The role for rail in port-based container freight flows in Britain

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Abstract

As supply chains become increasingly global and companies seek greater efficiencies, the importance of good, reliable land-based transport linkages to/from ports increases. This poses particular problems for the UK, with its high dependency on imported goods and congested ports and inland routes. It is conservatively estimated that container volumes through British ports will double over the next 20 years, adding to the existing problems. This paper investigates the potential for rail to become better integrated into port-based container flows, so as to increase its share of this market and contribute to a more sustainable mode split. The paper identifies the trends in container traffic through UK ports, establishes the role of rail within this market, and assesses the opportunities and threats facing rail in the future. The analysis combines published statistics and other information relating to container traffic and original research on the nature of the rail freight market, examining recent trends and future prospects. The paper concludes that this is an important market for rail, with considerable growth potential but to realise this it is important that a number of constraints are overcome, otherwise the long-term prospects for this rail market will be compromised.

1. Introduction

In Britain, as in many other countries, increasing attention is being devoted to the land-based transport infrastructure linking ports with the major locations of storage, consumption and, to a lesser extent, production. The greater internationalisation of product supply chains, together with changes in stockholding policies, has placed additional emphasis on good, reliable land-based transport infrastructure to serve the hinterland of major ports. Britain's high dependency on imported goods, together with the existing congestion of a number of ports and inland transport links, have led to concerns about supply chain efficiency. Containers are significant in terms of port volumes, accounting for approximately 10% of the total tonnage passing through UK ports [1], with containerised volumes growing rapidly in the last 20 years. Further, it is estimated that there will be considerable further growth in the next 15 to 20 years, so the existing problems are likely to become more critical unless action is taken. From rail's perspective, containerised traffic moving to and from ports is an important freight sector, accounting for approximately one-sixth of tonne kilometres[1] in 2004/05 [2]. This paper builds on previous research by the author [3] by analysing the recent trends in containerised flows, both through the ports system itself and by rail between the key ports and inland terminals, and assessing the likely future trends in the container market and the associated prospects for rail freight, primarily through the use of a SWOT analysis. The next section provides the background to this research area. This is followed by the specific research objectives of this paper and an account of the methodology adopted. In Section 4, trends in the UK container market are assessed, then in Section 5 the main features and trends relating to container flows in the rail sector are detailed. The prospects for the future movement of containers to/from ports by rail are then identified and discussed in the final sections of the paper.

[1] The tonne kilometres measure combines weight carried and distance travelled; 1 tonne kilometre is equivalent to the movement of 1 tonne over a distance of 1 kilometre

2. Background

By way of context, this section first establishes the global development of containerisation. It then sets out the key elements of the transport policy framework that potentially influence the development of international container traffic and rail's role in movements to and from ports. Finally, the key issues identified by previous research in this area are explored.

2.1 Global trends and forecasts for container traffic

Growth in global container shipping has been rapid. By 1980, 36 million TEU[2] were shipped through ports; this had risen to 266 million TEU by 2002 [4]. In 2006, the fiftieth anniversary of containerisation, global container flows are expected to total approximately 350 million TEU. Preliminary figures for early-2006 show a 9% year-on-year growth in TEU handled [5]. The container market is becoming increasingly dominated by East Asia, which increased its share of throughput from 38% of all TEU in 1990 to 46% in 2002 [4]. The share for Europe and the Mediterranean fell from 27% to 23% in the same time period, although absolute volumes increased almost three-fold as a result of the huge growth in the market.

2.2 Policy framework

European transport policy supports the growth of international trade identified above. As the European Commission [6] states, 'it is difficult to conceive of vigorous economic growth which can create jobs and wealth without an efficient transport system that allows full advantage to be

[2] TEU = twenty-foot equivalent unit, i.e. a container with a length of 20'

taken of the internal market and globalised trade' (p.13). However, policy is also concerned with sustainability, and the use of shipping, inland waterways and rail is to be encouraged. Policies encouraging sustainability have featured strongly in UK government thinking since the 1998 Transport White Paper [7]. The term 'co-modality' has now been coined to refer to the appropriate use of modes, either on their own or in combination, to achieve sustainable resource utilisation [8]. The Commission foresees challenges associated with the further growth of maritime transport, stating that 'increased investment within ports and towards the hinterland is necessary in order to improve and extend services so that ports become poles for growth instead of potential transhipment bottlenecks' (p.11). An integrated ports policy for Europe is currently under development. Issues surrounding the land-based movements to and from ports are expected to feature, and this is likely to emphasise the use of rail where feasible. Similar issues feature in the UK government's Ports Policy Review, for which public consultation is taking place during 2006 [9].

Turning specifically to rail freight, this has been generally in decline in many European Union countries in recent years, particularly in terms of its share of all freight but also in absolute volume in some countries. From 1995 to 2004, rail's mode share of all freight (including sea and air) across the 25 European Union countries decreased from 12 per cent to 10 per cent [10]. This trend is contrary to European transport policy, with the 2001 White Paper setting a target to almost double rail's market share by 2020 [6]. The British government set a similarly ambitious growth target in its Ten Year Plan [11], though more recently this has been referred to as having been 'aspirational' and not necessarily achievable. Despite this, the expectation of rail freight growth remains and was confirmed by the UK Secretary of State for Transport in July 2005 [12].

Against the Europe-wide trend, rail freight in the UK has been resurgent in the last decade following a sustained period of decline. By 1994/95, rail freight volumes were only one third of

those in 1952, having declined to just 13.0 billion tonne kilometres, at a time when there had been dramatic growth in total freight movement in the UK, with rail's market share therefore shrinking even more dramatically. Since then, there has been considerable growth so that, by 2004/05 the figure had increased to 22.1 billion tonne kilometres, this being a 70% increase in 10 years [2]. As a result, rail's mode share has increased from 6% of the total British freight market (including road, coastal shipping and pipelines) in 1994 to 8% in 2004.

2.3 Key issues

This section summarises the key issues arising from the previous literature on the subject of container flows and land-based connections to ports. Many studies have considered the maritime and port elements of container flows (see, for example [13-19]), but less attention has been paid to hinterland flows. Much of the previous work has primarily focused on modelling and has not explicitly considered the wider, policy-based, issues that may affect future flows. Paixão and Marlow [20] and Bichou and Gray [21] both emphasise the importance of ports better integrating themselves into the supply chain in order to remain competitive. This applies particularly to containerised flows and demands an understanding of the land-based transport connections. In one of the studies most relevant to this paper, De Langen and Chouly [22] argue that effective transport links to a port's hinterland will not evolve of their own volition, but need to be coordinated in a process that involves both public companies and private authorities. Coordination is particularly important where intermodal transport involving rail and ultimately, in most cases, road distribution is involved. Large variations in rail's mode share were noted in Langen and Chouly's three case studies, resulting from a combination of differences in infrastructure, service provision and management and operating practices. In the UK, inland waterways cannot play a significant role in onward distribution, so rail and coastal shipping are

the only real potential competitors to road. Saldanha and Gray [23] assessed the potential for UK coastal shipping to feed into multimodal chains, and found support for multimodal solutions. Gilman [24] highlights the links between UK government policy and future port developments, and identifies rail connections as being important.

The liberalisation of rail freight services, notably in the UK, has led to a greater focus on the requirements of rail's customers, not least the ports and their shipping lines, and to greater marketing of rail's capabilities [25], and an increasing number of innovative means of cooperation have been developed. Road congestion is also encouraging more companies to consider rail as an alternative to road [26]. In an informative review of the container shipping sector, Notteboom [27] provides examples of integration between German and Dutch container ports and their connecting rail services to inland terminals, while Woxenius and Bärthel [28] examine the wider issues surrounding the various parties involved in the European intermodal sector. As with the maritime parts of the chain, there have also been attempts to model the operations of container trains [29-30], largely examining hypothetical scenarios. Rowlinson [31] considers the combined effects of rail deregulation and container port growth in Britain, and identifies both considerable potential for, and significant obstacles to, development of this rail market. Consequently, this paper attempts to develop a better understanding of the relationship between container ports and their hinterland transport connections, in the context of rail provision to the UK's container ports.

3. Research objectives and methodology

The research analysed and discussed in this paper brings together two areas of research that are generally treated as distinct entities, namely the maritime and rail freight sectors. As the

literature review in the Background section showed, there has been some previous work combining the two sectors, but scope still exists for better understanding the relationship between the two in the light of evolving policy and operating environments. In the light of the relatively limited previous research in this specific area, the paper aims to develop a more detailed understanding of the interactions between container traffic through UK ports and the use of rail for associated inland movements. The specific objectives are thus:

1. to identify the nature of port-based container flows by rail in Britain, together with the trends in this market
2. to assess the prospects for these flows by evaluating the main opportunities and constraints

Satisfying these objectives depends upon the extent to which a number of challenges can be overcome. In particular, there is a lack of detailed data relating specifically to the rail freight flows covered by this paper. As Section 5.2 discusses, the presentation of official rail freight statistics does not allow port-based container traffic to be examined in isolation. Further, there are some more general concerns about the comprehensiveness and consistency of the official freight statistics published in National Rail Trends [32]. In addition, both the UK rail freight market and the global container market have been experiencing rapid change in recent years, and there is considerable uncertainty over future container volumes through British ports (at both the UK and port-specific level). The capabilities of rail in this market in the future are also unclear, but this paper attempts to address this issue in the context of likely changes in container traffic passing through the ports system.

The research builds upon a review of published information (e.g. official transport statistics and policy statements; port authorities' documents) which has been supplemented by detailed analysis of the rail activity in port-based container flows using original rail freight databases of

activity conducted by the author on an annual basis. This allows a greater degree of investigation of the attributes of the market for containers by rail than is possible from the published statistics. It is important to emphasise that, while the data are representative of changes in the sector, their accuracy cannot be guaranteed since they do not come from official sources. Further details of the databases' methodology and content can be found in Woodburn [33]. Given that port intermodal services generally run to a fixed timetable, with fewer additional or 'special' services than in most other sectors, and that train lengths (particularly for Freightliner, the dominant operator) generally do not vary, the database analysis presents a strong understanding of changes in this market. Of course, it cannot provide any details relating to the extent to which individual services in individual years have typically been loaded. Despite this, the analysis provides far greater insight into the market than can be found from official statistics alone, and adds to knowledge in this research area. To develop what is largely a qualitative analysis of the research topic in as rigorous and structured a manner as possible, a SWOT analysis[3] has been undertaken to assess the strengths, weaknesses, opportunities and threats for rail freight in the market for feeder movements of containers to/from ports in the UK. A structured approach of this type is of great value in assessing rail's role in the container market, where both internal and external issues are being faced and where rapid, yet relatively unpredictable, change is expected both in the structure and scale of the market.

4. Trends in the UK container market

This section focuses on the development of the UK container market, particularly examining trends over the last 20 years. It considers the likely changes in this market over the next 20

[3] A SWOT analysis is a widely utilised strategy and planning tool to help companies or business sectors evaluate their current role in a particular market or operating environment and to develop strategies to deal with likely changes in the future [34].

years or so as a result of general growth in container volumes and new infrastructure developments that are expected to alter the pattern of flows.

In line with the global trend identified earlier, flows of containerised goods through UK ports have increased very rapidly in recent decades. Table 1 shows the trends in container volumes passing through the UK's ports since the mid-1980s. In tonnage terms, there was an increase of almost 140% between 1985 and 2004. While the rate of growth has slowed since the mid-1990s, there was a large annual increase (of almost 10%) between 2003 and 2004. In terms of the number of containers handled, the increase since 1985 (i.e. 130%) has been similar to that of tonnage, but the increase in TEU, at 162%, has been greater, reflecting the trend towards longer containers with 40' containers being increasingly dominant and 20' containers losing some of their market share. By 2004, just 36% of containers handled were 20' ones, compared to 43% in 1990 [35-36]. As can be seen, the number of TEU per container has increased fairly steadily, from 1.43 in 1985 to 1.63 in 2004. There have also been changes in container heights, with a general trend away from the use of 8'6" high containers to those that are 9'6" in height. For example, approximately 40% of 40' containers passing through Felixstowe in 2003 were 9'6" high [37]. At the UK level, there has been a significant increase in the proportion of containers handled that are empty, increasing from 15% in 1995 to 28% in 2004, presumably reflecting the growing imbalance between UK import and export flows.

Insert Table 1 here

Table 2 reveals the share of the market that each of the main container ports handles. Felixstowe is dominant, with one third of the total. Three quarters of all containers handled in 2004 passed through ports in South East England (i.e. from Felixstowe to Southampton inclusive) [1], so there is a high degree of geographical concentration, which has been

strengthening over time. Of note is the rapid growth at the relatively new Thamesport container terminal, situated in the Medway group of ports and owned by the same port company as Felixstowe: essentially Thamesport has absorbed growth that would otherwise have been expected to occur at the congested Felixstowe port. The share of traffic handled by 'other ports' has dropped considerably since 1985, though there has been relative stability since the late-1990s.

Insert Table 2 here

The growth trend in container volumes through British ports is expected to continue. National forecasts by MDS Transmodal [39] anticipate TEU growth of 70% between 2004 and 2015, and of 180% by 2030. The increase in the number of units carried is likely to be slightly lower as the trend away from 20' units continues. There is general convergence of forecasts with, for example, Ocean Shipping Consultants [40] predicting growth of approximately 40% between 2004 and 2010. In addition to the trend towards longer containers, there is an expectation that virtually all 40' containers will be 9'6" high by 2011 [37], since there are now virtually no 8'6" high 40' containers being manufactured.

To cater for the predicted growth in volumes, a combination of the expansion of certain existing terminals and the construction of new container ports will take place, which is likely to lead to further concentration of volumes through the southern part of the east coast of England [39]. The main developments are the expansion of Felixstowe South Terminal, and new terminals at Bathside Bay (at Harwich, across the estuary from Felixstowe) and London Gateway, on north Thameside. The former two have been approved by government in 2006, while the latter has

received minded approval[4]. An earlier application for a new container port near Southampton was refused. The two fully approved developments will add capacity to handle approximately 3.25 million TEU per annum [41-42], while the London Gateway proposal is expected to provide capacity for a further 3.5 million TEU each year [43]. Given that the total handled by UK ports in 2004 was 8 million TEU, these new schemes alone will allow for significant growth. In addition, incremental enhancements to capacity are expected at a number of other container terminals. There seems little doubt that the potential market for rail freight will increase.

5. The port-based container rail freight market in the UK

This section first provides a brief overview of the development of the container rail freight market in the UK. It then presents a more detailed analysis of the changes that have taken place since 1997, primarily through the use of original desk-based research into service provision in the port intermodal rail freight market. This analysis considers the trends both at ports and inland terminals, so as to provide a comprehensive assessment of the nature of this rail freight sector.

5.1 Historical development of the container rail freight market

The movement of ISO containers on Britain's rail network can be traced back to November 1965, with the first trains running under the Freightliner banner as a result of the Beeching Report into the future of the railways [44]. The initial routes were established to serve domestic markets (e.g. London to Scotland), but the network gradually evolved during the 1970s to focus

[4] Minded approval essentially is a preliminary stage in the approval process, and usually specifies conditions that need to be met before full approval is awarded.

on routes to/from the main ports. At the time of rail privatisation in the mid-1990s, all port-based container traffic by rail was handled by Freightliner; all other rail freight traffic was moved by English Welsh and Scottish Railway (EWS). This reflected the situation immediately prior to privatisation, whereby Freightliner had been a separate operating sector of British Rail. A detailed account of the privatisation process can be found in Clarke [45]. Each of the four other rail freight companies operating by 2006 (i.e. EWS, GB Railfreight (GBRf), DRS and Fastline) has moved into the port-based container sector within the last five years: EWS commenced in 2001, with GBRf starting in 2002, DRS in 2005 and Fastline in May 2006.

5.2 Analysis of changes in service provision since the mid-1990s

Section 2.2 identified the recent growth in rail freight volumes in the UK. One of the key factors generally believed to have assisted with the rail revival is the introduction of competition to the market. The effect of this at the overall level can be seen in Figure 1, with the lessening of EWS' dominance in terms of revenues received. The former Freightliner (FL) has separated into Freightliner Intermodal (FLI) and Freightliner Heavy Haul (FHH), with the former taking responsibility for the container traffic. This diagram hints at the growth of container flows, since Freightliner's Intermodal division has a larger market share in 2005 than Freightliner had in 1997 at a time when the overall rail market has grown. With the exception of Freightliner Heavy Haul, all operators shown in 2005 were active in the container market, compared to just Freightliner in 1997.

Insert Figure 1 here

Figure 2 displays the recent trend in domestic intermodal rail freight, this being the sector in official statistics that includes port-based container flows. These statistics have been produced on a quarterly basis since 1998/99; prior to that the official rail freight statistics referred only to coal and 'other', so it is not possible to monitor the longer-term trends in intermodal rail freight volumes. While port-based container flows dominate the domestic intermodal sector, other traffic is also included in the statistics. These are relatively small in number (generally Anglo-Scottish via the West Coast Main Line), although they have increased slightly in recent years, and so may contribute in some way to the 25% growth experienced by this sector between 1998/99 and 2005/06. This growth has been faster than in other sectors with the exception of coal and construction despite intermodal services being disproportionately affected by the network disruption following the Hatfield derailment in late-2000[5].

Insert Figure 2 here

The official statistics do not allow any greater disaggregation of trends, so the following analysis utilises the detailed information about service patterns contained within databases of rail freight provision constructed by the author. Figure 3 shows the number of container services operated each week by each of the rail freight companies every year from 1997 to 2006. This reveals an 80% increase in the number of services, and also makes evident the introduction into the market of new operators although Freightliner is clearly still the dominant operator. The growth rate appears to be significantly higher than shown by the official statistics because there was considerable growth in service provision between 1997 and 1999, prior to the start of the official

[5] This derailment, at Hatfield in Hertfordshire (just north of London), exposed inadequacies in the management of the maintenance and renewal of the British rail network and led to significant speed limits (often as low as 20 miles per hour) being imposed across large sections of the core network for a period of months. This had a major impact on container trains since: (i) they tend to operate at speeds of up to 75 miles per hour, faster than most other freight trains, so proportionally had larger cuts in their operating speeds, and (ii) they make greater use of the core network rather than low-speed freight only lines and, as such, are more closely influenced by passenger train performance, which suffered considerably from the disruption.

statistics, and the Freightliner network has evolved from a hub-and-spoke one to direct service provision between port and inland terminal pairs. Again, the effect of the Hatfield derailment is marked: the January 2001 figure was very soon after the incident so does not reflect the decline in service provision, but significant cutbacks are evident within the following year, including the almost complete (temporary) withdrawal of EWS from this market.

Insert Figure 3 here

Table 3 shows the changes in Freightliner service provision between 1997 and 2006 from the ports it serves, based on the database analysis. Over the entire time period, the total number of departures from the five key ports increased by approximately 60%. The 25% official growth rate from 1998/99 is broadly in line with the 23% shown below for the comparable time period. The four key ports in South East England have all experienced considerable expansion of service provision, with the greatest increase occurring at Felixstowe which has overtaken Southampton to offer the greatest number of departures per week to inland terminals. It appears that these increases in service provision mirror volume increases with, for example, Freightliner's volume handled at Thamesport increasing by 40% between 2003/04 and 2005/06 [47] at a time when service provision went up by 50%. The reversal of the upward trend, as a result of the Hatfield derailment, can be seen clearly, with the 2002 figure little above that of 1997. Generally, subsequent years have seen the growth trend continue.

Insert Table 3 here

Table 4 shows the growth of the non-Freightliner services, from just one service per week in January 2002 up to 70 services per week in January 2006, giving these other operators almost one quarter of the service provision and serving additional destinations such as Purfleet and

Tees (in 2006) as well as the four key South East container ports. No data regarding train length or loadings are available, but anecdotal evidence suggests that, with the possible exception of the GB Railfreight services from Felixstowe, average loadings are lower than for Freightliner, so Freightliner's market share is likely to remain considerably above 75%. Despite this, there now appears to be at least a degree of competition in the container market. In addition to the services shown in table 4, a number of EWS Enterprise less-than-trainload routes serve container ports and may be able to carry container traffic as necessary along with other types of consignment. In 2002, 55 Enterprise services operated from ports; by 2006, this had increased slightly to 60 services. For many of these services, however, containers are likely to be non-existent or negligible in terms of the composition of these trains, since the Enterprise network was set up to handle traditional rail wagons rather than containers and it is only more recently that some container movements have been handled by Enterprise.

Insert Table 4 here

While comprehensive data are not available, there is some evidence that rail has been increasing its share of the container market, in addition to the absolute growth in containers handled. For example, at Felixstowe rail increased its share of the inland container market from 20% in 2001 to 22% in 2004, an absolute increase of 25% in the number of containers handled [48]. Tilbury has been less successful since, despite a 50% increase in the number of containers moved by rail, the mode share dropped marginally from 18% in 2001 to 17% in 2004 as a result of fast growth in container throughput at the port. However, the Port of Tilbury remains much smaller than Felixstowe, handling less than one third of the number of containers handled at its larger competitor. No reliable annual data have been found for the other key ports.

5.3 Inland container rail terminals

Table 5 shows the changes that have taken place in inland terminal service provision by container trains from deep sea ports, aggregated across all four operators. For ease of comprehension, terminals located within the same region have been combined.

Insert Table 5 here

Of note is the huge growth in what could be considered to be the medium-distance market, catering for flows between the South East ports and the Midlands and Yorkshire in particular but also the North West, which was already well-served by container services in 1997 and has experienced considerable growth but at a lower rate than the other medium-distance regions. By contrast, the longer-distance corridor to Coatbridge, in Scotland, has experienced a considerable reduction in the number of services and has fallen from being served by the greatest number of trains in 1997 (jointly with Trafford Park) to sixth position in 2006. The long-distance Anglo-Scottish market was hit particularly hard by the post-Hatfield disruption and had still not recovered by 2006, most likely as a result of traffic transferring to coastal shipping services to/from Grangemouth and Greenock. The other long distance flow, from the South East to Teesside, has shown little growth. Cardiff has also experienced a decline in service provision with the withdrawal of the daily train from Felixstowe, perhaps because rail capacity constraints at the port mean that other destinations are favoured. It is clear that container capacity is now far more heavily concentrated on flows from the South East (particularly Felixstowe and Southampton) to the Midlands, North West and Yorkshire than in 1997. Many of the terminals in these regions have been constructed or expanded to cater for the increased flows (see, for example, [49-51]).

5.4 Summary

This section has presented a range of different measures of activity in the port-based container rail freight market, both from published statistics and significant original analysis. Table 6 summarises the changes between 1998/99 and 2004/05), this being the period where full comparison is possible.

Insert Table 6 here

The key findings are:

- Container traffic has become an increasingly important rail freight sector, with a faster than average growth rate.
- Despite this, there is no clear evidence that rail is increasing its market share for the intra-UK distribution and collection of containers, since there has also been a significant increase in container trade in the same time period. The gaps in official data and differences in units of measurement make comparison difficult, but the official statistics show that the growth in tonne kilometres has been less than the growth in the number of TEU handled at UK ports.
- There is evidence, however, both anecdotally from other sources and from the analysis of service provision, that the number of TEU handled by rail has grown at a faster rate than the growth in tonne kilometres, since the market has become more focused on medium- rather than long-distance flows.
- It appears, therefore, that there may well have been some modest increase in rail's share of the intra-UK market, when measured by TEU carried.

- The recasting of the Freightliner network to provide more capacity and faster services, away from hub-and-spoke to point-to-point service provision, has further increased the number of services operated and the level of terminal activity, relative to the tonne kilometres moved.
- The Hatfield derailment in 2000 reversed the growth trend, but there has been considerable growth in rail activity in the subsequent years.

6. Analysis of the prospects for port-based container traffic by rail in the UK

It is clear from the preceding sections that container volumes through UK ports are likely to continue to grow considerably. This section presents a SWOT analysis of rail's role in the market for the associated inland movements. Table 7 summarises the key findings from this analysis, sub-divided into each of the four categories.

Insert Table 7 here

A key uncertainty at present is the way in which container shipping services are likely to develop in the next 10 – 20 years. Further rationalisation of port calls by ever larger deep sea vessels trying to reduce their time within ports in Europe would be likely to lead to ongoing concentration of activity at a small number of ports mainly within the South East, assuming that the vessels still directly served Britain, placing additional demands on the rail network in this area but potentially generating sufficient numbers of containers to allow additional services to operate over new routes that are not currently viable. Feeder services may be attractive for some onward movement to other parts of Britain, but small feeder vessels may not be welcomed in the large container ports and, in any case, the key areas where containers originate from or are destined to tend to be inland (e.g. Midlands, Manchester, Leeds) and not easily served by coastal

shipping. More of a threat to rail would be a scenario whereby shipping lines reduce their number of direct calls at British ports, and rely on medium sized feeder vessels to serve a range of ports around the British coastline. This would reduce the average land distance movement per container, potentially threatening rail's viability. While there may be some examples in future of deep sea shipping lines choosing to avoid British ports, the planned increases in container handling capacity identified earlier at key ports in the South East that deep sea ships will be passing close to in any case is likely to ensure that the majority will still call in Britain and will therefore generate considerable volumes of containerised traffic to be moved over relatively long distances by land.

Focusing on the rail operations, it is evident that there too are many uncertainties about the future direction of port-based container traffic. It is feasible that incremental growth on the network can continue, for the foreseeable future at least, in the manner that it has done over the last decade. The increasing number of longer term agreements, specifying the provision of guaranteed container carrying capacity, between rail freight operators and shipping lines demonstrates the commitment to rail of both parties involved in each agreement [52-54]. More recently, a five year contract between Freightliner and Maersk covers the provision of 353 round-trip moves per day solely for the conveyance of Maersk containers [55]. It seems that such agreements are the favoured means by which shipping lines are seeking to protect or enhance their rail volumes. There is no evidence to suggest that the shipping lines themselves are keen to begin their own rail freight operations, unlike in some other parts of Europe. This is most likely due to the competition that already exists between rail operators in Britain which has led to improvements in service performance and capabilities and encouraged the development of partnerships between shipping lines and rail freight companies. The costs of setting up as a new rail freight operator are significant and, in the increasingly congested British rail network, there are problems of network and terminal access. It therefore appears likely that container

services will continue to be operated by rail freight operators, though increasingly with contracted services or portions of services for specific shipping lines.

At a more strategic level, there is increasing evidence that significant changes will take place that will safeguard, and indeed enhance, the role of rail in this market. It should be borne in mind that even for rail to maintain its current market share will require the handling of far more containers in future due to the growth in containerised trade. Government policy should logically lead to an increase in rail's share, which will require a step change in provision. In 2005, a national gauging policy was developed [56] which proposes a strategic intermodal freight network. Highest priorities for gauge enhancement are the routes from Southampton to the West Midlands and from Ipswich to Yorkshire. The following discussion reveals that both of these projects may well be realised in the medium term. A range of other routes were also identified, offering diversionary routes for times when the key corridors are unavailable, or access to smaller but still significant ports (e.g. Thamesport, Liverpool (Seaforth), Bristol (Portbury, Hull, Tees, Hunterston) and inland terminals (e.g. Cardiff). At present there are no definite commitments to upgrade the latter range of routes.

Planning conditions associated with new terminal facilities are a key tool in encouraging rail use. Some of the measures contained in recent planning agreements will provide additional capacity and capability, for example through a greater range of routes cleared to carry 9'6" high containers or the ability to run longer trains as a result of changes to passing loop lengths and signalling systems. For example, the agreement relating to the Bathside Bay development includes a capping mechanism to limit the number of lorry movements associated with the movement of containers to and from the terminal [41]. A mode share for rail of 22.5% of all containers travelling by land (i.e. excluding sea-to-sea transhipment) is set out in the agreement,

and various measures are to be imposed in the hope that this level can be achieved and, ideally, exceeded. These include:

- provision of a rail terminal and associated facilities at Harwich, on an open-access basis (i.e. available to any rail freight operator that wishes to run a service), to be completed prior to the opening of the container terminal
- gauge enhancement for the direct route between Ipswich and Yorkshire via Bury St Edmunds and Peterborough
- additional infrastructure works on the route between Ipswich and Peterborough

These measures are expected to enable the rail network to cope with demand until around 2018, after which the further growth in trade in containerised goods will require additional train paths even to maintain rail's mode share. Even before this time, it remains to be seen what sanctions, if any, will be imposed on this or any other terminal that does not meet its rail targets. The UK government is showing willingness to invest directly in rail freight enhancements to improve national productivity [57]. Significant levels of finance are programmed for the Transport Innovation Fund (Productivity) from 2008/09, and strategic freight schemes which 'improve the capacity and resilience of the strategic national freight distribution networks, hence supporting international trade and competitiveness' feature strongly in the first short list of projects. In fact, of the 12 short listed projects, four are for rail gauge enhancement and two others are for rail capacity enhancement. Only brief information regarding the proposed schemes has been made public, so full details of the potential impacts of each one are not yet known. By late-2006 it had not been announced which schemes, if any, will be funded, but those shown in Table 8 are the rail ones to have made the short list. The first four would certainly be beneficial for container movements to/from ports.

Insert Table 8 here

All of this discussion relates to investments that have not yet been made. Of course, it will be necessary to implement the range of proposals to allow further growth in rail freight volumes. It is particularly critical that the gauge enhanced network is developed, otherwise rail will find it increasingly difficult to compete in a market becoming dominated by 9'6 high containers. It certainly seems as though the momentum for network enhancement is building, and considerable attention is now being paid to the future requirements for port-based container traffic by rail.

There are other reasons to believe that rail's future is positive. The changing environment for road hauliers, generally reducing flexibility and increasing costs, is likely to lead to greater interest in rail. Feeder ships around the UK coast are also increasingly popular, which is affecting some of rail's markets. The majority of containers need to be moved into the heartland of Britain, however, which is a role not available to shipping. In terms of sustainability, it is beneficial for rail and coastal shipping to complement each other and reduce the overall requirement for road haulage. The rail freight market for containers is becoming increasingly competitive, with new routes and innovative marketing resulting in new-to-rail traffic. The rail freight operators generally are in a strong position to compete for traffic, as a result of large investments in locomotives and rolling stock since privatisation. New terminals have opened and infrastructure at existing ones has been enhanced. Further growth in service provision may lead to greater economies of scale, resulting in rolling stock and terminals being better utilised, thus leading to lower unit costs and a more competitive rail sector. The current situation shows a huge transformation since the mid-1990s, when Freightliner inherited much of the oldest and most unreliable equipment. There is much progress to report in the container rail freight market in the last 10 years, so much so that lessons from the experience in Britain are being

disseminated on the European mainland [46]. It is vital, however, that the rail industry and government work together to demonstrate strategic thinking and continuity of approach, in order to overcome any reluctance from shipping lines to commit further to rail.

7. Conclusions and Recommendations

It appears that rail has increased its volume of container movements broadly in line with the growth in container volumes through British ports in recent years. As a result, it seems unlikely that there has been any significant change in rail's market share, although it does appear that rail may have marginally increased its share of the market. There are clear opportunities to realise a higher share, but this is critically dependent upon enhancements to the capability and capacity of the network, most notably the ability to cater for large numbers of 9'6" containers on all main corridors and diversionary routes. The imminent development of additional port capacity in the South East will result in even greater reliance on already heavily-utilised routes, so measures to enhance capacity and reduce service delays will be required. Without these improvements, it is feasible that rail's share of the market will decrease substantially. Ideally, further ways to reduce the unit costs of rail movement in order to be more competitive should be implemented, for example the quicker turnround of trains at terminals and longer trains allowing a greater number of containers per train.

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Table 1: UK container traffic, 1985 - 2004

	1985	1990	1995	2000	2001	2002	2003	2004
Tonnage (millions)	23.7	34.5	47.6	51.6	51.7	51.1	51.3	56.4
Containers (millions)	2.13	2.84	3.64	4.32	4.45	4.49	4.51	4.90
TEU (millions)	3.05	3.97	5.36	6.71	6.98	7.22	7.30	7.99
TEU per container	1.43	1.40	1.47	1.55	1.57	1.61	1.62	1.63
% of containers empty	21	19	15	19	21	24	28	28

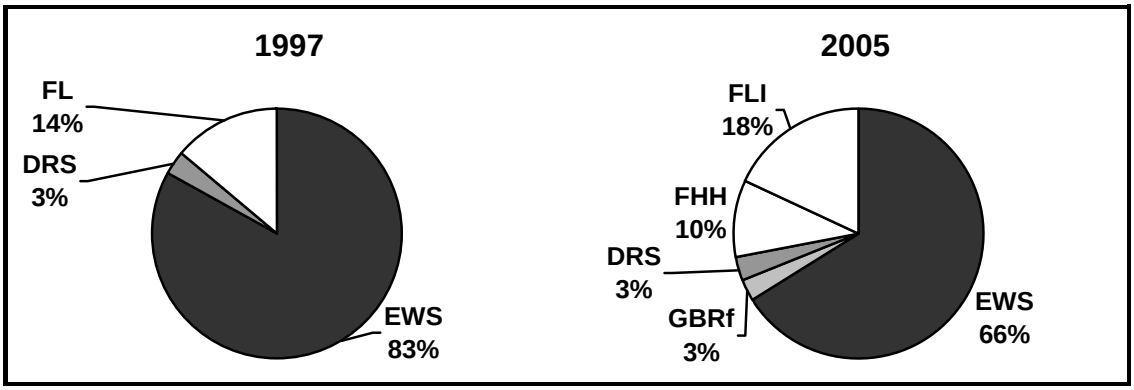
Source: based on DfT [1]

Table 2: Container volumes at the main UK ports, 1988 – 2004 (% of total in each year)

Port	1988	1993	1999	2000	2001	2002	2003	2004
Felixstowe	34	37	41	42	41	37	34	34
Southampton	9	11	13	16	17	18	19	18
London	12	10	10	8	11	12	12	12
Medway	0	4	7	8	7	7	7	8
Liverpool	4	8	7	8	7	7	8	8
Hull	4	5	3	4	3	2	4	4
Other ports	37	25	19	14	14	17	16	16
Total	100	100	100	100	100	100	100	100

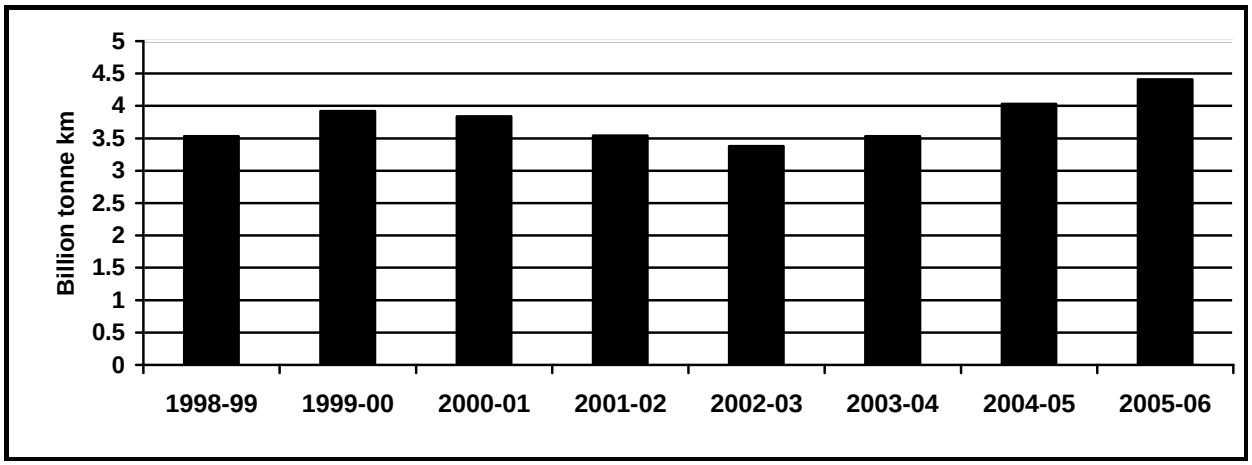
Source: based on DfT [1, 38]; Tilbury is part of the London group of ports; Thamesport is part of the Medway group of ports

Figure 1: UK operators' rail freight shares by revenue: 1997 and 2005



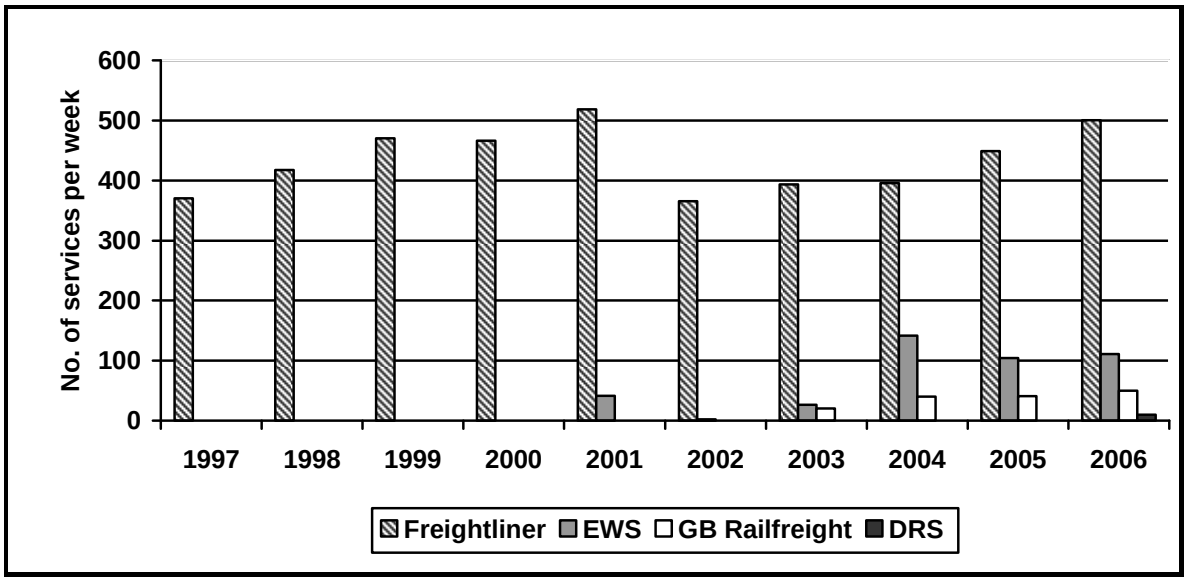
Source: EIM/EFRA/ERFCP [46]

Figure 2: Domestic intermodal freight by rail in Britain (billion tonne kilometres)



Source: ORR [2]

Figure 3: Total number of loaded services per week for port-based containers (both directions, plus feeders; Jan of each year, by operator)



Source: author's databases

Table 3: Freightliner container train departures from deep sea ports (no. of trains/week; Jan of each year)

Port	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	% change 97-06
Felixstowe	50	70	66	66	68	67	78	80	81	98	96
Southampton	55	63	64	53	67	53	67	67	77	79	44
Tilbury	20	23	23	23	20	20	30	25	25	30	50
Thamesport	10	15	20	20	20	10	15	10	15	15	50
Liverpool	6	11	11	11	11	5	5	5	5	5	(17)
Total	141	182	184	173	186	155	195	187	203	227	61

Source: author's databases

Table 4: Other operators' container train departures from deep sea ports (no. of trains/week; Jan each year)

Port	2001	2002	2003	2004	2005	2006
Felixstowe	-	-	15 (5/10/ -)	25 (10/15/ -)	26 (10/16/ -)	30 (10/20/ -)
Southampton	-	-	5 (5/ - / -)	20 (20/ - / -)	20 (20/ - / -)	20 (20/ - / -)
Purfleet	-	-	3 (3/ - / -)	-	5 (5/ - / -)	5 (- / - /5)
Tees	-	-	-	5 (5/ - / -)	5 (5/ - / -)	5 (5/ - / -)
Thamesport	-	-	-	15 (15/ - / -)	5 (5/ - / -)	5 (5/ - / -)
Tilbury	-	-	-	-	-	5 (5/ - / -)
Avonmouth	-	1 (1/ - / -)	1 (1/ - / -)	1 (1/ - / -)	1 (1/ - / -)	-
Ipswich	10 (10/ - / -)	-	-	-	-	-
Harwich	5 (5/ - / -)	-	-	-	-	-
Liverpool	-	-	-	1 (1/ - / -)	-	-
Total	15 (15/ - / -)	1 (1/ - / -)	23 (13/10/ -)	67 (52/15/ -)	62 (46/16/ -)	70 (45/20/5)

Source: author's databases; numbers in brackets represent number of services operated by EWS/GB Railfreight/DRS respectively

Table 5: Container train arrivals at inland terminals from deep sea ports (no. of trains/week; Jan each year)

Region	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	% change, 97-06
Midlands	15	14	25	30	40	25	41	73	72	78	420
Yorkshire	26	26	31	31	36	38	40	46	51	71	173
North West	61	56	66	76	86	67	79	86	97	92	51
South East	17	11	10	10	20	10	15	20	10	20	18
North East	10	5	10	10	12	12	11	11	12	11	10
Wales	11	15	20	15	10	10	15	16	13	10	(9)
Scotland	36	41	36	35	35	25	20	20	20	20	(44)
East Anglia	0	-	-	-	-	-	-	-	10	5	n.a.
Total	176	168	198	207	236	187	221	272	285	307	74

Source: author's databases

Table 6: Summary of key trends relevant to the containers-by-rail market, 1998/99 – 2004/05

Measure	1998/99	2004/05	% change
UK container traffic (million TEU)*	6.45	7.99	24
Domestic intermodal rail freight (bn tonne km)	3.53	4.03	14
No. of loaded services per week **	470	594	26
No. of departures per week from deep-sea ports **	184	265	44
No. of container train arrivals per week at inland terminals **	198	285	44

* - 1998 and 2004 calendar year figures; ** - January 1999 and 2005 figures

Table 7: Summary of SWOT analysis

Strengths	**Weaknesses**
• Government and EU policies supportive of sea-rail integration. • Proven record of growth in this market, both prior to and, more notably since, rail privatisation. • There is already a competitive rail freight market in this sector, with competition between all existing rail freight operators, thus giving customers choice of operators and access to a wider network of route and service options. • Considerable recent investment in locomotives and wagons, leading to better service capability and performance. • Addition of several new inland terminals, and upgrading of certain older ones, in recent years to provide additional capacity in key regions. • Commitments by port authorities to upgrade rail routes to provide additional capacity and capability, notably the Felixstowe branch line and the cross-country route from Felixstowe/ Harwich to the East Coast Main Line. • Growing number of long term contracts between rail operators and shipping lines, providing certainty for both parties involved	• Existing terminal and network congestion, leading to difficulties in running additional trains to/from ports and in obtaining additional train paths on certain sections of the rail network. • Requirement for special wagons to cater for 9'6" containers on many of the key corridors: only Felixstowe/Tilbury to terminals on West Coast Main Line corridor (via north London) currently cleared to gauge suitable for standard conveyance of these containers, leading to circuitous routings and/or additional rolling stock costs. • Train lengths are generally limited by siding and passing loop lengths, despite the locomotives being able to haul considerably more wagons per train. • Perception that rail freight is treated as inferior to passenger services in allocation of capacity. • Rail struggles to compete with feeder ships on the longer-distance flows, particularly to/from Scotland.
Opportunities	**Threats**
• Rapidly expanding sector, with further significant growth in containerised international trade predicted. • Capacity enhancements at rail connected ports (e.g. Felixstowe, Tees), or at new terminals with planning conditions encouraging the use of rail (e.g. Bathside Bay, Thames Gateway). • Possible government funding for rail upgrades, for example through the Transport Innovation Fund (Productivity). • Potential for further improvements in rail service capacity utilisation through measures to encourage smaller volume consignments (e.g. Freightliner's Logico, EWS' Enterprise). • Impacts of changing road conditions (e.g. congestion, Working Time Directive, driver shortages) on flows within Britain, favouring alternatives to road. • Increasing container trade through small number of ports would make it easier to generate viable trainload volumes on specific corridors • Development of east-west rail services elsewhere in Britain, particularly Trans-Pennine from Humber to the North West. • Potential for further long term contracts between rail operators and shipping lines.	• Lack of strategic direction within rail industry, so not well placed to counter weaknesses above. • Increasing rail network congestion, as a result of growth in both passenger and freight services. • Lack of consistency in government policy may mean capacity enhancements required are not provided, so weaknesses persist. • Continued growth of 9'6" containers' share of market, which rail will struggle to cater for from all key ports except Felixstowe and Tilbury (and new ports) unless gauge enhancement work takes place: Southampton is especially critical, with a requirement for W10 loading gauge to carry 9'6" containers on standard wagons. • Lack of diversionary routes even on corridors where gauge enhancement has taken place, thus limiting the flexibility and robustness of rail's service provision. • Competition from British feeder ships (and also direct calls at regional ports by European feeders or deep sea services) may reduce the inland market, both in terms of no. of containers to be moved and average distance from port to customer (thus favouring road).

Table 8: Short listed Transport Innovation Fund schemes and their likely impact on rail-based container flows to/from ports

Scheme name	Scheme details	Likely impact on rail-based container flows to/from ports
Teesport/East Coast Main Line	Gauge enhancement in north east England to allow 9'6" containers to travel by rail on standard wagons	Allow greater use of rail for containers passing through the growing Teesport terminal, and for containers moving by rail from other ports to/from the existing inland rail container terminal on Teesside
Nuneaton - Peterborough	Gauge enhancement of east-west route to allow 9'6" containers to travel by rail on standard wagons	Provide an alternative route capable of carrying 9'6" from Felixstowe and Bathside Bay to Midlands/North, thus avoiding London
Southampton – West Coast Main Line	Gauge enhancement of main freight access route to/from Southampton allow 9'6" containers to travel by rail on standard wagons	Provision of a route from Southampton to Midlands/North capable of accommodating 9'6" containers, aiding continued growth in rail volumes
Gospel Oak - Barking	Gauge enhancement of short route within north London to provide second route for 9'6" containers on standard wagons	Alternative route across London for containers to/from north Thameside (i.e. Tilbury and Thames Gateway), providing additional capacity for these services and potentially freeing up capacity on the existing north London route for more Felixstowe services
Humber ports/ Immingham – East Coast Main Line	Rail capacity enhancements to allow more (and longer/heavier) trains to operate	Fairly limited impact on containers in short term but potential for new services to/from Humber ports in longer term
Olive Mount rail chord (Liverpool)	Reinstatement of short section of rail line to allow direct access in to Port of Liverpool	Increase in route capacity and decrease in time taken for trains to access the Port of Liverpool, but implications for container services are not yet clear