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ALONG DIFFERENT PATHS: INTERMODAL RAIL TERMINALS IN NORTH AMERICA AND EUROPE

BRIAN SLACK
Department of Geography
Concordia University
1455 de Maisonneuve Blvd. W.
Montreal, Quebec H3G 1M8 CANADA

Abstract

Intermodal (combined) traffic represents a new and increasing market for the railways of North America and Europe. In both areas, piggyback and containers have opened up fresh opportunities for the rail freight industry. Although certain similarities are apparent, for the most part strikingly different terminals are evolving.

INTRODUCTION

Unmistakedly we live in a global economy. The world-wide reach of corporations in terms of sourcing, production and distribution, and recent multi-lateral trade liberalisation treaties are two important manifestations. Transportation has helped make globalisation a reality, and at the vanguard of the innovations in transportation is intermodality. Here, the long-cherished dream of achieving essentially a seamless system is being realised through the reduction of former obstacles to transfers between the modes.

As much as intermodal transportation has contributed to the establishment of the global economy, and despite the world-wide implementation of the concept of intermodality, one cannot avoid being struck by the fact that there are significant differences in the way systems are being implemented in various parts of the world. This paradox, of a virtually universal concept, with significantly different set of regional applications, forms the focus of this paper. It examines the differences in intermodal developments between North America and the European Union (EU), the evolving rail-based systems in particular. The analysis provides insights into radically different concepts of the role of terminals, and the ways in which intermodal facilities are managed and planned.

INTERMODALITY: COMMON ANTECEDENTS, DIVERGING TRENDS

The maritime container is at the base of modern intermodal transport systems. A maritime technology, introduced in the mid 1960s, containers greatly speeded up port transfers between land and ship, and thereby radically affected the efficiency of maritime mode. The technology has since diffused world-wide, so that today most non-bulk maritime shipments are containerised. The ISO container has become the standard unit for the shipment and handling of international maritime trade.

The impact of the maritime container on inland transportation has been slow and incomplete. In North America, the railways had already experimented, with less than satisfying results, with road trailers on flat cars (TOFC), and initially were reluctant to embark on yet another intermodal concept (Mahoney 1985). In western Europe, the container received a slightly more receptive welcome, with the creation of Intercontainer, a company established by the separate state-owned railroads to manage and organise international container flows across national borders. Up until the 1980s, however, intermodality remained largely as a minor traffic segment for the railroads on both sides of the Atlantic. In both areas, trucking captured the lions share of the general freight market, and the railroads sought to concentrate their efforts on core business: bulk traffic in North America, passengers and traditional bulk cargoes in the EU.

In the 1980s the fortunes of intermodalism in North America and Europe improved. The changes, however, took on a very different character in each region. In North America, the maritime container led the way. Double stacking (DS) permitted significant economies in rail operations, and deregulation allowed intermodal ownership of transportation operations. These two elements were exploited by the shipping lines, many of whom began to operate and manage DS rail services in order to effectively provide door-to-door service to their customers. It was a small (but very significant) step for the operators of these double stack import-export container services to offer space to domestic shippers (Slack 1994). From the inception of the services in the mid 1980s the containerised rail services have expanded very significantly, and by the early 1990s the majority of the business was made up of domestic traffic. This in turn led to a considerable proliferation in the dimensions of boxes, with the ISO standard containers being restricted to maritime-bound traffic. For the last decade, therefore, intermodal traffic has been a growth sector for North American railroads, and significant changes have occurred, including strategic alliances (as well as mergers) between railroads, trucking firms and shipping lines.

In the EU, the container has not played the dominant role as across the Atlantic (Dawson et al. 1989). Intercontainer faced many difficulties in expanding container service, not least being the frequently conflicting national interests of the member countries and high freight rates. In addition, other intermodal options have been pursued. Piggyback has received a boost by technological and policy developments in different parts of Europe. The Channel tunnel forces road freight onto rail for at least the undersea portion of the journey, and there is some expectation that this will provide opportunities for still longer-haul rail shipments between the UK and the rest of Europe. Similarly, Swiss and Austrian policies restricting truck movements across their territories, nominally for environmental reasons, are forcing trucks on to the railroads for trans-Alpine movements (Whitelegg 1988). Finally, Europe has developed a truck-based unit that can be transferred to rail that is unlike the rigid box character of the container. The 'swap-body' is distinct because its sides are open, being covered by a flexible material such as polyurethane, and it is wider than the maritime container. These features have made it highly successful. Its width, permitting two wooden pallets to be loaded side-by-side, is a very attractive option.

The result is that after 10 years of expansion and development, intermodalism in Europe and North America are developing in different ways. Nowhere are the contrasts more pronounced than in the terminals. Because the nature of the trade is dissimilar, and since the systems have developed under divergent policy environments, the terminals are where the differences reveal themselves in contrasting forms and functions. Furthermore, it is through the terminals that the differences are felt locally. Terminals are important land uses, and their activities impact on local communities. This paper goes on to analyse the nature of the differences in the terminals in North America and western Europe, and to explore some of the consequences.

TERMINAL DIFFERENCES

Differences in the nature of intermodal traffic between Europe and North America have obvious effects on the terminals. In North America, the growing importance of the container, both for maritime and domestic traffic, impacts on terminal operations. Containers are most efficiently handled by top lift equipment. Whether side approach vehicles or rail mounted gantry cranes are used, top lifting permits rapid handling and positioning. While the same equipment can be used to lift trailers, it requires the addition of a bar to permit the unit to be raised from beneath. Terminal operators prefer not to have to mix traffic, because of equipment modification delays, and thus either separate TOFC from COFC operations wherever possible, or manage terminals dedicated to one system or the other. In North America, therefore, terminals tend to be specialised. However, container operations may be quite diverse, because of the proliferation of box dimensions, from regular ISO 20 and 40 foot containers, to 29, 48, 53 foot, high and low cube domestic variants, that may be rail loaded as COFC or DS.

In the EU, on the other hand, the dominance of the container in terminal operations is rarely as evident. TOFC and swap body systems are usually prevalent in non-port terminals. Equipment requirements and yard operations normally reflect the greater diversity of intermodal units, and bottom or side lifting is far more evident. Operationally, therefore, most European facilities tend to be less specialised than their North American counterparts.

The nature of the traffic and the operating characteristics of the railroads also influences the morphology of the terminals. While mixed trains (intermodal and other freight) are not uncommon in North America, by far the greatest volume of intermodal traffic is handled by unit trains. On the high density corridors, double stack trains are dominant. These trains haul containers between traffic hubs over distances usually greater than 750 miles (Manlytics 1990). The typical DS train hauls 400 containers, and requires several locomotive units. The length of these unit trains, and their capacity has an immediate effect on the layout and operations of terminals. In order to prevent time consuming breaking up of the trains in order to fit into the terminals (with additional costs of shunting), optimal yard design requires long (over 2,000 meters) tracks, and thus terminals tend to be very long and elongated in their morphologies (Goodwin 1986).

Distances between markets in the EU are smaller, and thus the line-haul economies that favour rail intermodal traffic in North America are not as great. The large market is more diffuse, and

coupled with the smaller operating characteristics of European railroads, unit trains are significantly shorter. This has meant, therefore, that terminals do not have to be as extensive as those in North America. Shorter track lengths are more common, but because containers are not as evident in European facilities, working areas and storage requirements are generally more extensive. European terminals usually conform to a more box-like shape, than their more elongated trans-Atlantic counterparts.

Significant though these contrasts brought about by differences in traffic may be, they are far less striking than the contrasts engendered by political and policy disparities. Railroads in North America are privately owned (with the exception of Canadian National which is a Crown Corporation), while European railways are state monopolies (with the partial exception of British Rail that is in the process of being dismembered). Furthermore, there has been much more involvement of other commercial intermodal interests with North American railroads than in Europe. Shipping lines, trucking companies and third parties are all involved in the US in providing intermodal rail services and operating rail facilities. Although the situation is beginning to change in Europe, the state-owned railroads have been the dominant actors in shaping rail intermodal activity.

Commercial interests have moulded the evolving pattern of intermodal facilities in North America. Notable has been the decrease in the number of rail intermodal terminals. Seeking to maximise the opportunities afforded by the log-haul economies of double stacking and unit train services, there has been a massive rationalisation of terminals. From a total of 1,176 intermodal terminals in North America in 1978 (Down and Wise 1986), the number had fallen to 199 in 1992 (Slack 1992). This rationalisation has resulted in the emergence of a distinct hub and spoke intermodal system. Companies such as Burlington Northern have sought to establish hubs approximately 350 kms apart, linked by intermodal rail services, with trucks providing local pick up and delivery.

In the EU, intermodal traffic has still to become an important core business for the railways, and the development of terminals has been seen largely through national lenses. Each state-owned system has sought to develop terminals in the context of its own national interests, and consequently there has not yet been a Europe-wide rationalisation (Whitelegg 1988). Intercontainer has not had the ability to force intermodal rationalisation, since it is dependent upon its constituent members to provide terminal sites. In 1993, there were 254 intermodal terminals in the 9 of the 12 member states of the then European Union (Greece, Portugal and Eire are excluded) (Transport en Logistiek Netherland 1994). This number is larger than the total for North America, and may be taken as an indication of the slower rationalisation rate of the European system.

Further analysis reinforces the differences (see Table 1). If the number of facilities is compared with the land area of the two systems, a much greater difference is evident, with an average of one terminal per 50,396 sq kilometres in the US and Canada (minus Alaska, and only considering the area of the Canadian ecumene), against one terminal per 8,145 sq kilometres in the EU (minus Greece and Portugal and Eire).

There are considerable national differences in the number of facilities in the EU (see Table 1). Germany, Holland, Denmark and Belgium have a higher density of facilities than the average. This cannot be explained by the size of the market, since Denmark has twice as many facilities as the UK, and Germany has 17 times as many terminals as the UK and four times the number of France. These differences are reflections of varying national policies towards freight terminal development in general, and divergencies in response to changes brought about by the economics of intermodalism in particular.

Even greater discrepancies between North America and Europe are revealed by the fact that many of the 199 US and Canadian terminals are located in the same cities. Forty cities have 2 or more terminals within their confines, and 15 cities have three or more facilities. Indeed, there are 10 terminals in the Greater New York region, and 14 in metropolitan Chicago (see Table 2). The result is that if city-hubs in North America are considered, irrespective of the number of terminals located therein, there are 98 centres. In Europe, on the other hand, only 21 cities have more than one facility (there are 10 in Rotterdam), and 186 cities have one terminal only. The total number

of hub centres in Europe remains high, therefore, at 215. This is more than double the total for North America, and confirms the fundamental difference in intermodality between the two areas.

Table 1 Intermodal terminals in the European Union and North America, 1992

	Number of terminals	Density of terminals/km^2
United States and Canada	199	50,396
European Union	254	8,145
Belgium	8	3,755
Denmark	14	3,071
France	26	20,923
Germany	119	3,000
Italy	46	6,543
Luxembourg	1	3,000
Netherlands	19	2,210
Spain	14	36,071
UK	7	34,857

Table 2 Distribution of terminals by city, 1992

	Number of terminals per city										
	1	2	3	4	5	6	7	8	9	10	<11
Canada and US	62	26	3	3	1	4	1	-	-	1	1
EU	186	15	1	2	1	1	-	-	-	1	-

With 41% of the intermodal hubs in North America possessing more than one terminal, a high rate of duplication is suggested, despite the more concentrated network. This is due mainly to the number of railroads and other operators involved in intermodal rail business. Each company has developed its own intermodal network, and because most large cities are served by several railroads, a high degree of duplication has come about. Chicago has so many facilities because it is the main point of contact between all the US railroads that are essentially regionally-based.

In Europe, on the other hand, railways have been developed by state monopolies, and there is much less duplication. Only the largest rail hubs, such as Paris, or the largest ports, such as Rotterdam and Hamburg, have multiple terminals.

COMMERCIAL EFFICIENCIES OR PLANNED EFFECTIVENESS?

There is firm evidence that the intermodal system in North America is becoming more efficient and competitive. The growth of business, the expansion of services, the larger market share are all indications of a system that is becoming more successful commercially. Improvements in terminal operations, including the establishment of hub networks, have helped make this come about. In Europe, the market share of intermodal transport has not been growing as strongly, and is not possible to double stack and achieve the line haul economies of North America. It is tempting, therefore, to point to the highly regulated European railroads as comparative failures, and conclude that the free market forces are inevitably superior.

While throughputs are probably higher in North America, and terminal costs are almost certainly lower, the evidence of terminal duplication in North America presented here, suggests that a system that is driven by market forces in a deregulated environment is capable of producing spatial inefficiencies. The present pattern of intermodal terminal duplication appears to replicate the text book example of the ice cream vendors. It may be recalled that this problem demonstrates how market forces will result in two ice cream vendors serving a stretch of beach being located

next to each other, a solution that is not particularly advantageous to many of the customers. In a similar way, market forces have resulted in different companies choosing the same cities as hubs.

Apart from reducing opportunities for achieving scale economies in the yards, the duplication of facilities gives rise to important organisational and logistics problems for handling interlined traffic. In Chicago, the largest rail intermodal hub centre in the world, problems of linking the terminals produces difficulties and extra costs for operators, and gives rise to noxious problems for local communities. Rail interlining between terminals in Chicago (usually referred to as 'steel wheel' interchanges) is costly and time consuming, especially where the size of the block to be exchanged is small. It is claimed that a steel wheel interchange might take 48 hours to achieve, at a cost of over $75 per container (Personal communication, a terminal manager). Because of these difficulties, most intermodal firms transfer the containers on to trucks, for delivery to the other rail terminal: the so-called 'rubber tire' interchanges. Delays might be no more that 4 hours, and involve a transfer cost averaging $40 per container. The popularity of rubber tire exchanges has resulted in a significant increase in road traffic around the terminals. Some 8,000 rubber tire interchanges take place each month between the Conrail and Sante Fe yards alone (Chicago Area Transportation Study 1990), which is bringing about pressures from local governments to restrict truck movements to non-peak hours.

In Italy, in direct contrast to the North American experience, the government has been pursuing a policy of developing an integrated multimodal transport network, in which the establishment of a limited number of terminals forms a central part. Nine *Interporti*, or intermodal load centres, have been established. They are strategically located to serve the most important markets. Lombardy (Lachiarella-Segrate), Piedmonte (Rivalta Scrivia and Orbasso), Venezia (Verona and Padua), Tuscany (Livorno-Guasticce), Emilia-Romana (Bologna and Parma), and Campagna (Marchianise-Nola). A number of second tier facilities are also being set up (Charlier and Ridolfi 1994). Because the system has been designed and implemented as a whole, there is less duplication. A comparable system-wide approach is being pursued by the French Railways, but one in which a hub (in Paris naturally) is linked in a spoke-like fashion to regional centres. All the interregional traffic will be routed and interchanged in the Paris hub at Noisy-le-Sec, where a sophisticated terminal, capable of multiple sorting and repositioning of units, is being tested. This Commutor Project is adopting a Federal Express-type solution, and if it is found to be workable will be one of the most sophisticated intermodal freight terminals in the world.

The Italian and French system-wide approaches to terminal development also exhibit characteristics that many other European facilities are adopting in terms of multi-functionalism. Terminals are being planned to be more than transfer points. The concept of the freight village has been put forward as an attempt to foster intermodalism, to relieve road congestion, and to promote economic development. For example, at Rivalta Scrivia, which was the first of the Italian *Interporti*, storage facilities, bonded warehouses, office space, overnight accommodation for truckers, a data processing centre, repair and maintenance facilities are provided on its 200 hectare site, in addition to the transfer activities. It performs traditional warehousing functions as well as labelling, weighing, and re-packing.

A prototype of what is hoped will be a new generation of terminals in Germany is the *Guterverkehrszentrum* of Bremen. It has been established in order to centralise the location of firms involved in distribution and logistics in the region. Instead of firms seeking individual premises all over the city, they have been combined in one complex, to reduce traffic flows. Both vertical and horizontal cooperation is considered important in policy formulation. Vertical cooperation is where one firm, a freight forwarder for example, buys in the service of a neighbour, a cold storage depot for example, and later when the products are distributed to retail outlets by a local for-hire trucker. Horizontal cooperation is what is referred to in Germany as 'freight exchange' (Holtgen 1992). Here, consignments from different companies in the centre are pooled, with the help of data interchange, and given to carriers according to availability. In this way small firms are able to offer a wider range of services to more destinations more competitively. At the same time it has contributed to a reduction of urban truck traffic. Several other benefits have been recorded for the Bremen facility. It accounts for an employment of 2,000 on a site of 200ha, and its 30 firms contribute 48 million DM to the city in business taxes. The communal use of on-site

facilities, such as truck wash, container repair, security, and restaurants are regarded by the businesses on site as an advantage that would not be available elsewhere (Holtgen 1994).

No equivalences exist in North America. There the goal of the terminal operators is to move the intermodal units in and out of the yards as quickly and cheaply as possible. This is a commendable objective, and one that most terminals achieve with greater efficiency than their European counterparts. On the down side, however, potential externalities are diffused, and local communities may suffer the negative effects of transport activity, without realising any potential economic benefits.

A COMMON GROUND?

It would be foolish to foresee the imposition of North American business solutions to the intermodal scene in the EU, just as it would be unrealistic to envisage European centralisation in Canada or the US. The transport *cultures* of each continent are just too different. This does not mean that either system cannot learn from the other. Indeed, there are signs that some of the differences are being softened, as various innovations are being introduced.

Individual nations, Great Britain in particular, as well as the European Commission appear set on a course of increased deregulation. The Commission has sponsored a number of studies and has put forward proposals to improve the services between major centres (European Conference of Ministers of Transport 1992). Part of the justification is that rail offers some possibilities of diverting traffic from the already heavily congested road system. Anticipating the Commission's proposals that would have taken effect in 1992, the state railways agreed to open their networks (Bukold 1993). A result has been the ending of the monopoly enjoyed by Intercontainer, resulting in the establishment of services by the International Union of Rail-Road Companies (IURR), a consortium of railways and trucking firms. It is oriented towards the domestic trailer and swap body business. In addition, the Chunnel has given rise to at least two intermodal operations, Allied Continental Intermodal which includes interests of Intercontainer and British and French Railways, and Combined Transport Limited which is owned by Novatrans (a French intermodal company) and Transfracht (its German equivalent). Intercontainer has responded to the competition by establishing new dedicated intermodal services, including its Qualitynet services between northern and southern Europe.

A growing number of terminals are being developed by non-rail interests. An example is the intermodal facility at Venlo, in the Netherlands, on the frontier with Germany, where ECT, the Port of Rotterdam's major terminal operator, is involved with other companies in operating a very large logistics and distribution complex, centred around the rail facility. One of the firms located in the terminal is Mead, a US cardboard manufacturer, which receives its raw materials by rail from Rotterdam, and distributes its manufactured products on a just in time basis to buyers all over Europe. The possible privatisation of British Rail freight operations, and moves to establish new intermodal terminals such as Trafford Park (Manchester) may auger a new, more commercial approach to terminal development.

In North America, some of the problems with the duplication of facilities are being resolved with the appearance of common user facilities. Here a railroad or a third party may operate and manage the intermodal yard for many clients. Grand Trunk Corporation's Detroit 'Möterm' terminal has been managed as a common user yard since 1990. It handles the business of ATSF, BN, CN, and CSX (Distribution Worldwide 1990), and has resulted in a $150 reduction in rates between Detroit and Los Angeles. Wider use of this approach may overcome many of the problems inherent in interlining. It is one of the options that is seen as a potential solution to Chicago's problems by local transportation planners.

It remains to be seen whether the freight village concept can be transferred to North America. It would require a degree of coordination between disparate private interests and local authorities that would be unusual. However, if the concept can be shown to have commercial viability in Europe, then it is possible that developers might become interested in promoting the integration of transport facilities with logistics centres. Success in the EU might enlighten local governments in

North America to the potential advantages as well. Thus, the experience of the European freight village/plateformes multimodales/Guterverkehrszentrum requires close monitoring.

CONCLUSION

This paper has addressed an essential paradox in modern intermodal transportation systems. Despite the universality of the concept, it is being applied in different ways in different markets. The contrasts are particularly pronounced in the terminals, where different functions and morphologies distinguish North American operations from their EU counterparts. The paper has revealed the fundamentally dissimilar network structure of the two regions, and has discussed the bases of the distinctions in terms of the degree of commercialisation and public policy.

Transport and regional policies have done much to shape the intermodal networks of Europe. There, the long tradition of public control and planning has produced a number of innovations that distinguish the terminals there from their North American equivalents. While operationally EU terminals have not achieved comparable scale economies, their integration in urban and regional planning is far superior, and there are many examples of innovative new functions and operations. One of the major problems of the intermodal system in the EU is the dominance of national interests and policies. Integration is difficult, and although the Commission is working to promote community-wide corridors and deregulation, progress is slow.

In the largely deregulated environments of the US and Canada, competitive forces have unleashed striking new and successful intermodal developments. Radically changes have occurred in network structure and operations, and the transport industry as a whole has been invigorated. Terminals show little public policy influence, and although their performance shows great improvements, there are spatial inefficiencies that the industry needs to address. If the difficulties over interlining are not addressed by the industry itself, pressures for public policy intervention may become forceful enough to bring about unwanted restrictions.

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