



PROSPECTS FOR INTER-MODAL FREIGHT TRANSPORT - THE CASE OF THE CHANNEL TUNNEL

A.S. FOWKES

C.A. NASH

G. TWEDDLE

Institute for Transport Studies, University of Leeds

Abstract

The opening of the Channel Tunnel made possible a network of through inter-modal rail services between Britain and points in Continental Europe for the first time. This paper reports on a number of surveys designed both to quantify the factors influencing mode choice for unit-load freight and to explore the barriers to further development of inter-modal transport chains. Further work will examine the consequences of pricing policies designed to reflect marginal social cost on each mode. It is concluded that raising the quality of rail services is the most urgent priority for the development of inter-modal traffic.

INTRODUCTION

With the opening of the Channel Tunnel, through rail-based inter-modal freight trains began operating between Britain and the rest of Europe for the first time. Previous studies by the authors (see for example, Fowkes, Nash and Tweddle, 1991) had suggested that the prospects for inter-modal services within Britain were very limited due to the short lengths of haul. However, it was anticipated that prospects for Channel Tunnel inter-modal traffic, particularly on the longer hauls between Britain and Italy, Germany, the Iberian Peninsular and Eastern Europe, would be good. In principle, it should be possible to offer faster journey times than road haulage at a competitive price, although it was always recognised that this would require a high degree of co-operation between the various railways concerned and that achieving fast and reliable transit times for such international services would not be easy. However, at the same time Eurotunnel began operating shuttle trains carrying road vehicles between terminals at the ends of the tunnel in direct competition with the ferries, and thus benefiting road haulage by additional capacity, a slightly quicker transit, and an ensuing price war.

As part of their research on this topic, the current authors developed and applied the Leeds Adaptive Stated Preference (LASP) methodology for quantifying the values placed on quality of service attributes by freight shippers, and this was used in forecasting work for British Rail, who were then expected to be the operators of the rail services within Britain. Following this study, the Economic and Social Research Council funded a study in which we were able to apply the same methodology to a 'before and after' survey of the behaviour of a sample of shippers for whom the Channel Tunnel opened up new service opportunities. The conclusion of this study (see for example Fowkes and Tweddle, 1997) was that the Stated Preference exercise had worked well, but that the disappointing build-up of inter-modal traffic immediately following the opening of the Channel Tunnel was due to the failure of the services to achieve the expected standards of quality. At the time of our 'after' surveys in 1995, inter-modal rail services were failing to achieve door-to-door journey times and reliability comparable with road haulage. Both this fact, and the fact that intense competition had substantially reduced charges for taking road vehicles across the Channel, also meant that the rail traffic which was moving was generally doing so at much lower charges than were anticipated, contributing further to the financial problems of the operations.

Our 1995 survey was undertaken soon after the opening of these services and it may be that, even without any major changes in external conditions, it will be possible to make rail more competitive by improving the quality of service - indeed, we understand that the volume of traffic handled by inter-modal services has grown substantially since 1995 following a marked improvement in reliability. However, there are significant external changes also to consider. Two are likely to be of particular significance. The first is the institutional environment. Channel Tunnel inter-modal freight services are currently operated jointly by the national rail companies concerned, space being sold generally to wholesalers who in turn market it to the ultimate customers. Already the British end of the rail operation has been privatised, by sale to the American led English Welsh and Scottish Railways company. This same company has expressed an interest in purchasing other European railways freight networks. At the same time, the EC has proposed further liberalisation of international rail freight services through the establishment of freight freeways, with open access for private operators, improved marketing of access rights and increased priority for international freight trains. Views differ widely on how successful this measure will be and on whether in practice it will lead to new operators taking responsibility for the entire journey across Europe and achieving higher quality of service at lower cost.

A second major development could come in the pricing policies for different modes. There is widespread concern at the external costs generated by road haulage and a wish to encourage the use

of rail in order to reduce these. The key question here is whether the existing pattern of charges (through taxes and tolls) for the use of roads, and of track access charges based on widely varying principles in different European countries, leads to an efficient allocation of traffic between modes.

This paper will both report on the earlier work on cross-Channel freight traffic, and consider what the prospects are for the future. It will draw on the work of two major projects for the 4th framework programme of the European Commission in which we are involved. The first is the STEMM project, where our involvement is both in Freight Modelling in the light of the latest (1996) O/D surveys of unit load freight traffic across the Channel and in examining the barriers to the greater use of inter-modal freight transport and ways of overcoming them. The second project is the PETS project, which is concerned with the development of more appropriate pricing policies in the light of all internal and external costs, and their likely effect on mode split on the Trans European Networks. As part of the PETS project, of which we are co-ordinators, we are undertaking a further case study of cross-Channel unit load freight traffic with respect to the infrastructure pricing issues raised above.

We proceed firstly to look at our cross-Channel study which made significant use of Stated Preference techniques.

STATED PREFERENCE AND FREIGHT MODE CHOICE

Why Stated Preference?

In most countries now, and certainly in the UK, it is no longer possible to obtain published information on prices charged for the movement of freight - the 'freight rate'. Such rates are individually negotiated and held to be commercially confidential. Although a few respondents might be happy to reveal such data, it would be impossible to obtain sufficient to produce accurate Revealed Preference models. Indeed, the number of freight shippers is anyway much less than the number of people making passenger journeys, so we should endeavour to obtain the maximum amount of information from each respondent. Provided we are confident to believe the generality of responses, an appropriate way out of this difficulty is to pose a series of hypothetical choices and ask respondents to choose, rank or rate them. This method has become known as Stated Preference. The history of the development of Stated Preference techniques in Transport Planning is discussed in Fowkes (1998).

Since freight comes in various shapes, sizes and physical states, and because its volume per tonne varies greatly, it is difficult to produce efficient Stated Preference experiments prior to meeting the respondent. We have found it advantageous to use a form of Adaptive Stated Preference, whereby several sets of alternatives are presented to respondents, with the attribute levels describing these alternatives being changed in later sets in the light of earlier responses. Much care needs to be taken to avoid bias and we regard it as essential to extensively pre-test the experiment to ensure that a wide range of assumed attribute valuations can be recovered. The result of our experience in this area is contained in our Leeds Adaptive Stated Preference (LASP) methodology, in which various weightings assume a crucial role and which calibrates separate models for each respondent.

LASP results

LASP was initially developed as part of an SERC funded study of mode choice for unitised freight within Great Britain (Fowkes and Tweddle, 1988; Fowkes, Nash and Tweddle, 1991). Intermodality was specifically considered, and the method came to the attention of the Railfreight Distribution arm of British Rail at the time of a 1990 review of projections for cross-Channel freight mode shares following the opening of the Channel Tunnel. A LASP survey was conducted in conjunction with The MVA Consultancy (MVA and ITS, 1990). Results were not published at that time due to commercial confidentiality restrictions, but they have recently been published, together with some

later repeat studies, in NERA, MVA, STM, ITS (1997). Table 1 presents a crude distillation of the results in the case of cross-Channel Unitised freight, and covers LASP interviews with over 100 firms as part of several surveys.

Table 1 Relative Valuations of Attributes Expressed as a Percentage Discount of the Freight Rate of Cross-Channel Unitised Freight

Current Mode (Before Tunnel opened)	Per half day longer scheduled transit time	Per 1% less ontime arrivals	Use of Le Shuttle	Use of Swapbody
Accompanied Ro-Ro	16%	4%	5%	10%
Unaccompanied Ro-Ro	16%	6%	10%	1%
Lo-Lo	8%	2.5%	0%	-6%

The results indicate that a high valuation is placed on service quality attributes by existing Ro-Ro users. On average, a through rail Swapbody service which was one day slower and 10% less reliable would have to be almost free to be regarded as competitive. When considering use of Eurotunnel's Le Shuttle, the value of the mode specific constant was higher for unaccompanied Ro-Ro than for accompanied Ro-Ro. This is because unaccompanied operation is not offered on Le Shuttle service, and the option of switching to accompanied services was not attractive. In the case of Lo-Lo, the alternative to road movement to ports would be to use the Swapbody rail services, which also carry containers. This was in fact thought to be an attractive option by those using Lo-Lo methods.

We now turn to look in detail at the latest of the surveys included in Table 1, namely those conducted by ITS in 1993 and 1995 respectively (reported in Tweddle, Fowkes and Nash 1995 and 1996 respectively).

ITS SURVEYS OF CROSS-CHANNEL FREIGHT SHIPPERS

Background

It was intended that the study should address the behavioural aspects of managers' decisions as to how freight is moved, with particular reference to choice of mode, quality of service, and route used. The first phase of the study is reported in Tweddle, Fowkes and Nash (1995) and was based on the results of a survey of manufacturers, international hauliers, and freight forwarders undertaken before the Channel Tunnel was opened to normal traffic. That survey used a combination of orthodox executive interviewing, to determine how firms transport their goods to the Continent, and a LASP Stated Preference survey, to determine the likely effects of changes in the cost and service levels on the Short Sea routes following the opening of the tunnel. For that second part, a typical traffic flow was taken.

The second phase of the study consisted of two parts:

- (i) A repeat of the executive interviews to determine how firms had adjusted their Anglo-Continental traffics as a result of the Tunnel and the availability of new services, and in particular, what had happened with regard to the previously chosen typical flow.
- (ii) A postal survey of a larger sample to expand the amount of data on the total quantity of freight moving, and how the volume being moved had been distributed between the main corridors.

In both phases part 1 of the questionnaire established the total volume of European traffic handled by each company in the sample. In part 2 much greater detail was obtained concerning one flow which could use Tunnel services, and which was thought to be fairly typical of the companies operations.

In Phase II additional questions to those asked in Phase I determined whether or not any of the firms' current traffic did actually use the tunnel and by which service. In the case of the typical flow the interviewee was asked which route and mode would be used if the current service was not available, and what were the implications for cost and quality of service of having to do so. Where the typical flow was no longer passing, or was handled by another firm, an alternative flow was chosen as close as possible to the original.

In Phase II, part 3 of the questionnaire was a repeat of part 2, but asked for detailed information concerning a second flow of traffic. In this case, if the flow provided in part 2 had switched to using a Channel Tunnel service, that in part 3 should be one that did not use the Tunnel. Where the typical flow had not switched to using the Tunnel since the phase I interview had taken place, then the sample flow requested for part 3 should be one which did use the Tunnel. Ten of the interviewees could not provide answers to part 3, mainly because they did not have any traffic using the tunnel, or there were no suitable alternative traffics.

Part 4 asked for information on broader issues concerning the Tunnel. These related to changes in the location of distribution depots and the quantity and location of inventory. In addition, the effect on the balance of traffic and costs between the various corridors and between modes on those corridors was determined.

The Sample

The total usable sample for the Phase I interviews was 34. Of these, 30 took part in the second phase. Of the others, one freight forwarder had ceased trading and one freight forwarder refused to take part, as did two manufacturers because their distribution personnel changed. The sample was not random. The breakdown of firms interviewed by type and location are shown in Table 2. Although preparations were made to replace those firms which dropped out, and also to expand the sample by undertaking additional before and after survey interviews as part of phase II, it was concluded that 30 matched interviews were sufficient and the quality of the data might be spoilt if attempts were made to expand the sample. It would, in any event, have been very difficult to have found suitable flows without approaching many firms and spending a lot of time screening-in likely matches.

Table 2 Structure of SP sample by UK region and activity

UK Region	Activity Category						Total	
	Manufacturers		Freight Forwarders		Hauliers			
	I	II	I	II	I	II	I	II
South East	2	2	3	2	7	7	12	11
West Midlands	3	3	3	2	2	2	8	7
North	3	2	2	2	2	2	7	6
Scotland	4	3	1	1	2	2	7	6
Total	12	10	9	7	13	13	34	30

Note: Numbers of respondents from the two phases shown under I and II

Not all the Phase II sample were interviewed on their premises. Given that an adaptive SP was not being used, two interviews were conducted by telephone, and two interviewees completed questionnaires and returned them by post. It was clear that these firms felt that the Tunnel was a 'non-issue', just another way of crossing the Channel, and did not feel a second meeting could be justified. Of the thirty flows remaining in the SP sample, two flows had been lost by the transport operator. However, one provided details of how the traffic would be moved if it returned, while the other was able to provide details of the service which was being used (by a rival) in 1995.

Views of Hauliers and Freight Forwarders

The most important effect of the opening of the Channel Tunnel and the provision of the Le Shuttle services for HGV's has been to reduce the cost of HGV's using the short sea corridor from ports in Kent or through the Tunnel. Ferry rates had not generally increased in money terms, while capacity and sailings on some longer routes, notably from Portsmouth and the Tees, have increased. Discounts on longer crossings had only been applied selectively when traffic had diverted to Kent ports. Thus traffic normally using ferries from Portsmouth with a destination in the 'Centre' region of France may be attracted by lower rates on the short sea routes. The ferry operator may be willing to offer a discount for vehicles engaged on this work, but not for vehicles with a destination in Portugal, even when they are from the same operator.

Frequency of ferry sailings was an important factor considered by operators. Some traffic had been switched from the Humber to the Tees, and from the Portsmouth-Cherbourg to the Portsmouth-Caen route as sailings increased. The major attraction of Dover remained the number of sailings. For example there were 27 from Dover to Calais per day, whereas between Ramsgate and Calais there were only 3, and hauliers tended to prefer Dover as a result, even if the ferry operator on the Ramsgate route offered them slightly lower rates.

We were informed by operators that Eurotunnel had continued the practice of offering discounts to larger operators who provided large numbers of vehicles transiting the route. However, there remained discrepancies between the Continental and UK based operators. Because there is a higher proportion of small operators in mainland Europe they have historically been given larger discounts below the standard tariff for the same number of vehicles crossing the Channel per year. UK operators had reacted to Eurotunnel in the same way as to the ferries by booking transits through Continental operators where they find there is a differential.

It seems that UK manufacturers and operators expected higher quality services than on the Continent, with the exception of Germany and Netherlands. This may result in the intermodal services having a greater market penetration for imports to the UK. This has implications for imbalanced operations reinforcing the imbalance in trade. Competition for loads leaving the UK is much greater than for loads entering.

The extra capacity and reliability offered by Le Shuttle had prompted a number of hauliers to offer express groupage services to destinations much deeper into the Continent. Two of the flows given as a basis for the SP data had changed from being traditional driver accompanied to services where the trailer hardly stops moving, mainly as a result of using trailer switching techniques and setting up driver changeover points on the Continent. The drivers may be away from the U.K. for several weeks at a time. Examples of such services were as follows:-

-Greater London to Duisburg in 11.5 hours seven days per week (traffic won from air and exempt from lorry bans).

-Scotland to Northern Italy in 36 hours with two driver changeover points in France.

-South East UK to Northern Italy in 24 hours five days per week with one driver changeover in France.

Apart from the need for the provision of accommodation for drivers at the changeover points, such operations require:

- (i) High quality vehicles with rapid access to repair facilities should a breakdown occur;
- (ii) Replacement hired equipment being available, with or without driver;
- (iii) Accounts with tyre and fuel agencies throughout the route.

This type of express service clearly requires a high degree of organisation, and costs would appear to increase. However, the cost increase is contained to some extent by the fact that as the round trip time of the equipment is considerably reduced, the capital expenditure for the provision of the service is reduced, and the positive benefit is that the services attract more traffic at higher rates, some switching mode from air freight transport.

Although many operators had reservations concerning the reliability of the Le Shuttle services when the first phase of this study was undertaken, by the time of the second phase they were considered to be superior to the ferries in two respects. Firstly there is perceived improvement in time keeping and reliability during bad weather, particularly in winter. Secondly, they provide an improved night time service, when ferry sailings are reduced and some disruption may occur as a result of running repairs being undertaken on the ferries. It seems it is largely these factors which have given a few operators the confidence to introduce long distance express services which use the Le Shuttle during the small hours.

Nevertheless, express services were the exception rather than the rule. For the vast majority of operators, the Le Shuttle services were merely an alternative to the Cross Channel ferries. Which they used depended primarily on the cost. Many firms had accounts with both the ferry operators and Eurotunnel Le Shuttle, and effectively played one against the other.

Many traffics are not allowed on Le Shuttle. The most common of these are vehicles carrying hazardous material. Out-of-gauge loads cannot be accommodated on Le Shuttle HGV trains, either because they are too high, too wide or too long. Such traffic forms a substantial proportion of the total. It seems from the qualitative evidence we collected that at least 20% of groupage trailers carry some hazardous cargo and cannot use the Tunnel, before any consideration of lorries carrying entire loads which are subject to hazardous goods regulations.

Though we did not survey lorry drivers directly, operators informed us that the majority preferred the ferry. This was mainly because of the better facilities and food. It could also prove difficult to use the time on Le Shuttle to count as a break as required by the drivers hours legislation. Another problem affecting a minority was claustrophobia. This applied to routing vehicles through long tunnels on the Continent such as Mont Blanc, as well as the Channel Tunnel. Operators generally allocated such drivers work on other routes, or carrying hazardous goods which could not in any case use the tunnels.

The Le Shuttle HGV services only compete for accompanied road goods vehicles. While there may have been a very small switch from unaccompanied operation on either the Cross Channel or longer ferry routes, our survey did not detect such a change. The other freight service using the Tunnel is the intermodal rail service, and this may have had more impact on unaccompanied traffic, and had certainly gained traffic which previously was taken to the Continent by road and then transferred to rail, using mainly Lo-Lo ferry services across the North Sea.

Regarding rail based inter-modal services, in general operators felt that the rates structure was about right, but the service in 1995 did not come up to the standard promised (even before the SNCF strikes later that year). It seems that, in order to maintain reliability, some operators were promising a slow rail service, and moving part of a regular flow direct by road. This means that some goods were received by customers at regular intervals, at the expense of more inventory, and transport costs higher than anticipated by the operators when negotiating with their customers. Responses to the phase II survey confirmed this theory as the manufacturers generally quoted higher reliability figures than the operators for intermodal traffic.

The collection and delivery (c&d) charge structure limited the competitive radius surrounding terminals. One operator moved UK-Milan intermodally, but UK-Naples by road because the c&d charges from Milan to Naples were high (this may be because the trip involves a night out by the c&d vehicle). There was widespread dissatisfaction with cartage operations in Italy, many UK firms having difficulty finding reliable operators. There was also a shortage of equipment to handle 'heavy' boxes (those which

would exceed the 38 tonne GVW limit in the UK), and tipping frames in the UK and some other countries. Again Italy was one of these, but they just used what they had got, and in some cases it was suggested that equipment provided was unsuitable or even illegal.

A number of operators thought some rail services did not have sufficient capacity. This may have been partly because of strikes and other delays which extended the round trip time of the sets of intermodal wagons. Though many Swapbodies and containers could be diverted to routes using rail from Zeebrugge or be hauled entirely by road, this did not apply to the large number of heavy units. As there was no alternative route for these units, since legally they had to be taken to rail terminals and not to a port, many heavy units had had to wait several days before loading onto trains.

The most contentious issue related to intermodal services was the security regime. This resulted in rail being less attractive and more bureaucratic than road, even when the road vehicle used the Le Shuttle services. It is understood that this problem has since been eased.

Views of Manufacturers

With regard to intermodal services, manufacturers' views generally closely followed those of operators. Many manufacturers were reluctant to register for security clearance, apparently because they did not think they should be required to do so for one mode and not another. It also required them to take out insurance cover. If security inspectors have the right to inspect loading operations this leads to reduced flexibility and delays at the loading docks. It is not only intermodal which was having security problems; they have also arisen with the X-ray of sensitive materials travelling via Le Shuttle. Several interviewees commented on the perceived lack of security on the Continent.

Although the results of the SP part of the first phase of the study had shown manufacturers to be less willing to use the Le Shuttle services than operators, or at least requiring a greater discount to do so when compared to the services they were currently using, the attitude had changed by the time of phase II. Virtually all were completely neutral.

Intermodal Traffic - Overview of Results

Generally, manufacturers and operators had found the intermodal services too unreliable for high value goods, those in the production chain requiring reliable delivery, and groupage. In the case of the latter, only one consignment may require a reliable service, but that means the whole unit does. Some consignments are delivered without being transhipped at a depot to minimise costs and maximise the number of services offered per week. A relatively large proportion of groupage trailers contain some hazardous goods and are unable to use Tunnel services.

Anglo-Italian traffic was often chosen as either the typical flow of traffic, or as the secondary flow where the typical flow did not use the Tunnel in 1995. As a result, detailed information on 17 flows of full load traffic between the two countries, 7 of which used intermodal services, were obtained. Comparison of the quality of service actually being achieved by the two modes on this route raises interesting questions concerning the various operators. The road transport operators offered shorter transit times on an origin to destination basis than did the intermodal rail services, except in a single case. Surprisingly even within the road movements, all of which were driver accompanied vehicles, operators providing the shortest transit times also offered the most reliable service (at a marginally higher price).

The quality of the intermodal service had been found to be very variable by shippers, 13 of our sample of 30 having tried the intermodal services through the Tunnel. Transit times were generally slower, but the main cause for concern was reliability which was, in half the cases, much worse than road. Reliability also showed large variations between individual flows. Clearly, in these circumstances shippers will look on rail as an extension of the market, offering them a low cost but less attractive

service than road.

Many of the hauliers who had tried intermodal had withdrawn because of the quality of service. They had found that it was difficult to market both a high quality accompanied service and a lower quality (and price) rail alternative. Some now subcontracted any traffic which their customers wished to send by rail. Operators who previously offered unaccompanied services had less problem in this respect.

Most of the traffic using inter-modal services fell into one of the following categories:-

- Lower value goods which would only move at low rates.
- Goods forming substantial and regular flows where lead times could be extended by one or two days to overcome reliability problems.
- 'Heavies', used to reduce unit costs, using 44 tonne GVW vehicles to and from rail terminals (according to Rfd, these constituted around 50% of all intermodal traffic).
- Traffic using rail to avoid lorry bans/restrictions, eg delivery required in Milan on Monday morning.

A number of problems had arisen at the rail terminals, apart from general congestion. The main complaints were that a box had not arrived when expected, which disrupted the plans and cost effectiveness of collection and delivery (c&d) operations. A second problem had been the inadequacy of information systems on the location of boxes within the terminal. Terminal staff unable to find a box in the terminal had frequently kept c&d lorries waiting. The stock of swapbodies and other intermodal units at terminals was high, partly because of imbalances in traffic but also because lead times had been extended to overcome unreliability, resulting in inbound loaded units held for delivery, and outbound loaded units awaiting slots on trains.

INTERVIEWS WITH POTENTIAL OPERATORS OF MULTI-MODAL CHAINS

Background

This section reports some results from the STEMM (Strategic European Multi-modal Modelling) project. The aim of the interviews in STEMM was to explore further the barriers to the development of inter-modal freight services. The firms interviewed as part of the ITS input into the STEMM survey covered a wide range of company activities and, even though most interviews were conducted in the UK, they included meetings with managers who were Irish, Danish, Belgian, French and Italian nationals. In addition, the headquarters of the firms involved were even more widely spread, including additionally the Netherlands, Switzerland, and Sweden. The firms had been approached because it was known they had recent experience of at least attempting to provide a multi-modal chain either singularly or, more often, in partnership with others. It was not intended to be a random sample.

It was clear, from the positive response to requests for interviews, that the subject of multi-modal chains was an issue currently being assessed by many firms. Though it proved difficult to arrange appointments, we were eventually able to meet many senior managers within the companies. They included three Managing Directors and three General Managers, most of the other interviewees being operations or commercial managers and directors. Even though the sample was only 14, the outcome gave a wide range of companies who operate multi-modal chains involving rail, sea and barge systems. In some additional cases, firms who were unwilling to be interviewed did give comments during phone calls and correspondence and this information has been taken into account here.

The breakdown of the 14 interviewed companies by main activity was as follows, though most of those interviewed were involved in more than one activity, and in more than one part of a multi-modal chain:-

- Ferry company 3
- Multi-modal operator 3
- Terminal operators 2
- Logistics companies 2
- Deep sea container shipping company 1
- Manufacturer 1
- Freight forwarder 1
- Combined transport operator 1

The shortest chain operated by one of the respondents was a UK domestic movement of 130 km by rail taking 2 hours, while the longest was over 3,000 km by sea to Turkey from the UK taking 11 days. The interviews were undertaken in the period May-September 1997.

Main Findings

Some problems were highlighted by a large number of respondents. These relate to the rail loading gauge, particularly in the UK, but to a lesser extent in other parts of Europe, and the provision of rail wagons capable of carrying the latest generation of containers and swapbodies. These can be up to 45 feet (13.7m) long, 9ft 6in (2.9m) high and 2.6m wide. There are potential long term problems in the mis-match of deep sea shipping container dimensions and those of intra-European container units.

The other major barrier surrounded financing multi-modal chains, particularly sea based operations which do not receive government support (bearing in mind that a North Sea ferry costs \$65-\$100M to build). Where support is available, as is the case with rail Freight Facilities and Track Access grants in the UK, the procedure is said to take too long before decisions are reached.

There are also problems relating to financial risk sharing among the partners in a multi-modal chain. Nationalised railway companies are usually delighted to provide a train, for a fixed price per day, but reluctant to share losses in the start up period or to provide equipment without guarantees. Even among the more commercially aware private companies there is a desire to push as much of the risk as possible on to other partners forming a chain.

Barriers to Inter Modality

Question 8 of our survey asked respondents to allocate a total of 100 points to indicate (by the highest number) the reason for not using a rail based multi-modal chain, and then to allocate points for not using ship and barge based multi-modal chains (where relevant) relative to the points allocations for rail.

Responses to question 8 are tabulated in Table 3 which is fairly complex and so will be described in detail. There were 14 respondents in total, of which 8 could reasonably be described as predominantly shipping companies or ferry terminal operators (coded S), 3 were rail based multi-modal operators (coded R) and the remaining 3 were made up of a manufacturer and two logistics companies (coded O). Of the shipping companies, only 6 had experience of the rail mode. Of the rail based multi-modal operators, only 2 had experience of the ship mode, and this was the case for the three respondents coded O, too. Two of the shipping companies and one of the 'O' companies had experience of the barge mode, and so their data on this is included for completeness, although it is obviously a very small sample.

To begin with, each respondent was asked to split 100 points over these 8 categories of barrier, in respect solely to the rail mode. The more points allocated the greater the reason for NOT operating a multi-modal chain using this mode.

Table 3 Mean Point Allocations to Barriers to Multi-modal Use

BARRIER	RAIL MODE				SHIP MODE				BARGE MODE		
	R	S	O	TOT	R	S	O	TOT	R	S	TOT
SERVICE QUALITY	22	17	22	20	13	19	20	18	14	10	12
INFRASTRUCTURE	8	19	25	17	13	14	17	15	6	30	14
TECHNICAL INTEROPERABILITY	4	13	20	13	1	6	7	5	5	5	5
FINANCIAL	41	16	15	22	13	23	25	22	5	10	7
INFORMATION SYSTEMS	4	9	5	7	3	7	7	6	6	0	4
ROAD NETWORK MANAGEMENT	8	7	5	6	3	7	3	5	8	5	7
ORGANISATION	6	10	3	7	6	6	0	5	5	0	3
REGULATORY	7	9	5	8	3	10	3	8	15	0	10
TOTAL POINTS ALLOCATED	100	100	100	100	55	93	82	84	64	60	62
SAMPLE SIZE	3	6	3	12	2	8	2	12	2	1	3

KEY: R - Railway operating company
 S - Shipping Company
 O - Other respondents

The arithmetic means of these point allocation are reported in the first four columns of Table 3; i.e. one column for each of the three groups (R,S,O) and one column for the overall average (TOT). Bearing in mind these allocations, each respondent was then asked to similarly allocate points (shown in columns 5 to 8 for ship mode and 9 to 11 for barge mode), for any non-rail-based mode of which they had experience. The allocations were to be relative to those for rail mode, and so need not sum to 100. For two shipping companies who had no experience of rail, and so had no rail allocation to relate to, their ratings for the ship mode were scaled to give the same points total as that given on average by respondents who had made a rail allocation.

Considering first the total points allocated, it is clear that use of the rail mode for multi-modal chains is considered more difficult than for ship or barge. Compared to the fixed mean allocation of 100 for rail, ship was only allocated a mean of 84 points and barge only 62 points. Within these figures, it is clear that rail operators feel that the difficulties of using the ship mode are only half of using the rail mode. From the shipping companies' point of view, however, there is little to choose between the difficulty of using rail or ship modes.

Looking next at the detailed figures for rail mode, the highest number of points were awarded to the Financial barrier. However, this was strongly affected by the very high allocations given by rail

operators to this barrier, the remainder feeling it was somewhat less of a difficulty. Closely in second place came Service Quality, with fairly general agreement on its allocation. A little behind in third place was Infrastructure. This time the rail operators did not perceive this as a great difficulty, but everyone else did. Some way behind in fourth place was Technical Interoperability. Again, the rail operator did not see this as a great difficulty while everyone else did. The remaining barriers all received low allocations.

Moving next to the detailed figures for the ship mode, Finance again gains the highest mean allocation, and at the same number of points as for the rail mode. This time, however, it is everyone *except* the rail operators who feel it is a great difficulty. It appears as though, in relative terms at least, the rail operators are underestimating the financial barriers to using the ship mode, whilst the shipping operators are underestimating the financial barriers to using the rail mode. Clearly everybody thinks that the other person has things easier than them.

The second highest allocation for the shipping mode is, once again, Service Quality, although here again the rail operators feel it is less of a problem than do the others, and indeed less of a problem than rail service quality. Again, third place goes to Infrastructure, with fairly general agreement on this by all. We have thus had exact agreement on ordering of the three greatest difficulties in the case of each mode. However, the matching does not proceed beyond there, since Technical Interoperability is not perceived as a problem for ship. Indeed, all but the top three barriers received low allocations. As we have noted earlier, the overall affect is to show the ship mode as subject to less difficulties than the rail mode.

Moving finally to the detailed figures for the barge mode, we must remember that only three respondents contributed to these and so they should not be taken too seriously. However, it is plain that Finance is not perceived as a difficulty for this mode. The highest allocation was for Infrastructure, where its mean allocation is not much lower than in the case of rail and ship modes. Second comes Service Quality, beyond which all barriers receive rather low mean allocations.

Improving Multi-Modal Chains

In part 3 of the questionnaire, respondents were asked to describe a potential chain, preferably on one of the case study corridors, indicating what would be the most attractive technology, route, partners and finance. In most cases such a chain already existed, and respondents' comments on what they would like to change if they were starting afresh revealed possible previous miscalculation, which they would not otherwise admit too, or the effects of evolutionary changes to the service over time.

The most pertinent factors were:

- Desire to send by rail containers up to 45 feet long and 9 feet 6 inches high, particularly a problem in the UK, but also on many continental routes.
- Extending the UK's 44 tonne GVW limit, at least for container movements to ports.
- The use of larger and faster ferries, capable of handling containers stacked two high on ramp loaded Maafi flats in order to improve productivity.
- Easier access to, and a more commercial attitude by, the railway networks.
- Rail charges for short distances through intermediate countries, and the Channel Tunnel, a major problem on some routes. As a result, multi-modal operators concentrate on long haul rail services (UK-Italy) rather than shorter routes (UK-Germany via France and Belgium), especially where they involve a number of rail networks.
- Balancing flows on many routes would improve cost effectiveness; currently empty movements to re-loading point are excessive.

- Would like to be able to use swing deck rail piggyback wagons for traffic from the U.K. to the continent. Otherwise they would welcome standardisation of rail wagons.
- Preference for the provision of river berths for ro-ro ferries rather than passing through locks.

Open Discussion

The final part of the interview took the form of an open discussion, in which respondents were invited to firstly offer an ideal scenario which would encourage the development of multi-modal chains, and then were asked about the use of subsidised rail services (in many cases in partial competition with sea services offered by their own company).

Many respondents re-iterated their view that the main thing which would encourage development of multi-modal chains was an improvement in the performance of the rail networks, both cost reductions and service quality improvements. They felt it would be nice to be approached by train operating companies willing to propose a variety of services rather than having to ask if one could be provided. The loading gauge problem in the UK was again said to be a major barrier.

Many respondents clearly felt that shipping was neglected. The financial and policy measures (notably 44 tonne lorries) favouring the Channel Tunnel were compared to an almost total lack of support for shipping. This resulted in mixed feelings about the use of subsidised rail services. Many would use them if they could make money, but some felt sea should be treated the same as rail. There was concern about the long term provision of subsidised services in general, not just rail.

CONCLUSIONS

Although traffic is steadily rising, experience to date with the rail based inter-modal services offered through the Channel Tunnel appears disappointing when traffic levels are compared with projections. There are two main reasons for this. The first is that intense price competition and, to some extent, improved services made possible by 'Le Shuttle', have made road haulage services much more competitive than was anticipated. To a degree, this may be temporary, as ferry services are rationalised and all parties recognise that they would benefit from less intense price competition.

The other and more important reason is that, particularly in the period immediately following the opening of the Channel Tunnel, rail service quality fell well short of that predicted. It appears that the difficulties involved in establishing a new set of international services to operate reliably across a string of frontiers were greatly underestimated. It is not yet clear to what extent these problems are being overcome by the existing operators, or whether European Commission policies on open access will lead to the establishment of high quality services by new operators. It is understood, however, that traffic has risen substantially since our surveys, suggesting that quality is improving. Our latest survey certainly heard reports of greatly increased reliability, though with room for further improvement.

Interviews with operators of inter-modal chains confirm that it is the combination of cost and service quality that are the greatest barriers to inter-modality. Of other barriers, inadequate infrastructure - and particularly the problem of the restricted loading gauge within Great Britain - was most frequently cited, followed by technical inter-operability, regularity of service, organisation and information systems.

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REFERENCES

- Fowkes, A.S. (1998), The development of Stated Preference techniques in Transport Planning, **Institute for Transport Studies, University of Leeds, Working Paper 479.**
- Fowkes, A.S., Nash, C.A., and Tweddle, G. (1991). Investigating the Market for Inter-Modal Freight Technologies, **Transportation Research, Vol 25A, No 4.**
- Fowkes, A.S., and Tweddle, G. (1988). Computer Guided Stated Preference Experiment for Freight Mode Choice, PTRC SAM, Bath, **Proceedings of Seminar D, Transportation Planning Methods, PTRC, London, pp295-305**
- Fowkes, A.S. and Tweddle, G. (1997). Validation of stated Preference Forecasting: A case study involving Anglo-Continental freight, in **Transportation Planning Methods Vol II, (code P415), Proceedings to Seminar F. 25th European Transport Forum**, published by PTRC Education and Research Services Ltd, London, pp173-186.
- MVA Consultancy & ITS University of Leeds (1990) Values of Freight Transit Attributes, **Final Report to BRB OR and Railfreight Distribution.** Commercial-in-confidence.
- NERA, MVA, STM, ITS (1997), **The Potential for Rail Freight**, A report to the Office of the Rail Regulator, National Economic Research Associates, 15 Stratford Place, London WIN 9AF.
- Tweddle, G., Fowkes, A.S., and Nash, C.A. (1995) Impact of the Channel Tunnel - A Survey of Anglo-European Unitised Freight: Results of Phase I Interviews, **Institute for Transport Studies, University of Leeds, Working Paper 443.**
- Tweddle, G., Fowkes, A.S., and Nash, C.A. (1996) Impact of the Channel Tunnel - A Survey of Anglo-European Unitised Freight: Results of Phase II Interviews, **Institute for Transport Studies, University of Leeds, Working Paper 474.**