaport (Woodbridge, 2004/c).

An example also served by barge is the Edouard Herriot Port in Lyon some 300 km inland from the Port of Marseille. The ports are connected by both rail and barge shuttles, of which the barge service is considered the more important. The Lyon terminal hosts an office operated by Port of Marseille and a wide range of services like customs clearance and forwarding are provided qualifying it to be an Advanced Port as defined above (Port of Marseilles, 2004).

3.3 Close dry ports

Transport hubs are significant generators of freight traffic both between and within major cities impacting ever more severely on local communities (Slack, 1999). Solving the local traffic problems related to ports is of particular interest to public bodies that most often also control the port authorities although the private sector is increasingly involved in port operations (Baird, 2002/b, Cullinane et al., 2001, Notteboom, 2002 and Woxenius, 2003). Of measures for mitigating congestion, long-distance road operators and those using intermodal rail services seem to favour arterial priority schemes, dedicated streets for port access and longer operation hours by ports (Golob and Regan, 2000). In addition, most ports suffer from a lack of a space and capacity, problems for which conventional mitigation measures were outlined in the introduction of this article.

Another option is to introduce a close dry port at the rim of the seaport city. The close dry port consolidates road transport to and from shippers outside the city area offering a rail shuttle service to the port relieving the city streets and the port gates as shown in Figure 7.

![Figure 7: A seaport with a close dry port.](image)

In this case, shippers 1-3 and 7-10 use the dry port and the seaport generates no road transport or gate congestion from shippers at long or mid-range distances. Compared to the other types of dry ports, a close dry port offers larger possibilities for buffering containers and even loading them on the rail shuttle in sequence to synchronise with the loading of a ship in the port. This obviously requires a very reliable rail service not to risk increased dwell times of container vessels and then, at least at a start, the short distance with a dedi-
icated track is a prerequisite. In the longer run, direct transhipment between trains and ships can be implemented as is done by HHLA in Lübeck (HHLA, 2004) or full container terminals can be specialised for rail-sea transhipment as proposed by Ashar (World Cargo News, 2004/b).

Road hauliers lose a marginal market share in terms of road-kms but would still benefit from speedier operations. In cities not allowing long or polluting road vehicles, calling a close dry port is an alternative for splitting up road vehicles or changing to less polluting ones.

The 32 km long Alameda Corridor connects the ports of Los Angeles and Long Beach to intermodal terminals near downtown Los Angeles. It can be referred to as an example of a close dry port project since the containers were previously trucked between the terminals and the ports or used degraded small railway lines. Some 200 street-crossings were eliminated by letting the tracks run in a trench. Road congestion is significantly decreased and the containers move at more than double the speed than before. The ports carry about 20% of the construction costs amounting to 2.4 billion USD and the railway operators are supposed to pay it by user fees (ACTA, 2004).

Before improving the local road network, containers were also moved by a just 15 km rail shuttle between Schenker’s general cargo terminal and the Port of Gothenburg. Moreover, a close dry port is planned at Enfield some 18 km from Sydney’s Port Botany (Sydney Ports, 2003). The Enfield Intermodal Terminal should facilitate more effective clearance of containers from the port and increase the productivity and capacity of existing port lands. A special dimension is that the expansion of the port is questioned for ecological reasons and the dry port is one of many measures to mitigate the consequences.

### 4 A fully implemented dry port concept

Comparing a combination of the three types of dry ports with the original example, as is done in Figure 8, shows that the port and its surrounding city can be relieved from all road connections referring to locations outside the city area. In the example the shippers closest to the port (1, 2, 9 and 10) call the close dry port, two at medium distances (7 and 8) call the mid-range dry port through another intermodal terminal while the shippers furthest away from the port (3-6) use the distant dry port. Previously only the shippers very close to the conventional intermodal terminal used rail services.

The distant dry port is here directly connected to the port since the flows were already before large enough to ensure a full train service. If any of the mid-range or close dry port is used as a consolidation point coordinated with ship calls by dedicated trains, then the distant dry port would be served by a shuttle to the consolidation point. The same principle applies for the mid-range dry port if the close dry port is used for coordination or sequenced loading related to individual ships. Regardless of if the containers pass several dry ports, they can obviously use the same railway line into the port.

It is not only the number of direct road connection that changes. There are opportunities to transfer activities currently causing congestion at the seaport gates to the dry ports. These activities include customs clearance, security checks and information handling. Also physical handling such as stuffing and stripping as well as buffering laden and empty containers can be done at the dry port and thus saving precious space in the port.
The benefits, however, obviously come at a cost and they require that certain conditions are fulfilled. The most significant one is that the flows are large enough to facilitate efficient terminal and rail operations, the latter with satisfactory speed and frequency. Mid-range and distant dry ports also come with distance requirements. In some cases implementation of the dry port concept assume some new thinking from authorities; if immensely expensive infrastructure projects can be avoided, why not take some of the saved money to relieve the rail services from some costs? Hence, the costs and benefits must be analysed at a rather aggregate level and be justly divided between the involved actors. This is obvious in theory and makes common sense, but in practice shortcomings in this field have stalled numerous theoretically viable projects.

5 Conclusions

It is here asserted that the dry port concept goes beyond the conventional use of rail shuttles for connecting a seaport with its hinterland. Being strategically and consciously implemented jointly by several actors, it also goes beyond the common practice in the transport industry.
Besides the general benefits to the ecological environment and the quality of life by shifting flows from road to rail, the dry port concept mainly offers seaports a possibility to increase the throughput without physical expansion as well as better services to shippers and transport operators. The seaport cities, often also the principal of the port authority, are offered less road congestion or infrastructure investments.

The real-world examples also show that dry ports can be introduced and are being introduced by several ports. The immediate reasons may vary, but a common dominator is that rail has a role to play as an intermediate traffic mode between sea and road. For implementation, however, costs and benefits must be carefully evaluated and distributed between the actors.

References


