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THE ROLE OF LOGISTICAL STRUCTURE IN THE DEVELOPMENT OF RAIL FREIGHT SERVICES IN GREAT BRITAIN

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A thesis submitted in partial fulfilment of the requirements of Napier University for the degree of **Doctor of Philosophy**

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ABSTRACT

Modal shift from road to rail for freight movements is a potential means by which the negative environmental and social impacts of such transport can be reduced. As such it features strongly in contemporary transport policies in Great Britain. This thesis examines the interactions between logistical structure and freight modal choice, to determine the extent to which rail's mode share is likely to be increased. The research assesses the influence of recent logistical changes both within companies and along supply chains on mode choice and identifies the likelihood of future changes resulting in greater rail usage. A combined approach involving a postal questionnaire survey and in-depth company interviews was adopted. Further, to consider the interactions between the supply of rail freight services and their level of uptake, original databases of rail freight services at the disaggregated level have been constructed and analysed for the years 1991, 1997, 1998, 1999 and 2000.

The research thus provides a greater understanding of the importance of modal choice in individual firms' logistical decision-making processes, as well as through supply chains from source to customer. Key logistical issues that have affected, and are likely to affect, mode choice are identified and utilised to assess the potential for rail. Significant potential for modal shift is found to exist though many obstacles are also identified for many types of movement, relating to both supply- and demand-side factors. The importance of a coherent transport policy to deal with these obstacles to allow rail freight to meet its potential is highlighted.

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

The volume of freight moved by rail in Great Britain has suffered a long period of decline since the Second World War, certainly until the point in time when this research was commenced in 1995. The prime reason for this decline has been the reduction in trainload movements of bulk commodities, mainly that of coal between collieries and power stations. However, the decline in wagonload volumes has been far more dramatic - the volumes involved have been smaller but the number of customers lost has been greater than for bulk movements. In 1991 British Rail withdrew its Speedlink wagonload network to concentrate on trainload movements, though this has been reversed more recently. Overall, there had been a large reduction in the customer base for rail freight over recent decades, so that by the mid-1990s the number of direct rail freight customers numbered only around 100 (Guardian, 1996).

The continuing reductions in rail freight volumes in the early- to mid-1990s occurred at a time of increasing road freight traffic and greater concern for the environment. In policy terms, a shift from road to rail is seen as desirable. The Royal Commission on Environmental Pollution (1994) argued that the proportion of freight moved by rail should be increased from 6.5 per cent of tonne kilometres in 1993 to 20 per cent by 2010.

The emphasis on rail freight can be seen in recent government policy documents, such as the Integrated Transport White Paper (DETR, 1998a) and the Sustainable

Distribution daughter document (DETR, 1999a). It is not at all clear, however, how the targets and objectives in these reports should be achieved. This research aims to provide a greater understanding of the potential role for rail freight under current and predicted logistical conditions. It is obvious, though, that it is not a straightforward issue.

Returning to the levels of even the 1970s will not be easy, due to the changes in industrial structure (e.g. the decline in heavy industry), transport infrastructure, etc., that have occurred in the intervening period. Indeed, rail has not held twenty per cent of tonne kilometres since 1965, when the total freight market was far smaller than at present (see Figure 2.2) and the operating environment was almost unrecognisable in comparison to the present time. However, other developments such as freight facilities grants and new combined transport techniques may assist in attracting traffic to rail.

The author was involved in a previous research project, studying the general relationships between the structure of logistical systems and road freight demand upon which this research builds (see McKinnon and Woodburn 1993, 1994, 1996). From interviews with logistics managers it was clear that perceptions of rail freight differed widely and that similar companies (in terms of geographical location, nature of product, size of company, etc.) used rail freight to differing degrees. Also, very little research has been carried out to examine the interactions between logistical structure and rail freight demand.

1.2 Research Objectives

To address these key issues, this thesis has two main objectives. Firstly, ***to determine the major interactions between logistical structure and choice of rail as a mode for freight movement***. There have been many logistical changes that could potentially affect the modal split decision. For example, changes in the location of activity, the structure of manufacturing and distribution networks, the trading relationships between firms and the scheduling of production and distribution may all be important factors that influence mode choice for freight movements.

Following on from the first objective is the second main one: ***to identify means by which logistical changes may assist in increasing the share of freight moved by rail***. This is of direct importance to rail freight service providers, whose survival may depend upon attracting new traffic to their services. It is also of significance to those other parties who are interested, for various reasons, in transferring freight from road to rail. These may include central government, as part of a coordinated transport policy, environmental campaigners who wish to see goods transferred by less environmentally damaging means, local authorities who are keen to reduce road maintenance costs, or even the general public as a whole, keen to see fewer large lorries on the roads.

1.3 Thesis Structure

The thesis is divided into eight chapters as follows:

Chapter Two provides a background to and literature review of the freight modal choice issue and is divided into four main sections. To provide the contextual background to this research, the changing nature of freight movements in Great Britain since 1945 is discussed. Second, the importance of the freight modal choice issue is raised. The third main section consists of a review of the literature on the role for rail freight. Finally, research examining the role of changes in logistical structure in the freight modal choice decision-making process is reviewed.

Following on from this literature review, Chapter Three identifies the key research hypotheses to be tested. These are developed with the aim of addressing the gaps in knowledge and understanding in order that the two objectives of the research are satisfied.

The methodologies used to address the research objectives use both quantitative and qualitative techniques, primarily disaggregated databases of rail freight flows, an industry-wide questionnaire survey and in-depth company interviews, are outlined and justified in Chapter Four.

The more detailed changes in the supply side of British rail freight are discussed and analysed in Chapter Five. This develops previous work by incorporating the disaggregated analysis of original databases of rail freight services for time periods between 1991 and 2000, so that changes in the structure of rail freight can be identified. These databases were necessary in order to address a number of the research hypotheses since the data required are not available elsewhere. They are thus fundamental to the subsequent research examining the interactions between logistical structure and modal choice, since the range and nature of services on offer will affect the ability of rail to attract or retain new traffic flows.

Chapter Six reports on the analysis of the attitudes of industry to the use of rail freight, both past and present and with predictions for the future, through the analysis of the questionnaire that was distributed to a sample of manufacturers and retailers throughout Great Britain. It also identifies the main impacts on transport operations of logistical changes.

While the predominantly quantitative data gathered in the databases and questionnaire survey is sufficient for a number of the hypotheses under examination, this is strengthened in Chapter Seven by the case study analysis of individual companies and, where possible, supply chains. This provides a wealth of more qualitative information which, combined with the other data sources, is used to address the hypotheses and ultimately satisfy the overall research objectives.

Chapter Eight summarises the main conclusions and identifies areas where additional research would be beneficial to assist in further developing understanding of the interactions between logistics and the choice of rail for freight movements so that future freight policies can be better informed and more targeted to lead to achievement of the desired outcomes.

1.4 Research Limitations

It has already been stated (see Section 1.1) that this thesis focuses on developing a greater understanding of the logistical issues influencing mode choice within Great Britain, with particular reference to rail. Different countries have a unique set of circumstances, due to the wide range of factors that influence the nature of freight movements. These include differences in:

- geographical, economic and social conditions (for example the fact that Britain is an island leads to a higher proportion of goods using coastal shipping);
- the industrial and distribution structure;
- the regulatory environment for transport operations;
- the provision of, investment in, and operation of transport infrastructure and services; and
- other aspects of transport policy.

This list is by no means comprehensive, but aims to show that the outcomes of this research are specific to the prevailing situation in Great Britain. The research findings do not make any claim to apply elsewhere, but that is not to say that they have no relevance to the situation in other countries. Some may have more general applicability if handled carefully.

The nature of this research means that there are very few clear cut answers, given that it relies so heavily on complex logistical operations combined with the vagaries of human behaviour in the mode-choice decision making processes.

Thus the aim is to develop a deeper analysis and greater understanding of the topic, so that the likely outcomes of changes in logistical operations and/or policies targeted at modal shift can be more thoroughly assessed.

Furthermore it has not been practical to fully control for a number of external variables, such as the effects of economic cycles, other than to acknowledge their potential role in affecting demand for freight transport. Given that the focus of this research is on gaining an understanding of the effects of logistical changes on mode choice, the underlying behavioural nature of the problem is unlikely to be significantly affected by these external variables.

1.5 Definition of Key Terms

Prior to examining the relevant literature, it is appropriate at this stage to define the concept of logistics and the supply chain as used in this research, together with the key parameters that this research examines in the context of freight modal split. There are many definitions, but that of the Institute of Logistics and Transport has been adopted for this study, as follows:

- "Logistics is the time-related positioning of resource, or the strategic management of the total supply chain;
- The supply chain is a sequence of events intended to satisfy a customer;
- It can include procurement, manufacture, distribution and waste disposal, together with associated transport, storage and information technology;

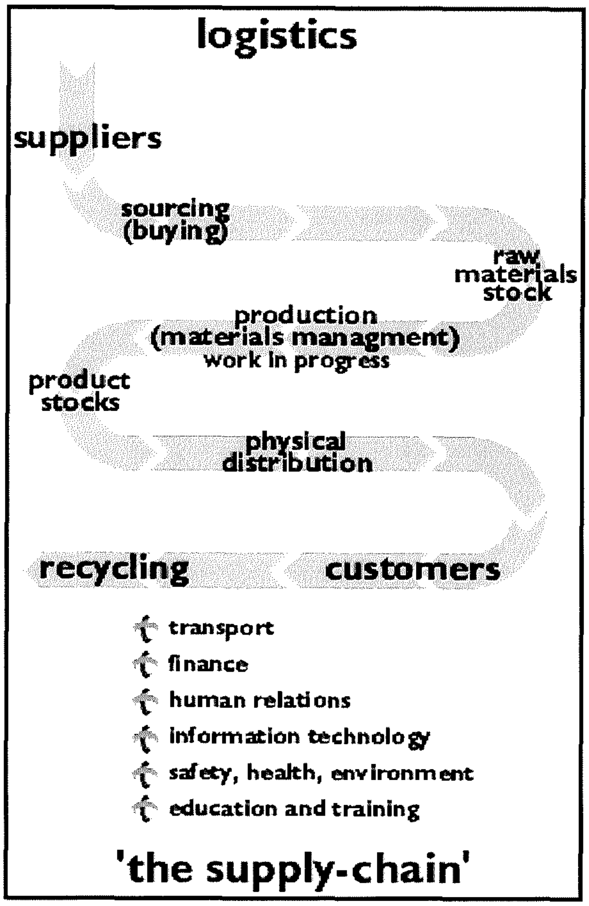
- The application of logistics is essential to the efficient management of the supply chain; and
- Transport is an integral part of the supply chain, not only between the sequence of events but during the processes."

(ILT, 2000)

Given these definitions of logistics and the supply chain, the research focuses upon the examination of the key logistical components and how they impact upon freight modal split. Figure 1.1 shows the nature of logistics and the supply chain diagrammatically, with freight modal choice being a component of the transport element. As such, it is of importance throughout the supply chain, since movement of raw materials, work-in-progress and products all requires the use of transport.

The key issues for this research include the standard trade-offs between freight transport and production and distribution facilities, stock control and information technology. Also crucial though are the broader issues crucial to operation of the complete supply chain and which may directly influence the use and choice of freight transport, such as customer service levels and changes in sourcing and distribution channels. Certain of the issues are not of direct relevance to this study, such as safety, health, education and training and, as such, do not feature to any great extent.

Figure 1.1: Relationship Between Key Logistical Parameters and Freight Modal Split



Source: ILT (2000)

1.6 Summary

Chapter One has provided a brief introduction to the general research problem and has identified two specific objectives to be addressed in the thesis, through the review of published work and the development and implementation of specific research methodologies. The structure of the thesis has been outlined and an introductory overview of the methodological approaches has been provided. Finally, the limitations of the thesis have been identified.

CHAPTER TWO: BACKGROUND AND LITERATURE REVIEW

2.1 Introduction

Chapter One set out the objectives of the thesis and provided a brief introduction to the problem to be tackled. This chapter provides a background to the problem by reviewing the literature relating to the role of logistical structure in freight modal choice and aims to highlight where a gap in the literature exists.

The chapter is divided into four main components. Firstly, the literature on changes in the nature of freight movement (Section 2.2) and the importance of the freight modal choice issue is discussed (Section 2.3). This is followed in Section 2.4 by a review of the literature on the role for rail freight, highlighting the main areas in which attention has been focused thus far in studies of the potential for rail to increase its market share. Section 2.5 considers previous work on the role of logistics in freight modal choice and identifies where further research is required to gain a better understanding of the relationships between logistical factors and choice of mode.

As the chapter progresses, it moves from setting the scene for the thesis to reviewing in greater detail the previous research in freight modal choice and the importance of logistics in mode choice decision-making. Throughout, the approaches and methodologies used by previous researchers are detailed, the aim being to identify where previous work has highlighted a lack of understanding of issues and their effects. This is reinforced by detailing the relevant changes in transport policy that have taken place, which have resulted in a change in the focus for modal split issues and introduces further questions to be addressed.

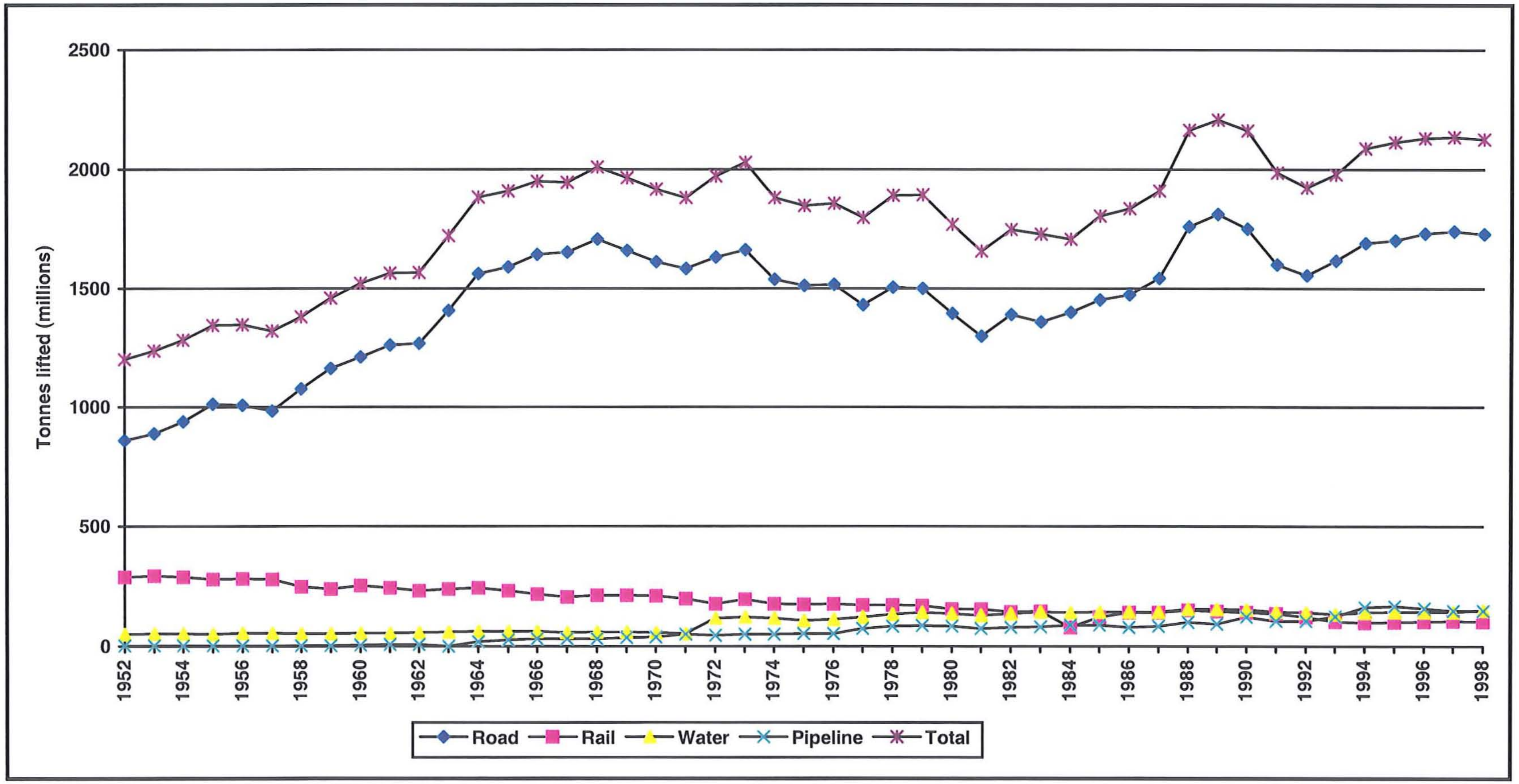
2.2 Major Freight Transport Trends in Great Britain

The freight transport market in Great Britain, in common with other industrialised countries, has undergone considerable change in the post-World War II period. There are various measures that can be used to present and analyse the changes in freight movements, the main indices being *tonnes lifted* (as shown in Figure 2.1) or *tonne kilometres* (see Figure 2.2). While both are important, the use of tonne kilometres takes into account both the weight of consignments being moved and the distance over which the movements take place, thus reflecting the actual volume of movements materialising on the transport networks. Tonnes lifted on its own gives no indication of the distance involved. The availability of data for both indices enables an analysis of the trends in *average length of haul* (i.e. the mean distance that a consignment moves in a single journey). Further discussion of these key freight indices can be found in McKinnon and Woodburn (1993).

Two major trends have dominated the freight transport sector, these being:

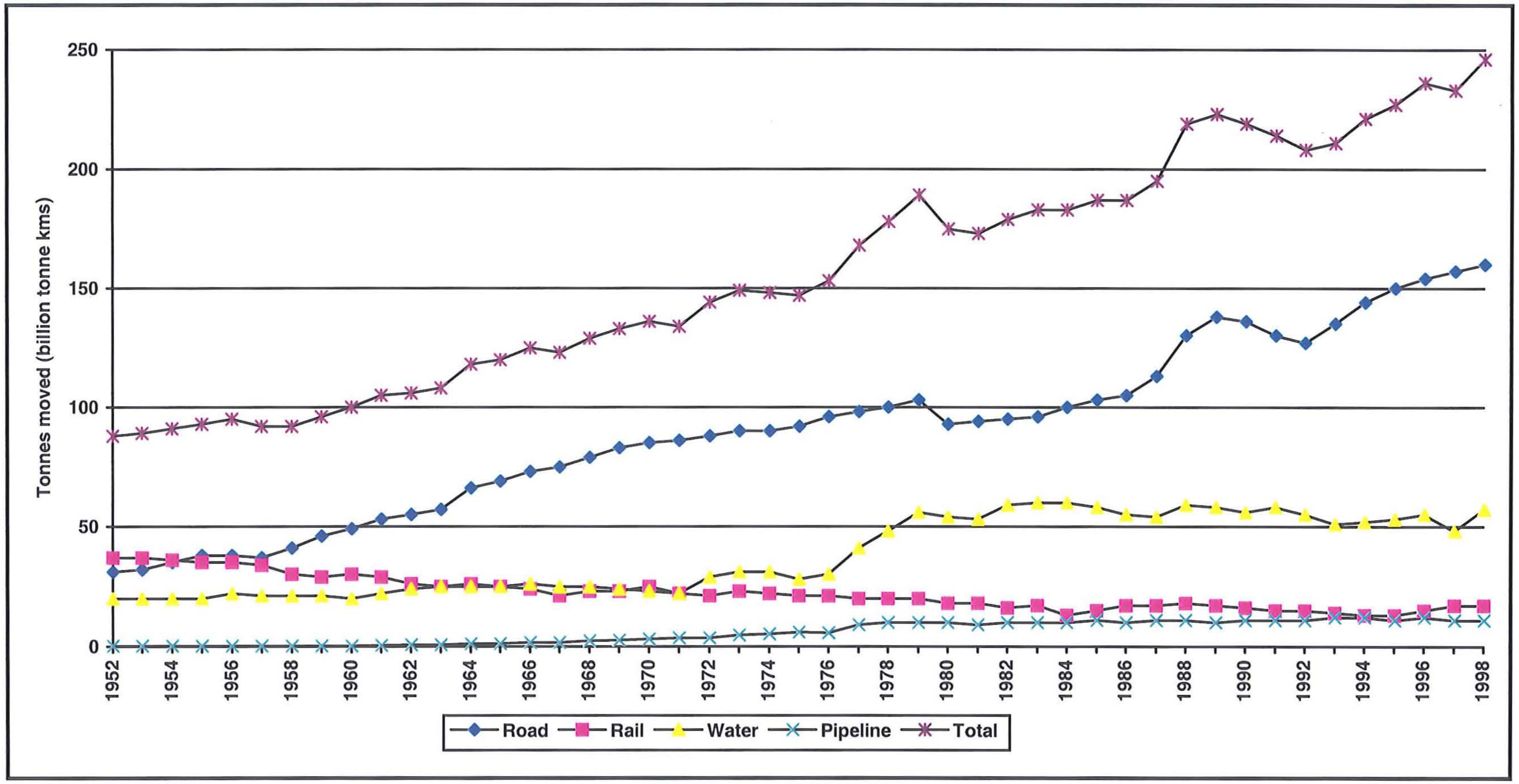
1. the growth of freight transport in absolute terms; and
2. the shift away from particular modes of transport towards others.

Figure 2.1: Freight Lifted by Mode in Great Britain (million tonnes)



Source: DETR (1999b)

Figure 2.2: Freight Moved by Mode in Great Britain (billion tonne kms)



Source: DETR (1999b)

As Figure 2.2 shows, there has been a dramatic increase in the volume of freight moved in Great Britain since 1952. Freight movements by all modes increased from 88 billion tonne kilometres (bn tonne km) in 1952 to 246 bn tonne km in 1998, an increase of 180 per cent (DETR, 1999b). The detailed analysis of the relative importance of changes in tonnes lifted and average length of haul is beyond the scope of this research and, in any case, is discussed in depth in McKinnon and Woodburn (1993) for road freight. The main conclusion is that, over the entire period from 1952 to 1990, tonnes lifted and average length of haul played almost equal roles in accounting for the growth in road tonne kilometres, although the relative contributions of each varied during the intervening time period. There may be important implications for rail freight in that increases in average length of haul may be beneficial for rail, as could be a genuine increase in tonnes lifted, especially if in large quantities. Alternatively, since tonnes lifted measures the weight of goods transported on each particular journey, an increase in tonnes lifted may reflect increasing complexity of the supply chain and make rail movement more difficult.

There appears to be general agreement that the demand for freight transport will continue to increase, though there is more debate on the rate of growth that is likely to occur. Official forecasts cover only road freight, with those published in 1989 predicting that the volume of road freight, in terms of tonne kilometres, would increase by between 101 per cent and 215 per cent between 1988 and 2025 (Department of Transport, 1989). These forecasts are based upon the long-standing close relationship between road tonne kilometres and Gross Domestic

Product (GDP) and make no allowance for other developments that may modify or break this relationship (McKinnon and Woodburn, 1993).

Peake and Hope (1991) point out that the increase in road tonne kilometres between 1952 and 1990, a similar length of time, was actually over 350 per cent and argue that the official predictions are fairly modest. However, Hallett (1990a) believes the forecasts to be implausible, since future changes to the economy would be unlikely to result in so much extra freight movement.

Changes in government thinking since the publication of the 1989 forecasts, away from the prevailing predict-and-provide approach towards policies aimed at managing freight transport demand, may also influence the future trends. This is discussed in Section 2.3. However, given the current dominance of movement by road, should a significant increase in freight movement materialise it would clearly be a result of further overall growth in freight transport. Even an increase significantly less than that forecast could not result purely from a modal shift in favour of road.

The second of the major trends is the change in modal share of each mode of freight transport. With particular reference to rail freight traffic, its share decreased from 42 per cent of tonne kilometres in 1952 to six per cent in 1994, while road freight's share increased from 35 per cent to 65 per cent over the same period (see Figure 2.2). This represented a decrease in the absolute volume of rail freight of 65 per cent (i.e. from 37 bn tonne km in 1952 down to 13 bn tonne km in 1994). The absolute increase in the volume of road freight was 365 per cent, from 31 bn tonne km in 1952 to 144 bn tonne km in 1994. It is against this background of modal change that the emphasis of the current research on increasing rail's share is set. This emphasises the difficult task involved in achieving a significant modal shift towards rail.

The long term decline in rail freight's share of the freight market has been occurring throughout Europe, though the scale of change has not been quite as substantial as in Great Britain. Between 1983 and 1993, there was an increase of 25.4 per cent in tonne km by all modes in 17 countries in Europe (excluding Great Britain). During that same period, the increase in tonne km in Great Britain was 29.3 per cent. Focusing on rail freight, there was an increase in tonne km of 3.3 per cent at the European level compared with a 19.5 per cent decrease in Great Britain.

In terms of modal share across Europe, rail decreased from having 22 per cent of tonne km in 1983 to 18 per cent in 1993. This share is consistently higher than in Great Britain, where the decline was from 14 per cent to nine per cent in the same time period. Table 2.1 shows the specific trends in other major European countries and emphasises the widely differing situations in different countries. This highlights the fact that this thesis is focused on the British situation and the outcomes may not be representative of other countries.

The reasons behind the greater mode share of rail in France and Germany are beyond the scope of this research, but are likely to result from a wide range of different circumstances (see Section 1.4 for examples). However, in all the countries shown in Table 2.1, rail's share of the market declined between 1983 and 1993. As can be seen, this has not resulted in an absolute decline in rail freight volumes in all cases due to the large increases in total freight volumes.

Table 2.1: Freight Transport Trends in European Countries (tonne km)

Country	% change in tonne km, 1983-1993 (all modes)	Modal share for rail, 1983 (%)	Modal share for rail, 1993 (%)	Change in absolute rail tonne km, 1983-1993 (%)
France	0.9	31.6	26.0	-3.3
Netherlands	17.0	5.0	4.0	-5.0
Spain	26.5	8.3	4.6	-2.5
Italy	27.1	9.8	8.7	1.3
Great Britain	**29.3**	**14.2**	**8.8**	**-2.8**
Belgium	44.1	21.2	16.1	2.0
Germany	55.0	26.5	24.4	11.3

Source: Department of Transport (1995)

It should be noted that the data apply only to national transport and do not include international movements which are more significant in certain countries, in particular the Benelux grouping. Despite the significant growth in international movements that has been occurring within Europe, particularly as a result of the creation of the Single European Market (Banister and Berechman, 1993), consistent historical data have not been published.

This section has introduced the key long term freight transport trends in Great Britain, namely the absolute growth in freight movement and the increasing modal share of road at the expense of other modes, including rail. It has also introduced the units of measurement used, and shown that the general trends are by no means specific to Great Britain. The 1990s were an important watershed in

Great Britain in terms of transport policy and this has had an impact on the role that rail freight is expected to play in the economic and environmental well-being of the country. Section 2.3 synthesises the main changes that have taken place in government policy and reviews the recent literature that has examined the mode choice issues.

2.3 The Freight Modal Choice Issue

The debate surrounding the importance of mode choice for freight transport is, on the whole, less developed than that for passenger movements. This is perhaps not surprising, given that the general population is less involved in the movement of goods than of people. In addition, the sheer number of cars on the road makes the passenger modal choice issue far more apparent.

A large number of studies (e.g. Goodwin *et al*, 1991; HMSO, 1996) have examined the options for effecting a change in modal split, but overwhelmingly these studies have focused most of their attention on the passenger market. Hallett (1990b) argued that the study of freight should not be viewed as inferior to that of passenger traffic and this is increasingly being seen in studies of transport growth and the resulting problems. In its report, the Royal Commission on Environmental Pollution proposed targets to:

> "increase the proportion of tonne kilometres carried by rail from 6.5 per cent in 1993 to 10 per cent by 2000 and 20 per cent by 2010."
>
> (RCEP, 1994)

There were no explicit statements in the report however on how these targets could or should be achieved. An increased target for movements by water was also proposed, in an attempt to reduce the dominance of road freight, it being the most environmentally destructive of the land modes. Therefore, as Tyler (1995) noted, the aspiration to shift freight away from road and onto rail has now been adopted by an ever-growing range of institutions and individuals and is no longer confined to environmental campaigners.

Several authors have emphasised the difficulties involved in attracting freight to the rail network and have even questioned whether the potential for a substantial switch of mode from road to rail exists. For example, Cooper (1990) argued that the conditions found in Great Britain tend to favour the use of road, whereas many other countries are better suited to movements by rail and water. The main arguments in support of this statement are that lengths of haul are low in Great Britain (since population and industry are strongly concentrated in a triangle based upon London, Liverpool and Leeds), the road network is well-developed and the road haulage industry is largely free from regulation. The latter two of these arguments, however, are heavily dependent upon government policy and are by no means fixed in the long-term, while the first one ignores the increasing significance of long-distance international flows (see Section 2.4).

Indeed, in its response to the Transport Debate, the Conservative Government at the time stated that:

> "it wants to see the long-running decline in rail's share of the freight market checked and reversed", and acknowledged that "big shifts....(from road freight)....may well only be achieved by events which make road transport significantly less attractive than it is now."
>
> (HMSO, 1996)

Evidence of substantive government action prior to 1999 is hard to find, though, given that these proclamations began as long ago as 1991, when the then Transport Secretary (Malcolm Rifkind) declared his desire to "see more traffic, both passengers and freight, travelling by railways." (Modern Railways, 1991).

Freight transport in general, and rail freight in particular, has witnessed an increased profile in government policy since the publication of the Sustainable Distribution strategy (DETR, 1999a). The aims identified by this policy document were:

- to promote sustainable transport of goods;
- to promote integration within the freight transport industry and with planning and roads policies;
- to promote the integration of the freight distribution infrastructure;
- **to ensure rail freight plays a full part in sustainable goods distribution;**
- to promote sustainable distribution by sea and inland waterways;
- to improve the understanding of the distribution industry;
- to improve safety in the industry;
- to promote an efficient, competitive road haulage industry;

- to reduce the noise and disturbance caused by lorries;
- to promote the sustainable distribution of goods in urban areas;
- to help meet the Government's objectives for air quality;
- to help meet the Government's target for CO_2 reductions;
- to improve environmental performance in other sectors of freight distribution;
- to promote best environmental practice in the distribution industry; and
- to track the success of the sustainable distribution strategy.

Highlighted in this list is the specific aim relating to rail freight, though many of the other aims are reliant upon a greater role for rail freight. Within the rail freight aim, two specific actions were identified, which were to:

- promote greater use of the rail network for freight through incentives such as the increased availability of grants (see Section 2.4.4); and
- set up a Strategic Rail Authority to promote the improvements of both passenger and freight services.

Other elements of the policy document highlighted the importance of promoting intermodal integration though, given the dominance of road freight, the rest of the document was primarily concerned with actions specific to road.

Gwilliam (1990) highlighted the high level of dependency of many companies' transport operations on road freight, as changing distribution trends and the relative cheapness and accessibility of road haulage have occurred in tandem, making substitution of rail instead of road a more difficult task. The task of increasing rail's share of freight movements through the development of combined (or intermodal) transport systems is suggested as a means of maximising the environmental benefits of rail for longer hauls while utilising road for local distribution work. Intermodal systems are discussed further in Section 2.4.3.1.

In the context of European freight transport movements, Button (1993) similarly emphasised the benefits to companies of using road freight transport rather than other modes. Developments in technologies utilised by railways and waterways are acknowledged, but are claimed to be of little significance given the flexibility afforded by the greater ease of use of the road network. Even the Royal Commission on Environmental Pollution (RCEP, 1994) accepted that, due to the consumer-oriented nature of British society and the difficulties that confront other modes in the distribution of consumer products, road freight will be the major freight mode for many years even with major changes to try to alter the modal split.

It is frequently argued that rail can only compete with road over long distances, with a lower threshold value generally assumed to be around 150 to 200 miles (FTA, 1995). This argument is extremely simplistic, since distance is only one of the factors affecting modal choice, important though it may be. The nature of the consignment is a major factor, with bulk flows more suited to rail than are individual wagonloads. Indeed some bulk rail freight flows in Great Britain are less than 10 miles in length, such as coal movements between Blindwells Opencast Site and Cockenzie Power Station in South East Scotland and Newport

Docks and Fifoots Power Station in South Wales (see, for example, Transrail, 1995; EWS, 2000a).

It is in the non-bulk market where length of haul is cited as being more significant, although Transrail, one of the three regional pre-privatisation bulk freight companies, claimed that rail can compete at distances down to 100 miles if there is direct rail access at one end of the route and at least eight trailer-loads of goods per day (Transrail, 1995). Therefore the fact that intra- rather than inter-regional freight flows are dominant (Goodwin *et al*, 1991) should not necessarily preclude the use of rail. Furthermore, new rail freight technology and changes in public sector involvement in road and rail freight operations may increase the viability of rail movements (Section 2.4), as may increasing lengths of haul and logistical restructuring (Section 2.5).

There are numerous arguments that have been proposed for encouraging a shift from road to rail. These can be classified as being influenced by environmental, social, economic and political factors, though with much overlap.

2.3.1 Environmental and Social Factors

There is a strong argument in favour of focusing attention on reducing the absolute volume of freight transport, since any form of movement imposes costs on society (Plowden and Buchan, 1995). However, means by which such an absolute reduction could be achieved are extremely difficult to find. The changing demands and aspirations of society, in particular the increasing importance of consumer goods, mean that any absolute reduction would be likely to significantly affect the vast majority of the population and the economy as a whole, with either a reduced range of products available or an increase in prices (or both). Therefore, greater attention has been focused on how best to reduce environmental impact through other means, while maintaining the emphasis on a consumer-oriented society.

One of the most frequently quoted reasons for encouraging a shift of freight from road to rail (and, indeed, other modes) is that damage to the environment is reduced for a given amount of freight moved. The Royal Commission on Environmental Pollution (RCEP, 1994) identified the heavy goods vehicle (HGV) as the most polluting mode of freight transport. Rail is far less polluting per tonne km, although coastal shipping, inland waterways and pipelines are each even less damaging than rail. However these other modes are more commodity-specific and route-specific than rail, so the scope for significant transfer of traffic to water and pipeline is severely limited. In many cases, then, rail is the only potentially viable alternative to road movement.

Transport 2000 (1993) summarised the many environmental and social factors that make up what it termed 'the heavy lorry problem'. Noise and vibration, pollution (especially carbon monoxide emissions), vehicle size, congestion, safety and community severance were the major factors identified. A switch of traffic from road to rail may reduce the impacts of many of these factors, by reducing the volume of road movement and possibly reducing the demand for new road infrastructure provision.

An alternative, or perhaps complementary, way of addressing many of these issues has been to examine means by which the efficiency of the road haulage industry can be improved. This body of work has primarily focused upon improving vehicle utilisation, optimising vehicle routing and scheduling and introducing new technologies such as low emission vehicles (see, for example, DETR, 1998b; Jones and Newson, 1998; McIntyre, 1998). The tendency to focus upon road is entirely understandable, given the overwhelming modal split in its favour and in the context of complex logistical operations discussed in Section 2.5. Identification of the potential role for rail has not featured in this work to any great extent, although whether this is because it has been excluded or discounted as being unsuitable is not clear. This presents an interesting research area to be examined in this thesis.

2.3.2 Economic and Political Factors

There may also be sound economic and political reasons for encouraging a shift from road to rail. It is not the intention here to provide exhaustive coverage of all potentially relevant factors, but instead to highlight the main areas of interest in the literature. Of course, there is much overlap with those issues identified in Section 2.3.1.

Until recently, little emphasis has been placed on the cost of infrastructure provision and maintenance. However, given the environmental arguments outlined above, and the increased pressure on government spending, there is a growing consensus that efforts should be made to maximise the use of existing infrastructure rather than continually providing new capacity.

This has been exemplified by recent government policy documents, such as the Integrated Transport White Paper (DETR, 1998a) and the Sustainable Distribution daughter document (DETR, 1999a). It is an undisputed fact that the costs of providing infrastructure for freight traffic, particularly by road, are significantly higher than those for passenger traffic alone, though the scale of the extra cost is less obvious.

At the same time much rail infrastructure is currently underused, or could possibly be enhanced at lower cost than for the road network, and could play a role in accommodating a significant increase in rail freight volumes. If the regulatory framework for road freight was reformed, to take into account the true costs imposed on society, Plowden and Buchan (1995) have argued that the need for subsidies (or grants) for rail would be obviated. This emphasis on forcing users to address their external costs (e.g. vehicle emissions, noise and vibration, congestion, accidents) was discussed in depth in Maddison *et al* (1996).

As road congestion in particular has become a bigger issue, methods of alleviating the problem have been sought. Large goods vehicles contribute to, as well as suffer from, road congestion, so there are a number of factors to be considered both at the societal and individual company level. Increasing road congestion may lead to companies searching for ways to avoid congested routes and times, which may involve considering the use of rail. Thus, purely for reasons of economic self-interest and without any specific effective policy changes in favour of other modes, rail may become relatively more attractive to individual firms as road network congestion reduces the cost and service quality differentials between using road and rail. However, there would appear to have been little direct research thus far on this issue.

At the macro level, there have been policy changes in fuel taxation in the 1990s, though again the effects of this do not appear to have been quantified through independent research. Various pressure groups, for example the Road Haulage Association (RHA, 1999) and the Freight Transport Association (FTA, 1999; FTA, 2000), have argued that the impacts have been particularly damaging to the road haulage industry, though whether any shift to rail has resulted is not apparent. More recently, the annual increases in fuel taxation have been relaxed (Treasury, 2000), making future policy unclear.

There may be further policy changes in fuel pricing, either as a general taxation measure or as an attempt to make road users pay the true costs of utilising the road network. The introduction of road pricing, particularly if varied depending on location or time of network usage, may have an effect on individual companies' operations which could vary substantially depending on their transport requirements. The effect of motorway tolls on road freight was investigated by Bryans (1995), who estimated that significant additional costs would be placed on operators. However, the prospect of a modal shift away from road was not explored.

In addition to the charging regime for infrastructure usage, policies relating to the provision of new transport infrastructure may be reappraised, leading to road and rail investment proposals being evaluated using the same criteria. The growing influence of the European Union in the development and enforcement of policies and regulations on a whole range of issues may also result in changes to the environment in which the various modes operate. For example, further changes in regulations relating to drivers hours and maximum operating speeds for HGVs could have an impact on the economics of road haulage, particularly when combined with increasing road congestion. Similarly, investment decisions for infrastructure development and improvement may be used to try to encourage one mode at the expense of another.

2.4 The Role for Rail Freight

The previous section examined the general literature relating to freight modal choice and highlighted the key arguments for encouraging greater use of alternative modes to road. This section reviews the literature on the role for rail freight, with particular reference to the supply-side of services. It discusses the main issues pertaining to rail and highlights the principal areas in which attention has been focused thus far in studies of the potential for rail to increase its market share. It also considers the specific policies that have been implemented in Great Britain to encourage the use of rail.

2.4.1 Issues of Ownership and Management

There have been moves in a number of countries to transfer the ownership of rail freight from the public sector to private operators, though the means by which this has been done has varied substantially. The most frequent argument used in favour of privatisation from the transport point of view is the freedom that it bestows on operators, giving them financial and operational flexibility rather than being constrained by public sector financial restrictions. In New Zealand, whose rail freight operations were privatised in 1993, the rationale behind the sale was as follows (Cavana, 1995):

1. to refocus the public sector on core areas of government responsibility; and
2. to transfer from the public sector business enterprises that will perform better in private hands.

The argument, also used in Britain, was that other transport operating companies in New Zealand were already privately owned, so it was logical to privatise rail freight to allow modal competition on equal terms. This ignores the issue of in-built biases towards specific modes in other spheres of government involvement, such as infrastructure investment (Button, 1993).

Overwhelmingly though, the main objectives of privatisation have been to reduce the size of the state, to achieve economic efficiency and to raise finance for government from the sale (Economist, 1993). The transport effects of privatisation often appear to be of secondary importance and traffic growth or modal shift are rarely fundamental issues in the privatisation process. In many other countries, rail freight operations have been restructured while remaining in public sector ownership (Button, 1993).

Given that rail privatisation, where it has occurred, has been a recent phenomenon there is a lack of literature analysing the significance of this issue on the role for rail freight and whether ownership influences the capabilities of rail to meet the demands expected of it.

2.4.2 Commodity Focus

One of the most basic factors that characterises rail freight operation is the difference between a full trainload from a particular origin to a particular destination at the one extreme, and individual consignments of wagonloads (or even smaller quantities) at the other extreme (Fowkes *et al*, 1993). In reality, there actually exists a continuous spectrum. A major determinant of consignment size is the type of commodity being transported, with the type of market being supplied also being an important factor.

Rail has traditionally been a major player in the bulk market, focusing particularly on commodities such as coal, aggregates and petroleum products. Throughout the 1990s, coal alone has accounted for around 30 per cent of rail's tonne km, though this share has declined from 35 per cent in 1982/83 (DETR, 2000a). The long-term decline in the absolute volume of freight moved by rail in Great Britain can be explained, in part at least, by the decimation of the coal industry. In a review of the decline in the coal industry and its impacts on rail freight, Shannon (2000) highlighted the link between the contracting domestic coal industry and the decline in rail freight volumes. In 1947 there were 958 operational deep mines, declining to 57 following the 1984 miners' strike, with only 16 remaining by early-2000. The effects of this decline both on volumes produced and moved by rail can be seen in Table 2.2.

Table 2.2: Decline in the British coal industry:

(a) Total coal production and consumption (1960-1998; million tonnes)

Year	Production	Consumption
1960	197	200
1970	147	151
1980	130	120
1990	93	108
1998	41	62

(b) railborne coal traffic (1989/90-1998/99; million tonnes)

Year	Electricity supply industry	Other
1989/90	58	17
1994/95	38	8
1998/99	31	7

Source: Shannon (2000)

This analysis clearly identified the effect of the declining coal industry on rail freight volumes, even when the growing import volumes were included (i.e. consumption rather than production). Rail freight's share of the coal tonnage consumed declined from around 70 per cent in 1989/90 to just over 60 per cent in 1998/99, but this was dwarfed by the 43 per cent decline in tonnage consumed in this period. Due to the overall dominance of coal movements for rail freight, this decline had a serious impact on the total volume of freight moved by rail.

As the traditional heavy industries have declined, the emphasis has shifted to the manufacture of consumer goods which are less bulky and more diverse and demanding in their transport requirements. As a result of the absolute growth of these industrial sectors, it is here that rail's share has decreased most markedly at the expense of road movement in many countries (Laird, 1992) and where attention must be focused if rail is to play a more significant role in freight movements.

Through a series of 12 detailed case studies of traffic flows in Great Britain in 1998/99, Pearson (1999) attempted to show that the traffic base handled by the main rail freight operator, English Welsh and Scottish Railway (EWS), is indeed broad. The case studies included coal, steel, aggregates, automotive, mail and intermodal flows. However this analysis made no attempt to identify the significance of each of the flows studied in terms of the overall volume handled, instead treating the case studies as standalone examples of EWS' services. For example, despite the continued significance of coal as a proportion of rail freight volumes, it was the subject of one case study as was the relatively insignificant (in volume terms) movement of supermarket supplies within Scotland. The literature on the impacts of changes in commodity focus on rail freight is discussed further in Section 2.5.

2.4.3 Development of New Techniques and Operating Methods

As has been seen from the discussion of policy changes and recent literature on freight modal split in Section 2.3, there has been a resurgence of interest in rail freight in Great Britain in recent years. Many of the 'new' developments in Britain are not in fact new at all, but simply involve the adoption or adaptation of techniques that have been in use elsewhere around the world for some time. This particularly applies to the advances in intermodal technology that have occurred since the opening of the Channel Tunnel. Other developments have been specific to Britain, most notably the way in which the rail network and its operation have been privatised, allowing a degree of competition between rail freight service providers. These developments are considered within this section.

2.4.3.1 Intermodal advances

One of the developments cited most frequently in policy documents (see, for example, RCEP, 1994; DETR, 1999a) as a means by which rail freight could regain a greater market share is the potential for adopting a wider range of intermodal techniques, primarily road/rail combinations. This is an important issue highlighted in many studies of freight modal split in the last 10 years.

The various techniques are discussed in detail in Smith (1992), including established containerised methods as well as swap bodies, Piggyback and rolling motorways, where a strong case is put forward for a combination of intermodal operations being required if rail freight is to strengthen its portfolio of commodities carried. The use of many of these intermodal systems is far more widespread in continental Europe, both generally and in specific situations such as the transit of Alpine countries where stringent regulations apply to road vehicle movements (Westerink, 1990).

In Great Britain, a number of intermodal advances have been made in recent years. Most of the literature has focused upon the commencement of Channel Tunnel freight services in 1994, serving a small number of regional terminals using swap bodies and containers (see, for example, McKinnon, 1996; Worthington, 1996; EWS, 1999). The application of the new technologies is severely hampered, though, by the restrictive loading gauge in Britain in comparison to most mainland European countries (McKinnon, 1996).

There has been much debate surrounding the extent of the loading gauge problem and the priorities for increasing clearances in the future, due to the differing requirements of different types of intermodal systems (see, for example, Smith, 1992; Woodburn, 1999). What is not in doubt is that widespread infrastructure upgrading throughout the country would be costly. As a result, Railtrack has identified a costed programme for improving the loading gauge of key corridors, though without giving firm commitments to timescales or funding availability (Railtrack, 2000).

As an incentive to encourage the use of intermodal transport, and to allow for the extra weight penalty for intermodal equipment, a weight concession was introduced in 1993 for road vehicles operating to/from rail terminals for consignments using rail for part of the journey. This concession has been criticised in the past for not applying to all intermodal movements, such as those using the Piggyback system (Piggyback Consortium, 1994). Furthermore, the allowance has been gradually eroded in recent years, from the original six tonnes (i.e. 44 tonnes maximum gross vehicle weight for intermodal movements as opposed to the standard 38 tonnes) down to just three tonnes at present, with a complete elimination of the allowance to result from the general introduction of 44 tonne vehicles from 2001 (Treasury, 2000).

The available literature is lacking in the formal analysis of the impacts of the introduction of new intermodal technologies, or the extent to which the weight allowance for vehicles on intermodal movements has impacted upon mode choice decision-making. The particular problems for rail in playing a role in many of the recent logistical developments, and the potential for intermodal systems to have an impact, are discussed in Section 2.5.2.

2.4.3.2 Marketing policies

Traditionally, rail freight operators have been content to cater for the traffic that is given to them, with very little effort being made to encourage new flows. In Britain this is a legacy of the pre-1962 common carrier legal requirement (Shannon, 1991).

Much of the literature analysing the fortunes of rail freight pays very little attention to the possibility of winning traffic through marketing initiatives. Ferreira and Otway (1993), in their study of Australian rail freight profitability, concentrated mainly on service level and productivity gains as a way of improving the performance of the rail system. Emphasis was placed on the withdrawal of uneconomic business, with only brief mention made of the possibilities of expanding certain types of traffic.

The Freight Transport Association stated, perhaps unrealistically, that:

> "the mission for rail freight should be to delight its customers with irresistible prices, unquestioning flexibility and unfaltering levels of service and reliability....(and)....to trade on its business strengths and reach a wider market through offering better solutions for customers."
>
> (FTA, 1995)

Particularly relevant would appear to be the need to concentrate on reducing what is often a significant cost differential between rail and road. Road haulage is generally, though not exclusively, cheaper than rail. Reductions in rail freight costs could result from a general change in the pricing of rail freight operations as a result of the Rail Regulator's review of Railtrack's pricing regime, more competitive pricing by operators for marginal flows, or the provision of government support (see Section 2.4.4).

While the literature reveals little evidence of a pro-active marketing policy under nationalised ownership, early indicators from English Welsh and Scottish Railway (EWS) suggest that more emphasis has been placed on attracting new traffic to rail by actively seeking out potential business. EWS is the private operator of the re-grouped trainload companies and, as such, handles the vast majority of rail freight movements in Britain. The other main operator, Freightliner, would also appear to have been more active in marketing its services.

In a letter to his staff, EWS' former Chief Executive criticised the approach taken by the nationalised British Rail, drawing comparison between the British Rail network with just 100 customers at the time of privatisation in 1996 and the smaller Wisconsin Central system (under the same ownership as EWS) in the United States which had 670 customers at the same time (Guardian, 1996). Changes since 1996 would appear to offer considerable scope for analysis, given the lack of comprehensive independent research of the changes.

A further issue, resulting from privatisation, is the pivotal role that Railtrack has in developing freight traffic. As the infrastructure owner, it largely controls the key factors of network connections, capacity and loading gauge. In its 2000 Network Management Statement (Railtrack, 2000), Railtrack argued that all routes can accommodate projected freight growth, though gauge enhancement work is required on key corridors. This has been challenged by operators and other bodies, such as the Rail Freight Group (2000) who have argued that Railtrack is unenthusiastic about freight and is potentially endangering its long-term success. The issues would appear to be as much political as to do with the actual operation of the rail network with Railtrack and the government debating their responsibilities for promoting and funding the development of rail freight.

2.4.3.3 On-rail competition

In most countries, rail freight operations are under government control and operated by one single body (also generally publicly-owned) which is usually responsible for all aspects of operation, including passenger traffic and infrastructure maintenance in addition to freight services. This was the position in Great Britain until the privatisation process was implemented under the Railways Act 1993, when the concept of *liberalisation* of service provision was voiced. In its privatisation proposal, the then Conservative government expressed its desire for:

> "the opening up of the railway network to wholly new operators, with all that this entails in terms of new ideas and new ways of doing things. The introduction of open access to the rail network is central to the Government's aim of stimulating competition and customer choice in the supply of rail freight services."
>
> (Department of Transport, 1993)

The concept of liberalisation, or open access as it has come to be known, was not an entirely new one, having been in operation in a milder form in Britain for some time (Shannon, 1995a). Foster Yeoman, one of the leading aggregates companies, introduced privately-owned locomotives onto its services in 1986 and was followed in 1990 by one of its competitors, ARC. These two operations have since been combined into one operating company, MendipRail. The major difference between this early private operation and the open access concept was the requirement for these aggregates trains to be crewed and locomotive maintenance to be carried out by British Rail staff.

In the first four years of private sector rail operations, only two fully open access operators have attempted to run their own services, both of which basically involved the transfer of operation of rail freight services from the formerly nationalised operators. Direct Rail Services (DRS), a subsidiary of British Nuclear Fuels Limited, encountered significant problems in gaining a safety case to operate over the Railtrack network, including the availability of suitable motive power, driver recruitment, third party insurance and the negotiation of a track access contract with Railtrack (Shannon, 1995b).

Similar difficulties were experienced by National Power, who also had to battle to receive approval for their safety case (Modern Railways, 1996a). The general problems involved in gaining safety case approval were highlighted by Ford (1995), who argued that there was little incentive for operators to try to enter the market. Ford also argued that the obstacles were likely to lessen over time, though this has not apparently happened as yet, but in any case there is no evidence that open access will in itself be a sufficient reason to encourage any significant modal transfer.

In fact, in 1998, National Power handed over their rail operations to EWS, leaving DRS as the sole open access operator at the time of writing. A new entrant, GB Railways, has obtained a safety case and is planning to commence its own operations in the near future. In contrast, road haulier and logistics specialist Eddie Stobart has abandoned plans to set up their own rail services due to rail's inflexibility and outdated equipment (Modern Railways, 1999a).

There is increasing evidence however of direct competition between EWS and Freightliner, the two operators created out of the former British Rail freight operations. EWS has started container services to and from Southampton and Felixstowe in competition with Freightliner (Modern Railways, 1999b). This has been followed by Freightliner winning contracts from traditional EWS customers, such as Ford automotive traffic (Modern Railways, 2000). The implications of this for growing the overall rail freight business have not yet been established.

2.4.4 The Use of Public Finance

Another theme to be found in the literature is the availability of public money to support the provision of rail freight services. The nature of the grants system varies between different countries and depends, in particular, upon the level of regulation of road transport, since this directly affects the viability of individual rail freight movements (Button, 1993). In countries where road transport has been more strongly regulated (e.g. Germany), rail is more likely to be able to compete with road without requiring additional finance. These issues were discussed in Section 2.3.

In Britain, the grant system was set up under Section 8 of the Railways Act 1974 and amended under sections 139 and 140 of the Railways Act 1993. According to the Department of Transport, grant could be provided:

> "for investment in rail or inland waterway facilities where the goods are currently travelling by road, for new rail or inland waterway traffic which would otherwise go by road and for reinvestment where the

> traffic would revert to road without further capital expenditure....to enable rail and waterways to compete in financial terms with road transport."
>
> (Department of Transport, 1994)

This type of grant is now known as a Freight Facilities Grant. Additionally, Track Access Grants were introduced to ensure that the new track access charging regime introduced under rail privatisation did not result in the loss of rail traffic.

Following this restructuring of the grants system, some examples from the literature of grants that were awarded to keep various types of traffic off the road included:

1. Limestone - Freight Facilities Grant for loading and conveyor facilities at Buxton Lime Industries' plant, to ensure rail is used where possible in the Peak District National Park area, saving up to 125 lorry movements per day (Modern Railways, 1996b).
2. Scrap metal - Freight Facilities and Track Access Grants for fragmentised scrap metal traffic between Mayer Parry in Willesden, north west London, and Co-Steel in Sheerness, Kent, saving over 8,000 lorry journeys per year (Modern Railways, 1996c).
3. North Sea condensate - Freight Facilities Grant for the upgrading of track for the movement of North Sea condensate, the sludge from inside pipelines, between North Walsham, Norfolk, and Harwich, Suffolk, for Carless Refining

and Marketing Limited, to ensure the traffic remained on rail rather than using unsuitable East Anglian roads (Modern Railways, 1995a).

4. Coal - four year grant to retain coal traffic between Lanarkshire and Cockenzie Power Station, East Lothian, for Coal Contractors Limited, ensuring 3,500 heavy goods vehicle movements per annum are kept off the road network (Local Transport Today, 1996).

It would appear that the awarding of grants to particular traffic flows in Britain has, however, had an extremely marginal effect on retaining existing rail traffic or in encouraging new flows and did nothing to halt the progressive decline in market share of rail. Until recently, the number of grants awarded was low and the amount of money allocated was significantly less than that budgeted for by the then Department of Transport. For example, in 1994 only £3 million was spent on grants instead of the £13 million budgeted for (Watts, 1995). This underspend resulted in a reduction of £5.8 million in the total allocated for the following year.

The whole grants system was strongly criticised by the National Audit Office (NAO, 1996), which highlighted a number of failings of the system and proposed ways in which the system should be revamped in order that it could more effectively encourage the use of rail. A major development following publication of the NAO report was the increase in the mileage allowance used to calculate the benefit from reducing lorry mileage on motorways. It increased from 5 pence per mile to 20 pence per mile, thus substantially increasing the potential grant to be awarded with the aim of making rail viable for more longer distance flows (Local Transport Today, 1996).

A feasibility study for the introduction of a 'RoadRailer' intermodal service between London and Glasgow found that rail was not feasible with the 5 pence per mile rate, but that at 25 pence per mile the balance would tip in favour of rail (TDG, 1995). Therefore the four-fold increase in the allowance to 20 pence per mile was a significant improvement.

Critics of the system, including the NAO, argued that much of the grant available, particularly Track Access Grants, simply pays for the extra costs imposed on rail movement by the privatisation process and the in-built governmental bias towards road and does little to redress the imbalance between the access costs to the road and rail networks. Since 1997, the new Labour government has injected significantly more funds into the grants, as can be seen in Table 2.3.

Table 2.3: Grant Funding for Rail Freight

Year	Total value of awards (£m)
1993/94	4
1994/95	3
1995/96	4
1996/97	15*
1997/98	29*
1998/99 (estimate)	31*
1999/00 (plan)	50*
2000/01 (plan)	52*
2001/02 (plan)	54

Source: DETR (1999a); * - includes £75m Track Access Grant to Freightliner (over five years)

A revised set of figures was not yet available at the time of writing, but the recent evidence suggests that the increased spending targets have been met. The most recent figures show that during 1999 almost £47 million of grant funding was committed (DETR, 2000b). Unfortunately this figure refers to the calendar year, while the figures in Table 2.3 apply to financial years, but it is clear that there has been a significant increase in funding. Several large awards were made in 1999/2000, including the following:

1. Polymer - combined Freight Facilities Grant for TDG Nexus (on behalf of BP Chemicals) and Track Access Grant for Freightliner for a new terminal at Grangemouth to distribute containerised chemicals to sites in England and Wales via the Freightliner network (Modern Railways, 1999c). This should reduce road miles by more than 5.9 million per annum from summer 2000.
2. Retail distribution - Freight Facilities Grant to Safeway to allow it to expand its overnight distribution of products from Lanarkshire to the Scottish Highlands, removing 9,000 lorry journeys (or 600,000 lorry miles) per annum (Scottish Executive, 2000).
3. Tyne Dock Rail Freight Terminal - Freight Facilities Grant towards the capital costs of a new rail terminal which will relieve the local road network of 90,000 lorry journeys to/from the port over five years (DETR, 2000c).
4. Automotive - Freight Facilities Grant to Central and Midland Properties Limited, in association with CAT UK) for the construction of a new rail-connected car terminal near Coventry for the distribution of Renault cars (DETR, 2000b).

Overall, there is little evidence from the literature that the grants system has made any significant impact on the volume of freight moved by rail, although the impacts of recent awards have not yet been identified and reported. Prior to 1990, the government estimated the freight tonnages transferred to rail as a result of the Section 8 grants (as they were at that time) that were awarded. No auditing of this estimation process is believed to have occurred and recent estimates of the impacts of grant funding do not appear to have been made.

Referring back to Figure 2.2, the reversal of the decline in rail freight volumes since the mid-1990s may be as a result of the various issues raised in the literature and reported throughout Section 2.4, but comprehensive analysis of this recent trend appears to have not yet taken place. This is one specific area where a research void is identified in this thesis.

On balance, the literature on the provision of rail freight services suggests that there will not be a significant shift towards rail solely through supply-side changes. This leads on to the focus in the next section on the importance of logistical structure on mode choice, particularly in an environment which has clearly been seen to be geared towards road transport as the major freight mode.

2.5 The Importance of Logistics in Freight Modal Choice

Given the growth of interest in logistics as a discipline in its own right since the 1970s and the recent emphasis on finding ways to alter the modal split in favour of less environmentally-damaging modes of transport (see Sections 2.3 and 2.4), surprisingly little research has been carried out examining the interactions between logistical structure and modal choice. There have, however, been widespread changes in companies' logistical systems that are likely to have had at least some impact on modal choice.

For general reading on the concept of logistics see, for example, Christopher (1986), Cooper (1994), and McKinnon (1989). An extremely large volume of literature now exists to examine and account for logistical structure: the intention in the remainder of this chapter is to provide a summary of the main issues, to identify the principal work that is relevant to freight modal choice, and to highlight where the research gaps exist.

2.5.1 Recent General Logistical Trends

Much attention in the academic literature and trade publications has been focused on the changing distribution patterns and the growing importance of logistics to companies operating in an increasingly competitive environment. The field of logistics is increasingly seen as being an area where there is scope for a firm to gain a competitive advantage through more efficient control of the supply chain. It has been stated that logistics is:

> "the science which integrates all the activities required to move goods from the original sources of raw materials to the location of the ultimate consumer of the finished product."

(Sussams, 1991)

A fundamental part of this logistics system is the transport function, but also important are other functions such as warehousing and stock control. It is this shift away from considering solely the transport operations towards the broader concept of logistics that has complicated the issues surrounding modal choice. This section reviews the literature on the key logistical trends that have been taking place.

One major research area has been the analysis of trends in the nature of the geographical operation of companies' activities, particularly concerning manufacturing, distribution and retailing activities. The trends towards concentration and rationalisation that have occurred in Britain over the last few decades, as in most other countries, have been taking place more recently at the European level. In a study of the consumer electronics manufacturing sector, Moffat (1992) found that companies had started to rationalise their European distribution networks even in advance of the introduction of the Single European Market. Subsequently, Cooper (1993) identified that many companies were beginning to aim for globalisation, though the impacts on transport requirements were not apparent.

Linked to these changes, much of the literature focuses upon the way in which companies at different stages within the supply chain interact with each other. Indeed, there is evidence that this has been changing significantly. For example, Whyte (1993) concluded that there have been attempts to break down the barriers between suppliers and customers in an attempt to achieve greater supply chain integration and control, the overall aim being increased efficiency.

Previous work involving the author (McKinnon and Woodburn, 1994) concurred with this change in supply chain operation and management. It found that in the retailing industry, particularly food retailing, the large multiple retailers have increasingly taken control of the inward movement of products from suppliers. They have channelled products through their own retailer distribution centres (RDCs) rather than the manufacturers delivering direct to shops through their distribution networks as was traditionally the case. The evidence from this research suggested that this fundamental restructuring of the distribution system has had major implications for the nature and scheduling of freight movements. The mode choice implications will be discussed further in Section 2.5.2.

A number of authors have highlighted the significance of changes in the scheduling of production and distribution that have been taking place across industry as a whole. In his study of Swedish logistics trends, Bjornland (1994) found that, in particular, average consignment size and lead times have both been decreasing rapidly while shipment frequency and stock turnover have increased. The study argued that the evidence suggested that these trends would continue for the foreseeable future.

One frequently quoted development that has caused these changes has been the introduction of a just-in-time (JIT) regime to a larger proportion of companies' supply chains. A comprehensive review of JIT was carried out by Allen (1992), with the relevance for rail freight being considered in Section 2.5.2.2. In addition, American authors have examined the effects of JIT and its impacts on mode choice, though primarily in the North American context (Lieb and Millen, 1988; Garreau, Lieb and Millen, 1991). Greater use of JIT, as well as general increases in customer service requirements, were the most commonly mentioned developments expected to cause an increase in road movements in an industry-wide survey of British manufacturers and retailers (McKinnon and Woodburn, 1996).

A further major research area in recent years has been the identification of means by which some of the conflicts resulting from the adoption of new logistical practices can be minimised. An increased awareness in society of environmental and other issues (see Section 2.3.1) has occurred at the same time as the more intensive use of road haulage resulting from logistical changes, with the problems being most apparent in urban areas. As a result, there has been a large body of work examining urban distribution systems and their impacts on both society and the environment and the efficiency of the logistical systems in an effort to become more sustainable (see, for example, European Commission, 1995; FTA, 1997; Whiteing and Edwards, 1997; Visser and van Binsbergen, 1998; Loffler, 1999). While these studies are focused on road-based operations, some of the concepts (such as transhipment centres) could potentially incorporate rail usage for inter-urban flows into these more sustainable urban systems. Key to this work has been an understanding of the complexities resulting from a logistics-based approach, meaning that the transport element can no longer be treated in isolation.

This section has identified the relevant broad themes of research in logistics to date, without specifically considering the modal choice issue. In the next section a more detailed resume of relevant studies, including the extent to which they considered the use of rail, is presented.

2.5.2 Previous Studies on Interactions Between Logistics and Freight Modal Choice

It is the intention in this section to focus on the extent to which previous research has considered the issue of rail use when examining the logistical changes that have taken place and *vice versa*. The key changes were discussed in Section 2.5.1.

2.5.2.1 Cross-disciplinary issues

Throughout this chapter, it has been apparent that the nature and effects of freight transport do not fit neatly into one academic discipline. Instead the topic transcends a number of different disciplines across the sciences and social sciences, with the focus of previous research being largely dependent upon the backgrounds of the researchers and their motivations for carrying out the research. This section identifies the various different approaches that have been adopted in previous logistics-based research in this area.

Much of the previous academic literature on the potential for increasing rail's modal share has been at the theoretical level, focusing on operational research and mathematical modelling. This literature was reviewed extensively in Cordeau *et al* (1998) and Ferreira (1997). While this type of work is of significance in attempting to quantify some measure of rail freight service quality, and the components thereof, it tends to ignore the other factors that affect rail freight operations. There has also been a tendency to ignore the different influences on mode choice in different countries. The lack of incorporation of the essentially unquantifiable human and political influences on mode choice and performance in particular means that the theoretical solutions proposed cannot always be implemented so successfully in reality.

Econometric studies of rail freight have also been undertaken, although again they have tended to be theoretical in nature and have been lacking in their incorporation of those elements of mode choice that are not easily quantified. Abdelwahab (1998) summarised this area of research and presented the results of a new study of manufactured goods in the United States freight transport market. He found that, in general, rail and road demand elasticities were both elastic with respect to the price of the service in most commodity groups, although rail tends to be more elastic. Mode choice was found to be insensitive to the other main service variable under consideration, which was transit time.

Campisi and Gastaldi (1996) examined the Italian freight system and used demand elasticities as a means of identifying the potential for switching movements from road to rail upon implementation of a pollution tax. While acknowledging the complex relationships in freight mode choice, this research was predominantly theoretical and again focused on just a few of the key variables. The research concluded that a pollution tax would result in a modal shift to rail, but it did not examine the consequences on the current road-based logistical systems.

While it is not denied that these elasticities provide an insight into the mode choice process, they focus on a very limited number of variables that influence the decision on mode. As such, given the wide range of influencing factors identified in earlier sections of this chapter, studies on demand elasticities tend to be narrowly focused and theoretical rather than considering the broad range of attributes that affect mode choice.

Other economic studies have examined the interactions between transport and industrial location (Nelson *et al*, 1994; Button *et al*, 1995), but few have explicitly examined access to the rail freight network as an important variable. In a review of warehousing and road-rail terminal provision, the University of Westminster (1996) concluded that further studies were needed to examine the importance of network access as part of a package of measures to make rail more user-friendly. The emphasis of the study was on intermodal developments, where capacity is at least as important a factor as the number of terminals (i.e. network access points) due to road haulage being required for at least some of the journey between origin and destination.

A further set of studies (see, for example, FTA, 1995; Plowden and Buchan, 1995; Komor, 1995; Tyler, 1995) have focused almost exclusively on the characteristics of rail freight and the environmental and social benefits, arguing that only relatively minor policy changes are required to effect a significant modal shift from road to rail. A common theme of these studies, however, is a lack of understanding of the extent to which the logistical changes that have taken place in the last 20 years have affected mode choice. As a result, there have been overly-optimistic opinions of the ease of increasing rail's share of freight movements.

The Rail Freight Group of the Freight Transport Association (FTA, 1995), while acknowledging the external changes that have taken place, made many suggestions on how rail could regain its market share through meeting customers' needs. While the overall focus of the report was laudable (i.e. to effect a shift to rail), some of the recommendations were unclear and showed a lack of understanding of the nature of rail freight operations.

Similarly, the "New Framework for Freight Transport" proposed by Plowden and Buchan (1995) focused on the perceived benefits of using the regulatory framework to promote a shift to rail. While this framework would undoubtedly result in environmental and social benefits, it paid little attention to the significance of road haulage to the logistical operations of manufacturers, retailers and distribution companies.

Similar research has been produced in the United States. Komor (1995) examined ways to reduce energy use in freight transport and argued that huge savings would result from a switch from road to rail. While acknowledging that the two modes have different characteristics, he claimed that certain policy options would be successful in effecting a shift to rail. The logistical requirements of the potential rail customers were largely assumed to fit with the types of service that could be offered, with little attention being given to justifying this assumption.

In contrast, much of the social science-based research has tended to investigate revealed or predicted freight modal choice decision-making issues. In some cases, this has incorporated some understanding of the importance of logistics. This body of research has been based upon various methodologies and has included both general industry surveys and in-depth case studies of particular companies or industrial sectors.

During the 1970s and early-1980s, a number of studies examined the nature of the freight modal choice decision-making process. Most significantly for this research, Gray (1982) found that behavioural approaches to the topic added considerable insight to what was a subject generally believed to be influenced by quantifiable mode attributes. This study supported a more descriptive "perceptual approach" which bases its assumptions on the perceptions of the key decision-makers within organisations rather than the more traditional prescriptive approach.

The importance of decision-makers, in particular their reluctance to switch modes, was emphasised in shippers surveys on the effective competition between freight modes (McGinnis and Corsi, 1979). This study found that true competition between modes was limited due to the widespread perception that the different modes fundamentally catered for different types of movement.

McGinnis (1979) developed a factor analytic approach towards freight modal choice in an attempt to identify the key variables affecting decision-making. This identified speed, reliability, freight rates and loss and damage as highly important factors, which is broadly in line with studies using alternative methodologies. While the specific findings may now be dated due to more recent logistical developments, the emphasis on recognising the objectives and needs of the company when making mode choice decisions is still of significance. A more detailed case study approach to freight mode choice decision-making found similar issues to be of the greatest significance (Jeffs and Hills, 1990).

Pisharodi (1991) argued that the emphasis of the mode choice decision-making process would shift from the factors that influence decisions to the actual activities involved in the process. However, there does not appear to have been any further development of this approach since the early-1990s.

Some of the more specific issues relating to the interactions between logistics and modal choice are discussed in the next section, particularly focusing on more recent research.

2.5.2.2 The importance of the interactions between logistics and freight modal choice in research to date

As Chapter One stated, the primary motivation for this research was the apparent lack of understanding of the role of rail freight in a transport system driven by a focus on logistics rather than freight movements alone. In a review of available data, McKinnon and Woodburn (1993) identified the importance of the processes of centralisation and rationalisation of distribution networks in Great Britain, which have resulted in an increase in the average length of haul. Furthermore, concentration of manufacturing activity at fewer sites during the 1980s had had the effect of increasing the average output per plant in most business sectors. These trends were confirmed by an industry-wide survey, through a combined questionnaire and interview approach (McKinnon and Woodburn, 1996).

Superficially, these trends would appear to have been of benefit to rail since they suggest that flows of goods, at least in the earlier stages of the supply chain, have been focused on fewer locations. If this had been the case, then an increase in consignment size would have been expected to have resulted from a broadly similar volume of goods being transported between fewer origin-destination pairs. However there was little evidence of rail playing a significant role in goods movement in the companies sampled in this study and the scope for greater use was not explored at that time.

The trend towards JIT (and JIT-type operations), identified in Section 2.5.1, would appear to have countered this consolidation argument and may have negated any benefits to rail. It appears that, in many industrial sectors, consolidated flows have not resulted from the concentration of activity, but instead that the flows have become more frequent between the particular origins and destinations that remain.

JIT production and distribution is assumed in most of the literature to be entirely dependent upon road, given that it is best suited to frequent movements of small consignments. In most cases, the use of rail is ignored completely. Allen (1992), however, acknowledges the negative environmental effects of JIT resulting from more intensive road movements. He highlighted road's general benefits of speed and flexibility, but also identified that:

> "it is possible that a greater proportion of JIT distribution could be attracted towards rail if government made the necessary investments in rail.....However, it remains to be seen whether rail freight services could be sufficiently improved so as to facilitate JIT transportation."
>
> (Allen, 1992)

Higginson and Bookbinder (1990) specifically examined the implications of just-in-time production on rail freight systems in the United States context. Through analysing the perceptions of rail by JIT manufacturers and the capabilities of the rail mode, they concluded that JIT does not necessarily exclude rail movements despite the fact that it tends to be synonymous with road. The key to JIT is precision and, given the right operating environment, there is no inherent reason why rail cannot handle some of these movements. They identified an "ideal rail JIT system", based on characteristics favourable to rail such as long haul lengths, use of intermodal equipment and the adoption of new information technology to allow scheduling and tracking of movements.

The use of consolidation centres, where consignments can be grouped into large enough quantities to make rail viable, was proposed by Konings (1996). This work has many common themes with the urban distribution studies discussed in Section 2.5.1. Consolidation centres may be beneficial in general terms, given the trend towards the production of smaller, lighter-weight products rather than the heavy industrial activity that was dominant. In particular, rail is more likely to succeed in gaining JIT inter-plant and primary distribution traffic, with road freight being used for secondary distribution which tends to be more dispersed in nature. Again, this points to the development of intermodal systems to minimise the inconvenience of transferring from road to rail and *vice versa.*

The importance of understanding the context in which JIT and mode choice interact was highlighted by Nieuwenhuis (1994). The historical development of different modes and contemporary policy influences, for example, have affected the degree to which rail has handled changed production and distribution methods in different countries. In Germany, rail plays an integral part in movements to and from car assembly plants due to the traditionally high modal split for rail and the pro-rail policies of the German government.

In one of the few major industry-wide freight studies carried out in Great Britain to consider the role for rail freight, Fowkes *et al* (1993) undertook a disaggregated analysis of freight transport by commodity. This focused on the identification of the disaggregated statistical trends in road haulage, with a stated preference survey of a sample of companies involved in the movement of a range of commodities. No attempt was made to quantify the amount of traffic capable of being handled by rail, but for domestic traffic the potential for a significant modal shift was found to be small.

Logistical changes were largely assumed to be disadvantaging rail's prospects. The development of new operating methods, particularly intermodal systems, and the growth in international movements predicted to result from the opening of the Channel Tunnel were identified as likely growth areas. The conclusion that road freight volumes will not be greatly influenced by modal shift, unless backed up by significant government incentives and regulations, was common to the majority of the literature. However rail's ability, in theory at least, to handle a greater proportion of traffic was not doubted. Clearly since this study there have been quite major changes in government policy, the effects of which are unclear. These changes are, however, of interest for this thesis.

There is thus a belief in some of the literature that there may be scope for rail to deal with JIT-type flows (and indeed it does, as discussed below) if it can offer a reliable service and if the rail operation can be built into the production schedule. This emphasises the importance of the logistical decision-making processes both within companies and along supply chains.

This belief that rail offers scope for at least some JIT-type movements, and should not be ruled out completely, is dependent upon the incorporation of mode choice into the complete logistical decision-making process. However this is rarely considered to be a major issue and has traditionally been seen to be low in importance in decision-making. Indeed most of the recent logistics handbooks (Kasilingam, 1998; Wood *et al*, 1995) and academic texts barely mention the mode of transport to be used at all or, if they do, the assumption is that road will be used.

In contrast, the large body of work on supply chain management (see, for example: Hughes and Merton, 1996; Neuman and Samuels, 1996; Spekman *et al*, 1998) has paid a great deal of attention to the linkages between suppliers and customers. While this work has focused on the importance of human relationships and quality of service factors, it has neglected the issue of modal choice. Instead, the focus has been on strengthening partnerships along the supply chain in the interests of customer service and economic efficiency.

Very little recent research has been carried out to examine who actually makes the decision on which mode of transport to use, given the development of logistics that has taken place since the earlier studies discussed in Section 2.5.2.1. Matear and Gray (1993) examined whether or not shippers and freight forwarders employed different criteria in choosing air and sea services between the Republic of Ireland and Great Britain. Their research concluded that there were differences, in particular that shippers value carrier characteristics, timing characteristics and pricing characteristics, whereas for freight forwarders service performance is most important, followed by schedule and pricing characteristics. Neither category of company was found to be particularly bothered about the route chosen, suggesting that the actual route (and perhaps even mode) was relatively unimportant as long as the service provided was satisfactory.

Liberatore and Miller (1995) conducted a predominantly qualitative study of the decision-making processes for mode selection, to supplement the wider body of quantitative research on the subject. Their model was able to incorporate a wide variety of criteria deemed relevant and provided a means by which outcomes could be predicted, but was focused on the choice between air and sea for long distance freight movements.

Neither of these studies specifically looked at rail, but the conclusions may have implications for rail freight in that forwarders in particular are relatively unconcerned about the mode they use as long as it meets their service requirements. There is a lack of literature, though, on who is responsible for deciding on the mode to be used and the subsequent influence that differences in responsibility in different companies has on the outcome. This clearly will affect the decision-making process, being dependent upon such factors as department or function responsible for the decision, level of seniority of those responsible for deciding, conflict of roles of those responsible, etc.

2.5.2.3 Evidence of rail's capabilities under contemporary logistical conditions

Even with the gaps in knowledge identified in the previous section, the literature reveals British cases where companies explicitly choose to use rail. As part of the pre-privatisation process, the British Government requested the views of British Rail's existing freight customers in 1992 and found that many users had:

> "large and complex rail distribution requirements which have literally been built into their own production chains."
>
> (Department of Transport, 1993)

Examples of companies which successfully use rail freight as part of an integrated supply chain have been identified in a number of different case studies, even operating with many JIT features. Academic studies have also focused upon the customer's perspective when looking at rail freight developments, though generally looking at niche markets or specific types of movement. This section reviews these two areas of research.

There is some evidence of companies successfully using rail freight as part of an integrated supply chain. In the automotive industry, strongly characterised by JIT, the Rover Group relies heavily on the movement of components between its factories. The most intensive flow amounts to two or three trainloads per day of body panels between Swindon and Longbridge. Many movements of finished vehicles also take place by rail, both for the domestic and international markets.

Similarly, Ford UK makes use of rail freight both for domestic and international movements, much of which is inter-plant traffic and is closely allied to production schedules. The most impressive service, which operates at least five times per week, is that conveying car parts from Silla (near Valencia) in Spain to Dagenham in Essex (Modern Railways, 1994a). With a commitment to a much reduced and more reliable transit time through the Channel Tunnel than was the case with the previous sea route, the savings in inventory to Ford have been significant and a major factor in choosing rail. In fact, the switch was just one element of a restructuring of the supply chain at the Spanish end, which also included the setting up of a consolidation centre for suppliers to streamline the system.

Another well-documented example of rail being used for the movement of urgent, time-sensitive consignments is the Railnet network for letter mail traffic:

> "The whole operation is extremely time-critical and the emphasis is on high speed.....to improve the reliability of the letter mail service for Royal Mail's customers'."
>
> (Royal Mail, 1996)

The movement of mail involves very small consignments moving between very dispersed locations, something that rail traditionally is not considered to be good at. The use of consolidation points means that the trunk haul is often by rail with road handling the dispersed distribution requirements. This is a good example of rail successfully implementing JIT principles, though this success has depended upon significant investment in new facilities and technology.

These, and other (see, for example, EWS 2000b) case studies of traffic and commodity flows on the rail network show that rail can play a major role in certain supply chains, though not always on a JIT basis. EWS has stated its intention to develop high speed, reliable freight services in order that customers can use rail to meet their logistical requirements in future (EWS, 2000c).

Recent attitudinal surveys of freight users and industry experts in Britain have revealed that there is a growing consensus that there will be a sustained shift from road to rail. Browne and Allen (1997) conducted a survey of 46 freight industry experts from transport and distribution companies, manufacturers, academics, pressure groups, etc. and found that 60 per cent expected the proportion of freight lifted by rail to increase by 2000, with 78 per cent predicting an increase between 2000 and 2005. This optimism, while significant for the research in this thesis, was based on a relatively small sample of respondents.

A survey of Freight Transport Association members (Turvey, 1993) found strong support for the development of intermodal equipment and services to maximise the use of rail for general merchandise movements. This support was tempered by the findings that rail freight was still considered to suit only niche markets with certain characteristics and that any future for rail will require it adapting to the logistical demands of industry.

McKinnon (1994) examined the likely influence of the Channel Tunnel on the demand for rail freight by Scottish manufacturers. While much interest in the new link was expressed, particularly for intermodal services, there were many concerns surrounding loading gauge limitations and network access from Scotland. In an earlier, but Britain-wide, study of freight shippers, Fowkes *et al* (1991) focused on the potential for intermodal technologies to shift freight from road to rail. The findings were largely negative, though they did identify key long distance routes, primarily Anglo-Scottish and to/from mainland Europe, where niche markets offered potential.

From some of the developments discussed above though, it would certainly appear to be the case that rail freight operators themselves have become more aware of the importance of understanding how companies' logistical operations are structured, rather than simply looking at the freight movements in isolation.

Potential customers appear to be interested in such developments, but comprehensive analysis of the extent of potential demand across Britain is lacking.

2.6 Summary

This chapter has reviewed the literature relating to freight mode choice and its interactions with the growing importance of logistics-based, rather than solely transport-based, operations within and between companies. This involved four stages: firstly, highlighting the changing nature of freight movement; secondly, considering the freight modal choice issue; thirdly, reviewing literature on the specific role for rail freight; and, finally, trying to identify the main drawbacks and omissions in the current literature.

It has been found that there has been a renewed emphasis on encouraging a greater use of rail freight, particularly as part of a move towards a more integrated transport policy which recognises the environmental and social impacts of movement to a greater degree that in the past. However, the majority of this literature reveals a lack of understanding of the complexities of modern-day freight transport and the extent to which the development of logistics practices have been intertwined with an almost exclusive reliance on the characteristics of road-based movements. To enable rail to play a greater role in goods movement requires a better understanding of the opportunities and barriers facing companies in the "real world", otherwise the pro-rail policies are unlikely to fulfil their aims.

In conclusion, it appears from this review of the literature that research gaps in the subject of road versus rail freight modal choice occur in the following areas:

- the changes that have occurred in the supply-side of rail freight in Britain and their impacts on mode choice decision-making;
- the identification of the impacts of recent logistical changes on mode choice decision-making, particularly in relation to rail freight; and
- the assessment of changes to mode-choice decision-making that may result in an increase in rail's mode share from logistical changes in the future.

It is these areas that the thesis aims to address, with the next chapter setting out the hypotheses to be tested in order to satisfy the two research objectives outlined in Chapter One.

CHAPTER THREE: HYPOTHESIS DEVELOPMENT

3.1 Introduction

Chapter Two reviewed the literature on freight modal choice and logistical restructuring within the overall context of the research objectives laid down in the introductory chapter. The aim of this chapter is to develop a series of linked research hypotheses to be tested during this thesis and which will satisfy the two overall objectives by means of addressing the key issues raised in the literature review.

3.2 Development of Detailed Research Hypotheses

It was stated in Chapter One that there are two main objectives for this thesis. The first is to determine the major interactions between logistical structure and choice of rail as a mode for freight movement. The second expands on this and aims to identify potential means by which logistical changes might increase rail's share of freight moved.

Fourteen research hypotheses have been developed in order to address these two overall objectives. They fall into three main areas of research, which were identified in the literature review as being under-researched in the past:

- the development of a greater understanding of the supply-side of rail freight and its impacts on mode choice decision-making;

- the identification of the impacts of recent logistical changes on mode choice decision-making, particularly in relation to rail freight; and
- the assessment of changes to mode-choice decision-making that may lead to an increase in rail's mode share resulting from logistical changes in the future.

By addressing these three perceived gaps in the literature, particularly as they relate to the changing situation in Great Britain concerning logistical restructuring and changes in the provision of rail freight services, the thesis seeks to provide greater knowledge and understanding of the interactions between logistical changes and mode choice decision-making can be gained.

In the remainder of this chapter, each of the three under-researched issues is dealt with in turn and the hypothesis under test are explained, although the three areas are inter-related and cannot be easily isolated. Through the use of this approach, the extent to which rail can meet the current logistical demands of industry can be assessed and, subsequently, measures to influence that potential modal shift in favour of rail can be identified.

The underlying theme is based upon identifying and understanding the attitudes and perceptions of key decision-makers and the impacts that these have on mode choice decision-making. It should be emphasised that not all of the hypotheses can be fully tested quantitatively due to them essentially being non-quantifiable in nature but that the combination of research methodologies, presented and discussed in Chapter Four, provide the means by which the hypotheses can be either tested or their relationships inferred.

Further, not all of the hypotheses fit solely within the section boundaries in which they have been placed, due to the interactions between the issues under examination. The classification has been made in an attempt to show the logic behind the choice of hypotheses and the general ways in which they add to the knowledge of the subject and thus assist in answering the key research questions.

3.2.1 Developing a Greater Understanding of the Supply-Side of Rail Freight and its Impacts on Mode Choice Decision-Making

It was shown in Chapter Two that there has been a tendency in the literature to focus on either: the assumption that the logistical changes that have taken place imply the exclusive use of road freight; or, where rail has featured, that the key to improving rail's mode share is in the analysis of operational research issues. Little attention has been devoted to developing an understanding of the changes that have taken place in the provision of rail freight services and the impacts that these have had on the mode choice decision-making processes.

Four hypotheses have been developed in this sub-category, largely based on the premise that changes in the supply of rail freight services in the last five years have resulted in a greater customer focus than before. The hypotheses are as follows:

Hypothesis One: There has been a growth, both in relative and absolute terms, in rail freight services over the last five years, in particular those catering for non-trainload and intermodal traffic.

<u>Hypothesis Two</u>: *Accessibility to the rail network has improved in the last five years, in terms of the number of operational terminals.*

<u>Hypothesis Three</u>: *The provision of rail freight services is now more commercially aware than five years ago.*

<u>Hypothesis Four</u>: *Perceptions of rail freight amongst manufacturers and retailers have improved in the last five years and will lead to greater interest in rail freight services amongst potential customers.*

The first two are essentially means by which changes in the provision of rail freight services can be measured in a quantifiable manner, using number of services of different types and number of terminals served as measures of changing rail freight activity and markets being targeted. The combination of these supply-side measures, together with the impacts that these have had on existing and potential customers form the basis of the latter two hypotheses.

As Chapter Two reported, it is widely accepted in the literature that the historic gulf that has existed between the needs of industry and the service levels and quality provided by rail freight operators needs to be bridged in order to achieve a significantly greater role for rail freight. Accounting for the fact that these issues are based on a mixture of qualitative and quantitative factors, Hypothesis Three aims to test the evidence on the changing commercial awareness of rail operators.

The fourth hypothesis tackles the more subjective, but equally important, issue of industry perceptions of any changes in the provision of rail freight services that have been found to have occurred, since providing a greater customer focus will only result in a significant shift of traffic if the potential customers are made aware of and are convinced by the changes.

In combination, these four hypotheses aim to provide a more detailed understanding of the supply-side changes in rail freight that have taken place, both as a means of providing the context in which the rest of the research is set and to allow a better awareness of these issues in the complex area of logistical changes and mode choice decision-making processes upon which this research is based.

3.2.2 Identifying the Impacts of Recent Logistical Changes on Mode Choice Decision-Making, Particularly in Relation to Rail Freight

Chapter Two highlighted the constant evolution that has taken place in logistics in the last thirty years in Great Britain, primarily based on the competition and flexibility in the road haulage sector and the development of road-based infrastructure. The lack of research on the long-term impacts that these logistical changes have had on the potential for rail to reassert itself in the freight industry raises difficulties in assessing the extent to which recent policies which favour rail over road will be successful in the future.

Four hypotheses have been developed with the overall aim of generating a better understanding of the impacts of logistical changes on mode choice decision-making in the last five years. They are as follows:

Hypothesis Five: Mode choice decision-making has been of low importance in the last five years when companies have been making changes to their logistical operations.

Hypothesis Six: The changing relationships between companies at different stages in the supply chain have been detrimental to rail freight and have instead favoured road over the last five years.

Hypothesis Seven: Companies that have high-level logistics/transport representation (i.e. at Board level) are more likely to consider the issue of modal choice at an earlier stage in their logistics decision-making processes.

Hypothesis Eight: The earlier consideration of mode choice in those companies with high-level representation has resulted in the structure of the logistical system being more rail-friendly than in other similar companies.

The first of the hypotheses in this section is designed to establish the degree of importance that has been attached to mode choice over the last five years, based on the premise that this has tended to be of little significance to the majority of freight generating organisations. The published literature and data on this topic, as discussed in Chapter Two, has certainly neglected the mode choice issue to a large degree. This is likely to be as a result of its low importance to the majority of companies when compared with other issues such as the adoption of low inventory strategies or the reorganisation of supply chains so as to provide improvements in customer service levels as a means to competitive advantage.

Given that there have been changes in the relationships between companies at different stages in the supply chain, for example the large retailing groups extending their responsibility for their supply chain further upstream, Hypothesis Six aims to test whether or not these changes have led to a greater reliance on road freight and, as such, made the use of rail less likely.

The remaining two hypotheses are designed to test whether there is any relationship between the level of seniority within the company of those making decisions on logistics and transport issues and the stage at which mode choice decision-making is considered and, indeed, whether it is even considered at all. The distinction is made in Hypothesis Seven between those companies with Board level representation and those without. Hypothesis Eight develops the previous one, testing whether there is any relationship between the level of representation of transport/logistics employees and the extent to which the logistical system has been structured in such a way that rail does or could play a part.

Through the analysis required to investigate and test these four hypotheses, the knowledge and understanding of the changes in logistics that have been taking place and the impacts that these have had on mode choice decision-making will be enhanced in such a way that will lead to the research objectives being addressed. Added to this is the requirement to assess the potential for future logistical changes to lead to a greater use of rail freight and this is discussed in the next section.

3.2.3 Assessing Changes to Mode Choice Decision-Making that may Increase Rail's Mode Share as a Result of Logistical Changes in the Future

Following on from the analysis of the impacts of recent logistical changes on mode choice decision-making discussed in Section 3.2.2, the final set of hypotheses primarily relate to the second main research objective, namely the identification of ways in which logistical changes may be influenced as a tool to assist in increasing the share of freight moved by rail to meet the desired policy objectives of a reduced reliance on road freight. Six hypotheses have been identified in this section, as follows:

Hypothesis Nine: A significant proportion of freight movements is inherently unsuitable for rail, but of the remainder there is great potential for traffic to shift to rail given the right environment.

Hypothesis Ten: The likelihood of using rail freight in the next five years is greater in those companies that have experience of using rail in the last 10 years.

Hypothesis Eleven: The factors affecting choice of rail in mode choice decision-making are complex and depend upon the unique circumstances of each company.

Hypothesis Twelve: The attitudes towards (and perceptions of) rail of specific individuals within companies are of great significance in determining whether rail will be considered as an alternative to road.

Hypothesis Thirteen: Future logistical changes are more likely to involve the consideration of modes other than solely road when compared to recent changes.

Hypothesis Fourteen: Negative attributes of road rather than positive attributes of rail will be the main driving force for an increased uptake of rail freight services in the next five years.

Hypothesis Nine is designed to provide a greater understanding of the suitability of freight movements to transfer from road to rail in the future, based on product, supply chain and transport characteristics. This will be addressed on two levels, firstly by identifying the attributes of companies that perceive that rail has the potential to play a part in their freight transport demands and, secondly, by determining the proportion of movements this sub-group of companies believe would be viable for rail to handle. This will then give an approximation of the potential that companies currently see rail as having to satisfy their needs, as well as identifying key issues that have prevented a switch to rail thus far.

The tenth hypothesis aims to test whether there is any relationship between companies who have stopped using rail in the last 10 years and those who believe they are likely to start using rail in the next five years. In combination with the previous hypothesis, this will provide guidance on which types of organisation scarce resources (of, for example, rail freight companies or government) should be targeted at to encourage the maximum modal shift, at least in the near future.

Developing these issues further, however, Hypothesis Eleven is designed to examine whether the factors affecting choice of rail in mode choice decision-making are complex and depend upon the unique circumstances of each company. Thus, the evidence found to satisfy the earlier hypotheses is likely to be tempered by the fact that individual companies have their own unique environment in which they operate. Through comparing the experiences of similar companies this hypothesis will be tested.

The importance of the decision-making processes and how they relate to logistical changes have been identified as a central theme in developing this research and, as such, Hypothesis Twelve focuses on the impacts that attitudes and perceptions of the key individuals within companies whose decisions affect mode choice. This may either be positive or negative for rail's fortunes dependent upon the nature of the attitudes and perceptions, but this behavioural aspect may be of great significance in influencing the modal split.

The final two hypotheses are specifically designed to address the overall importance that companies are likely to attach to the consideration of, and subsequent use of, rail in the next five years. This is of prime importance in establishing whether current and future government policies on modal shift will result in the desired outcomes. As such, Hypothesis Thirteen aims to find out whether or not companies are likely to show more consideration to other modes in the future rather than continuing the almost exclusive use of road.

The final hypothesis is aimed at determining whether future changes in mode choice decision-making, assuming they are more pro-rail than at present, will be a result of an improved perception of the attributes of rail freight or the worsening perception of road's attributes as a result of changes to the relative performance of the two modes. Again, this has implications for the policies required to influence modal split.

When considered together, these six hypotheses are designed to address the question of identifying ways in which logistical changes may assist in increasing the share of freight moved by rail in the future.

3.3 Summary

This chapter has defined the research hypotheses to be tested, analysed and discussed in this thesis. The 14 hypotheses have been developed as a result of the findings of the literature review in Chapter Two and are designed to provide sufficient evidence to satisfy the two key research objectives.

The methodological approaches adopted are justified in Chapter Four, in order that the remainder of the thesis can deal with testing the hypotheses and providing the evidence to address the objectives of the thesis.

CHAPTER FOUR: METHODOLOGY

4.1 Introduction

This chapter introduces and discusses the methodological approaches adopted in this thesis. It firstly compares overall research strategies and explains why the combined approach used in this research was chosen. The remainder of the chapter then describes the various different methods that have been used and argues that this combined approach strengthens the validity of the research.

4.2 Approaches to Research

The general aim of this research is to gain a more comprehensive understanding of the interactions between rail versus road freight mode choice and logistical restructuring. This requires the combination of a focus on the key trends and attitudes in freight transport and a detailed knowledge of the supply-side of rail freight services.

Table 4.1 provides an overview of the principal types of research methodologies, which helps to demonstrate the reasons for the approaches adopted in this thesis. Given the nature of the research questions, a combination of survey and case study approaches were considered to be most appropriate.

Table 4.1: Types of research methodology

Research strategy	Form of question	Need control over behavioural events?	Focuses on contemporary issues?	Advantages	Disadvantages
Experiment	How, why	Yes	Yes	Generalisable to a statistical population	Limited focus; *a priori* theoretical commitment
Survey	Who, what, where, how many and much	No	Yes	Generalisable to a statistical population	Limited scope; may ask the wrong question
Archival analysis	Who, what, where, how many and much	No	Yes/no	Interpret past events in light of new information; find mistakes in previous interpretations	Not generalisable to a statistical population; may be subjective
History	How, why	No	No		Often lack access to subjects of research
Case study	Who, what, how, why, where, how many and much	No	Yes	Ability to ask why and to narrate; uses range of methodologies	Not generalisable to a statistical population; subjective; may use small sample sizes; validity of results from interviews with actors may be difficult to establish

Source: based on Campbell (1978), Platt (1992), Hakim (1992) and Yin (1994)

The very nature of this research, in that it requires an understanding of processes within companies and along supply chains, ruled out an experimental approach. Control over behaviour is not possible in this form of research and any attempt to do this would alter the realities of the situation by removing the issues from the context in which they are found. Furthermore, the requirement to follow a certain theory may lead the researcher to ignore certain important issues because they were not identified at the outset. Both archival and historical analyses were also ruled out since the research concerned current issues and processes in contemporary organisations.

Based on the attributes shown in Table 4.1, a combination of survey and case study methodologies was decided upon as being most appropriate for analysing the interactions between freight mode choice and logistical changes. This was backed up by the construction of original databases to track the changes in the number and nature of rail freight services, the intention being to deal with the same range of questions as the standard survey method.

Survey-based techniques were considered in part to be a suitable methodology due to the wide range of questions that they can be used to address and the generalisable nature of the results. However, many of the hypotheses set out in Chapter Three essentially require an understanding of the "why" type questions that surveys tend not be able to handle. Complete reliance on a postal questionnaire survey would not be capable of answering these questions in sufficient detail. Therefore in-depth interviews were adopted to supplement the general surveys, to allow more detailed study of the processes which may affect mode choice under different logistical conditions. This allows the "why" type questions to be addressed.

Two of the three constituent parts of the methodology in this thesis (i.e. a questionnaire survey and a series of in-depth interviews or case studies) are largely based upon the same methodological approach to that used in the previous research involving the author, as outlined in Chapter One (McKinnon and Woodburn, 1993; McKinnon and Woodburn, 1996). The three key methodological approaches are dealt with in turn later in this chapter, but first a brief justification of the combination of quantitative and qualitative methods is presented.

4.3 Methodologies Used in this Research

This section considers the various methodological techniques that have been used within the overall framework of the thesis, as introduced in the previous section. It reviews the different types of data collection that are suitable for this type of social science research. It then discusses their advantages and disadvantages and reveals how they can be used in combination to arrive at the conclusions of the research.

One of the key issues identified for this research is the breaking down of the barriers between the transport policy-based literature and that focusing primarily on logistical operations. Chapter Two showed that there has been a limited amount of research that has attempted to integrate both of these subjects. There is a large body of methodological literature highlighting the significance of a flexible approach to data collection, so that new factors found to be relevant can be incorporated into the research project. For example, Bell (1989) believes that methods should be adopted to provide information required to undertake a comprehensive piece of research. Similarly, Taylor (1984) argues that new issues should be built in to the research rather than being eliminated for lying outside a pre-determined research structure.

Therefore there is good reason to adopt an approach that remains open to addressing issues as they arise during the research. This led to the combination of quantitative and qualitative techniques being deemed appropriate for this thesis. This is justified in the following sections.

4.3.1 Quantitative Methods

Quantitative methods have been used to gather a limited quantity of information from a large number of respondents through a questionnaire survey of manufacturers and retailers. Due to the nature of this research, quantitative data are not used to try to find statistically significant differences or for hypothesis testing in the hypothetico-deductive sense. Instead, in combination with the qualitative methods (see Section 4.3.2), the purpose is to explore the relevant issues for this thesis through addressing the hypotheses set out in Chapter Three.

Table 4.2 sets out the key advantages and disadvantages of quantitative approaches, primarily based upon the use of questionnaire surveys. The main practical advantages are their ability to cover a relatively large sample relatively cheaply and quickly and their ease of administration and analysis. However, there is a danger that they may not ask the right question, since the questionnaire may be designed without an understanding of the critical issues. This was highlighted by Fowler (1993), who emphasised the importance of being clear about the questionnaire's aims to ensure the answers required. Section 4.5 discusses the ways in which this has been done.

Table 4.2: Advantages and disadvantages of quantitative techniques

Advantages	Disadvantages
Low cost, so allows one researcher to gather a large amount of information efficiently and effectively	Needs simple questions, especially in self-completion surveys, which limits the depth of information that can be gathered
Structured questionnaire decreases bias from different interviewer styles	No opportunity for probing to get a more in-depth response
Increases anonymity for respondents	No control over who responds and how they understand the question
Random sample allows confidence that sample is representative of population as a whole	Non-respondent bias, since they are likely to have significantly different characteristics from respondents
Allows respondent time to consider answers (for self-completion questionnaires)	
Accessibility to large populations through postal surveys	
Provides easily comparable information about all respondents	

Source: based on Patton (1989)

The specific focus of this research on modal split issues and logistical restructuring, particularly where rail freight is concerned, also requires a clear picture and a detailed understanding of the nature of rail freight flows being provided. As no such inventory of rail freight services exists in any published source, it was necessary to construct the databases of flows from scratch using the available data sources. As this is an original piece of work, it is discussed in detail in Section 4.4.

4.3.2 Qualitative Methods

Due to the nature of this research, reflected in the hypotheses outlined in Chapter Three, the quantitative methods introduced in the previous section have been supplemented by qualitative techniques. These provide the means by which phenomena can be explored in detail without having to be fitted into artificial groups for the ease of analysis. As the terminology suggests, qualitative techniques examine the qualities of the phenomena without specifically looking to statistical analysis.

In social science-based research, Bryman (1988) pointed out that quantitative research is for testing hypotheses and qualitative research is for discovery. It is the author's belief that this thesis is concerned with elements of both of these, hence the hybrid approach. Certainly, the significance of the processes involved in the human element of freight mode choice leads to the inclusion of qualitative methods, since they do not generally lend themselves to quantitative analysis alone. Thus, a basic premise of this thesis is that the complexity of the processes under examination could not have been adequately understood solely through quantitative analysis.

Table 4.3 summarises the main types of qualitative research techniques, together with their relative strengths and weaknesses. Interviews were chosen as the best technique to support the quantitative methods in satisfying the research objectives. These have strengths in being targeted and insightful, particularly when supporting the questionnaire surveys and rail freight databases. Three main drawbacks are identified with qualitative techniques, these being bias, reflexivity and access to subjects and information.

Through the methodology adopted in this thesis, bias and reflexivity have been minimised through careful investigation and probing of respondents to ensure that answers given were a true reflection of the realities and attitudes. In addition, the fact that interviewees had all taken part in the postal questionnaire survey prior to being interviewed provided stability in the qualitative aspects of the research. While access is highlighted in the methodological literature as potentially being a major problem (see, for example, Gans, 1982), again the use of a questionnaire survey prior to the interview phase ensured that this problem was minimised.

The case study interviews, as well as the questionnaire surveys, were based upon traditional approaches to identifying preferences and attitudes. Given the lack of previous research in this area, it was felt by the author that this was the most suitable methodology. An alternative that could have been adopted would have been to use stated preference (SP) techniques, either on their own or in combination with the methods chosen for this research.

Table 4.3: Strengths and weaknesses of qualitative research techniques

Source of evidence	Strengths	Weaknesses
Documentation	• stable - can be reviewed repeatedly • unobtrusive - not created as a result of the case study • exact - contains exact details • broad coverage of events in time and space	• can be difficult to retrieve • biased selectivity if collection is incomplete • reporting bias - reflects unknown bias of author • access - may be deliberately blocked
Archival records	• same as for documentation, plus: • precise and often partly quantitative	• same as for documentation, plus: • accessibility can be poor for privacy reasons
Interviews	• targeted - focuses directly on case study topic • insightful - provides perceived causal references	• danger of bias if questions poorly constructed • response bias - may not be a random sample • risk of inaccuracies if interviewer's recall poor • reflexivity - interviewee tells interviewer what they want to hear
Direct observations	• reality - covers events in real time • contextual - covers context of event	• time-consuming • selectivity - unless broad coverage • reflexivity - process may unfold differently because it is being observed • resource cost - hours needed by human observers to be present to observe phenomena
Participant observations	• same as for direct observations, plus: • insightful into interpersonal behaviour and motives	• same as for direct observations, plus: • bias due to investigator's manipulation of events
Physical artefacts (e.g. office layouts)	• insightful into cultural features • insightful into technical operations	• selectivity • availability

Source: Yin (1994)

SP-based methods have been widely used in transport research, primarily for the analysis of passenger movements. The main use in a British freight study was the study by Fowkes *et al* (1993) discussed in Section 2.5.2.2. The basic premise of the SP approach is that it is possible to quantify the reactions of respondents to changes in one or more key variables that are abstract to the current situation.

Hensher (1994) reviewed the state of practice in stated preference in passenger transport. While highlighting its benefits, if not constructed carefully the actual outcomes have been found to be considerably different to those predicted by SP studies. This is particularly the case where the variables involved in determining the outcomes are complicated and/or interrelated and cannot easily be simplified into a format suitable for SP. The complex and numerous variables involved in logistical restructuring and their interactions with modal choice decision making, as shown in Chapter Two, mean that any SP approach would either be too simplistic, only able to specifically address a small number of variables, or too complicated and lengthy for respondents to deal with. In either case, the validity and practicalities of using SP were considered to be serious concerns.

The detailed understanding of logistical operations and the potential for a shift to rail that is necessary to address the research objectives would not have been particularly well-suited to SP. The analysis of recent actual changes in supply chains and short term forecasts of future change, combined with perceptions and opinions relating to mode choice, through the use of questionnaires and in-depth case study interviews was deemed by the researcher to be more suitable.

Thus the approach adopted provides a balance between quantitative and qualitative approaches, both of which are required when examining the influence of human behaviour on the nature of logistics and, in particular, freight transport movements.

4.3.3 Overview of Data Collection

There are three main ways in which data have been collected so as to satisfy the research objectives:

1. Inventory of rail freight services - construction of comprehensive rail freight databases containing a wide range of disaggregated information about rail freight services in Great Britain for 1991, 1997, 1998, 1999 and 2000.

2. Postal questionnaire - survey of a sample of manufacturers and retailers across Great Britain to obtain general information on freight transport patterns and attitudes towards the use of rail freight. Responses to the questionnaire have also been used to assist in the identification of suitable companies to take part in the in-depth interviews.

3. In-depth interviews - semi-structured detailed discussions with relevant managers in a number of major manufacturing and retailing companies. This involved the examination of the changes that have been, or are likely to be, taking place in their logistical operations and the interactions between these logistical changes and mode choice, particularly relating to the use of rail.

In combination, as Table 4.4 demonstrates, these three original sources of information, together with the published literature, provide the means by which the overall objectives can be addressed. To this end, the combination of the postal questionnaire survey and the subsequent in-depth interviews is a proven methodology that was used in a previous study of the relationship between the structure of logistical systems and road freight demand in Britain (McKinnon & Woodburn, 1993; McKinnon & Woodburn 1996). In addition to this being a sound methodology, the adoption of the same principles for this research allows analysis of certain trends between the two study periods. Each of the three sources of information will now be dealt with in turn in greater depth as they apply to this research.

4.4 Inventory of Rail Freight Services

Chapter Two highlighted the lack of data on rail freight operations in Great Britain, particularly at the disaggregated level. This section focuses on the construction of original databases which provide comprehensive data on rail freight services being operated at the particular points in the period under consideration. It discusses the construction of these databases, providing details of the information collected and its sources and outlining the suitability of such a method for analysing changes in rail freight activity.

Table 4.4: Summary of Original Data Collection Required for Hypothesis Testing

Hypothesis	Data Collection Methods
Hypothesis One: There has been a growth, both in relative and absolute terms, in rail freight services catering for non-trainload and intermodal traffic in the last five years.	Rail freight databases
Hypothesis Two: Accessibility to the rail network has improved in the last five years, in terms of the number of operational terminals.	Rail freight databases
Hypothesis Three: The provision of rail freight services is now more commercially aware than five years ago.	Rail freight databases; questionnaire survey; in-depth interviews
Hypothesis Four: Perceptions of rail freight amongst manufacturers and retailers have improved in the last five years and will lead to greater interest in rail freight services amongst potential customers.	Questionnaire survey; in-depth interviews
Hypothesis Five: Mode choice decision-making has been of low importance in the last five years when companies have been making changes to their logistical operations.	Questionnaire survey; in-depth interviews
Hypothesis Six: The changing relationships between companies at different stages in the supply chain have been detrimental to rail freight and have instead favoured road over the last five years.	Questionnaire survey; in-depth interviews
Hypothesis Seven: Companies that have high-level logistics/transport representation (i.e. at Board level) are more likely to consider the issue of modal choice at an earlier stage in their logistics decision-making processes.	Questionnaire survey; in-depth interviews
Hypothesis Eight: The earlier consideration of mode choice in those companies with high-level representation has resulted in the structure of the logistical system being more rail-friendly than in other similar companies.	Questionnaire survey; in-depth interviews
Hypothesis Nine: A significant proportion of freight movements is inherently unsuitable for rail, but of the remainder there is great potential for traffic to shift to rail given the right environment.	Questionnaire survey; in-depth interviews

Table 4.4 (cont.): Summary of Original Data Collection Required for Hypothesis Testing

Hypothesis	**Data Collection Methods**
Hypothesis Ten: The likelihood of using rail freight in the next five years is greater in those companies that have experience of using rail in the last 14 years.	Questionnaire survey; in-depth interviews
Hypothesis Eleven: The factors affecting choice of rail in mode choice decision-making are complex and depend upon the unique circumstances of each company.	Questionnaire survey; in-depth interviews
Hypothesis Twelve: The attitudes towards (and perceptions of) rail of individuals within companies are of great significance in determining whether rail will be considered as an alternative to road.	Questionnaire survey; in-depth interviews
Hypothesis Thirteen: Future logistical changes are more likely to involve the consideration of modes other than solely road when compared to recent changes.	Questionnaire survey; in-depth interviews
Hypothesis Fourteen: Negative attributes of road rather than positive attributes of rail will be the main driving force for an increased uptake of rail freight services in the next five years.	Questionnaire survey; in-depth interviews

4.4.1 Database Construction

A total of five databases have been constructed, these being for 1991, 1997, 1998, 1999 and 2000. Initially, two databases were constructed to enable the longitudinal analysis of rail freight operations between 1991 and 1997, though the success of the quality of these resulted in an annual record of services being completed from 1997 to 2000. This has allowed detailed monitoring of this period of significant change, as well as making available a record of supply-side changes to supplement the information gathered from the questionnaires and interviews. It also allowed independent checking of the accuracy of the information on the availability and use of rail freight services that was provided by questionnaire respondents and interviewees in the other stages of the fieldwork. For the purposes of consistency across the databases, January was chosen as the fixed point in time each year to record the information.

The two initial points in time, i.e. 1991 and 1997, were chosen due to their significance in terms of the changing provision of services, particularly wagonload, and because of the relative ease of obtaining comprehensive information. In early-1991, there was considerable interest in rail freight services due to the imminent cessation of Speedlink services and the effects that this was likely to have on traffic flows, whereas in early-1997 the recent privatisation of rail freight operations meant that much discussion and analysis of services was taking place in the railway press.

The main sources of data included Rhodes and Shannon (1991a) and Freightmaster (1997, 1998, 1999, 2000), both of which contain much general information about a large proportion of services operating. The use of a different primary source of data for the 1991 database was not felt by the researcher to be a major issue, since the different sources fulfilled the same role and were reinforced by other material in each year. In an attempt to ensure as complete coverage as possible of services operating, the following further sources were utilised, each of which provides details of new, altered or lost rail flows:

- monitoring of the railway press, in particular enthusiast magazines and industry-based publications;
- the in-house journal of EWS (for 1997 onwards); and
- for 1999 and 2000, the growing number of web sites, particularly rail enthusiast- based but which provide much information on freight services operating.

The suitability of these time points and the comprehensiveness of the databases is discussed further in Section 4.4.2. While the primary data sources were aimed mainly at the rail enthusiast market, they nevertheless provide invaluable details of traffic flows and services being operated and are believed to be of significant accuracy and value for the purposes of this research. Table 4.5 shows the main information that has been included in each of the databases.

Unfortunately it was not possible to obtain complete information for all traffic flows that were identified, but in almost all cases the crucial details of origin, destination, service frequency and commodity/sector were available. The databases contain information about all freight services, with the exception of those operated on behalf of the Royal Mail and those involved in infrastructure maintenance. The former were excluded due to the difficulties in obtaining reliable information for 1991 and the latter are extremely variable in terms of their origins, destinations and service frequencies and, in any case, are involved in carrying materials for the rail industry itself rather than for external customers.

Table 4.5: Information Contained in the Databases

	Database				
Type of information	1991	1997	1998	1999	2000
Origin of service	•	•	•	•	•
Destination of service	•	•	•	•	•
Departure time from origin	•	•	•	•	•
Arrival time at destination	•	•	•	•	•
Intermediate stopping points	o	•	•	•	•
Service frequency	•	•	•	•	•
Days of operation	•	•	•	•	•
Sector	•	-	-	-	-
Commodity	-	•	•	•	•
Coal-based flows	•	•	-	-	-
Nature of service	•	•	•	•	•
Operator of service	-	•	•	•	•

• comprehensive information; o partial information; - no information

Source: author's databases

Only the 1991 and 1997 databases contain details of coal flows (where known). Due to their extreme variability and subsequent exclusion from the analysis, this information was not incorporated into the later databases. Finally, one-off and trial services were excluded, though the significance of these services is discussed in Chapter Seven. Sample sheets from the databases are shown in Appendix One.

Further detail of the classification of information is as follows:

- Origin and destination of service: to allow analysis of changes in the number of points served by rail freight services, operating patterns (e.g. routing of traffic), geographical spread of operations, etc. In many cases, however, the data only revealed general origins and destinations, for example only naming a particular town rather than identifying specific terminals used. This was not a significant problem for the research objectives.
- Departure time from origin and arrival time at destination (where known): a critical factor for many freight movements is journey time, particularly for the time sensitive non-bulk flows that rail is attempting to gain. To enable changes in journey time to be analysed, departure and arrival times have been incorporated into the databases.
- Intermediate stopping points for detaching or uplifting traffic *en route*: this category has been included in order that changes in operating patterns can be identified; however, information was found to be extremely limited for 1991 thus limiting any time series analysis.
- Service frequency: i.e. number of days per week on which the service operates. This is vital to enable any calculations of the total number of movements and any subsequent calculations based upon this. As the databases are intended to reflect regular services, those known to be operating on a one-off or trial basis have been excluded.
- Days of operation: this is useful to allow identification of changes in operating practices, for example an increase in the operation of services at weekends

may reflect a greater awareness and responsiveness to the demands of customers.

- Commodity/sector: in 1991, traffic flows were classified according to the operating sector (i.e. Coal, Construction, Metals, Petroleum, Chemicals, Railfreight Distribution, Speedlink and Speedlink Coal); the other databases have been classified according to commodity, which provides more detail than sector alone but still allows comparison between the two.
- Nature of service: i.e. whether loaded or empty. This information was fairly easily gathered for trainload flows, but was less forthcoming for wagonload services. For these, to maintain consistency between time periods, it was assumed that all wagonload services were loaded, although in reality they were likely to be carrying a mixture of loaded and empty wagons. This is clearly not the case for many of the wagonload trip workings, where terminals either only receive or despatch traffic and there is no balancing flow. To start isolating particular known cases of this though would introduce significant potential inconsistencies into the databases, since there is no way of ensuring that all such cases can be identified.
- Operator of service: this information was included in the databases from 1997 onwards to provide details of post-privatisation responsibility for service provision, given the changes that took place during the 1990s; prior to privatisation, services were operated by the different rail freight sectors (see above).
- Other relevant information: for example, whether or not the service runs every day it is scheduled to or only 'as required'.

4.4.2 Comprehensiveness of the Databases

As was stated in the previous section, the choice of time periods for the databases was to a large extent dictated by the availability of information about traffic flows. It is believed that the use of these points (January in each of the years under consideration) is suitable for the purposes of this research, since the main aim for the databases is to analyse changes in the supply of rail freight services. By choosing January in each of the years as the precise point at which the database information is based, any seasonal variations in traffic are controlled for. This is an important factor, since many rail freight flows are highly seasonal. For example, power station traffic is far greater during the winter when demand for electricity is at its highest, while automotive traffic peaks in early summer prior to August deliveries of new cars, though this has recently changed. Many of the other types of traffic that rail is expected to attempt to gain are also seasonal in their nature.

It is acknowledged that there may be other factors that will affect how representative the databases are of the overall time period. By taking particular points in time, there are dangers that they will not give a true reflection of general changes between the early-1990s and the present day. Certainly rail freight volumes are affected by external factors, for example the level of activity in the construction industry or changes in the storage of petroleum products at customers' sites due to tighter government regulation. The effects of many such changes are discussed in NERA (1997) and will be referred to in Chapter Seven in the context of logistical restructuring. In the context of this thesis, the focus is on the actual supply-side changes in rail freight provision.

More significantly, an attempt has been made to assess the comprehensiveness of the databases, as any analysis would clearly be of limited value if they were found not to provide details of the vast majority of services. The intention has been to log as great a proportion of the regular scheduled services as possible, although it is acknowledged that the databases are not likely to achieve 100 per cent coverage. What is desirable, and necessary for the research objectives, is a series of databases which cover the overwhelming majority of services. It is also important to collect the data in as consistent a form as possible for the different years under consideration, which the author believes has been achieved.

Table 4.6 shows a comparison, in terms of tonnes lifted, between the summation of the individual entries in the databases and the published gross annual statistics for the first two years, i.e. 1991 and 1997. This comparison was deemed to be important to ensure that the validity of the databases was great enough to make further ones (i.e. those for 1998, 1999 and 2000) worthwhile.

This comparison reveals that the estimates of tonnes lifted based on the databases actually exceed the published annual statistics for both years. However, the difference in data collection methods in this thesis when compared to official statistics would be expected to lead to different outcomes. What is clear though is the similar trend in tonnes lifted, despite the variation in absolute values. The databases were constructed through the identification of disaggregated service patterns, as opposed to aggregated official statistics, and as such would not be expected to provide identical data. The official statistics cover a three month period (including January) whereas the databases are focused upon that one month in each year. This may introduce a slight discrepancy into the comparison. Further, the limited collection of official freight data casts some doubt on the accuracy of the official statistics.

Table 4.6: Database Information and Published Statistics for Rail Freight, 1991 and 1997

	1991	1997	% change
Database information (excluding coal):			
Total number of database entries**	1,471	1,096	-25%
Approx. number of loaded services per week**	3,386	2,351	-30%
Tonnes lifted by rail (millions) (annualised)**	81	57	-30%
Published annual statistics (excluding coal):			
Tonnes lifted by rail (millions)*	63	50	-21%
Tonne kilometres by rail (billions)*	11.0	11.3	+3%

Source: DETR (1998c)*; author's databases**

This comparison of tonnes lifted is purely to gauge the accuracy of the databases, as the research objectives require the analysis of the disaggregated trends in rail freight service provision which are contained in the databases. This is discussed further in Section 4.4.3. For the purposes of the comparison with the published statistics, a number of assumptions were made:

1. Coal traffic has been excluded from the comparison. This is because it was not found possible to obtain detailed flows of coal traffic for the earlier time period. At that time, there was far greater short-term fluctuation in terms of flows between specific origins (predominantly collieries) and destinations

(mainly power stations), due primarily to the greater number of collieries still in operation in 1991. Since then, there has been a reduction in the number of working collieries, so the pattern of flows is more stable. That said, there is still considerable weekly variation of flows between origins, now a combination of collieries and import locations, and power stations.

2. It was necessary to translate the number of database entries into a more meaningful figure. The number of loaded services per week was used, since this gives a more accurate picture of rail freight patterns. The former measure is of limited use as it does not compare like with like in terms of the actual number of services operating in a given time period. For the majority of services the days of operation are fixed, but for a significant minority the service frequency varies depending on the availability of traffic. In the case of these services, based on observations by the author of freight services during the summer of 1997, it has been assumed that they operate on 50 per cent of the potential number of days that they are timetabled for. In 1997, 205 out of 1,096 database entries (i.e. 19 per cent) operated on such an 'as required' basis, whereas in the 1991 database none of the entries were being operated in such a way. The reason for this difference is not clear, though it is probably due to the greater flexibility in service provision in 1997 compared to 1991, when services tended to operate to a much more rigid pattern. However, it is almost certain that some services operated 'as required' in 1991, so differences in the standard of information may exist between these two databases due to the use of different sources of data for the two years. While

this may have a slight impact on the accuracy of the time series analysis of the databases, there is unfortunately no way of quantifying this degree of error.

3. In not all cases was it possible to determine whether services were loaded or empty, particularly in 1991, although this only accounted for a small proportion of movements. Those that were potentially carrying a mixture of loaded and empty wagons, generally the wagonload services, have been assumed to be loaded for the purpose of calculating the approximate number of loaded services per week since the vast majority would have been carrying at least some revenue earning traffic.

4. To convert from the number of loaded services per week to tonnes lifted required an assumption on the average payload of a freight train. Based on physical observations by the author, it has been assumed that 500 tonnes is a reasonable approximation of payload. This takes account of the fact that the main types of wagon in use have capacities ranging from eight tonnes (for car-carrying wagons) up to 100 tonnes (for some oil tanks), with the average being in the region of thirty to forty tonnes (Marsden, 1984). The assumed average length of train is 15 wagons, though this again varies considerably depending on the commodity and flow characteristics. It can range from one up to fifty wagons, though shorter length trains predominate, which gives the average of 15 wagons. The lack of any hard data to support this unfortunately means that this is no more than a "guestimate", though this does not affect the actual use of the databases in this research.

While the differences in tonnes lifted revealed by the databases and published statistics may be a result of incorrect assumptions, it is likely to reflect the fact that in some cases individual flows will be counted on more than one occasion due to staging of services or re-marshalling *en route*. This is particularly the case with the jumbo aggregate trains from the Mendip quarries to the South East of England, which are generally split into two or three portions in West London for local distribution, and with wagonload flows which may make use of a number of different services to get from origin to destination.

The fact that the degree of over-estimation is far greater for the 1991 database lends weight to the double-counting argument. This is because wagonload services, with their greater marshalling and trip working (and thus double-counting of individual consignments), accounted for 32 per cent of all database entries in 1991 (i.e. Speedlink services) compared with just 24 per cent in 1997 (i.e. Enterprise and Connectrail services). A lower, though potentially realistic, assumption of 400 tonnes average load for 1991, to take account of the greater use of wagonload services at that time, gives an annual tonnage very similar to the published statistics.

The other factor affecting the 1991 database, discussed previously, was the lack of information on whether services operated on all scheduled days or only 'as required' and again this may have led to an over-estimation of the tonnage carried. Therefore, after taking these factors into account, it appears that the databases provide a good representation of the actual flows at those points in time. It is the author's view that the database accuracy is suitable for the purposes of this research. Furthermore, informal discussions with an EWS representative regarding the completeness of the 1997 database flows from, to and within Scotland suggested that in excess of 95 per cent of services were incorporated in that database.

4.4.3 The Measurement of Change in Rail Freight Usage

Much of the discussion thus far has related to the reversal of the trend by which tonne kilometres moved by rail had been declining over a number of decades, albeit with a reversal of this trend since the mid-1990s. The emphasis has overwhelmingly been placed on setting targets that relate to increases in tonne kilometres, for example the Royal Commission on Environmental Pollution's goal of achieving a modal share for rail of 20 per cent of total tonne kilometres by 2010 (RCEP, 1994) or EWS' original aim to double tonne kilometres in five years and triple it within 14 years (Heaton, 1997). Freightliner has instead expressed its intention to increase its volume of freight moved in the first five years of private ownership by 50 per cent in terms of number of containers carried rather than in tonne kilometres (Modern Railways, 1996d). Unlike the other targets, this therefore takes no direct account of the distances involved or the weight of the containers' contents.

There are clearly many ways in which change can be measured. These include number of services run, number of units (e.g. containers) carried or train kilometres, as well as the more standard measures of tonnes lifted and tonnes moved. It is feasible, for example, that numbers of services operated or units carried could increase substantially without a corresponding increase in tonne kilometres, particularly if new flows are of non-bulk commodities with low tonnage relative to volume. Given that rail already has a major proportion of bulk flows, significant traffic gains are likely to have to come from the non-bulk sectors. However, for comparison with other modes, particularly to determine the modal share of rail, tonne kilometres are the most appropriate measure to use, given the lack of consistent information for most of the other measures.

In terms of analysing the databases, it is not feasible to quantify changes in tonne kilometres without the considerable task of attempting to determine tonnages and distances for each individual flow. This was not considered practicable given the large time requirement and the degree of error likely to be introduced into the calculations. Therefore the analysis of the databases in Chapter Five combines the changes in the number of loaded services per week with other ways of analysing change, such as developments in commodity flows, service operating speeds, service frequencies, etc. It is the opinion of the author that this range of measures is perhaps even more significant than the traditional measure of tonne kilometres when analysing the potential for rail to play a role in new markets.

4.5 Postal Questionnaire Purpose, Design and Implementation

As Table 4.4 revealed, a postal questionnaire survey was adopted to address the majority of the hypotheses, in combination with in-depth interviews. Postal questionnaires were sent out to senior distribution/logistics managers in 1,000 large manufacturing and retailing companies in Great Britain. The purpose, design and implementation of this survey is discussed in this Section, with the methodological issues surrounding the subsequent company interviews being dealt with in Section 4.6. This combined approach was justified in Section 4.3

4.5.1 Questionnaire Purpose and Design

In-depth analysis of mode choice decision-making within companies and along supply chains, through face-to-face interviews, has been utilised to provide greater probing and therefore greater depth of understanding. It was decided also to conduct a more general survey of a large sample of manufacturers and retailers across Great Britain to obtain a larger volume of information on freight transport patterns and attitudes towards the use of rail freight. This gives an overview of the attitudes of a larger cross-section of industry, with the interviews then focusing on supply chains within specific industrial sectors.

Given that the number of interviews that could be carried out was necessarily limited by the availability of resources, a postal questionnaire was decided upon to complement the interviews and enrich the overall breadth and representativeness of the data collection. The combination of a questionnaire and interview from those companies being examined in depth meant that consistent general information was obtained, through the questionnaire, for all companies being interviewed. This then allowed the interview itself to be more flexible in terms of exploring key relevant issues to that particular company and its supply chain, without compromising the ability to analyse trends and attitudes across industry more generally since this could be done largely from the responses to the questionnaires.

A further benefit of the questionnaire is that the responses have been used to assist in the identification of companies willing to take part in the in-depth interviews. This introduces a potentially significant degree of bias into the methodology, as was discussed in Section 4.3.2 in the context of qualitative work, due to the interviewees largely being self-selecting. The application of a methodological framework within which these interviewees fit (i.e. through the supply chain and matched pair analysis discussed in Section 4.6) ensures that the methodology is appropriate, together with the use of a questionnaire survey based upon a far more structured sampling procedure. The in-depth interviews therefore are designed to add to the survey by providing more detailed information at a case study level. This is discussed further in Section 4.6.

The questionnaire was designed so that certain questions were comparable with the previous questionnaire and interview survey carried out in 1993 by the author as part of an earlier research project at Heriot-Watt University (see, for example, McKinnon and Woodburn, 1996). While the focus of this previous project was the relationship between logistical restructuring and road freight growth, the issue of mode choice is clearly inter-related with this.

Therefore, while there is a difference between the two pieces of research in terms of the specific hypotheses being tested, there is much in common between them, not least that neither mode choice nor road freight growth can be detached from the logistical restructuring that has been taking place in recent decades. This means that there is scope for analysing changes in logistical operations and the attitudes of key industry personnel over the time period from 1993 and 1999. Unfortunately for this thesis, mode choice was not examined in detail in the earlier survey, so limiting any detailed longitudinal analysis of changes in the potential for rail freight and attitudes towards it.

To ensure that any comparisons between the two surveys were valid, the sampling framework was largely consistent, though the sample size was larger in the current survey and retailers as well as manufacturers were included. The sampling framework is discussed in detail below, but the consistency allowed longitudinal analysis of logistical issues to take place with the questions and industrial sectors that remained constant between the two survey periods. In addition, more detailed analysis of the additional questions and sectors included in the questionnaire for this research was also possible. The questionnaire used for this study is included in Appendix Two, while the one from the 1993 Heriot-Watt University research project is shown in Appendix Three to enable comparison.

The information sought by the questionnaire for this thesis was clearly far more specific to modal choice, particularly regarding the potential for rail freight, whereas the 1993 questionnaire was targeted primarily at issues surrounding the growth of road freight. However, the two are clearly inter-related and an understanding of the logistical causes of the growth in road freight is a precondition for gaining an insight into the means by which rail freight may increase its modal share.

The questionnaire was split into four main sections, as can be seen in Appendix Two, with some sections requiring completion by all respondents while others were specific to those currently either using or not using rail freight services in Britain.

<u>Section A</u>:

This section was designed to be completed by all respondents, its primary aim being to gather general company information that could be used in the analysis to determine whether basic attributes of companies affected their subsequent views on logistical restructuring and the scope for rail. The general information was also intended to provide background on those companies later involved in the in-depth interviews.

<u>Section B</u>:

This section was designed to be completed only by those whose company or division currently uses rail for some of their freight movements and covered the following issues:

- the type and geographical nature of rail freight services being used.
- the rail freight service providers being used.
- whether there had been any change in the volume of goods moved by rail by the company or division in the last two years, together with the scale of any change and an explanation.

- whether the volume of freight moved by rail is likely to increase, remain static or decrease over the next five years. The likely direction and magnitude of change were requested, together with an explanation for this view.

Section C:

This section was designed to be completed only by those whose company or division does not currently use rail for any of their freight movements in Britain and dealt with the following issues:

- whether the company or division had made any use of rail freight in the last 14 years.
- for those that had, the previous question (see section B above) on the type of rail service that had been used was asked.
- again for those that had used rail, the year in which they ceased using this mode was requested. The reasons for this cessation were then asked in an open-ended question.
- for all respondents answering Section C, whether they believed that their company or division would start to use rail at all in the next five years, together with an open-ended question requesting justification of their answer.
- for those that thought they would start to use rail, the same question (previously asked twice in different contexts) on what type of rail freight service they would use was asked.

Section D:

As with Section A, this section was designed to be completed by all respondents and covered the following logistical issues:

- the person within the organisation who makes the decision on which mode of transport to use for freight consignments.
- whether the respondent believed that decisions relating to mode choice for freight transport are given the attention they deserve within their organisation. If they did not believe this to be the case they were asked to explain why not.
- the way in which the mode options were examined prior to the commencement of new freight flows, in particular whether or not there is a formal analysis. The options given were three variations of formal analyses (i.e. based on company strategic policy, set criteria or ad-hoc) or no formal analysis at all.
- for those companies or divisions that do carry out a formal analysis, they were asked if this was based on product attributes, customer attributes, distance, a combination of these three or by some other method (in which case they were asked to specify this).
- the effect of rail privatisation on the decisions that the organisation has been taking when deciding on which mode of transport to use.
- the relative importance to the organisation of a wide range of factors when choosing whether or not to use rail as a mode of transport for freight transport within Great Britain. The range of factors included such things as cost, journey time, service quality and availability, environmental impacts, road congestion, supplier/customer requirements, etc. and space was left for respondents to specify any other factors that were important to them. For each of the factors, the level of importance was rated on a five-point scale. Bearing in mind that respondents may rate many factors to be of the same degree of

importance on such a scale, a follow up question asked for the specification and ranking of the three most important factors.

- the effect of a number of logistics-related factors on the demand for freight transport, by all modes, in Great Britain over the previous five years. This covered factors relating to sales, production, stockholding, supply chain responsibility, customer requirements and transport, as well as leaving space for respondents to add any further factors. A five-point scale was used, ranging from a large increase in demand for transport due to that particular factor through to a large decrease. Given that many of the factors may not have been applicable, this option was also included. This question was one that had been included in the 1993 Heriot-Watt University survey, so it was reproduced in the same form to allow analysis of responses from the two time periods. Respondents were again asked to rank the three factors that have been most important to their company or division.
- the significance of a number of factors in constraining the growth of lorry traffic for the organisation's operations over the last five years. The factors were broadly related, either directly or indirectly, to government policy issues and included the displacement of traffic to rail as well as taxation and regulatory factors. Respondents were asked to specify any additional factors that were relevant to them. Again, a five-point scale was used, ranging from no constraint to major constraint, and this question was one that had been used in the 1993 Heriot-Watt University survey.
- respondents were then asked to assess to what degree the same range of factors are likely to be constraints on the growth of lorry traffic in the next five years. Two extra factors, motorway charges and urban road pricing, were

added as potential policy measures that are not used at present but may be introduced in the next five years. The same five-point scale was used to rate the degree to which the respondent believes these factors are likely to constrain the growth of lorry traffic for the organisation.

- the existence or otherwise of any sort of environmental policy or statement that relates to the transport operations of the organisation. If one does exist then the respondent was requested to send a copy along with their completed questionnaire.
- a final open-ended question, asking for any further comments that the respondent may wish to make regarding the issues raised in the questionnaire.

Therefore, the questionnaire contained a mixture of closed and open-ended questions, designed to collect information in a structured manner. In addition to these four sections, other general information was requested from respondents, this being details of their name; their job title; their company or division name and address; and their contact telephone number.

4.5.2 Implementation of the Postal Questionnaire Survey

Prior to distribution of the questionnaire to the sample of companies detailed below, copies were sent to rail freight development specialists in both EWS and Railtrack Scotland. Only relatively minor comments were received and a small number of amendments were made to the questionnaire structure and wording to take into account the suggestions where appropriate.

The questionnaire was distributed to senior distribution/logistics managers in the 100 largest companies (in terms of annual turnover) in eight key manufacturing sectors in Great Britain, as well as the 200 largest retailers. The manufacturing sectors were as follows:

- food and drink manufacturing;
- construction and building materials;
- chemicals and fertilisers;
- paper and publishing;
- textiles, clothing and footwear;
- electrical and electronic equipment;
- non-electrical machinery; and
- transport equipment.

The sample was based on companies listed in a major business directory (Dunn & Bradstreet, 1994), which ranks companies in each sector based on turnover. Unfortunately this directory was four years out of date, but it was chosen as it was a more recent edition of the same source used to identify the companies in the 1993 Heriot-Watt University survey. As such, the eight manufacturing sectors that were targeted were the same in both studies, though only the eighty largest companies in each sector had received questionnaires in 1993.

The questionnaire for this current research was piloted in October 1998. It was distributed to fifty companies out of the 1,000 included in the full sample (i.e. five per cent), which represented five companies in each of the eight manufacturing sectors as well as 14 of the retailers. Only three completed questionnaires were returned, representing a response rate of just six per cent, this being considerably lower than the 14 per cent obtained from the full sample in the 1993 Heriot-Watt University survey. The latter was the rate that was taken to be the minimum desirable response rate for this second questionnaire.

There were no apparent problems with the way in which the returned pilot questionnaires had been completed and, since a number of the questions had successfully been used previously in any case, it was decided not to make any changes to the actual content of the questionnaire. To have done this would have risked jeopardising the consistency between the questionnaires from the two time periods. Instead, a number of telephone calls were made to logistics/distribution managers in companies that were included in the pilot survey to try to determine the reasons for such a low response rate. Great difficulty was experienced in contacting those who had actually received a copy of the questionnaire, or at least remembered receiving one. This suggested that either the mail shot or the phone call was not managing to reach the correct person within some of the organisations. The fact that questionnaires were simply being addressed to the "Logistics/Distribution Manager" within the company, rather than a named individual, meant that tracking of what happened to the questionnaire when it reached the company was extremely difficult. Attempts had been made to identify named individuals, for example through approaches to professional bodies to obtain membership lists, but this proved fruitless.

Of those who had received the questionnaire but had not replied, the main reasons for non-completion were due to pressure of time and the sheer number of questionnaires received by the individuals concerned. Some of the companies had a blanket policy not to respond to any questionnaires. The most useful feedback was that some of the targeted individuals did not believe that the questionnaire was relevant to them, since at first glance it appeared to be solely about rail freight. Given that so few companies actively use, or are considering the use of, rail it seemed that they did not see the point in filling in the questionnaire. This was despite the fact that it was actually designed for those with no experience or interest in rail as well as those that did.

Based on this feedback, a number of changes were made to certain aspects of the questionnaire and its distribution, as follows:

- the questionnaire was printed onto green rather than white paper in order to make it more eye-catching and professional looking.
- FREEPOST reply envelopes were included with the questionnaire. The pilot had simply provided a FREEPOST address on the questionnaire to which respondents should return completed questionnaires. Enclosing envelopes reduced the amount of time and effort required on the part of the respondent to complete and return their questionnaire.
- the title of the questionnaire was changed from "The Role for Rail Freight in Great Britain" to "Freight Transport in Britain" as the feedback suggested that the original title may have discouraged many companies from responding due

to them believing that it would not be relevant to their operations unless they already used or were considering use of the rail network.

- the covering letter sent out with the questionnaire was rewritten to emphasise the fact that the questionnaire was relevant for all companies, regardless of their current involvement with rail freight, so as to encourage them to read on and respond to the survey.

Having made these alterations, the 950 questionnaires in the main sample were distributed in March 1999 with the request that recipients completed and returned them within two weeks of receipt. The return of completed questionnaires was disappointingly slow, with many being returned by Royal Mail due to the addressee no longer being in existence. This was an unfortunate consequence of the edition of the business directory not being as up to date as in the original survey, where returns by Royal Mail were fewer though still a problem. After four weeks, 73 completed questionnaires had been returned from the 950 sent out (i.e. 7.7 per cent), a slight improvement on the pilot but still disappointing. In an attempt to boost the response rate, reminder letters and further questionnaires were sent to all those companies from whom no response had been received, either in terms of completed questionnaires or returns from Royal Mail. This second mailshot had considerable success and generated another 57 completed questionnaires. The total number of responses, broken down by industrial sector, is shown in Table 4.7.

Table 4.7: Responses to the Postal Questionnaire Survey (by Industrial Sector)

Sector	No. of responses	Response rate (% of total question-naires sent)	Response rate (% of total excl. Royal Mail returns)
Food and drink manufacturing	20	20	23.0
Chemicals and fertilisers	15	15	16.3
Construction and building materials	11	11	12.6
Transport equipment	18	18	18.9
Textiles, clothing and footwear	17	17	18.5
Paper and publishing	16	16	17.6
Electrical and electronic equipment	9	9	9.6
Non-electrical machinery	8	8	8.6
Retailers	19	9.5	10.4
TOTAL	133	13.3	14.6

Source: author's questionnaire survey

The alterations made subsequent to the pilot and prior to the main survey clearly had a positive impact on the response rate, since a total of 130 completed and valid questionnaires out of the 950 were received. This represented a response rate of 13.7 per cent for the main batch, giving an overall response rate of 13.3 per cent for the full sample of 1,000 companies.

When the returns from Royal Mail were taken into account, this reduced the total of 1,000 companies actually receiving questionnaires down to 912, meaning that the response rate from those companies actually in receipt of a questionnaire was 14.6 per cent. The response rates varied considerably by industrial sector, from a low of eight per cent to a high of 20 per cent, which had implications for the sectors targeted for in-depth interviews of companies (see Section 4.6). The next section discusses the method of analysing the questionnaires.

4.5.3 Method of Analysis of the Postal Questionnaire Survey

The means by which the completed questionnaires were analysed was with the standard SPSS/PC statistical software package. The hypotheses to be tested for this research did not require complex statistical analysis, with the nature of the questionnaire reflecting this. The vast majority of questions were closed ones with pre-determined sets of potential responses. A number of the other questions had quantifiable answers, so again were suitable for SPSS. The remainder were open-ended, but they provided the opportunity to code them into groups of similar responses.

To satisfy the research questions, measures such as comparisons of means and rankings of responses were required. This allowed sufficient analysis to take place between different groups of respondents (e.g. between rail and non-rail users, or between different industrial sectors) in terms of their company's behaviour and opinions of rail freight. The comprehensive analysis of the postal questionnaires can be found in Chapter Six.

4.6 In-Depth Interview Purpose, Design and Implementation

It has already been shown (see Section 4.3) that the nature of the research hypotheses raised in Chapter Three required qualitative methods to answer the "why" type questions that the quantitative techniques alone could not adequately address. This resulted in the most intensive part of data and attitude gathering from industry, that being the series of in-depth interviews that was carried out to support the questionnaire survey described in the previous section. While the questionnaire was structured in nature, designed to elicit responses in a consistent manner across a relatively large sample size, the interviews were less rigidly structured, within the overall research methodology outlined earlier.

4.6.1 In-Depth Interview Purpose and Design

Since the interviewees had already completed a questionnaire, much of the standard (and quantifiable) information had already been gathered. The purpose of the interviews was therefore primarily to gain a more detailed understanding of the issues through case studies of individual companies. The intention was that the majority of the individual case study companies would combine to allow in-depth analysis of a number of particular supply chains rather than just standalone companies. Furthermore, where there was the potential, matched pairs of companies were to be included in the interview sample. This focus on supply chains and matched pairs will now be discussed in greater detail.

As the review of literature in Chapter Two revealed, there has been a change in focus over the years in freight transport decision making, away from simply examining the transport element towards a more integrated logistics-based approach. It is therefore fundamental that any study such as this reflects this broader approach, since decisions and actions taken at one particular point in the supply chain may have far-reaching consequences along the supply chain as a whole. To focus solely on individual companies without examining them in the wider context of the supply chain in which they operate, and in which they are only one of a number of companies whose decisions may influence the outcome for all those in that supply chain, would be of interest but would not give as complete an understanding as a series of interviews with companies within particular supply chains would.

The intention for the interviews was to target several supply chains and, from the pool of questionnaire respondents who were prepared to be interviewed, identify a number of companies from each of the supply chains who fitted into this sampling framework. As complete a range of companies as possible was included for each of the supply chains, with the aim of ensuring that they were as representative as possible of the supply chain through from source to end user. The ideal scenario was that, in a typical supply chain consisting of perhaps five or six stages, two or three companies at each stage would be interviewed. This would provide the scope for matched pairs of companies to be included at some of the stages in the supply chain where this was possible, so that differences in attitudes and decision making concerning mode choice could be examined in companies that were similar in many respects. Where the sampling base allowed, pairs of companies that were as similar as possible, for example in terms of turnover, product range, market area, etc. were to be identified and interviewed to examine the reasons for any significant differences in their transport operations.

Matched pair analysis is a technique that has been applied in other social science studies (see, for example, O'Farrell and Hitchens, 1989), but is not believed to have been used in a modal split study before. The basic guiding principle of matched pair analysis is to identify the key factors that result in either similarities or differences in experiences or choices between two cases. This has tended to focus on such issues as industrial location decisions, business organisation and supplier selection policies. The principle of matched pair analysis is believed by the author to be suitable for the examination of mode choice decision making and related logistical issues.

If three or four separate supply chains were to be sampled, then the total number of interviews that could theoretically be conducted would be somewhere in the region of fifty. Given the detailed nature of each of the individual interviews as well as the resourcing constraints, particularly those of time and finance, of interviewing companies based throughout Great Britain, a realistic sample in the range of 40 to 50 quality interviews was deemed to be sufficient as part of the overall methodology.

As discussed previously, the questionnaire responses acted as the primary means by which potential interviewees were identified. Of the 133 completed questionnaires received, 66 (i.e. 50 per cent) indicated that were willing to be interviewed in greater depth, revealing considerable interest amongst the respondents in being involved with the research. This method of identifying potential interviewees was to a large degree self-selecting, since it was perhaps more likely that those with an interest in rail freight would be the ones that would be more likely to want to discuss their particular set of circumstances and the issues facing them. However, with a statistically small sample of interviews such as that proposed for this research, the fact that the companies are basically self-selecting is not a major issue. In any case, they do all come from the original sample of 1,000 companies which was selected on the strict criterion of the top 100 companies from each industrial sector in terms of their turnover, so there is some consistency in their status within their own industrial sector. Furthermore, even for those companies with a very "pro-rail" outlook, the majority of their freight movements are likely to be by road, so this offers plenty of scope in terms of analysing their decisions on mode choice.

The breakdown of willing interview participants by industrial sector is shown in Table 4.8. As can be seen, there were certain industrial sectors that showed a greater degree of willingness to be interviewed than others and this was reflected in the supply chains chosen for interview.

Supply chains, however, do not always neatly fit into the industrial sector classification used by the Dunn and Bradstreet business directory. For example, as raw materials undergo conversion during the manufacturing processes their nature and purpose may change, resulting in a change in classification. Similarly, there are many cases where the manufacturing stages themselves require the input of materials from other industrial sectors. An example of this is the chemicals industry, whose products are used in many other industrial sectors such as food and drink, paper production and the engineering industries. In the case of retailers, they often sell the products from a number of different industrial sectors either through their individual retail chains or the broader portfolio of stores that the larger groups operate.

Table 4.8: Number of Questionnaire Respondents Willing to be Interviewed (by Industrial Sector)

Sector	No. of respondents willing to be interviewed	% of respondents in sector willing to be interviewed
Food and drink	10	50
Chemicals and fertilisers	3	20
Construction and building materials	5	45
Transport equipment	13	72
Textiles, clothing and footwear	3	18
Paper and publishing	12	75
Electrical and electronic equipment	4	44
Non-electrical machinery	5	62
Retailers	11	58
TOTAL	66	50

Source: author's questionnaire survey

Three main supply chains clearly presented themselves from the absolute numbers of willing participants and were selected for the interviews, as follows:

- paper and publishing
- food and drink production and retailing
- transport equipment

While these supply chains are consistent with the industrial sectors in the business directory, the actual companies selected for interview in each of these supply chains did not necessarily come solely from that particular industrial sector for the reasons discussed above. These supply chains also represent a cross section of value densities for goods moved, generally ranging from low value high density paper-based movements through food and drink products to higher value density transport equipment. This in itself makes for an interesting study of differences in freight transport usage and attitudes on rail freight that may exist between the three supply chains. Further to this, smaller groups of companies from particular supply chains were identified, particularly do-it-yourself (DIY) products and to a lesser extent electrical/electronic products and clothing manufacturing and retailing.

The vast majority of companies willing to be interviewed fitted into one of these supply chains selected meaning that, in theory at least, it was possible to obtain the desired sample of 40 to 50 interviews. Given that the locations of potential interviewees were scattered throughout Great Britain it was decided that, once the arrangements for the key interviews for the three supply chains had been finalised, it was logical to arrange any supplementary interviews with other willing companies located nearby that could be found to fit within the schedule as a means of boosting the overall sample size. The implementation phase of the in-depth interviews is discussed in detail in Section 4.6.2.

The interviews were designed to satisfy two main requirements:

- first, to gain an overall view, across the whole range of interviewees, of the current logistical trends, those predicted for the future, and the interactions with mode choice decision making. This basically involved exploring the issues raised in the postal questionnaire, but in greater detail.
- second, to identify the issues facing the specific supply chains under consideration, or indeed specific companies within those supply chain. This was less structured, with the nature of this part of the interview being dictated by the individual circumstances of the company being interviewed.

In order that there was as much consistency as possible, a series of questions was drawn up to be used as a prompt while conducting each of the interviews. The semi-structured nature of the interviews meant that there was scope to explore particular issues that were identified during the discussions, though broadly the same issues were covered with each interviewee. This ensured that all the main issues were raised with the complete sample of interviewees though, as can be seen from the list of questions (see Appendix Four), not all of the questions were relevant to all companies. Therefore there was considerable variation in the exact details of questions asked and the emphasis placed on different aspects of the research. To have stuck rigidly to the questions without deviation would largely have negated the benefits of the face-to-face interviews and instead would have been more like a detailed questionnaire. The semi-structured nature of the interviews, whereby exploration of pertinent points as they arose was possible, was designed to provide far greater depth of understanding of the main issues facing that particular company and its position in the supply chain than would have been possible from a totally fixed format.

As stated, Appendix Four shows the complete list of questions formulated for the interviews, termed the interview schedule. The questions included reflected the specific elements of the research related to modal choice decision making and tended to focus on the five year period to date and also looking five years into the future when examining changes that have taken, or are likely to take, place. Broadly speaking the interview schedule was broken down into five main components, the latter four of which closely resemble the levels of logistical decision-making used in the earlier Heriot-Watt study (McKinnon and Woodburn, 1996). The categories were designed to fit within the overall objectives of the research and were as follows:

- general company information, to find out more detail about division of responsibility for logistics within the company, range of supplies and products, etc. This was supplementary to the information already provided from the questionnaire responses.
- design of the logistical system, in particular changes in internal industrial structure and changes in the internal stockholding system. This examined changes in the physical infrastructure that is linked by freight movements, such as the number and location of production, warehousing and retailing locations, changes in production processes at these locations, etc.
- trade relationships, focusing on the supply chain both upstream and downstream from the particular company. This was primarily concerned with changes in the linkages between the various suppliers and customers involved in the supply chain and the related issues of sourcing and market areas, responsibility for transport between the different companies, etc.
- scheduling of product flow, particularly looking at the degree of adoption of just-in-time techniques and their impacts, load consolidation and the use of logistics and transport specialists.
- choice of transport mode, focusing on the modes of transport used and the decisions that have led to the current situation. The main issues investigated included the ways in which companies have been responding to changes external to them, such as worsening road congestion and government policies,

either existing or potential, for example the fuel duty escalator, urban road pricing and motorway charging. Specific attention was paid at this stage to the scope for rail freight to be a more realistic option for freight movements, looking at what would actually have to happen in the future to effect a shift of at least some goods from road to rail.

Throughout, the relationship between all these factors and changes in the use of freight transport was investigated. This reflected the fact that the whole subject of logistical restructuring and modal choice decision making is interrelated and it is not possible to isolate the mode choice part of this from the overall picture. This meant that much of the discussion on choice of transport mode actually took place in the earlier parts of the interviews when discussing the logistical structure. As a means of tracing supply chains through from start to finish, interviewees were also asked to provide details about their main suppliers and customers, as well as their main British customers.

4.6.2 Implementation of the In-Depth Interviews

An initial interview was carried out in Scotland a week in advance of the main batch so that any potential problems would be identified and could then be rectified. The main issue that arose from the initial interview was that it lasted approximately one hour and 45 minutes, considerably longer than the allotted one hour. This was as a result of the lack of familiarity with the interview schedule due to it being the first attempt at using it and the interviewee being particularly enthusiastic about the issues being discussed, as well as spending some time providing feedback on the structure and content of the interview. Fortunately this feedback was extremely positive and no major changes to the interview schedule were required.

The remainder of the interviews were carried out between September 1999 and January 2000. Due to the time and finance restrictions and the geographically dispersed nature of the companies suitable for interview, considerable difficulty was experienced in arranging as many of the interviews as was desired.

It was unfortunately not possible to arrange to visit a number of the companies that had indicated their willingness to be interviewed and which fitted into the sampling frame. While the original intention was for all the interviews to be face-to-face, it was clear that the sample size was going to be considerably short of target if this was to remain the case. Since it was not cost-effective to travel hundreds of miles for specific interviews, certain of the most important ones that were required to fit in with the sampling frame were carried out by telephone instead. Though not as good as face-to-face, this proved to be a satisfactory way of obtaining comparable information to that gained from the rest of the interviews. A total of three interviews were conducted in this manner.

Another attempt to improve the quality and comprehensiveness of the interview sample, as well as boosting the overall sample size, involved directly targeting a small number of companies within Scotland that had been highlighted in other interviews as being important as competitors, suppliers or customers to those already interviewed. This involved directly approaching an additional five companies. They were sent questionnaires to complete and a covering letter specifically asking for their co-operation in order to provide comprehensive information on their specific supply chains. Despite sending out reminders, only one additional interview was arranged in this way.

Table 4.9 summarises the breakdown of the 39 interviews that were carried out in each of the supply chains in focus. This breakdown by supply chain is fairly crude and two points came to light when actually conducting the interviews. Many companies that were thought to be linked in the supply chain, based on their questionnaire responses, turned out to have independent supply chains with no overlap. Conversely, though, companies that had been believed to be from completely independent supply chains actually overlapped with each other in terms of the movements of their supplies or products. This reinforces the complex nature of contemporary industrial and logistical structures as discussed earlier. Full discussion and analysis of these issues is in Chapter Seven.

Table 4.9: Total Number of Interviews Conducted (by Supply Chain)

Supply Chain	Number of interviews*
Paper and publishing	12
Food and drink production and retailing	11
Do-it-yourself products	5
Transport equipment	4
Electrical/electronic products	3
Clothing manufacturing and retailing	3
Others	3
TOTAL	39

* - some companies were involved in two of the supply chains, so addition of totals for each supply chain exceeds the overall total

Source: author's interviews

The total number of completed interviews fell very slightly short of the target, though the depth of the interviews was considerable and the coverage of certain supply chains, or stages within them, was significant and sufficient to allow the detailed examination of the hypotheses (see Chapter Seven). The method of analysis of the interviews is dealt with in the next section.

4.6.3 Method of Analysis of the Interviews

The interviews were primarily designed to generate qualitative information to add depth and understanding to the other data collection methods. The purpose and nature of qualitative techniques was discussed in Section 4.3.2, in particular that there are benefits to be gained from obtaining this type of information in a less-structured manner. The analysis of the qualitative data from the in-depth interviews was designed to satisfy two purposes. Firstly, it was to provide general supporting information to the more structured and quantitative data gained from the questionnaire survey when examining the research hypotheses, particularly those requiring a more detailed understanding of the processes taking place in freight mode choice.

Secondly, the qualitative data were used in specific instances to enrich the analysis by allowing the use of individual case study examples to highlight trends that, whilst not necessarily representative of the population at large, were of interest in revealing a more detailed knowledge of the interactions between logistical structure and mode choice. In particular, specific circumstances that led to rail either being chosen or not being chosen could be explored at this level.

To allow these two forms of analysis to take place, each interview was recorded through note-taking during the interview itself, which was then transcribed in full as soon as possible thereafter. This method was successfully implemented in the pilot interview and was found to be satisfactory during the main interview phase. It allowed comprehensive notes to be made, without the issues of confidentiality and general reluctance to provide as much information which are often found with tape recorded meetings (Taylor, 1984).

The transcribed interviews allowed both a general matrix of significant mode choice issues for different types of companies (e.g. within specific supply chains, or for rail users) and detailed content analysis of the interviews. This provided the focus for addressing the more complex questions raised by certain of the hypotheses and allowed the identification of common attributes and attitudes among groups of companies. It also provided for the other main purpose of the interviews, that being to identify examples of behaviour and opinion that may be applied more widely as "best practice" in structuring logistical operations to offer greater scope for rail movements in line with current transport policies.

Building on this latter point, the analysis of the interviews also involved some quantitative data, for example in trying to estimate the proportion of freight movement that may feasibly be suited to rail in the foreseeable future. In doing this, though, the qualitative information was also used to support the outcomes of the analysis. Therefore, the analysis of the questionnaire surveys and in-depth interviews were largely combined to provide a more thorough view of the trends and their causes than would have been available solely from one of these methods. This combination aims to maximise the contributions of the different methods and avoids many of the pitfalls of the individual approaches, as was discussed in Section 4.3.

4.7 Summary

This chapter has dealt with the methodological approaches that have been adopted to satisfy the two main research objectives, through the testing of the hypotheses developed in Chapter Three. In particular, the construction of databases of rail freight services is believed to be an original approach to analysing the supply-side of the rail industry. The other two key components of the methodology, as discussed in this chapter, are on the whole well-established means of analysing the effects of logistical changes in a wide variety of ways, but the overall combination used in this research is believed to be unique. Furthermore, the specific focus on the ways in which decisions being taken on mode choice, with particular reference to rail, are interrelated with wider reaching logistical changes is designed to shed light on an area of logistics that is currently poorly understood, but which features strongly in the current government policy documents cited in Chapter Two.

In the following chapters, therefore, the utilisation of this methodology provides an insight into the interrelationships between logistical restructuring and mode choice and, in this context, identifies the major strengths and weaknesses of rail freight as it attempts to gain a greater modal share in Great Britain. Chapters

Five and Six deal with the analysis of the databases and questionnaire survey respectively, which then leads into incorporating the detailed interview material in Chapter Seven in order to address the series of hypotheses developed for this thesis.

CHAPTER FIVE: CHANGES IN THE SUPPLY OF RAIL FREIGHT SERVICES - BRITISH RAIL FREIGHT, 1990 - 2000

5.1 Introduction

It was clear from the discussion in Chapter Two that a gap exists in the literature relating to the interactions between the supply of rail freight services and the logistical requirements of industry as a whole. The last decade has witnessed significant changes in the provision of rail freight services in Great Britain, but there has been very little detailed academic study of these changes and the impacts that they have had on the logistical decision-making processes of companies. This chapter analyses in greater depth the general issues covered in Chapter Two, making use of the rail freight databases discussed in the previous chapter.

As Chapter Two revealed, there had been a long term reduction in the volume of freight being moved by rail, to such an extent that only six per cent of total tonne kilometres were moved by rail in 1996 (Department of Transport, 1997). More recent statistics have shown a modest reversal in this downward trend and this will be analysed later in this chapter. Figure 2.2 showed the trend in overall freight volumes and rail freight's share of that total.

While the inter-relationships between the supply of rail freight services and demand for those services are complex and bi-directional and are a key factor in this research, there have been many important changes to the structure of the rail freight network since 1990. In addition to the contraction in the range of services offered, the early-1990s were a time of almost constant restructuring of the management and operation of rail freight. Since privatisation took place 1996/97, there has been further restructuring and a renewed emphasis on increasing the modal share for rail in the freight market.

Through the analysis of the original databases constructed for this research, the nature and effects of the changes in service provision that have taken place are discussed. This detailed analysis of the provision of rail freight services at the disaggregated level is simply not possible from official published statistics which focus on the aggregate level. Sections 5.2 to 5.7 provide a descriptive chronological review of the general changes that have occurred between 1990 and 2000, by way of context, with the remainder of the chapter exploring the detail of these changes through the analysis of the five databases.

5.2 Rail Freight Services pre-1990: the Historical Context

The history of rail freight services in Great Britain prior to 1990 has been documented elsewhere (see, for example, Allen 1984; Anthony and Rogers 1989); only the main points that are directly relevant to this research are included here. The aggregate statistics reveal a steady downward trend in rail freight movement from the mid-1950s through to the early-1990s at the same time as the total volume of freight being moved in Great Britain by all modes was increasing substantially (see Chapter Two). This section provides greater detail of the supply-side changes that took place in rail freight during this period.

In the face of increasing competition from the growing road haulage industry and the consistent lack of serious investment and political certainty of direction in British Rail, rail freight managers were basically put in the position of managing the controlled decline of rail freight services. The nature of rail freight in Britain was transformed from being a fundamental part of freight distribution as a common carrier operating across an extensive network to being focused on certain bulk industries and niche markets where rail could still maintain a competitive advantage over road haulage and pipelines.

The route mileage of the rail network was cut dramatically between the 1950s and 1990s, from over 30,000 route kilometres in the mid-1950s to 16,659 route kilometres in 1998/99 (DETR, 2000a). The majority of this reduction took place in the 1960s as a result of the Beeching cuts and this forced the withdrawal of much of the network of freight services. Following a similar trend to passenger volumes, this elimination of much of the secondary route network resulted in the further decline of freight volumes in the core areas due to the reduction in overall network benefits.

The main developments to have taken place in the post-Beeching area were targeted at maintaining rail's share of its traditional markets, though in a period when these markets themselves were declining as a result of the loss of much of Britain's heavy industry (see, for example, Table 2.2 for the coal industry). The traditional bulk movements benefited from the greater use of air-braked rolling stock with higher carrying capacities, most notably with the introduction of merry-go-round (MGR) coal operations providing significant cost savings and operational advantages over competitive modes (Allen, 1984). The development of a network of high-capacity marshalling yards, in combination with the new air-braked rolling stock, provided reduced journey times at lower cost for many of the smaller volume movements that formed the basis of the development of the Speedlink network. This evolved from the 1955 Modernisation Plan, which had identified the following four aims (Rhodes, 1988):

1. Shorter transit times.
2. Greater reliability.
3. Punctuality of delivery.
4. Reduction in operating costs.

The fortunes of Speedlink are discussed in greater depth in Section 5.3, since they are of great significance to the nature of rail freight operations in the period under examination in this research. The other major development to affect rail freight was containerisation. As the use of ISO containers rapidly increased during the 1960s, a dedicated network of terminals and services was launched to cater for these flows, known as Freightliner. Originally this was intended to serve primarily a domestic market, with terminals in most of the major urban and industrial areas, but these flows soon suffered intense competition from the road haulage industry. Thus the Freightliner network gradually evolved to be focused on the rapidly growing volume of trade through the deep-sea ports (Collins, 1991), where the requirement to transfer modes (i.e. to/from sea) was present no matter which land mode was used and where the land distance to/from the origin or destination of the goods was often considerable.

The combination of all of these developments resulted in rail focusing on a relatively limited range of freight movements, primarily the bulk traffics for traditional industries and the longer-distance flows of containers and wagonload goods, the markets in which rail is commonly held to be best suited to. Even in these markets, though, competition from other modes was often intense and rail's market share was gradually being eroded. This focus on specific types of movements was formalised during the 1980s when all rail services were sectorised into business units as the British Railways Board attempted to become more customer-focused in its operations and management. The process of sectorisation as it applied to the freight operations is dealt with in Sections 5.3 and 5.4, but in general it resulted in dedicated management and resources for the key commodities and flow types, largely at the expense of other markets in which rail had minimal or no presence.

5.3 Withdrawal of Wagonload Freight Services

Perhaps the most significant and far-reaching change that had occurred to British rail freight since the Beeching era in the 1960s was the withdrawal by British Rail of the Speedlink network in July 1991. A detailed account of the issues surrounding the withdrawal can be found elsewhere (see, for example, Rhodes & Shannon 1991b), with only the main points being presented here.

The Speedlink concept was developed for those flows which were not suitable for containerisation or block train (i.e. trainload) working and thus wagonload operation was the only solution if the traffic was to remain on the rail network.

The problem was in making this profitable and there had been previous attempts in the late-1960s and early-1970s to abandon wagonload services. Between 1968 and 1975 trainload operations handled an increase in tonnage from 67 million tonnes per annum to 136 million tonnes, while wagonload volumes declined from 143 million tonnes to 39 million tonnes per annum (Rhodes, 1988). In 1973 the Total Operations Processing System (TOPS) was introduced, a real-time on-line computer system containing information about individual wagons, locomotives and train formations. This enabled freight consignments to be monitored and allowed analysis of train performance, use of resources and yard efficiency, as well as allocating empty wagons to traffic flows.

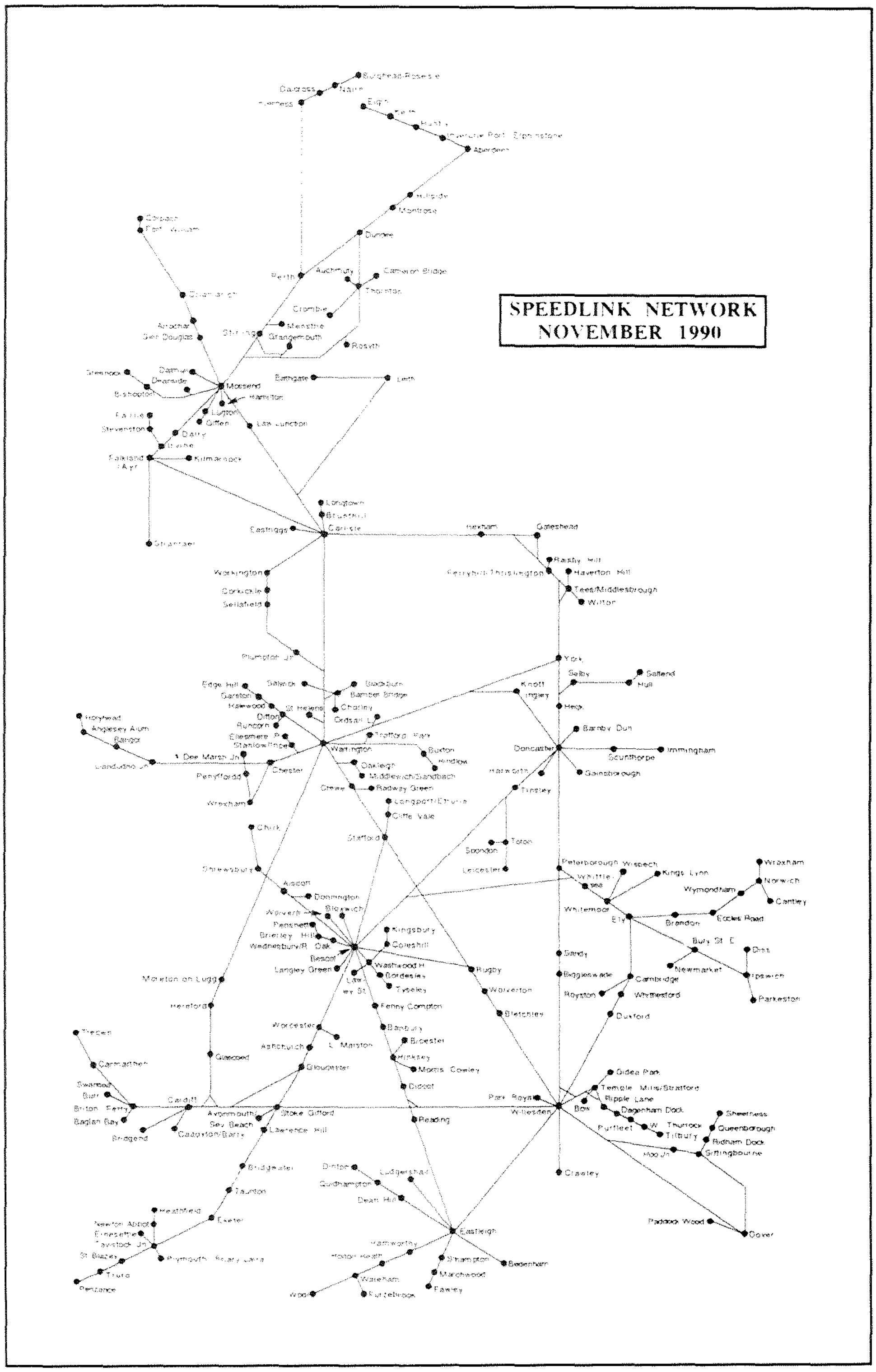
This development was used to launch Speedlink, a network billed as offering a regular, high speed service for wagonload consignments between major centres of population and industry. Initially, British Rail's own goods depots were used as the termini, but as more and more private companies took advantage of these higher speed direct services the trains were switched to operate to and from the large marshalling yards. This network was successful in retaining much traffic in the face of growing competition from the road haulage industry and, indeed, 20 per cent of the traffic carried by Speedlink was new to rail.

However the costs spiralled out of proportion as the amount of trip working (i.e. conveyance of individual consignments from private terminals to/from marshalling yards) and marshalling of trains increased. Analysis by the British Railways Board in the late-1980s showed that only 20 per cent of Speedlink's costs were associated with running the trunk hauls, whereas trip working accounted for 50 per cent and marshalling the other 30 per cent.

In 1980 there had been 12 trunk marshalling yards, almost 20 secondary yards and over 200 freight loading points. In an attempt to cut costs and to respond to falling demand, the 1980s saw dramatic reductions in both the number of marshalling yards and freight sidings, so that by 1990 there were only eight main yards and 100 or so sidings receiving regular wagonload traffic (although another 100 sidings received occasional traffic or regular traffic in bulk movements). Figure 5.1 shows the Speedlink network as it was in 1990, shortly before its cessation.

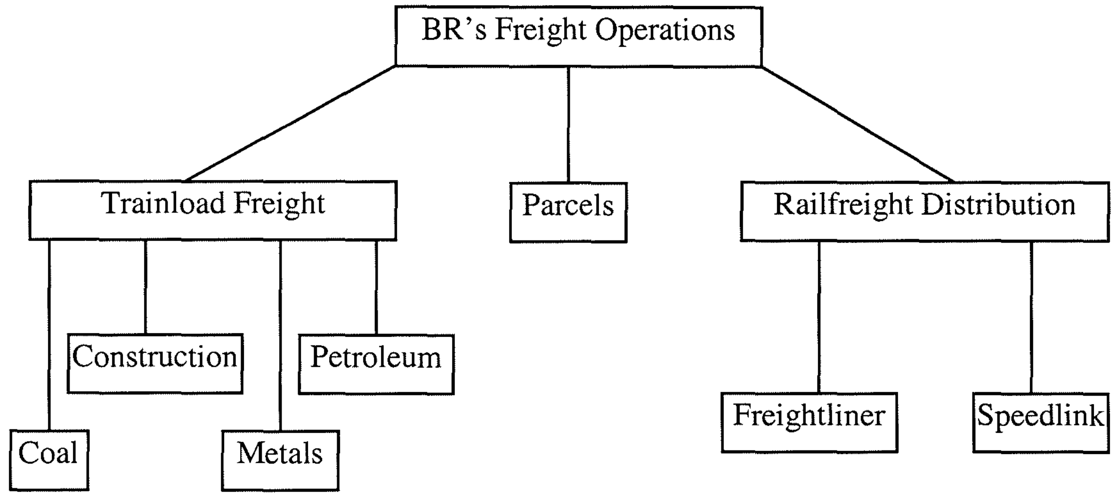
In the late-1980s, rail freight was split into two separate business units, Trainload Freight and Railfreight Distribution. The former of these units took responsibility for bulk flows, most of which moved directly in complete trainloads from private siding to private siding and were profitable. Railfreight Distribution took over the Freightliner and Speedlink networks, as well as certain trainload flows that did not fit neatly into Trainload Freight. It was this division (or sectorisation as it was known) which can be seen in Figure 5.2, that highlighted the problems with Speedlink.

Figure 5.1: The Speedlink Network, 1990



Source: Rhodes and Shannon (1991b)

Figure 5.2: The Sectorisation of Rail Freight circa 1990



Source: based on Rhodes and Shannon (1991b)

While Railfreight Distribution as a whole was unprofitable, under the accounting methods in use at the time, Speedlink was particularly poor. In 1989/90, British Rail's accounts revealed that Speedlink had lost £30 million on a turnover of just £45 million (British Railways Board, 1990), prompting the decision to completely withdraw from domestic wagonload freight. Therefore, in July 1991, the Speedlink network was disbanded and the remaining traffic was either transferred to trainload operation - either with Trainload Freight or remaining within Railfreight Distribution, depending on the commodity - if volumes were great enough, or was lost to rail. This meant the end of many traffic flows of general merchandise, grain, china clay, fuel oil, timber, fertiliser, etc., since these tended to involve low annual tonnages from dispersed locations (Shannon, 1991), though predictions at the time estimated that approximately 50% of traffic could be retained. In the event, approximately 70% of the traffic was transferred to continuing rail freight services (Department of Transport, 1993).

5.4 Concentration on Trainload Traffic: 1991 to 1994

This section details the changes that took place during the early-1990s, between 1991 and 1994, following on from the elimination of Speedlink services. The demise of Speedlink led to the consolidation of virtually all remaining rail freight traffic into trainload movements of bulk products. The Trainload Freight sector had already been divided into four sub-sectors, as was shown in Figure 5.2, each one being responsible for the movement of a particular commodity or group of related commodities:

1. Trainload Coal - at the outset, this sub-sector had two distinct types of operation. Firstly, and most significantly, there was the movement of coal to power stations. Rail-borne power station coal movements have been suffering in recent years with the demise of many collieries that sent out coal by rail. The proportion of electricity generated from coal has been decreasing with the switch towards gas fuelled power stations. The remaining coal-fired power stations have been gradually turning to imports rather than domestic sources, but many of these flows have utilised rail between the port of entry and the power station. The other Trainload Coal operation was the distribution of coal for domestic and industrial purposes, but this market has declined rapidly. From a network serving over twenty five locations from a number of collieries

in 1989, there was a reduction to the extent that only a few isolated flows had survived through to 1994.

2. Trainload Construction - this sub-sector was geared towards the movement of aggregates, primarily for property and road construction. The major market was the South East of England, supplied mainly by quarries in the Mendip Hills and Leicestershire, but the property price collapse in 1989, followed by general recession, reduced the demand for aggregates. Other flows handled by Trainload Construction included household and industrial waste (a growth market) and cement, a market which declined substantially during the late-1980s.

3. Trainload Metals - various flows for the steel industry, primarily iron ore into British Steel plants and a core network of semi-finished steel flows between steelworks. Much of the long-distance traffic originated at Ravenscraig steelworks (Lanarkshire), which has now closed, but heavy flows remained from South Wales, Teesside and Scunthorpe. Smaller flows of finished steel products that moved by rail were also placed under the Trainload Metals umbrella.

4. Trainload Petroleum - this sub-sector dealt with various petroleum flows (e.g. crude oil, aviation fuel, liquefied petroleum gas, bitumen) from oil refineries to customers. The main flows centred on Humberside, with lesser volumes from Grangemouth, Cheshire, South West Wales, Hampshire and North Thameside. A number of smaller terminals had been closed prior to this period and the supply of fuel oil to British Rail's own depots in many cases

transferred to road due to the small quantities and dispersed locations. The main flows by the early-1990s were high volumes concentrated on few routes.

Table 5.1 shows the trends in tonnages carried by each of the four Trainload Freight sub-sectors between 1988/89 and 1993/94, with projections made in 1994 through until 1997/98. All of the sub-sectors experienced decline over this time period, with limited potential for growth predicted for the period through until 1997/98 for Construction and Petroleum, further decline for Coal and stagnation for Metals. The widely held industry view at this time was that heavy industry in Great Britain would continue to decline and that rail was unlikely to be able to significantly increase its market share of the remaining traffic.

Table 5.1: Trainload Freight Principal Market Volumes (millions of tonnes)

Year	Coal	Construction	Petroleum	Metals
1988/89	63	18	11	21
1989/90	58	17	10	19
1990/91	59	14	10	18
1991/92	61	13	10	18
1992/93	57	12	10	16
1993/94	40	12	9	15
1994/95*	36	12	9	15
1995/96*	33	13	10	15
1996/97*	34	14	10	15
1997/98*	35	15	10	15

* - projections

Source: Modern Railways, 1994b.

These statistics show tonnes lifted - a number of freight flows were experiencing an increase in haul length, so the decline in tonne kilometres was less steep. Of course, it is the shorter rail flows that are often more susceptible to competition from road transport.

This focus on the bulk sectors was highlighted by the Rail Freight Group (Modern Railways, 1995b), who found that 80 per cent of rail freight's commercial turnover came from just 10 companies, with coal movement alone accounting for 40 per cent of total turnover. Thus rail's customer base was extremely limited and almost exclusively focused upon the bulk markets rather than the growing markets such as consumer goods and food and drink. Not surprisingly, the management focus on individual sub-sectors did not lend itself to the attraction of new traffic onto the rail network since attention was required simply to try to retain existing flows.

This focus on trainload flows resulted in a sharp decrease in the number of yards and private sidings receiving or dispatching regular flows of goods. This will be dealt with in detail when analysing the databases in Section 5.8.

5.5 Restructuring for Privatisation

The structure of rail freight was changed again in 1994 when, in preparation for life in the private sector, the Trainload Freight businesses were reorganised on a geographical basis rather than the existing commodity groupings. Thus, three new operating businesses were set up - Trainload Freight West, Trainload Freight North East and Trainload Freight South East - each covering a separate part of the British mainland.

Since many rail freight flows were of a considerable length, and therefore traversed more than one area, the origin of the traffic was taken as the determining factor for allocating flows to particular businesses. The exception to this was the coal supplies to power stations, where it was the location of the power station and not the coal source that was critical. Once the divisions had been made, the three companies theoretically had the power to compete for traffic in any other region, but in practice this was not treated favourably by the British Railways Board.

Operationally, very little changed after the reorganisation in 1994, since most flows were trainload and operated autonomously. There was limited scope for combining different commodity flows traversing similar routes, but this was fairly negligible. Within months of this restructuring further change occurred, with the three regional companies referred to above adopting the new business names of Transrail, Loadhaul and Mainline Freight respectively. Further details of these three operations can be found in Abbott (1994, 1995, 1996).

One of the first, and most significant, developments to occur following the geographical division of the trainload freight operation into three separate operating companies was the re-emergence of wagonload services in 1994. The only wagonload services to have survived the demise of Speedlink were centred on continental traffic using the train ferry to/from Dover. While these flows had been intertwined with Speedlink, the vast majority were retained by setting up a network based on Dover and servicing around fifty terminals. The British Railways Board, clearly influenced by government, saw it as vital to retain as much of this traffic as possible in advance of the opening of the Channel Tunnel and, indeed, these flows began to use the tunnel when it opened in 1994. This basic network, known as Connectrail, also provided a very limited service to domestic users whose flows fitted in with the international traffic. Further analysis of the wagonload freight services is dealt with in depth in Section 5.8.1.3, given that this is one of the types of service that is fundamental to rail freight gaining significant new flows in the less-than-trainload markets which now predominate.

One further commodity grouping handled by Railfreight Distribution, but which had been barely affected by the closure of Speedlink, was that of automotive traffic. Both car parts and complete vehicles have long been carried in trainloads, many either for import or export. This traffic was managed as part of the international rail freight network and started to use the Channel Tunnel when it opened. Finally, the Freightliner network of container services had again been separated out from Railfreight Distribution in order that it could be sold off as an autonomous company.

To summarise, the pre-privatisation process had resulted in the following division of rail freight services:

- three geographically-based trainload operations (i.e. Transrail, Loadhaul and Mainline Freight);
- Railfreight Distribution, operating the Channel Tunnel services and a limited number of domestic flows;
- Freightliner, responsible for container services, primarily to/from deep sea ports;

- and, finally, Rail Express Systems (RES), which consisted of the former Parcels sector's business (primarily Royal Mail traffic). This has been included here for completeness; the RES operations have not been included in this research, as discussed in Section 4.4.1.

5.6 Transfer of Rail Freight Operations to the Private Sector

The three trainload businesses were offered for sale in 1995 amid controversy, since many experts believed that rail freight operators should not have to compete with each other. Given rail's very low market share for freight movements, the main competitor was the lorry. It was argued that economies of scale in rail freight provision should be taken advantage of by having one single domestic operator rather than three separate companies.

Indeed, all three were handed over to Wisconsin Central, a U.S. private railroad operator, in February 1996, to be operated under common ownership as English Welsh and Scottish Railway (EWS). Furthermore, Wisconsin Central had already taken control of Rail Express Systems, the provider of Royal Mail services and in 1997 added Railfreight Distribution to its portfolio. Thus, virtually all non-passenger services are now in the hands of one operator, the main exception being Freightliner. This period, from 1997 to 2000, will form the main focus of the analysis of the changing nature of rail freight service provision contained in the remainder of this chapter.

5.7 Summary of the Main Changes in the Supply of Rail Freight Services

It is clear from the discussion in this chapter thus far, and more generally in Chapter Two, that rail freight has changed from being a major player in the general freight market to having a significant presence only in a small number of markets and industrial sectors over the last few decades. The trend in more recent years is dealt with later in the chapter. Certainly British Rail's stewardship of freight operations amounted to the management of a declining portfolio of services, with significant decline even in the traditional bulk and long distance flows for which rail tends to be best suited.

To summarise, the main supply-side changes in the provision of rail freight services since the 1950s include the following:

- Implementation of the 1955 Modernisation Plan, to try to maintain rail freight's competitiveness in the face of growing competition, in particular from the rapidly growing road haulage industry.
- The impact of the Beeching Report of the 1960s, which significantly reduced the mileage of the network open for freight traffic and identified a more limited scope for rail freight services.
- As a result of the Modernisation Plan, the Beeching Report and general advances in technology, the development of new technologies and/or specific networks to retain or develop certain types of traffic in which rail was perceived to have a future. This included developments in trainload operation (e.g. the introduction of the merry-go-round concept), as well as the introduction of the Speedlink and Freightliner networks.

- The restructuring of rail freight under the sectorisation of British Rail's management and operations, resulting in the creation of the Trainload Freight and Railfreight Distribution sectors. Within these two main sectors, the Trainload operations were split into sub-sectors based upon commodity flows and Railfreight Distribution contained the Freightliner sub-sector amongst its flows.
- The continued focus on the trainload movements in the four main bulk sectors and the withdrawal of the Speedlink network in 1991 as a result of the greater financial and operational transparency of individual components of the rail freight business.
- Further restructuring prior to privatisation, this time on a geographical rather than commodity basis for trainload flows, with three regional companies being established. Freightliner was also established as a separate business from the rest of the Railfreight Distribution sector.
- The acquisition by EWS of virtually all of the rail freight businesses as part of the privatisation process between 1995 and 1997, with the exception of Freightliner which was sold separately. Thus the industry structure has not greatly changed as a result of the transfer of operations into the private sector.

It is against this background of constant reorganisation and the management of declining traffic volumes that the detailed analysis of the databases in the remainder of this chapter is set. Clearly the events leading up until the mid-1990s have a very important bearing on the nature of rail freight operations and on the attitudes of existing and potential customers towards the use of rail. Therefore this is of great significance to the objectives of this research and is discussed in later chapters when examining the attitudes of industry towards the use of rail for their freight requirements.

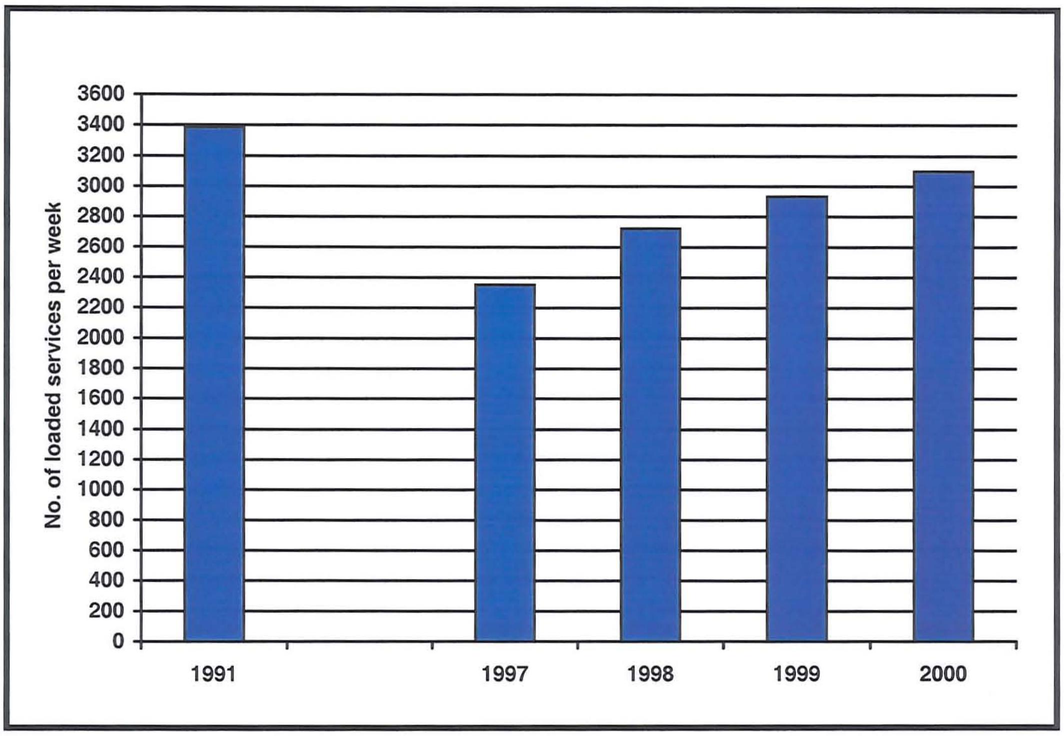
5.8 The Changing Nature of Rail Freight since 1991: Analysis of the Databases

It is apparent from the previous section that there have been considerable changes in the nature of rail freight service operations and management since the start of the 1990s. It was also found in Chapter Two that there have been other important issues during this period, such as greater government support for rail freight and increases in road congestion and fuel costs.

The remainder of this chapter is concerned with the detailed analysis of changes in rail freight service provision over the last 10 years, using the databases which provide disaggregated information about traffic patterns. In particular it focuses upon the period of rail freight growth since the mid-1990s. It should be borne in mind that the databases contain detailed information on the number of services operated, which does not necessarily equate to the volume of freight being moved. This was discussed in Section 4.4.3.

It was clear from the analysis of the comprehensiveness of the databases (see Section 4.4.2), that there was a decline of 30 per cent at the aggregate level between 1991 and 1997 in the number of loaded services being operated. It should be remembered that all the analysis of rail freight services excludes coal traffic (see Section 4.4.1). Figure 5.3 shows the total number of loaded services per week for each of the five databases. The percentage change in number of services between each successive database is shown in Table 5.2. The overall change between 1991 and 2000 is also included, as are the published rail freight statistics (both tonnes lifted and tonne kilometres) for the comparable time periods.

Figure 5.3: Number of Regular Loaded Rail Freight Services per Week



Source: author's databases

Not surprisingly the database figures follow the same general trend as the official published statistics, in particular those for tonnes lifted which is more closely linked to number of loaded services than the tonne kilometres statistics. The magnitude of the changes in the figures varies considerably, but this reflects the developments that have taken place. Between 1991 and 1997, as has already been established, the focus of rail freight operations was on bulk flows and long distance movements. The emphasis on distance is reflected by the dramatic increase in the average length of haul of rail freight movements from 173 kilometres to 228 kilometres (i.e. 32 per cent). All three of the measures of rail freight activity show an increase between 1997 and 2000, suggesting that this may be the beginnings of a revival in rail freight levels. At this aggregate level, however, the nature of this reversal of the trend is not clear.

Table 5.2: Comparison of Published Rail Freight Statistics and Percentage Change Between Databases in Number of Regular Loaded Services per Week

	% change in no. of loaded services per week[1]	% change in tonnes lifted[2]	% change in tonne kilometres[2]
1991-1997	-30.5	-21.9	+2.7
1997-1998	+15.8	+11.5	+10.6
1998-1999	+7.7	+3.1	+3.2
1999-2000	+5.7	+2.8	+4.7
1991-2000	-8.4	-7.7	+22.7

Source: author's databases[1]; Bulletin of Rail Statistics[2] (DETR, 2000a)

The dramatic reduction from 1991-97 in the number of loaded services per week was followed by three consecutive years of increases in service levels, initially at 16 per cent per annum, but slowing in each of the two subsequent years. This growth has been greater than that in the published statistics, but again it follows the same pattern. This greater rate of increase in number of services than tonnes lifted or moved from 1997 to 2000 is not surprising, since many of the recent changes that have taken place have involved a renewed focus on smaller and/or lighter weight flows that are under-represented in the statistics involving tonnages.

Overall, the number of loaded services per week was still eight per cent lower in 2000 than it had been in 1991. The number of tonnes lifted were still eight per cent lower in 2000, whereas the volume of tonne kilometres was 23 per cent higher as a result of the growth in the significance of longer distance flows. The detailed changes underlying these aggregate trends, in particular the nature of the recent growth in the number of rail freight services as revealed by the databases are discussed in the remainder of this chapter.

5.8.1 Changes in Commodity Flows

From the databases, it is possible to disaggregate by sector to allow more detailed analysis. Firstly, the changes in the absolute number of services operated in each of the sectors will be examined, followed by the analysis of the changes in the proportion of the total that each sector accounted for in each of the databases.

Figure 5.4 reveals the breakdown in the number of regular loaded services per week by sector in each of the databases. The comparison of sector types between the databases necessarily involved some assumptions being made on the classification of certain services, though this accounted for no more than five per cent of services in any one of the databases. This slight lack of continuity is due to the reorganisations, discussed earlier in this chapter, that have taken place since the initial database time period in 1991, which have meant that traffic flows are no longer strictly allocated to particular sectors. However, in virtually all cases it is obvious which of the former sectors the service would have been allocated to. The three bulk sectors (i.e. construction, metals and petroleum) are shown, with three other categories covering the remainder of the services. These are the ones formerly handled by Railfreight Distribution and are:

- container/intermodal/automotive, which fits neatly in with the classification of services throughout the time period under consideration since these traffics have consistently been handled separately to the traditional trainload flows.
- other bulk services, which include the majority of the trainload flows that do not neatly fall into the other categories and have largely been treated by the railway companies as independent operations. This includes such diverse commodities as chemicals, china clay, newsprint, nuclear flasks and petfood.
- non-bulk services, which covers all of the wagonload services, variously Speedlink, Connectrail and Enterprise during the period between 1991 and 2000.

It is the trends in each of these three sectors that will be the main focus of this section, since they are the most relevant ones in this research. For rail freight to be able to broaden its base of commodities carried and play a greater role in meeting the logistical demands of industry, it will have to be in these three types of services that the majority of the new traffics will come from. Most of the growth markets in freight transport are outwith the main bulk sectors of construction, metals or petroleum and, in any case, rail already is well-represented in the movement of these types of commodities so growth potential is more limited. It is the smaller volume consignments, either using individual traditional wagonloads or newer intermodal technologies that are fundamental to any major increase in rail freight's market share.

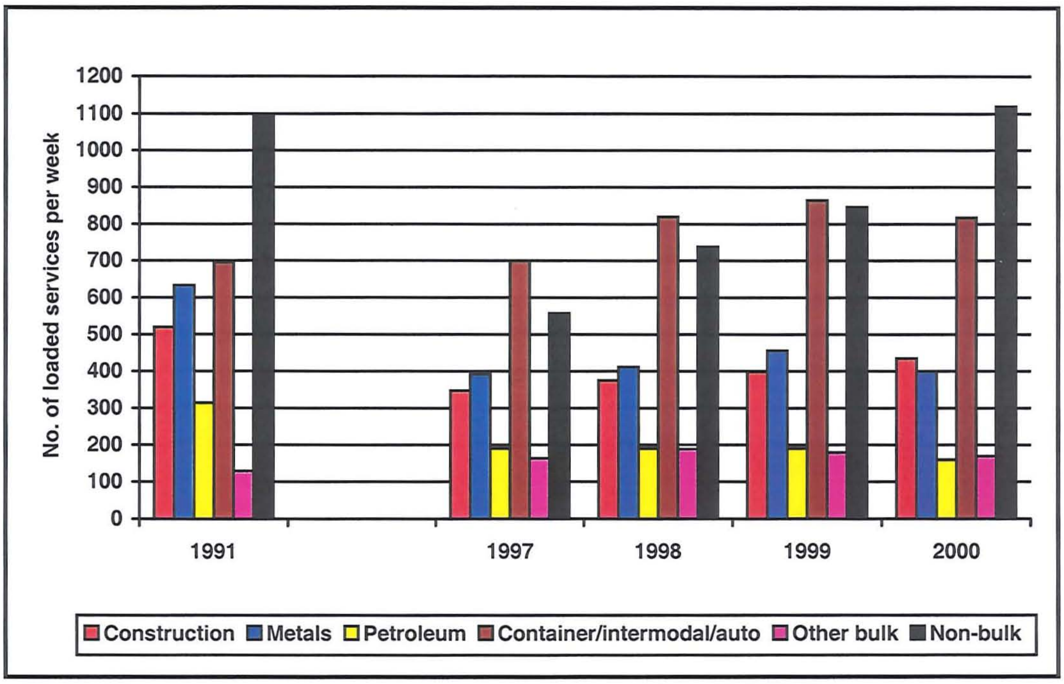
For ease of reference, Figure 5.5 shows the percentage change in the number of regular loaded rail freight services per week between the 1991, 1997 and 2000 databases for each of the six sectors.

It is clear from both Figures 5.4 and 5.5 that the aggregate picture discussed at the start of Section 5.8 hides quite significant variations in the trends between the different sectors between the different database periods. Within the overall trend of declining flows between 1991 and 1997 followed by growth each year from 1997 to 2000 there are quite specific trends in different commodity groupings.

5.8.1.1 Traditional bulk sectors

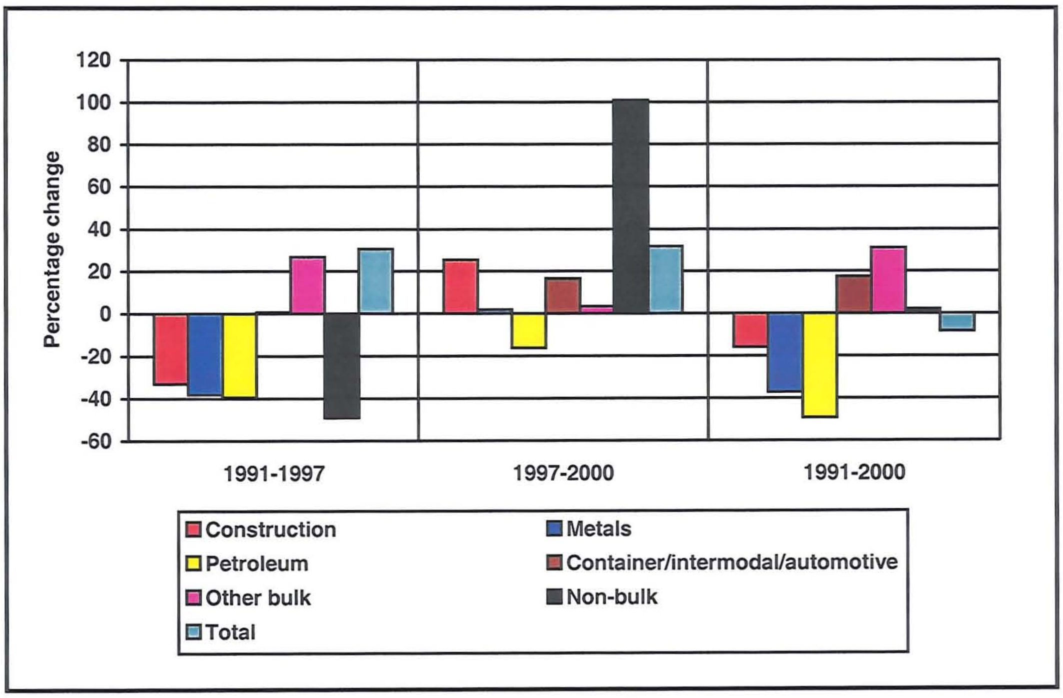
Examining the three bulk sectors in turn reveals quite different trends, though all three declined substantially between 1991 and 1997, in terms of the number of services operated. This decline was fairly consistent across all three sectors, ranging from 33 per cent for construction to 39 per cent for petroleum, with the decline in the metals sector being slightly less than petroleum at 38 per cent. This reinforces the fact that the traditional trainload flows were being eroded away during the early-1990s due to the decline in many of these industries and greater competition from other modes of transport, especially road haulage and, in the case of petroleum flows, pipelines.

Figure 5.4: Number of Regular Loaded Rail Freight Services per Week, by Sector



Source: author's databases

Figure 5.5: Change in Number of Regular Loaded Rail Freight Services per Week Between Selected Database Periods (1991, 1997 and 2000), by Sector



Source: author's databases

Within the rail industry itself, as has been stated already, prior to privatisation British Rail had been concentrating on retaining the key high volume flows but had quite happily withdrawn from many of the more marginal routes in an attempt to maintain profitability. The figures from the databases certainly bear out this continuing process of decline in trainload traffic between 1991 and 1997. The lack of intermediate databases, due to the unavailability of detailed information on service patterns, unfortunately precludes any more detailed analysis of this period. It is possible, however, to examine the year-on-year trends between 1997 and 2000.

In the construction sector there has been a steady increase in the number of services, with a 25 per cent increase over the three years being made up of fairly consistent annual increases of between six per cent and nine per cent. Most of the new services have been for the traditional aggregates market, mainly for new transport infrastructure projects and the building industry. Some of these new flows have been fairly long-term, such as the movement of aggregates from the Peak District to Manchester Airport for the second runway project and some feeder services from the Mendip jumbo trains to locations in South East England. However there have also been a significant number of short-term flows, including materials from the Mendip Hills for sea wall defences in North Devon, aggregates for road building projects in various locations and materials for telecommunications cabling work in Torbay. It is the combination of these new short- and long-term flows that has resulted in the steady increase in construction sector services being operated. There have also been other new construction flows, such as an increase in the number of domestic waste services from the

Greater Manchester area to landfill sites and additional movements of gypsum from power stations and import locations.

The metals sector has also displayed an increase in the number of services between 1997 and 2000, though only of two per cent. For 1997-98 and 1998-99 there were increases of five and 11 per cent respectively but these were almost entirely negated by a 13 per cent decline in the number of services between 1999 and 2000.

Further analysis of the databases reveals that there have been two trends taking place, with the relative importance shifting from one to the other. Throughout this period, a significant number of new metals flows have commenced operation. These have tended to operate relatively infrequently and have consisted mainly of semi-finished steel consignments from British Steel to its customers, imported steel or scrap metal. Examples include imported flows from Boston and Northfleet to the West Midlands, scrap metal from several locations to Liverpool and Newport Docks, as well as increased service frequencies on domestic steel services to the West Midlands. Individually, these new flows have not made a significant impact on the total number of services, but *en masse* they have accounted for over 80 per cent of the observed increases in metals volumes.

These increases were eclipsed in 1999-2000 by the trend towards a reduced number of services of raw materials into the key steelworks and, to a lesser extent, inter-works traffic as a result of the declining British steel industry. Very few flows have ceased completely, but in a number of cases service frequencies have been reduced. For example the flow of imported iron ore from Immingham Docks to Scunthorpe steelworks has reduced by 14 services per week (35 per cent) and the movement of steel slab from Lackenby (Teesside) to Dalzell (Lanarkshire) has been reduced from six to five services per week. In addition, a small number of services that were previously dedicated to metals traffic in 1999 had been incorporated into the Enterprise network by 2000. This issue will be returned to in the discussion of the trends in non-bulk services.

The petroleum sector is the one that has demonstrated a resistance to growth in the number of services. After suffering the largest decline of the bulk sectors between 1991 and 1997 in terms of the number of services operated, the period until 2000 has seen this reduction continue. Between 1997 and 1998, there was no change in the total number of petroleum services, followed by a very slight decline the following year and a 16 per cent reduction between 1999 and 2000. Thus it would appear that the long-term decline in petroleum flows has not been reversed in recent years. While there have been a number of new traffics, mostly operating once a week or less frequently, several longstanding regular flows have been lost. The reduction in some of these intensive flows, mainly originating on Humberside and to a lesser extent Teesside and South Wales, more than offset the new flows which largely originate on North Thamesside.

Furthermore, in the early-1990s in particular, the scale of the reduction in number of petroleum services was far greater than that in tonnage carried, primarily resulting from the focus on the core traffic flows. The operation of many services was simplified, with more direct terminal to terminal flows and less intermediate staging and marshalling of traffic, even for trainload flows. In addition the introduction of new motive power, particularly the Class 60 locomotive in the early-1990s and the Class 59/2s and to a lesser extent Class 66s more recently, has meant that heavier trailing loads are now possible and in some cases this has resulted in a rationalisation in the number of services without a decline in tonnage being carried. This trend has been most noticeable in the petroleum sector but has also occurred in the other bulk sectors to a lesser extent.

5.8.1.2 Container, intermodal and automotive services

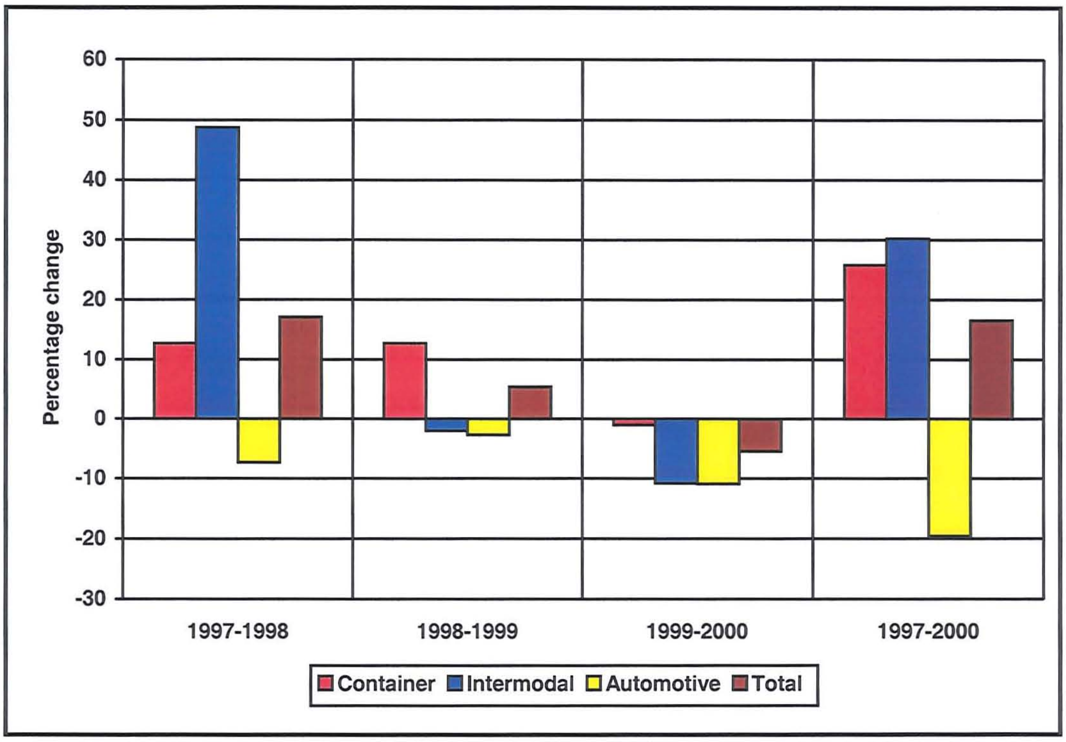
A further set of trainload services, though not in the same way as the bulk sectors, is that covering container, intermodal and automotive flows. Although these tend to operate as trainloads, with the exception of automotive services which are dedicated to one particular industrial customer the other flows in this category tend to offer smaller capacities (e.g. for individual containers or swapbodies) to customers, through aggregators and shipping lines, as part of larger trainloads. Between 1991 and 1997 there was a marginal increase in the number of services. During that period, the Freightliner network was rationalised with a reduction in the number of terminals served and the creation of a hub at Crewe Basford Hall Yard and the number of automotive services also declined slightly. The growth occurred in intermodal services through the Channel Tunnel, which were introduced in 1994 and grew at a fast enough rate to negate the losses in the other traffics. It is in the container/intermodal sector, as well as in wagonload freight, where future growth is most likely to occur, as is discussed later in the chapter.

The trend between 1997 and 2000 is somewhat surprising given the importance of intermodal growth to the long-term aspirations of rail freight operators. Between 1997 and 1998 there was a 17 per cent increase in the number of container/intermodal/automotive services, but this slowed to a five per cent growth in 1998-99 followed by a five per cent decline between 1999 and 2000.

Closer examination of the figures for the three sub-sectors is revealing, as can be seen in Figure 5.6. The number of automotive services declined by 20 per cent between 1997 and 2000. Year on year decline occurred between each of the database periods, the greatest decline taking place in 1999-2000. This was largely accounted for by restructuring of the Rover operations, in particular the withdrawal of 10 trainloads of car components per week between Swindon and Longbridge in 1999-2000. A number of flows have been streamlined, for example greater direct operation of Ford trains of components from Spain to Dagenham via the Channel Tunnel rather than staging them at Wembley Yard. Thus part of the decline in services is artificial and does not actually represent a true reduction in traffic levels.

There have been some new services, notably more imports of French vehicles and exports of Nissan cars from Tyneside, both using the Channel Tunnel, but these gains have not been significant enough to outweigh the losses. Other automotive traffic has been attracted onto rail, for example imported cars from Avonmouth, but the volumes have been small and have used the Enterprise network rather than dedicated services.

Figure 5.6: Change in the Number of Loaded Services per Week in the Container/Intermodal/Automotive Sector, 1997 to 2000



Source: author's databases

Intermodal services are defined as being those operated by EWS which are designated to convey any type of intermodal equipment on journeys that involve transit of the Channel Tunnel, which may actually include containers. The development since 1999 of a domestic intermodal network of services is actually classified as non-bulk since, for the most part, services carry both intermodal and traditional wagonload traffic. This will be discussed when looking at the non-bulk trends. The container sub-sector specifically covers those services operated by Freightliner to carry container traffic. This distinction has arisen from the fact that Freightliner services have been classified as a separate business unit since before 1991, so it allows a consistent approach to be adopted through the whole time period. While these sub-sector definitions may not be the most logical in terms of the type of service operated, they do have the advantage of providing consistent classification of services throughout the 10 year period which allows for analysis of the trends.

The 30 per cent increase in the number of intermodal services between 1997 and 2000 hides a significant variation in the annual figures. In 1997-98 there was an increase of 49 per cent in the number of services, which turned into a slight decline the following year and an 11 per cent reduction in 1999-2000. This is the most surprising of the trends in this sector and largely reflects the problems associated with attracting traffic to Channel Tunnel intermodal services. It is also a result of some intermodal services being integrated into the Enterprise network where duplication of routes existed and, to a much lesser extent, through running of services from British intermodal terminals through the Channel Tunnel rather than operating as separate services for the domestic leg to/from Wembley . This has enabled EWS to make more efficient use of its resources whilst still maintaining service levels, in terms of frequency of service at least. Overall, though, the growth in intermodal services has been much lower than predicted.

Following the period of rationalisation in the early-1990s, the number of Freightliner container services (i.e. scheduled links between two locations on the network) increased by a quarter between 1997 and 2000 reflecting the desire of the newly-privatised company to increase its share of the container market. In 1997-98 and 1998-99 the number of services rose by 13 per cent per annum. This was as a result of an increase in service frequency on some of the core routes, the introduction of direct services between terminals that had previously only been linked by interchanging at Crewe and some entirely new services. This two year growth period was followed by a very slight decline of one per cent in the number of services between 1999 and 2000.

For Freightliner, the network of container services in operation in 1991 can be seen in Figure 5.7. As mentioned above, the early-1990s witnessed a significant rationalisation in the number of routes and services and this can be seen by comparing the 1991 network with that for 1997, shown in Figure 5.8.

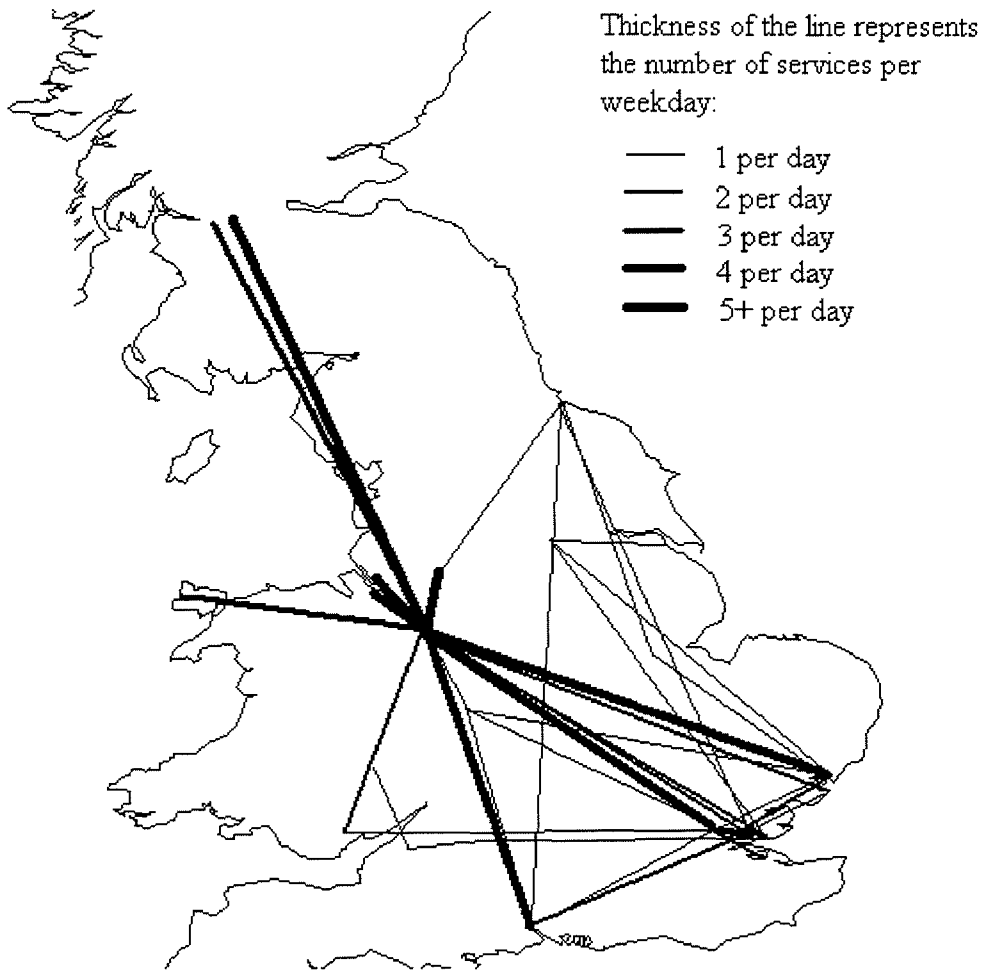
A significant proportion of terminals had ceased to be served by Freightliner in this period, notably Glasgow, Holyhead, Ellesmere Port, Immingham, Bristol, Harwich and two London terminals (Willesden and Stratford). As can be seen, a large proportion of services in 1991 passed through Crewe, due to its location on the West Coast Main Line and it was already a major remarshalling point for portions of trains. Between 1991 and 1997, the number of services per week operated by Freightliner declined by approximately forty per cent, primarily due to the contraction in the number of terminals served but also due to the restructuring of the remaining flows.

By 1997, virtually all Freightliner services were routed via Crewe as a result of this rationalisation process. This was because direct volumes between many terminal pairs did not justify direct services, so a hub-and-spoke system provided the connections between all points on the network with just a few services operating directly and not through the Crewe hub. These consisted of: Southampton to Leeds, Birmingham and Barking; Felixstowe to Birmingham and Teesside; and Tilbury to Leeds and Swindon. Most of the services to the Crewe hub were through ones between other terminals, with marshalling of train portions for various destinations taking place at Crewe. Thus the number of services operating from the remaining terminals had remained fairly static between 1991 and 1997, but the range of journey opportunities between these terminal pairs through the hub at Crewe had tended to increase.

Figure 5.9 shows how the network had evolved by 2000. While the Crewe hub still handled the vast majority of services, a significant number of new routes had developed. A number of these involved directly connecting termini that had previously only been served via Crewe. This included Felixstowe to Cardiff and Leeds; and Tilbury to Cardiff. New services had also been set up between Teesside and Doncaster; Purfleet and Crewe; and between Felixstowe and Hams Hall (near Nuneaton). Finally, the service between Coatbridge and Fort William, which had been previously classified under the metals sector, was incorporated into the Freightliner network.

In addition to these new routes, service frequencies have increased considerably on a number of the existing corridors. Most notably, there has been a doubling from two to four services per day between Thamesport and Crewe and additional daily services from Southampton, Felixstowe. This growth in the number of services continued during 1999-2000, but was offset by a slight rationalisation in some of the services between Crewe and Manchester/Liverpool. There has been a tendency towards more services operating as distinct trains to/from Crewe rather than longer distance ones stopping at Crewe for marshalling purposes.

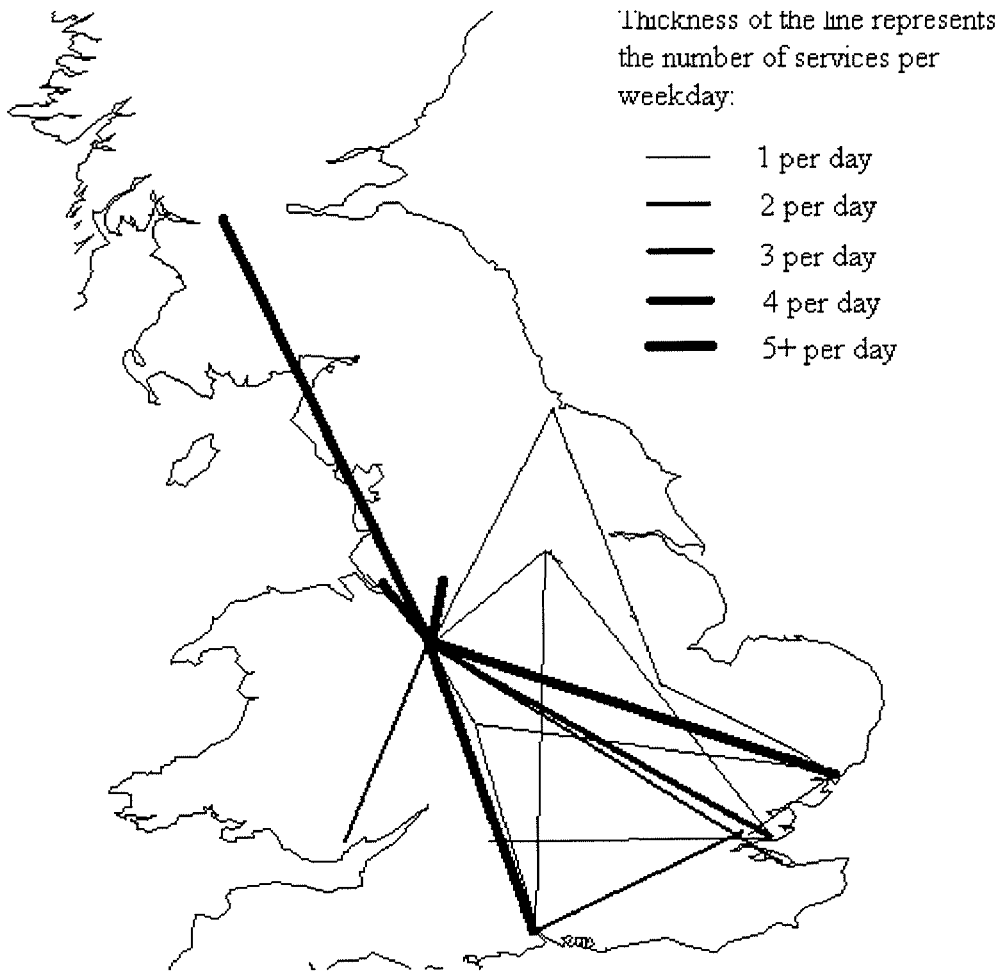
Figure 5.7: Standard Daily Scheduled Freightliner Services, 1991*



* - simplified representation due to imbalance of two-way flows between each pair of locations; some short distance trips between terminals/yards in London area omitted for clarity

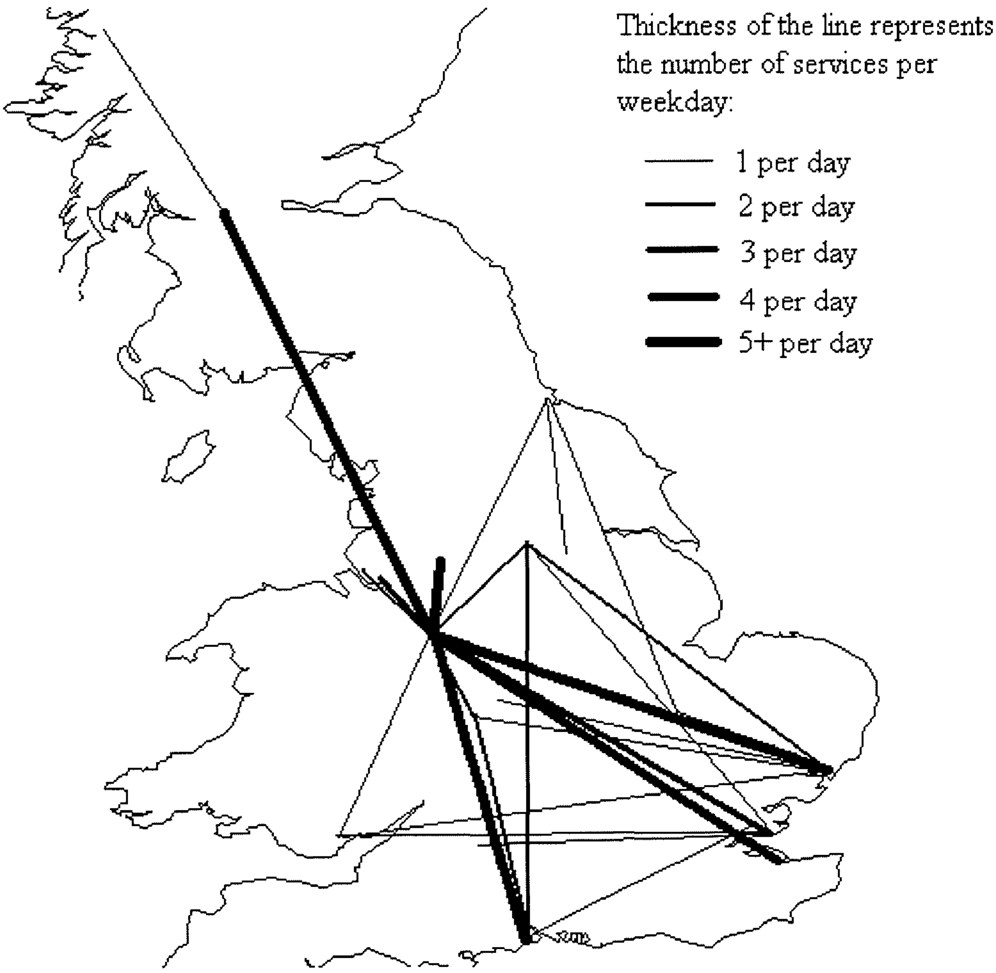
Source: author's database

Figure 5.8: Standard Daily Scheduled Freightliner Services, 1997



Source: author's database

Figure 5.9: Standard Daily Scheduled Freightliner Services, 2000



Source: author's database

Quite clearly the Freightliner network has evolved considerably to take advantage of greater volumes and to meet new demands being placed upon it, including the setting up of new routes and the use of new terminals, as well as strengthening services on its existing core routes.

5.8.1.3 Non-bulk services

The final category of services covers the traditional wagonload operations and is classed as non-bulk. This incorporates the various less-than-trainload networks that have existed at various times in the last decade, primarily Speedlink, Connectrail and Enterprise. The historical decline of these types of services, with the withdrawal of the Speedlink network in 1991, has been discussed in Sections 5.2 and 5.3.

Using the original databases of scheduled services, it is possible to analyse the changes that have taken place since 1991 in the provision of a wagonload network for the use of customers with less-than-trainload volumes to move between specific locations. These types of services are crucial to the main objective of this research, which is to identify the potential for rail freight operators to meet the logistical demands of industry in general, rather than just a small base of customers who have large volumes of freight to be moved. This is further developed in Chapter Seven, which brings together the analysis of the needs of industry resulting from the questionnaire survey and in-depth interviews and the capabilities of the rail operators to meet these needs.

Figures 5.4 and 5.5 revealed the trend in the number of non-bulk services being operated per week in each of the databases. In January 1991, there were almost 1,100 Speedlink services per week. Within the next six months, however, this network had been disbanded and traffic had either been lost to rail or had been transferred to the bulk operations if the volumes were sustainable for this type of movement. Once again, the lack of intermediate databases precludes analysis of the 1991 to 1997 period in detail, but the number of wagonload services had risen from a minimal number of international Connectrail trains in 1994 to 560 per week in 1997 as a result of the renewed focus on wagonload flows.

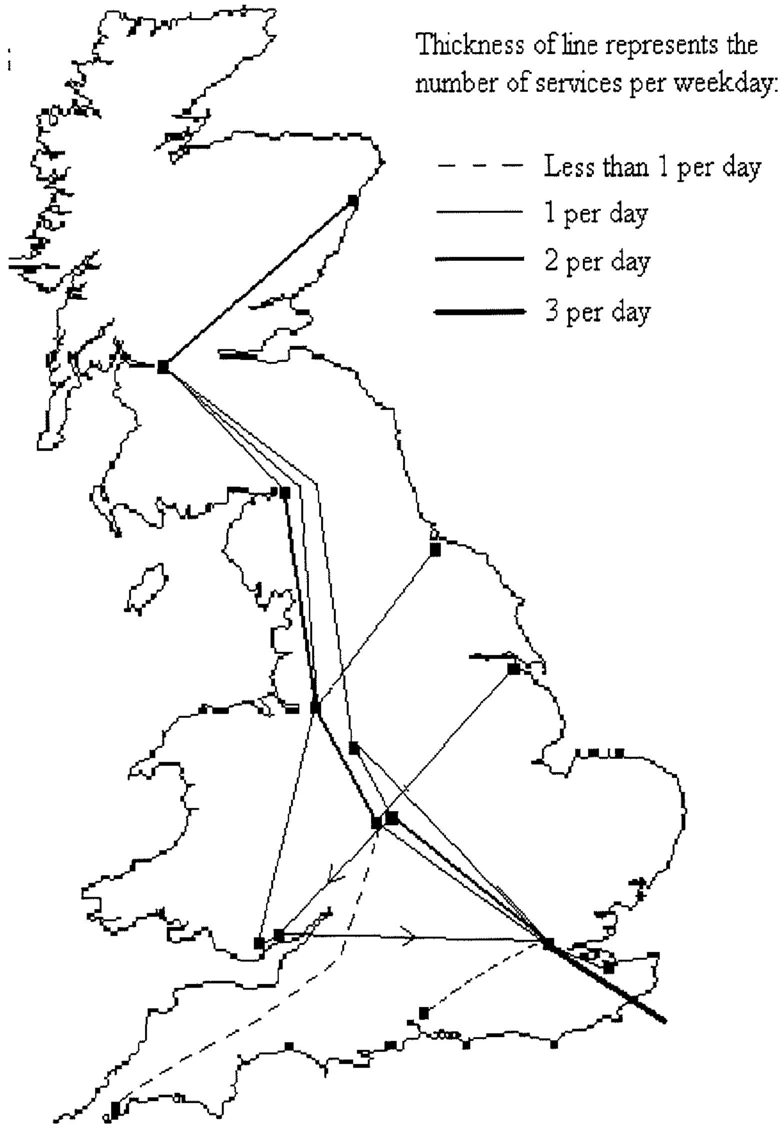
In September 1994, the Enterprise network was launched by Transrail to provide less-than-trainload services along two new 'rail motorways' (Transrail, 1995), basically mirroring the M1/M6/M74 corridor between South East England and West Central Scotland and the M5 corridor from South West England, connecting into the first corridor in the West Midlands. This basic network of just 10 trunk services per day was constructed through the consolidation of some of the smaller trainload flows that Transrail had taken over in the restructuring on regional lines and was limited in its geographical coverage. Examples of existing flows that were incorporated into the Enterprise network included carbon dioxide from Scotland to Birmingham and London, chemicals from Teesside and Cheshire to Ayrshire, timber from the Highlands to Deeside and china clay from Cornwall to Scotland, as well as infrastructure traffic internal to the rail industry.

Many of these flows previously had been operating autonomously by the different bulk sectors, though with much duplication of the routes used, so Transrail took the opportunity to consolidate these movements into larger trainloads. This basic network then provided the focus for attracting new custom and, by 1997, the now-privatised network had expanded to cover all the major industrial and urban areas of Great Britain, with many of the original Enterprise routes having seen considerable expansion in the frequency of services provided.

Figures 5.10 to 5.13 represent the trunk wagonload network based on the information in the respective databases from 1997 to 2000. For 1997 to 1999, this incorporates both the Enterprise and Connectrail services which had by then both been taken over by EWS but not fully integrated with each other. Ministry of Defence (MoD) were also included in the non-bulk category for consistency, since traditionally they had been part of Speedlink and subsequent to 1997 they have been reincorporated into the wagonload network following this spell of independent operation.

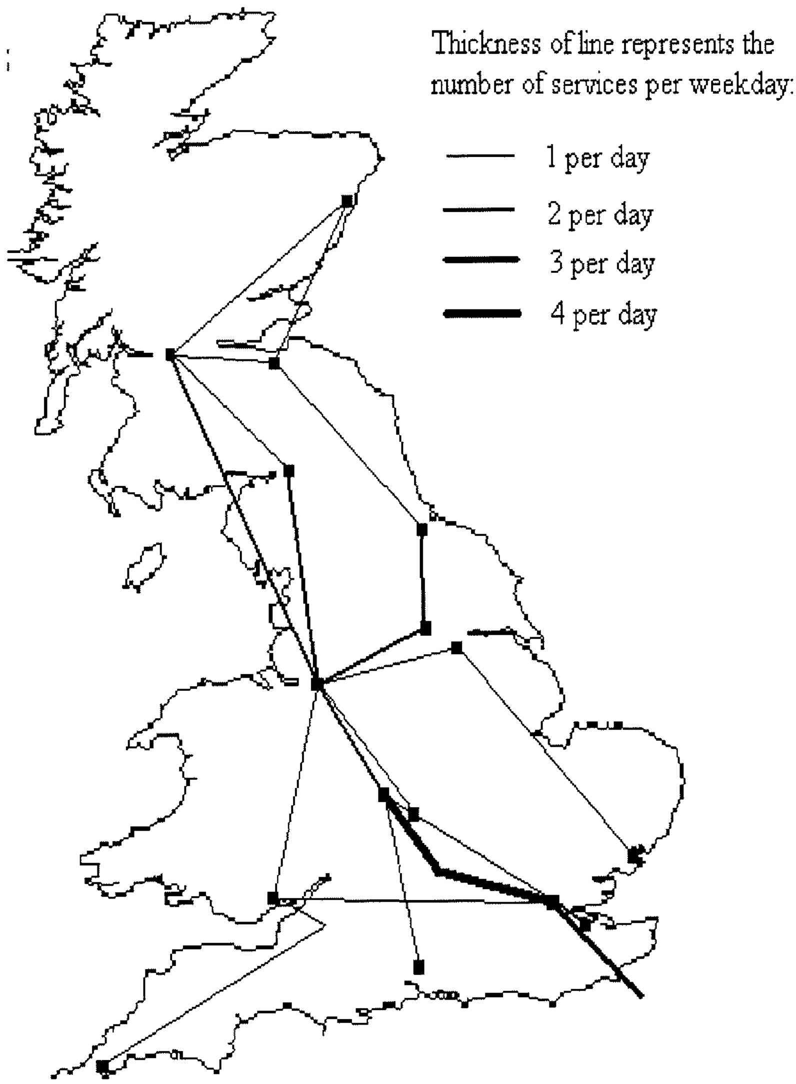
In 1997, the number of services for the dedicated MoD network numbered 78 per week, which accounted for 14 per cent of the total number of non-bulk services. Only one trunk MoD train was operated in 1997, a daily service from Eastleigh (Hampshire) to Carlisle via Birmingham and Warrington. This dedicated MoD service is not included in Figure 5.10, but had been integrated into the Enterprise network by 1998 so is shown in Figure 5.11.

Figure 5.10: Representation of Scheduled Daily Trunk Enterprise/Connectrail Services, 1997



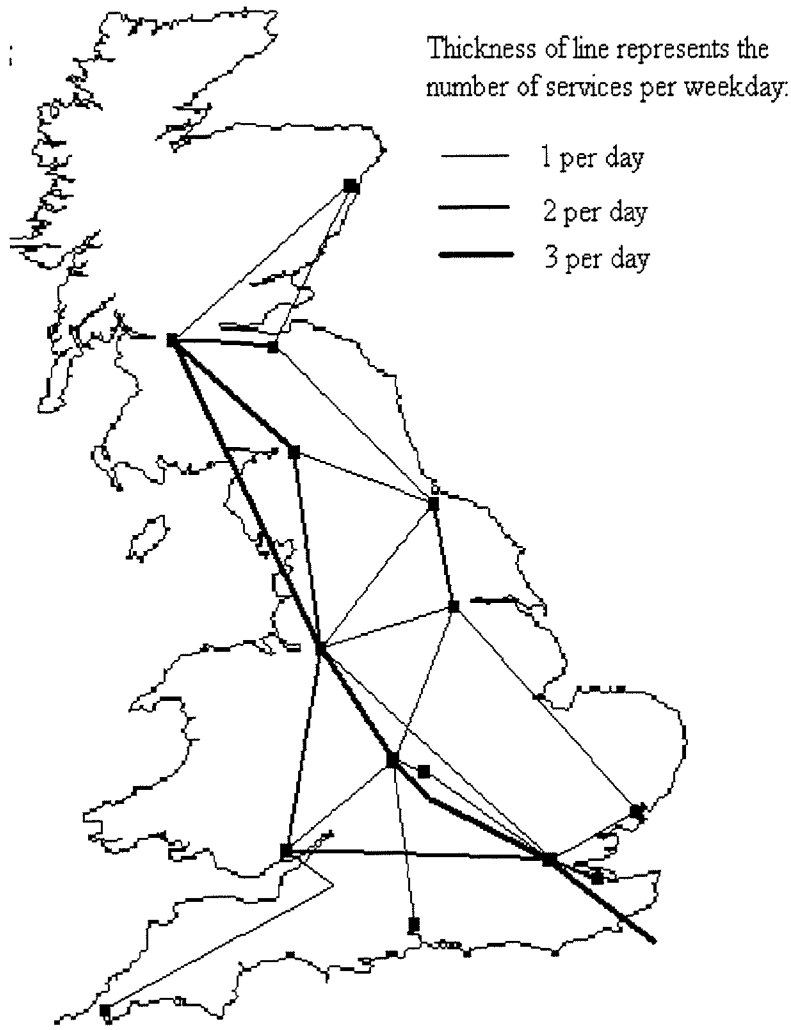
Source: author's database

Figure 5.11: Representation of Scheduled Daily Trunk Enterprise/Connectrail Services, 1998



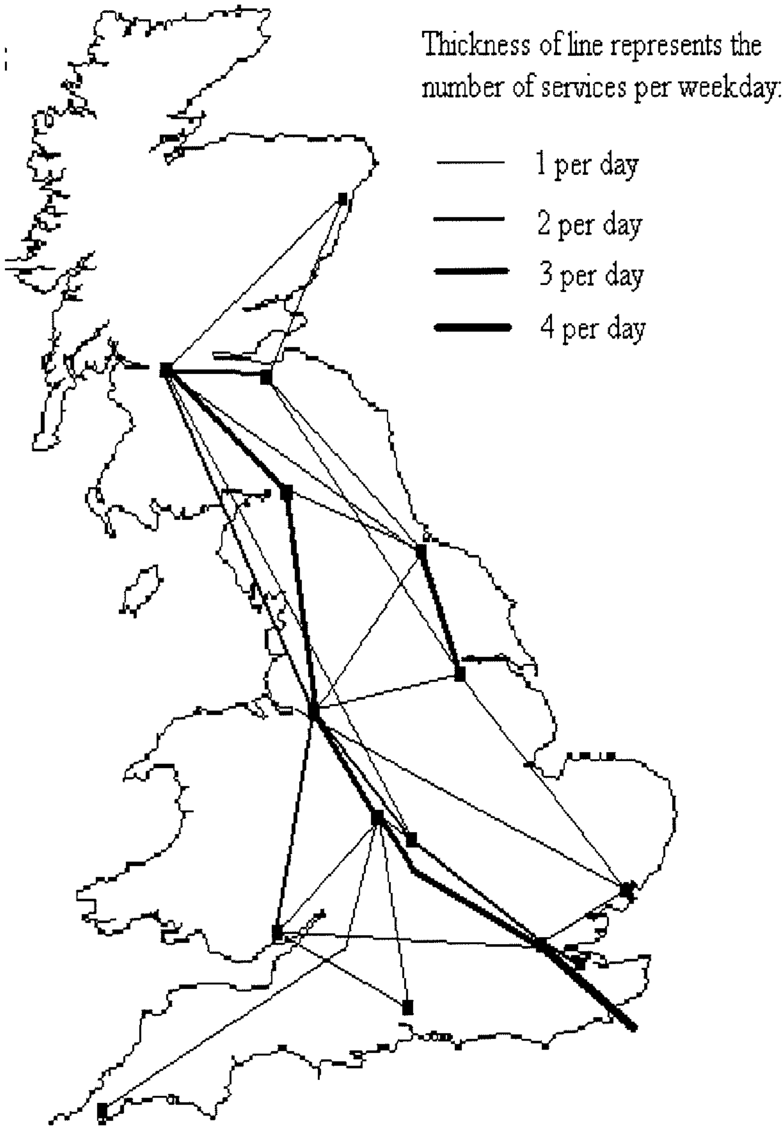
Source: author's database

Figure 5.12: Representation of Scheduled Daily Trunk Enterprise/Connectrail Services, 1999



Source: author's database

Figure 5.13: Representation of Scheduled Daily Trunk Enterprise Services, 2000



Source: author's database

By 2000, all Connectrail and MoD services had been fully integrated into the Enterprise network and it is the trunk services for this combined network which are shown in Figure 5.13. However, the pattern of trunk services as the years progress has become less clear cut for a number of reasons:

- The distinction between trunk and feeder services had become somewhat blurred. Many long distance services now operate from a main marshalling yard directly to a particular terminal rather than to another marshalling yard as was traditionally the case. These services have been omitted from the maps as they do not form part of the trunk network of services linking up the marshalling yards and major terminals.

- The network has grown based upon the major regular traffic flows and this has resulted in many routes having an imbalance of flows dependent upon direction. Therefore the frequency of services and intermediate yards served may vary by direction, though care has been taken not to exaggerate the number of services on the maps.

- Not all of the trunk services are able to convey all types of traffic. In particular, the development of a network of domestic intermodal services since 1998 under the Enterprise banner has resulted in some services not being suited to general wagonload traffic. This is because the intermodal services are generally timed at 75 miles per hour (m.p.h.) running whereas traditional wagons are mainly limited to 60 m.p.h. The maps show the combined trunk network for the traditional and intermodal services under the Enterprise banner.

Therefore, while the detail of the diagrams may be open to interpretation, the scale of change between 1997 and 2000 is evident. The 1997 network was still clearly based upon the original two main corridors along which Enterprise services were set up, with only a few new trunk routes being added between 1994 and 1997. By 1997, there were approximately 560 Enterprise services operating per week, including all the services feeding into the trunk network.

Since its inception, the Enterprise network has progressed through constant evolution, with existing routes being revised as the network has expanded. This is clear from following the sequence of four maps, where specific links have been added, removed or strengthened. As Figure 5.4 revealed, there has been an annual increase in the number of non-bulk services operating. In 1997-98 and 1999-2000, the number of services increased by just over 30 per cent each year, while in the intervening year the increase was a more modest 15 per cent. The whole period from 1997 to 2000 witnessed a doubling in the number of non-bulk services, a far greater increase than in any of the other sectors.

This increase has resulted in a dramatic increase in both trunk and feeder services. The increase in trunk services between 1997 and 2000 can be clearly seen from comparison of Figures 5.10 and 5.13 and has two main features:

1. There has been a significant increase in service frequencies along the routes that were already in existence in 1997. For example, there has been a doubling from three to six services per day in each direction on the Anglo-

Scottish West Coast Main Line route and an increase from three to five services per week between the West Country and the Midlands.

2. The basic trunk network of 1997 has been filled in considerably with the addition of some further regional hubs and the provision of many new direct journey opportunities between the new and existing hubs. In particular the network has become more nationally-based, for example developing services both down the eastern side of Great Britain and cross-country linking east and west.

Some of this network expansion has resulted from existing trainload sector-based services, particularly metals ones, being recast with the aim of attracting additional wagonload flows to these trains. This has involved the re-routing of some flows that previously bypassed the main marshalling yards, and often used their own hubs dedicated to particular types of traffic, so that they now serve the main Enterprise hubs instead. Thus these services have been incorporated into the wagonload network and have been reclassified as Enterprise trains. This has been to provide a greater range and frequency of scheduled wagonload services for potential customers without a significant increase in the resources required to provide these additional opportunities. In combination with the reclassification of some feeder flows from dedicated metals services to Enterprise instead, this may be a factor responsible for the slight decline in the number of metals services operated between 1999 and 2000 as highlighted in Figure 5.4.

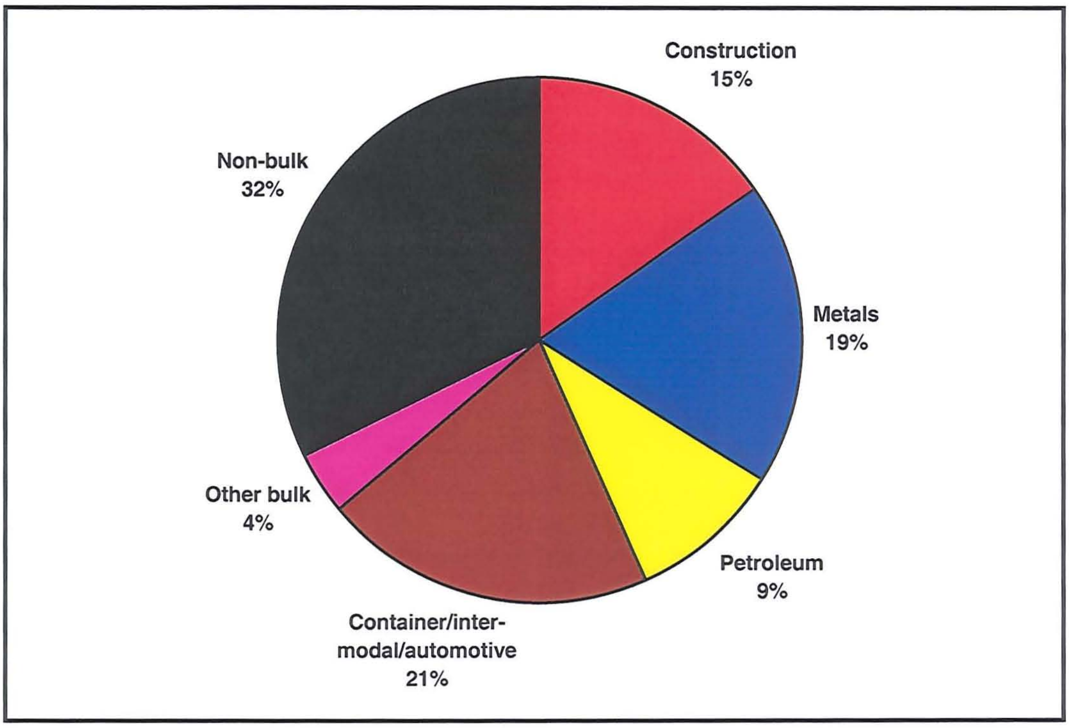
In addition to these changes to the trunk network, the number of feeder Enterprise services has grown substantially between 1997 and 2000. These represent the majority of Enterprise services and their growth is clear from the doubling of wagonload services during this time period. In fact, by 2000, the number of wagonload services had just eclipsed the 1991 database figure, emphasising just how much of a resurgence in wagonload traffic there has been since the introduction of Enterprise.

5.8.1.4 Summary of changes in commodity flows

By way of summarising the changing nature of the number of rail freight services in Great Britain as a whole, Figures 5.14 to 5.18 show the proportion of loaded services accounted for by each sector in each of the five databases. The analysis thus far has emphasised the fact that the performance of the individual sectors has varied dramatically during the 1991 to 2000 period. The overall eight per cent reduction in the number of loaded services has not been uniformly experienced at the disaggregate level. The charts highlight the declining significance of services operated under the three traditional trainload sectors as a result of the increasing importance of other types of flows.

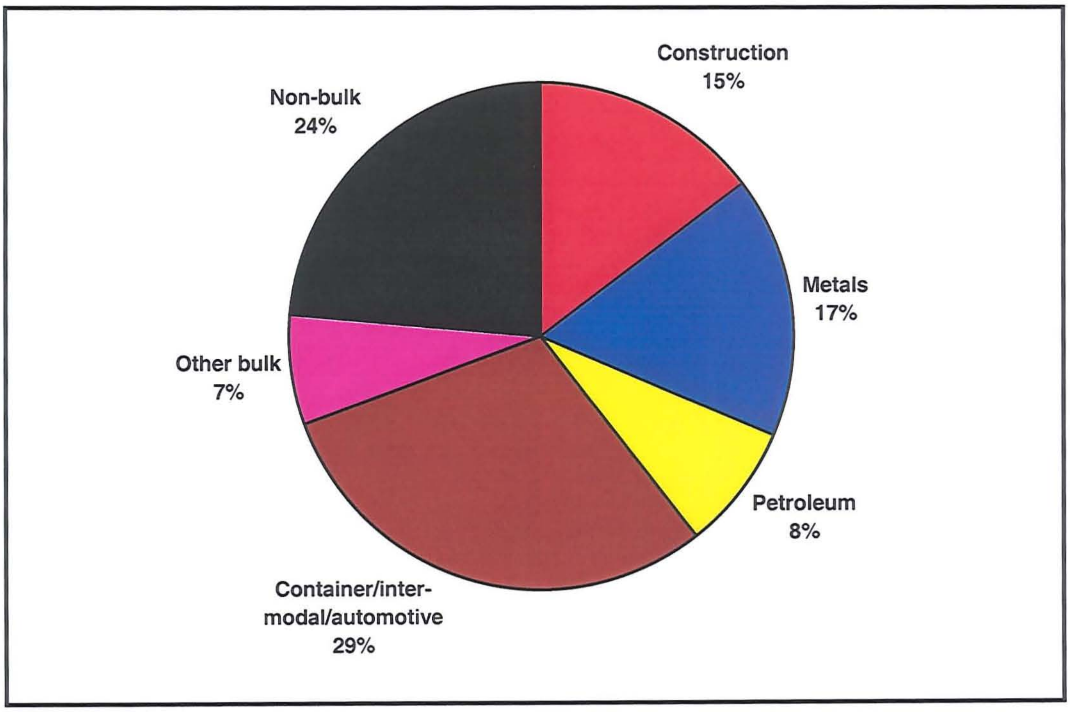
The proportion of services accounted for by the three bulk trainload sectors has steadily declined, from 43 per cent in 1991 to 32 per cent in 2000. As has already been discussed, the construction sector has fared best with only a very marginal decrease in its share of the total number of services. The metals sector's share has declined more significantly, with petroleum faring worst with an almost halving of its proportion.

Figure 5.14: Number of Loaded Services per Week by Sector, 1991



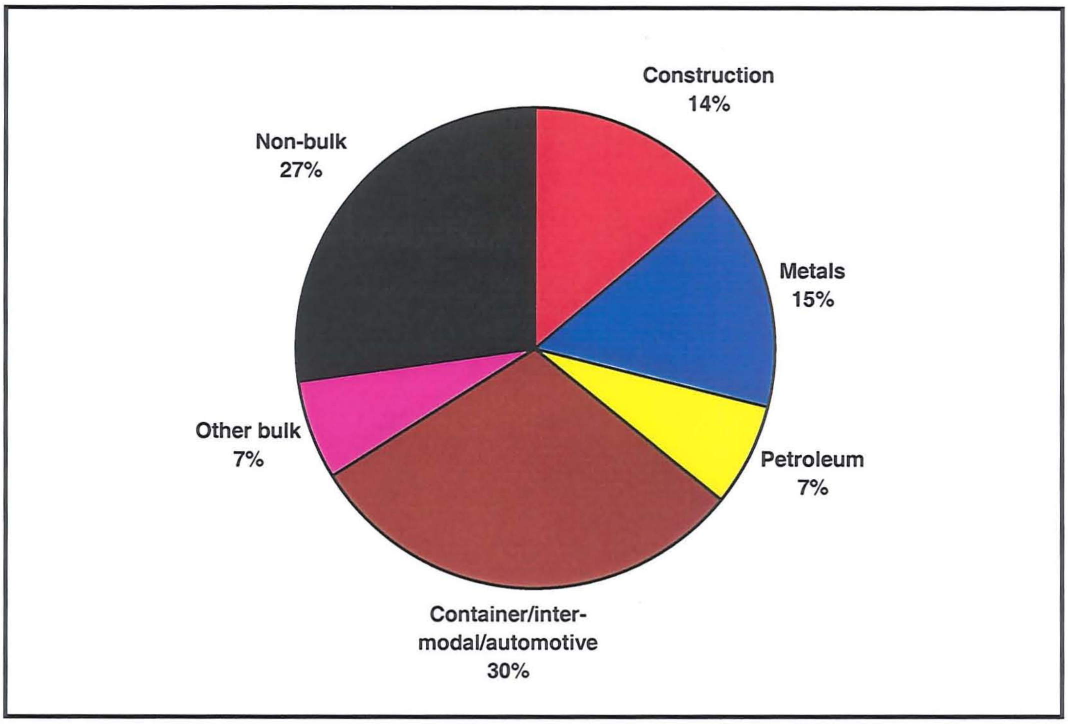
Source: author's database

Figure 5.15: Number of Loaded Services per Week by Sector, 1997



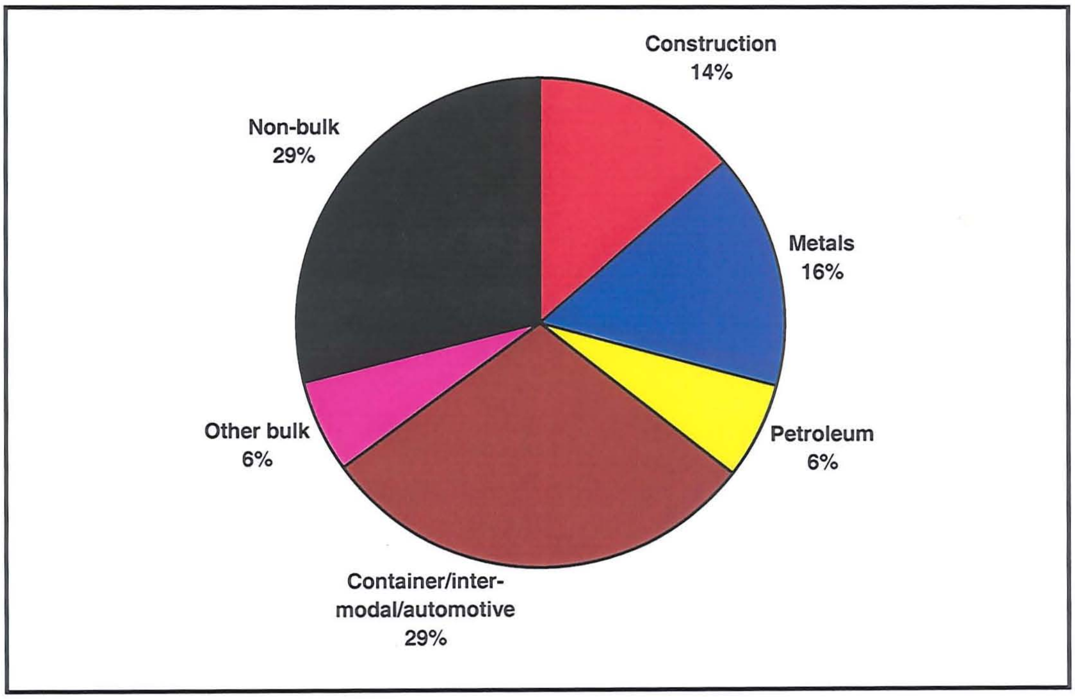
Source: author's database

Figure 5.16: Number of Loaded Services per Week by Sector, 1998



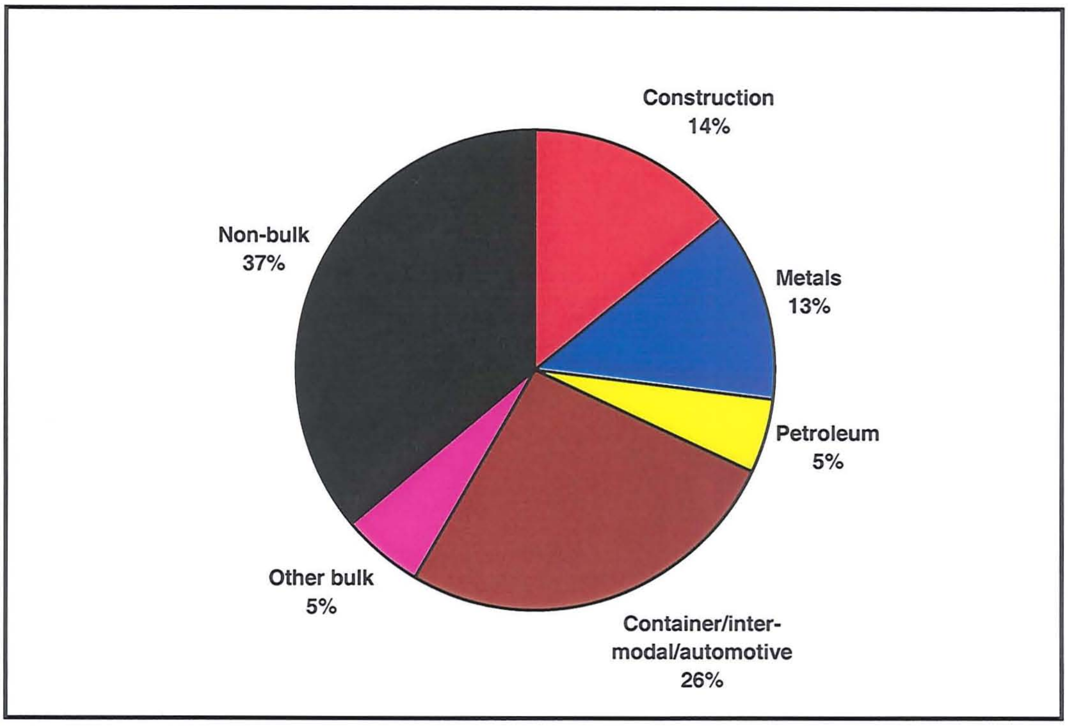
Source: author's database

Figure 5.17: Number of Loaded Services per Week by Sector, 1999



Source: author's database

Figure 5.18: Number of Loaded Services per Week by Sector, 2000



Source: author's database

It is the non-bulk and container/intermodal/automotive sectors that have taken on a much increased significance in rail freight operations, increasing from 53 per cent of the total number of services in 1991 to 63 per cent by 2000. During this period there was an eight per cent decrease in total number of services operated, whereas the non-bulk and container/intermodal/automotive sectors recorded an absolute increase of eight per cent in the number of these services. This is an extremely significant finding, since it provides strong evidence that the rail freight operators are now better geared to serve the wider demands of industry rather than the narrow focus on bulk traffics that was predominant in the early- to mid-1990s. In particular the increase in significance of the non-bulk sector, with the growth of Enterprise, has increased the accessibility of rail freight to industry as a whole and this will be analysed further in Section 5.8.2. Having declined from 32 per cent of all services in 1991 to less than one quarter in 1997, the non-bulk sector has grown and now accounts for 37 per cent of services, a greater proportion than in 1991.

Based on the previous analysis of the container/intermodal/ automotive sector, it is not surprising to find that it too has increased its share of services, from 21 per cent in 1991 to 26 per cent in 2000. It had been higher, at 29 to 30 per cent in 1997 to 1999, but the declines in intermodal and automotive services in 1999-2000 (see Figure 5.6) resulted in the decline.

Other bulk services increased from a share of just four per cent in 1991 to a high of seven per cent in 1997 and 1998, with a subsequent reduction to five per cent. This is a reflection on the fortunes of the wagonload network, since many of the flows in the other bulk sector had historically tended to form part of the Speedlink network. When this was disbanded, the proportion of services classed as other bulk increased, as those flows that remained on rail were largely forced to operate as autonomous services. More recently, many of these flows have been integrated into the Enterprise network as it has expanded both geographically and in terms of service frequencies.

5.8.2 Changes in Origins and Destinations

In addition to the number of services operated, a key factor in terms of the degree of penetration of rail freight across the country is the number of locations served by regular services. For each of the databases, Table 5.3 reveals the number of locations handling non-coal traffic flows on a regular basis. This information should be treated with some caution as it may not be a true representation of the actual number of locations receiving or dispatching traffic. This is because, in many cases, the information sources used for the databases do not distinguish between different terminals that are located in close proximity to each other.

In addition, the number of active terminals provides only an approximate guide to the long term vitality of rail freight. By considering solely the number of operational terminals, only an extremely crude picture of operations can be identified. This is because the databases provide no information on the ownership of terminals, the types of commodities that can be handled or the overall handling capacity of a particular terminal.

Furthermore, not all locations featured in the databases actually deal with originating or terminating traffic flows. The withdrawal of the Speedlink network led to a reduction in the number of operational marshalling yards, where traffic flows did not actually originate or terminate in any case but which feature in the databases. Subsequently, a number of these yards have re-emerged as hubs of the Enterprise network. This will have had only a very slight impact on the number of locations served by non-bulk services.

Perhaps more significantly, there were many terminals that in 1991 were supposedly still active and handling Speedlink traffic but for which no information has been found, so the total for that year may well be under-reported. Unfortunately it has not proved possible to find the historical data necessary to quantify this issue. It seems likely though that many of the terminals missing from the 1991 database were intermediate stops on Speedlink trips, for which information is extremely limited, or were receiving or dispatching traffic on an *ad hoc* basis rather than using regular timetabled services.

Table 5.3: Number of Locations Served by Regular Rail Freight Services in each Database Period, by Sector

Sector	1991	1997	1998	1999	2000
Construction	117	103 *(-12%)*	107 *(+4%)*	106 *(-1%)*	116 *(+9%)*
Metals	61	59 *(-3%)*	66 *(+12%)*	66 *(0)*	66 *(0)*
Petroleum	96	81 *(-16%)*	77 *(-5%)*	74 *(-4%)*	67 *(-9%)*
Container/inter-modal/automotive	47	46 *(-2%)*	46 *(0)*	49 *(+7%)*	49 *(0)*
Other bulk	50	51 *(+2%)*	56 *(+10%)*	48 *(-14%)*	43 *(-10%)*
Non-bulk	130	100 *(-23%)*	128 *(+28%)*	120 *(-6%)*	142 *(+18%)*
Total of above	501	440 *(-12%)*	480 *(+9%)*	463 *(-4%)*	483 *(+4%)*
TOTAL*	384	332 *(-14%)*	363 *(+9%)*	357 *(-2%)*	376 *(+5%)*

* - overall total may be less than sum of components due to some locations (as classified in databases) handling more than one commodity type; percentages give the change between databases for that particular sector/total

Source: author's databases

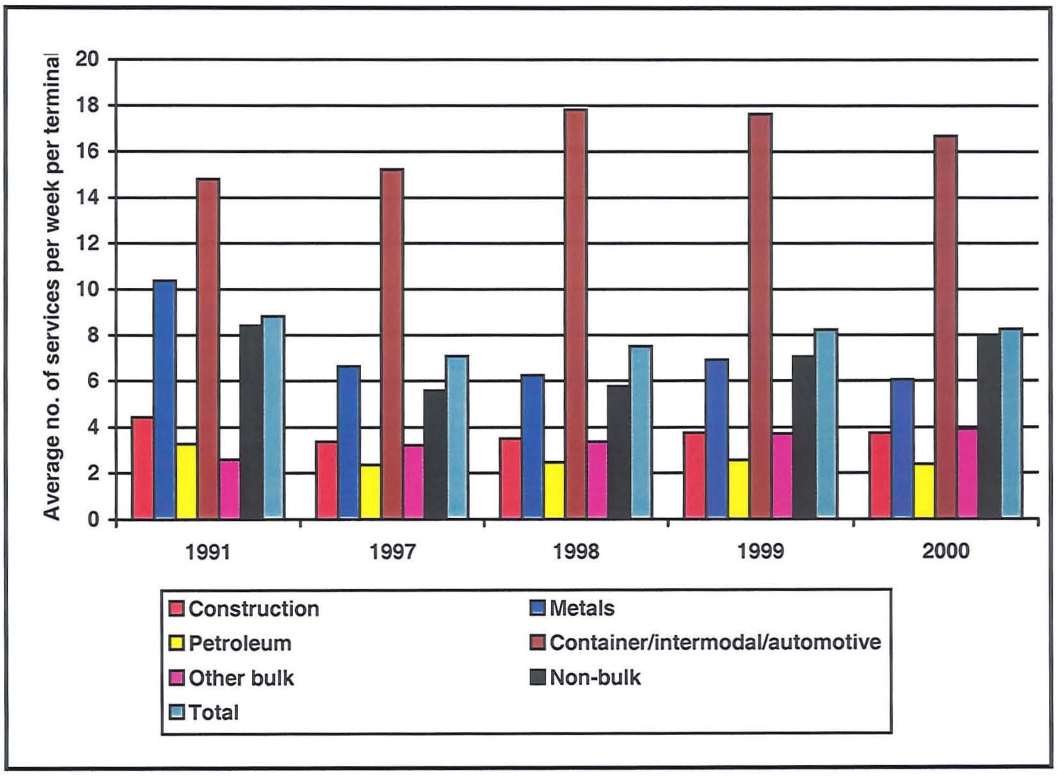
The trend in the number of terminals served by the container/intermodal/ automotive and non-bulk sectors is the most significant for this research, since it is terminals used by these types of train that reflects the range of customers that rail is in a position to serve at each point in time through the networks of general-user services. This issue of accessibility to the network is extremely difficult to quantify, either from the original databases or indeed any other source of information. The nature of rail freight in Britain is that the overwhelming majority of terminals connected to the network are privately-owned and dedicated to specific traffic flows or customers. It is extremely difficult to identify those terminals that are genuinely general-user, though the numbers are certainly minimal. It is only in the container and intermodal sub-sectors where there is a greater degree of access for a wide range of customers. However, the number of terminals served by regular rail freight services does provide a useful general measure of the accessibility of the rail network.

The total number of terminals served in 2000 was still slightly below that in 1991, though if indeed the 1991 figure is under-reported then the difference may still be significant. The rationalisation in rail freight services in the early- and mid-1990s is evident, with a 14 per cent reduction in terminals served between 1991 and 1997. Since 1997 the number of active terminals has increased by 13 per cent, though the eight per cent increase in loaded services in 1998/99 was strangely accompanied by a two per cent reduction in the number of terminals served. Given the nature of the databases and the relatively short time period of the analysis, it is not possible to state whether this change was significant or anomalous.

In general terms, it appears that the number of active terminals is once again increasing, particularly for the non-bulk sector which was hardest hit by the withdrawal of the Speedlink network, providing yet another indicator that rail freight operators are succeeding in broadening the range of flows that they carry. Once again, though, the reclassification of traffic between different sectors over this time period means that the disaggregated statistics should be treated with some caution. This analysis highlights the fluidity of the situation, since new flows and terminals have been added to the network, but at the same time other flows have been lost and terminals have closed down.

Unsurprisingly, the general trends revealed in Table 5.3 are similar to the sector breakdown in number of loaded services per week (see Figure 5.4) for each of the sectors, though the number of terminals served per sector does not entirely correlate to the number of loaded services per week in each of the sectors. This can be seen in Figure 5.19, which shows the average number of services per week per terminal served.

Figure 5.19: Average Number of Loaded Services per Week to Each Terminal, by Sector



Source: author's databases

The overall trend shows a drop in the average number of services per week to each terminal, though this is actually a result of a sharp decline between 1991 and 1997, with annual increases between 1997 and 2000. On average, each terminal received seven per cent fewer weekly services in 2000 than it did in 1991. If rail freight is to serve more customers then it would perhaps be expected that the average number of services per terminal would decrease, since this would reflect a more dispersed network catering for smaller volume flows. What is actually happening, though, is that the growth in the number of services is outstripping the increase in the number of terminals, so that the network is becoming more focused through the increased use of existing terminals. This is outweighing the overall growth in activity through the addition of flows to and from new terminals.

Even in the non-bulk sector, with its role of serving the less-than-trainload market, the average number of services per terminal has increased and, surprisingly, is higher than that for any of the traditional bulk sectors. This figure is significantly skewed by the use of the hub-and-spoke Enterprise network, with its marshalling yards which generate significant train movements. When the trunk services between marshalling yards are removed, the average number of services per terminal is between 25 and 30 per cent lower in each of the databases, but the overall trend is still the same. Thus the growth in non-bulk services that has taken place since 1997 has maintained the existing degree of intensity, with most terminals being served each weekday, rather than being new terminals being served less frequently.

The other sector geared towards a broader range of potential customers than the traditional bulk sectors (i.e. container/intermodal/automotive) has a significantly greater average number of services per terminal than any of the other sectors. This increased between each of the first three databases, but has declined slightly between 1998 and 2000. This reflects the development of the intermodal network following the opening of the Channel Tunnel and the subsequent period of decline since 1998, as well as the introduction of relatively low frequency services to the additional terminals on the Freightliner network. Since the total number of terminals served by this sector has remained fairly static, there is little evidence that access to these services has become any easier either in terms of increases in the frequency of services to existing terminals or a significant overall growth in the total number of terminals.

Overall, the evidence suggests that the growth in rail freight services that has occurred in recent years has been a result of the combination of an increase in the number of services to existing terminals and an overall increase in the number of terminals. The addition of new terminals to the network has occurred at the same time as the average number of services per terminal has increased, so the new additions would generally appear only to materialise if they can justify services on most weekdays.

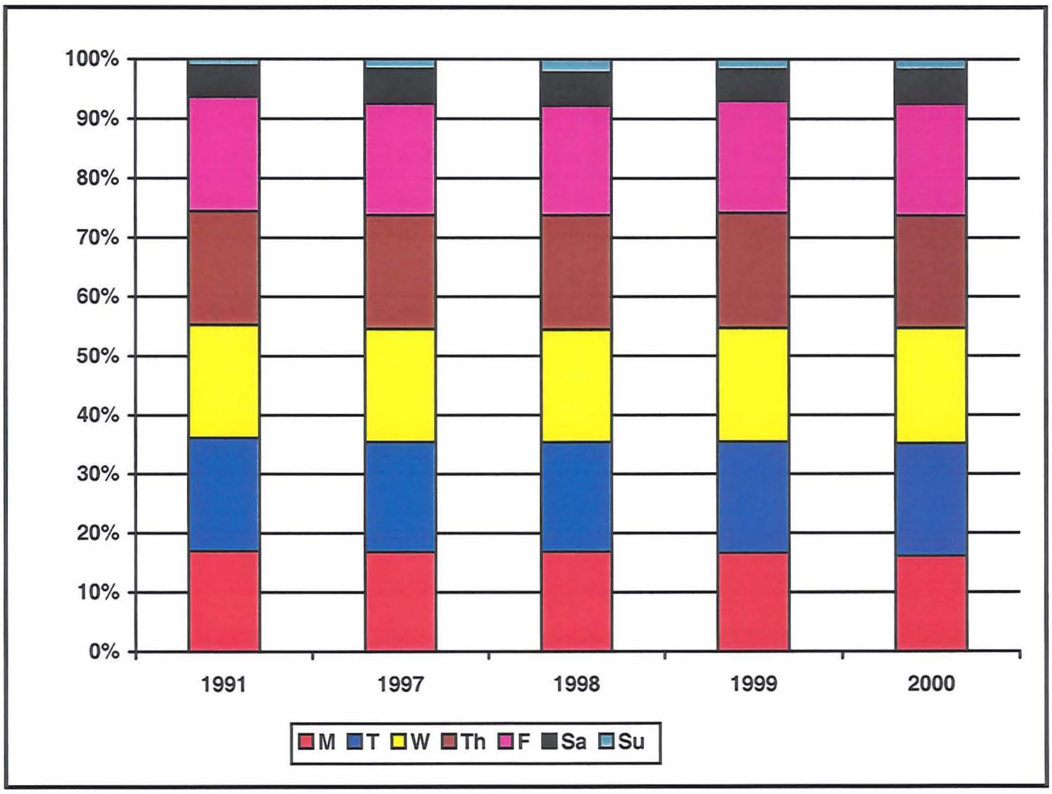
This is a sensible growth strategy for the rail freight operators, focusing on relatively high volume flows, since it avoids the pitfalls of the Speedlink network which was brought down by the small volume feeder flows from dispersed terminals. However, there is little evidence from this analysis that the rail network has become more accessible to industry at large. Anecdotal evidence suggests that increased service frequencies to some of the general-user terminals, such as Aberdeen Guild Street and Ely, have attracted new flows and commodities but the information in the databases unfortunately does not allow the extent of these increases to be tested since it is service-specific rather than flow- or commodity-specific.

In conclusion, Railtrack has protected a total of 88 sites across the British network that it considers to be of strategic importance for growing the rail freight business in the future (Railtrack, 1997). In addition to this, many of the other locations that have lost their traffic flows in recent years still have connection agreements so could feasibly see the resumption of wagonload or trainload services. In total, there are over 1,700 locations across the network that Railtrack considers to be suitable for freight, so there is great potential for growth. Many of the redundant locations are unlikely to be reused for rail freight, however, because they were previously used for flows to and from now extinct industrial premises.

5.8.3 Changes in Operating Periods

Another measure that may provide an indication of the responsiveness of the rail freight industry to the general changes in logistics operations is the proportion of rail services operating on each day of the week. In particular, as industry has tended to move from five day to seven day per week operation, it is of interest to examine whether the supply of rail freight services has adapted to this change and this is shown in Figure 5.20.

Figure 5.20: Breakdown of Loaded Services, by Day of Week



Source: author's databases

As can be seen, the trend is inconclusive. The proportion of services operating at the weekend has increased slightly, from six per cent in 1991 to seven per cent in 2000, accounted for primarily by an increase in the proportion of services operating on a Sunday. However, over 90 per cent of services have consistently been operating during the traditional five day working week, with only slight fluctuations from year to year and no clear trend can be seen to be emerging. Thus the growth in rail freight services in recent years has basically occurred during the traditional operating period and there has been only a marginal increase outwith this period.

5.8.4 Changes in Freight Train Speeds

One further measure of the extent by which the supply of rail freight services has been adapting to changing logistical circumstances is in terminal to terminal journey times. There are many elements to this, with the main ones being:

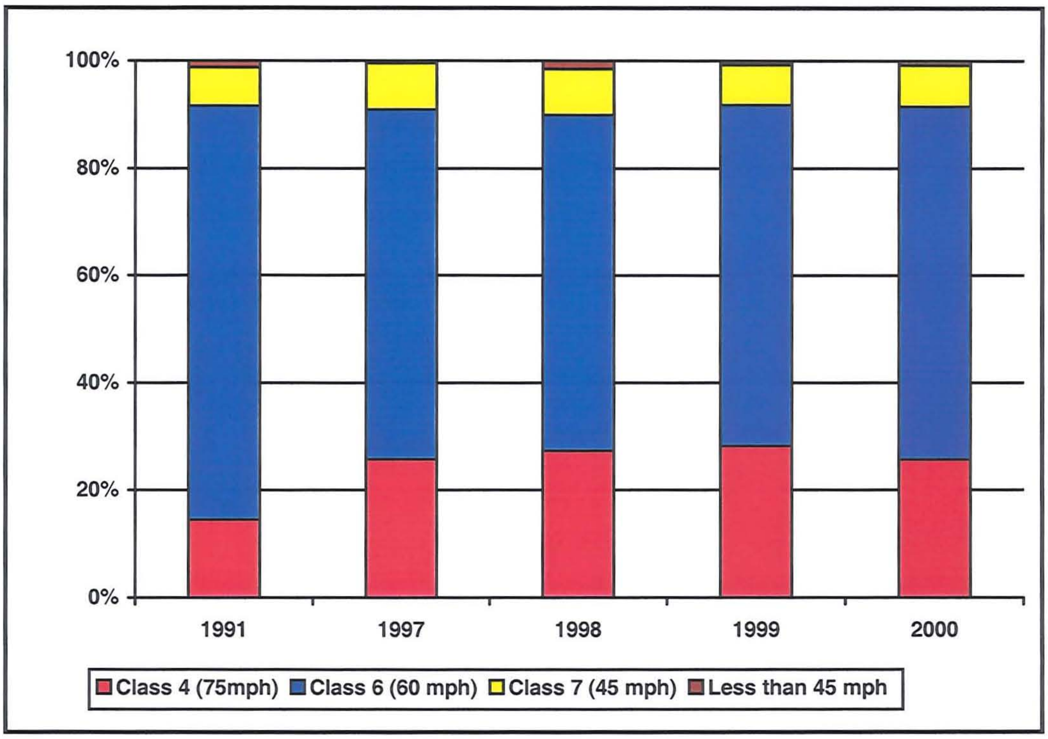
- the operating speed of the service;
- the number of stops en route for attaching and detaching traffic (and the length of time of these stops);
- and the number of times the service has to be held in passing loops for the passage of faster trains, together with the length of each of these stops.

From the databases, it is possible to analyse changes in the operating speeds of services, since all services are allocated a particular running code which incorporates details of the Class of the train. This defines the maximum speed at which that service may run. Scheduled freight services operate at one of four different speeds, as follows:

- Class 4: maximum operating speed of 75 miles per hour (mph).
- Class 6: maximum operating speed of 60 mph.
- Class 7: maximum operating speed of 45 mph.
- Class 8: maximum operating speed of 30 mph.

Figure 5.21 shows the proportion of services operating at each of these speeds for the five databases.

Figure 5.21: Breakdown of Loaded Services, by Class of Train



Source: author's databases

The proportion of services operating as Class 4 trains has increased since 1991, with increases in each of the periods except 1999-2000. For many years now, all Freightliner services have operated as Class 4 trains, as have the Channel Tunnel intermodal services that have been running since the mid-1990s and many automotive trains. Virtually all other freight services, including traditional trainload and wagonload ones, have however been limited to a maximum operating speed of 60 mph or less. Thus it would be expected that the trend in Class 4 would closely mirror that of the container/intermodal/automotive sector and comparison between Figure 5.21 and the series of pie charts of the breakdown of the number of services by sector in each year (i.e. Figures 5.14 to 5.18) shows that this is indeed the case.

There has been a growing number of services in other sectors that have been operating on Class 4 timings and, though they are negligible in absolute terms, they mark a significant development in terms of rail freight provision. June 1997 saw the introduction of the first domestic EWS intermodal service on Class 4 timings, the result being shortened journey times designed to compete with road transport. As Table 5.4 shows, the scale of reduction has been significant, with time savings of around 40 per cent between London and Glasgow. This has been achieved by the greater operating speed and reductions in marshalling time *en route*. This new higher speed service is only available to certain traffic types though, since much of the rolling stock currently in use cannot operate at 75 mph. Much of the growth in rail freight is expected to be intermodal, using equipment designed to run at this speed, and new wagons being considered for other traffic flows are likely to be able to operate at speeds of at least 75 mph.

Table 5.4: Journey Time Reductions for Anglo-Scottish Enterprise Services

Route	60mph time (hrs)	75mph time (hrs)	Percentage change
Mossend (Glasgow) - Wembley (London)	12.75	8.0	-37%
Wembley (London) - Mossend (Glasgow)	13.5	8.0	-41%

Source: author's databases

This initial domestic 75 mph service has been followed by the development of a number of other intermodal services, resulting in a limited network of such services having developed by 2000. The resulting time savings from these service accelerations, plus the fact that a number of the new Class 4 intermodal services are new routes, mean that rail should be able to compete much more effectively with road movements where time is a critical factor. Many of the recent traffic gains, particularly on the Anglo-Scottish routes, reveal that there are new flows that are traditionally assumed to be very time-critical, albeit many of them only on a trial basis. For example, Safeway has undertaken trials with EWS between Daventry and Mossend using intermodal wagons carrying cargoes such as wine, mineral water and canned products. Superdrug has also made use of EWS for the overnight transfer of a wide variety of toiletry products between Wakefield and Mossend, though this was on the 60 mph standard Enterprise service. These retail examples highlight the possibilities for rail to be used for the trunk haul of such commodities, with road haulage handling the secondary movements. Freightliner has also made slight inroads into the domestic container market, complementing its traditional deep-sea flows. Overall, though, only a very small number of domestic services have been introduced as or upgraded to Class 4 operation to date.

5.9 Summary

The analysis of the databases constructed for the purposes of this research has revealed the nature of the changes that have taken place in the provision of rail freight services through the 1990s, in particular the more detailed trends resulting from the annual databases between 1997 and 2000. The reversal since the mid-1990s in the long-term decline in tonnes lifted and moved by rail that is evident from the published statistics has also been found in the key database measure, that of number of loaded services being operated. To satisfy the aims of this research, the number of services together with the number of terminals served are key indicators of the extent to which rail freight provision is addressing the demands of wider markets than the traditional bulk commodities.

While the trends that have been analysed are not entirely clear, and the longevity of those trends that are emerging is not necessarily guaranteed, the overall picture is one of a broadening of the customer and commodity base of rail freight services, as well as the strengthening of some of rail's traditional markets. In particular, there has been a growth in the significance of wagonload services, to the extent that they now account for a greater proportion of all services than in 1991, having dropped significantly in the intervening period.

The container/intermodal/automotive sector has also increased in significance over the time period, though with a decline between 1999 and 2000. The growth in this sector, together with certain other targeted developments, has seen a general increase in the proportion of services operating at 75 mph rather than 60 mph or less.

Other measures have not revealed such significant changes in the provision of services. The decline in the number of locations served by regular services has been reversed, though the trend has been erratic, and there is no evidence that freight services are catering for seven day operations to a significantly greater extent than in previous years.

To conclude, the analysis of the databases has provided a significant insight into the changing nature of the supply of rail freight services in Britain between 1991 and 2000 and this will prove invaluable in the analysis of the requirements of industry and the likelihood of rail being able to satisfy these requirements in order to gain a greater share of the freight market.

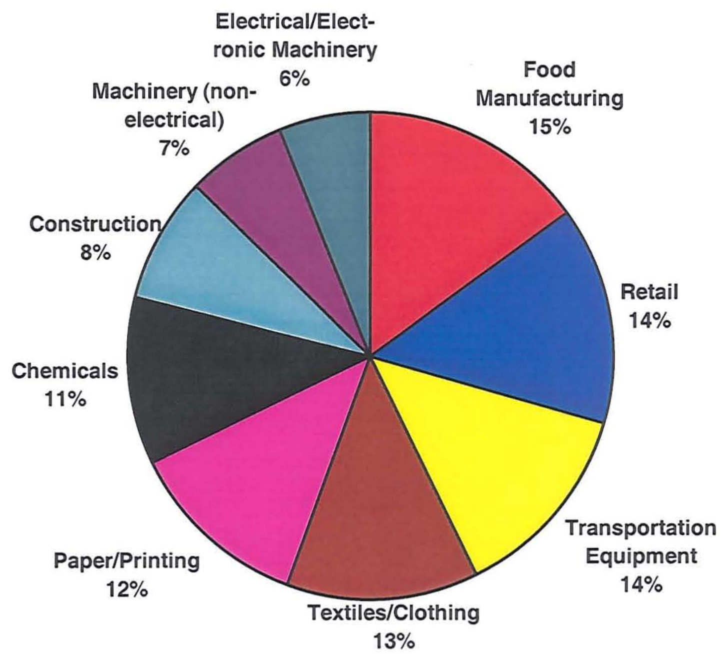
CHAPTER SIX: LOGISTICS TRENDS IN INDUSTRY AND THEIR IMPACTS UPON THE USE OF RAIL FREIGHT

6.1 Introduction

Through analysis of the rail freight databases, the previous chapter examined the main changes that have been occurring in the last decade in terms of the provision of rail freight services for the use of both existing and potential customers. This chapter is concerned with the attitudes of industry to the use of rail freight, through the analysis of the questionnaire that was distributed in early-1999 to a sample of manufacturers and retailers. The methodological issues surrounding the design and implementation of the questionnaire were discussed in Section 4.3.

The first section of the chapter considers the general statistical analysis of the responses to the questionnaire, in terms of the key characteristics of the companies involved. Figure 6.1 shows the breakdown of the 133 responses based upon the industrial sector in which the respondents' companies were classified. This highlights the variations in responses from the different sectors and was of importance in the decision on which sectors to target for the in-depth interviews. This was addressed in Section 4.6. The majority of the analysis in this chapter is at the aggregate level, since the sample sizes for individual sectors are not sufficiently large to support detailed statistical analysis. However, more detailed quantitative and qualitative analysis of certain of the sectors is a key part of the hypothesis testing in Chapter Seven, where the information supplied in the questionnaire responses is supplemented by the interview material.

Figure 6.1: Breakdown of Questionnaire Respondents, by Industrial Sector



Source: author's questionnaire survey (total number of respondents(n)=133)

The questionnaire responses are then analysed and discussed in the context of the research aims, basically in terms of determining attitudes to rail freight and the importance of supply-side changes and other factors (e.g. logistical requirements, government policy, road congestion) when making decisions on whether or not to use rail. This analysis also incorporates further investigation of the general characteristics of respondents' companies whilst in the context of the main research issues. Specifically, the chapter breaks down into the following sections:

- Existing and previous levels of usage of rail freight, including types of services and operators used and reasons for any changes in level of usage.
- Predictions of usage of rail freight services in the future, reasons for likely changes and types of services likely to be used.

- Nature of mode choice decision-making process, including responsibility for making decisions and the method by which the mode of transport is chosen.
- Factors influencing the choice of rail in mode choice decision-making.
- Logistical factors affecting the overall demand for freight volumes, including analysis of how the importance of individual factors have changed since 1993.
- Significance of rail freight in constraining growth of road freight, both at the present time and predictions for the future.

It is only with this understanding of the attitudes and logistical requirements of industry that the changes that have been taking place in the provision of rail freight services in recent years can be adjudged to be addressing the demands of industry and have the potential to significantly impact on the way in which those responsible for freight movements choose rail rather than road for their needs. This is developed fully in Chapter Seven.

6.2 General Statistical Analysis of Questionnaire Respondents

Prior to the detailed consideration of the questionnaire responses, this section provides background information concerning the general characteristics of the companies that responded to the survey. This information is then used in the remainder of the chapter when analysing the detailed responses to the key issues. Table 6.1 reveals that almost two thirds of respondents completed the questionnaire on behalf of their company, with the remainder only providing information relating to their own particular division for which they had responsibility.

Table 6.1: Breakdown of Questionnaire Respondents by Organisation Type

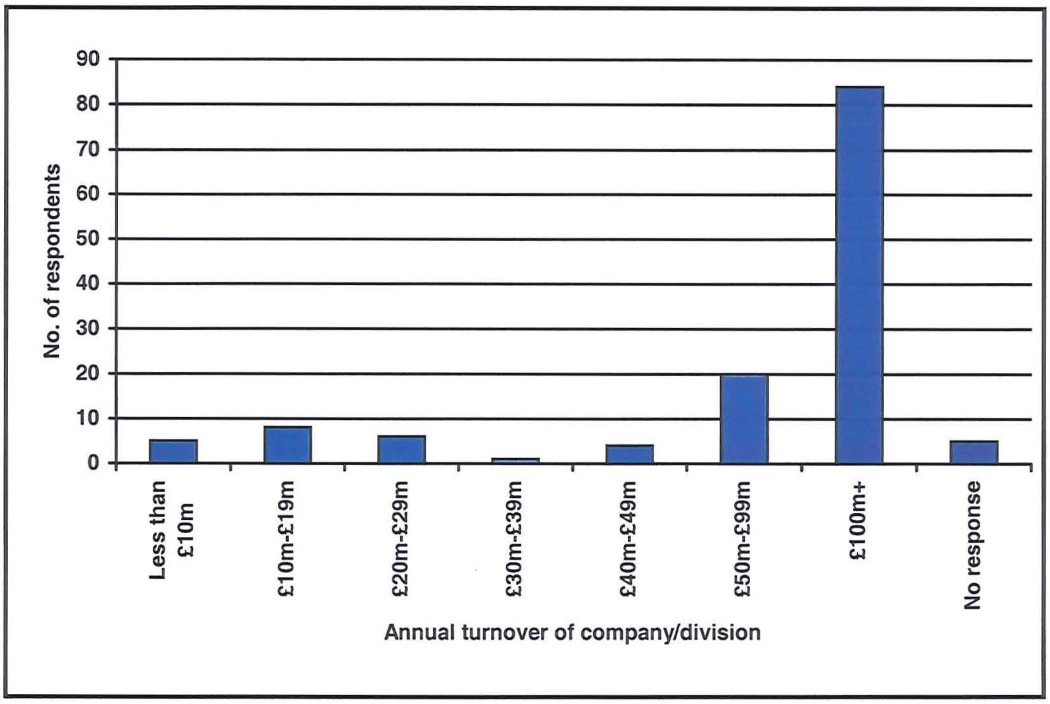
	Frequency	Percentage
Company	85	63.9
Division	45	33.8
No response	3	2.3
TOTAL	133	100

Source: author's questionnaire survey (n=133)

The intention of the questionnaire survey had been to gather information about companies as a whole, but given the nature of the sampling procedures it was recognised that this would not always be possible. In any case, particularly with the larger companies, responsibility for logistics and transport is often devolved to the divisional level. This is especially the case where large companies are involved with many different commodities or operate from a large number sites, or indeed a combination of these two with commodity-specific locations as part of the overall organisation.

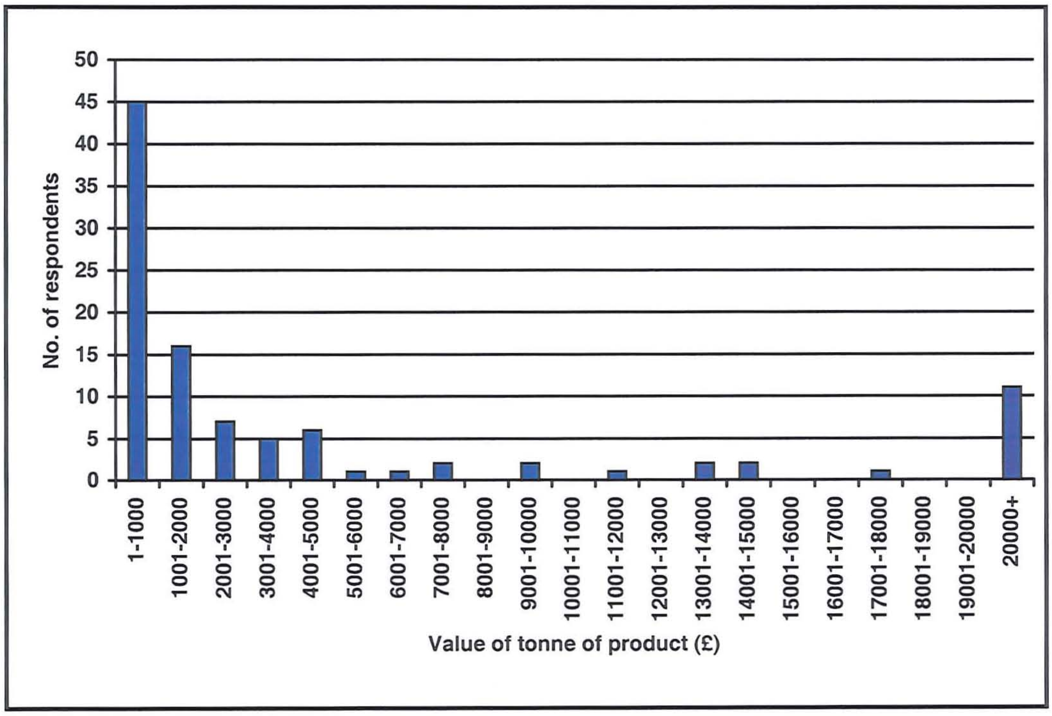
With the sampling procedures being based upon selection of the largest companies in each of the different sectors, it is not surprising that approximately one third of these companies have devolved transport responsibility to a divisional level. However, this does not detract from the scale of the transport operations covered by the respondents. As Figure 6.2 shows, 78 per cent of companies or divisions included in the survey have an annual turnover in excess of £50 million, with over 80 per cent of these having a turnover greater than £100 million per annum. Less than 10 per cent of the companies or divisions had an annual turnover of less than £20 million.

Figure 6.2: Breakdown of Questionnaire Respondents, by Annual Turnover



Source: author's questionnaire survey (n=133)

Figure 6.3: Breakdown of Questionnaire Respondents, by Value Density of One Tonne of Product



Source: author's questionnaire survey (n=102)

Of course there is not a direct correlation between turnover and volume of goods to be moved, since the value density of materials (i.e. £ per tonne) moved will influence the total volume. Figure 6.3 reveals the approximate value of one tonne of product, which varies significantly between respondents.

Of those respondents who provided information in response to this question, the average value of one tonne of product was just over £30,000. What is more interesting and relevant, though, is the dramatic polarisation of the range of values across the whole survey, with a standard deviation of £135,000 around the mean. Almost half of those who responded stated that the average value was less than £1,000 per tonne for their company, with 13 providing a value of less than £100 and the minimum being just £8 per tonne. At the other extreme, just 11 respondents reported values in excess of £20,000 but three of these exceeded £500,000 per tonne and it is this small number of large values that affects the overall mean.

This is only a crude measure of value density, since it focuses upon the product(s) of the company and this may not truly represent the value density of inward or inter-site movements in which the goods being moved may have considerably different value densities to that of the final product. However, value density of product was a measure that could realistically be obtained from a questionnaire survey and it does at least provide a consistent measure across the whole range of respondents. Having said that, only three quarters of respondents were able and willing to provide a figure in response to this question, though several of the remainder gave a range of values to reflect their circumstances.

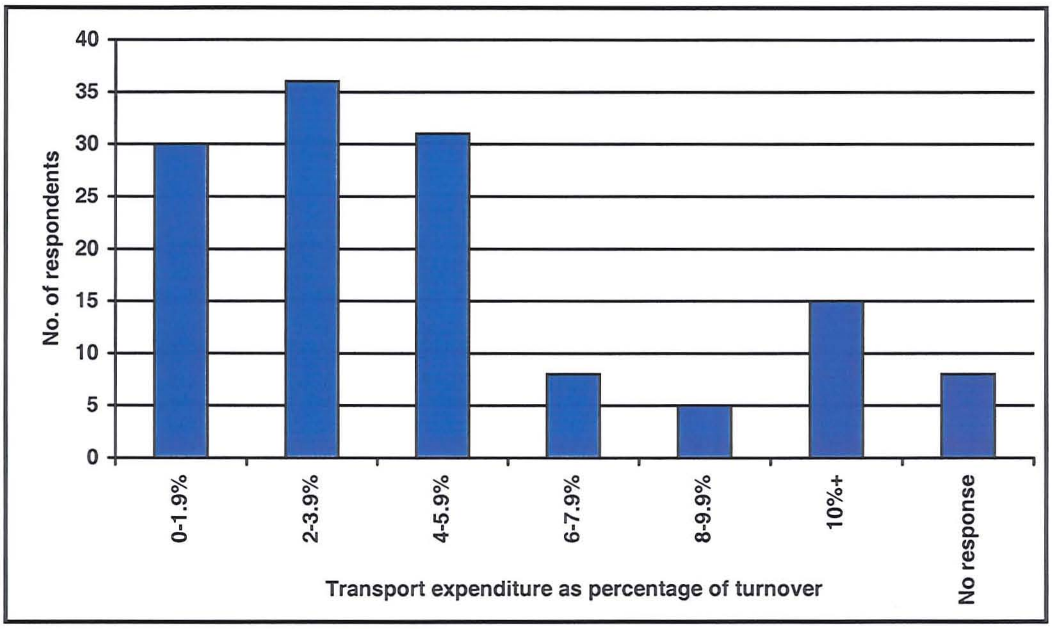
Whether those that provided no response did so as a result of a lack of knowledge of the value density of their goods or due to reasons of commercial confidentiality is not clear from the survey, though those companies that were later interviewed tended to have only limited or no information on this matter.

Unlike other measures related to freight movement, value density appears to be used only rarely by companies in the analysis of their operations, presumably since primarily it is an academic measure rather than being something that logistics/transport managers have any control over and which could be influenced to improve logistical efficiency.

A cost-based measure that is related to value density but is perhaps more revealing is that of expenditure on transport as a proportion of turnover. This too varies significantly within the group of respondents as Figure 6.4 shows. Over half of those providing information reported that transport expenditure was less than four per cent of turnover, while just over 10 per cent of respondents reported that it represented more than 10 per cent of their annual turnover. The nature of the product, in terms of its value density, is one of the factors affecting transport expenditure. There is a statistically significant correlation, though it is not particularly strong.

Other factors that may be relevant include the complexity of the network of locations to be served as part of the logistical operation and the geographical spread of activity of the company. The evidence from this survey suggests that neither of these are significantly correlated with transport expenditure as a proportion of turnover. In reality, each company will have a unique set of circumstances, based on the factors already mentioned and others, that affect their transport expenditure.

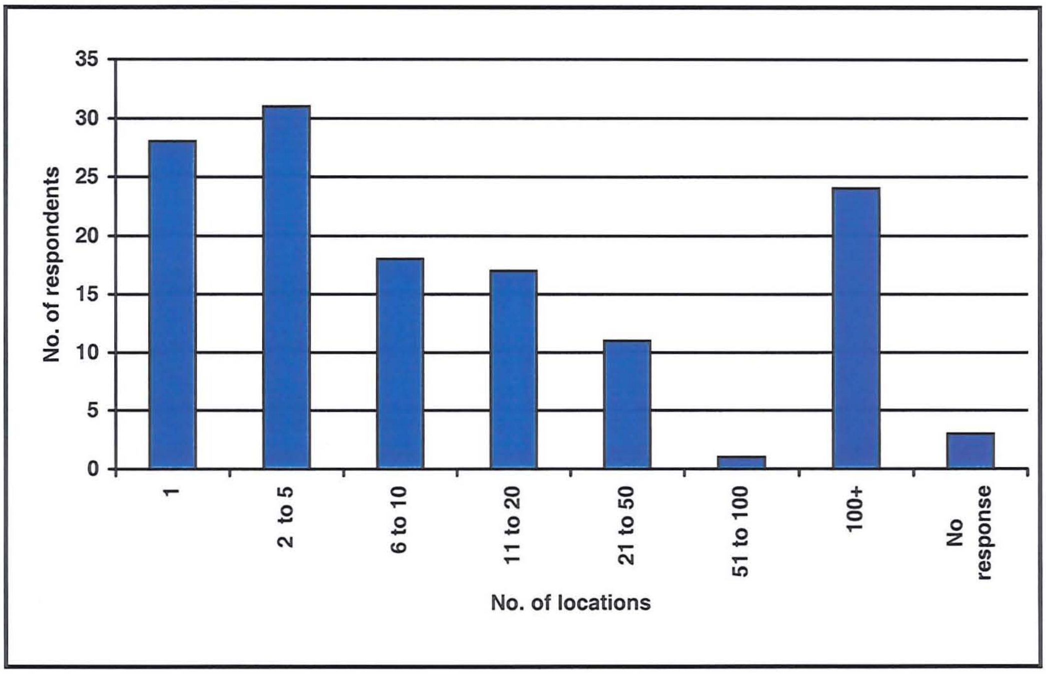
Figure 6.4: Breakdown of Questionnaire Respondents, by Transport Expenditure as a Percentage of Turnover



Source: author's questionnaire survey (n=133)

In Figure 6.5, the number of locations that each respondent has responsibility for is shown. Again, this shows a great degree of polarisation. Over 20 per cent of respondents were dealing with just one single location, with a similar proportion only covering two to five sites. At the other extreme, though, almost 20 per cent of respondents had operations that covered more than 100 sites. Only one fifth were responsible for between 11 and 100 locations.

Figure 6.5: Breakdown of Questionnaire Respondents, by Number of Locations Each Respondent has Responsibility for

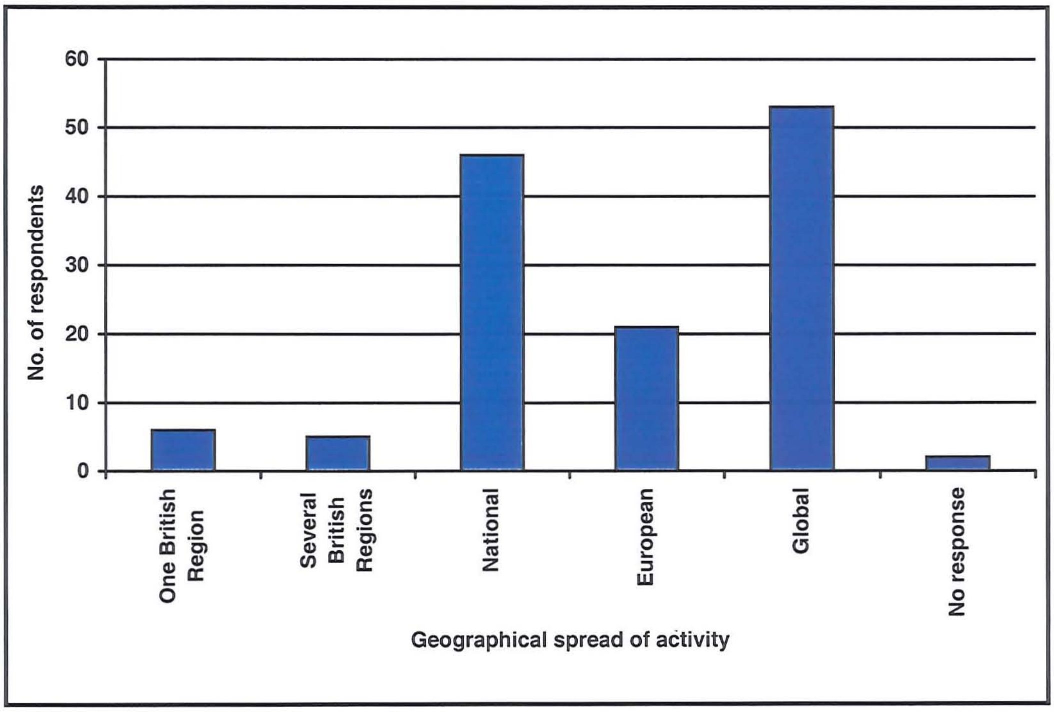


Source: author's questionnaire survey (n=133)

The geographical spread of activity can be seen in Figure 6.6, which provides an interesting insight into the sphere of operations of the companies involved. Just over half of all companies had international operations which is to be expected when sampling the largest firms. The majority of those operating internationally classified themselves as being global in nature. Around a third stated that their geographical scale of activity was at the British level, while only a small minority (eight per cent) classed their spread of operations as being more limited than this.

Also relevant to the nature and scale of the transport operations is the issue of the specific types of freight movements that are handled by those responding to the questionnaire. The way in which the questionnaire was distributed, to the "Logistics/Distribution Manager" of each company targeted, meant that there was no means by which the recipient could be pre-determined. The nature of transport operations means that, particularly in the largest companies, there are often two or more managers with responsibility for the transport elements of the parts of the supply chain covered by an individual company.

Figure 6.6: Breakdown of Questionnaire Respondents, by Geographical Spread of Activity



Source: author's questionnaire survey (n=133)

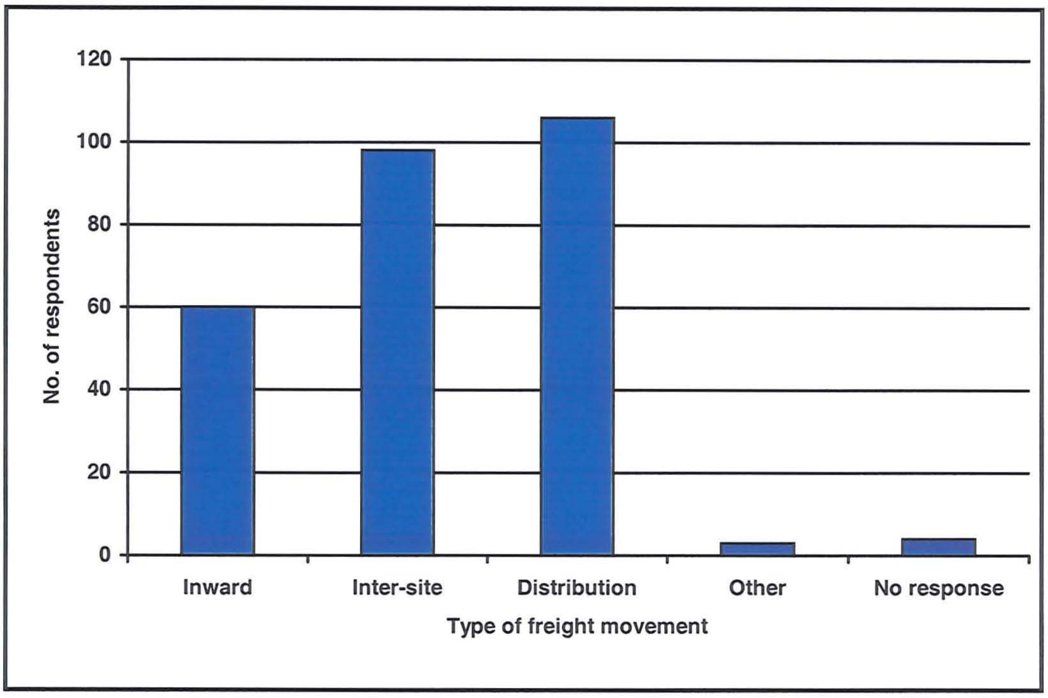
As a result, Figure 6.7 identifies the types of freight movement handled by respondents, broken down into the number of respondents having responsibility for the three key stages in their companies' segment of the supply chain. 35 per cent of those answering this question had overall responsibility for all movements, covering inward flows of materials, inter-site traffic and the distribution of products to customers. A further 30 per cent handled all inter-site and distribution flows and another 16 per cent covered only the distribution function. In total, therefore, 81 per cent of respondents were responsible for distribution and the vast majority of these also dealt with internal inter-site movements.

This represents the traditional focus of companies on the movements that are internal to their system or downstream of their position in the supply chain, with the inward movements being left in the hands of their suppliers. That said, almost half of the respondents oversaw the inward movements to their premises, primarily as part of the overall coverage of their part of the supply chain discussed above, but eight per cent of companies had responsibility only for inward or inward and inter-site flows.

A negligible number of companies also identified their responsibility for other types of movements, primarily waste flows. This issue of supply chain responsibility and trends that have been occurring or are likely to occur in the future is something that is returned to in the in-depth interviews (see Chapter Seven).

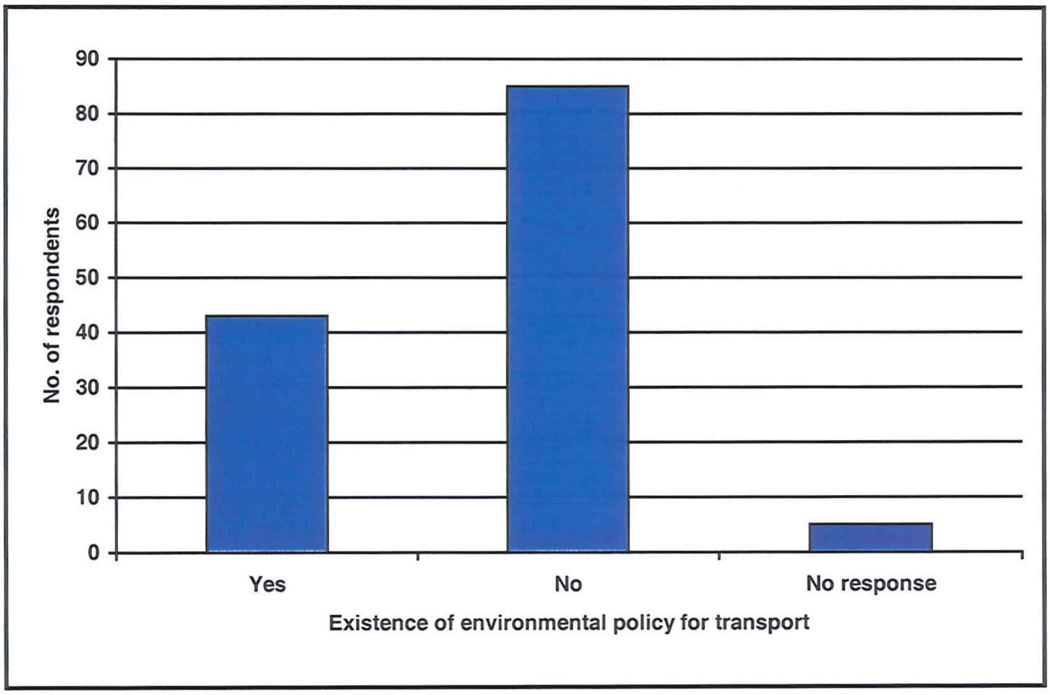
The final general question related to the existence of a company environmental statement to cover the transport-based operations. Despite the high profile attention that the impacts of transport on the environment currently receives, only one third of respondents' companies actually have such a statement referring to their own activities (see Figure 6.8).

Figure 6.7: Breakdown of Questionnaire Respondents, by Type of Freight Movement



Source: author's questionnaire survey (n=133)

Figure 6.8: Breakdown of Questionnaire Respondents, by Existence of Environmental Statement Covering Transport Operations



Source: author's questionnaire survey (n=133)

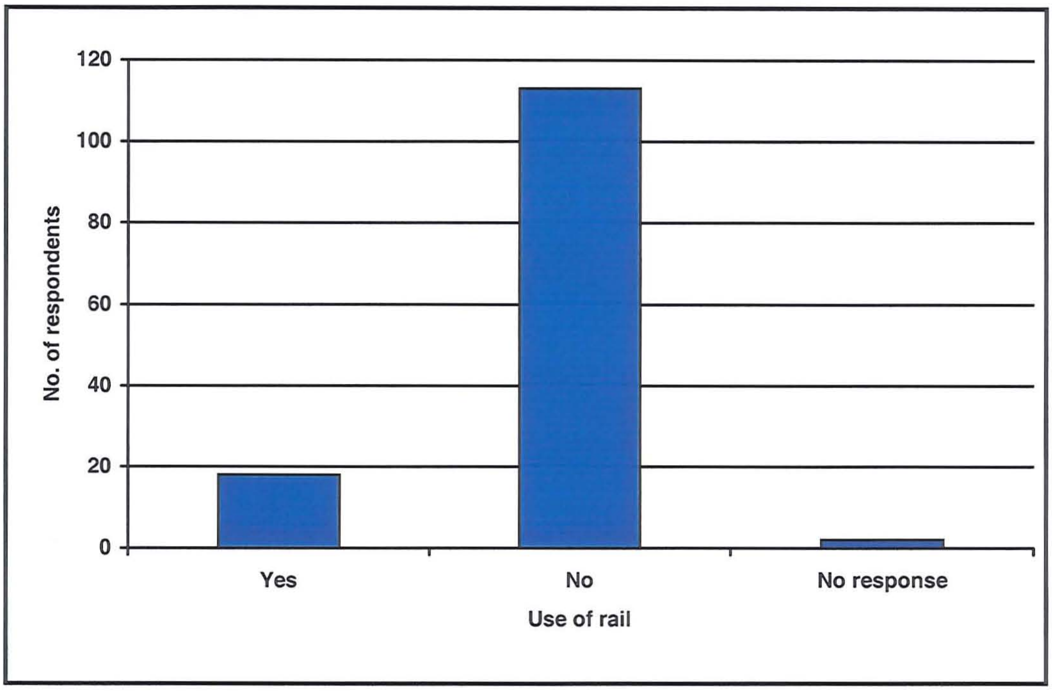
Overall, the analysis of the general company-based information has revealed that the survey is on a broad range of organisations, with great variations between their key characteristics. This therefore reflects the intention of the questionnaire survey to represent the trends and views of industry in Great Britain as a whole and allow aggregate-level analysis of the issues raised in the questionnaire, in particular the factors affecting whether or not rail is used currently or is likely to be used in the future.

6.3 Use of Rail Freight

Issues of fundamental importance to the analysis of the questionnaire survey are the proportion of the companies included in the sample who are currently making use of rail, together with those who have stopped using rail freight services in recent years and the likelihood of companies starting to use rail in the near future. This section deals with each of these in turn, examining the key factors that have been affecting or are likely to affect the use of rail.

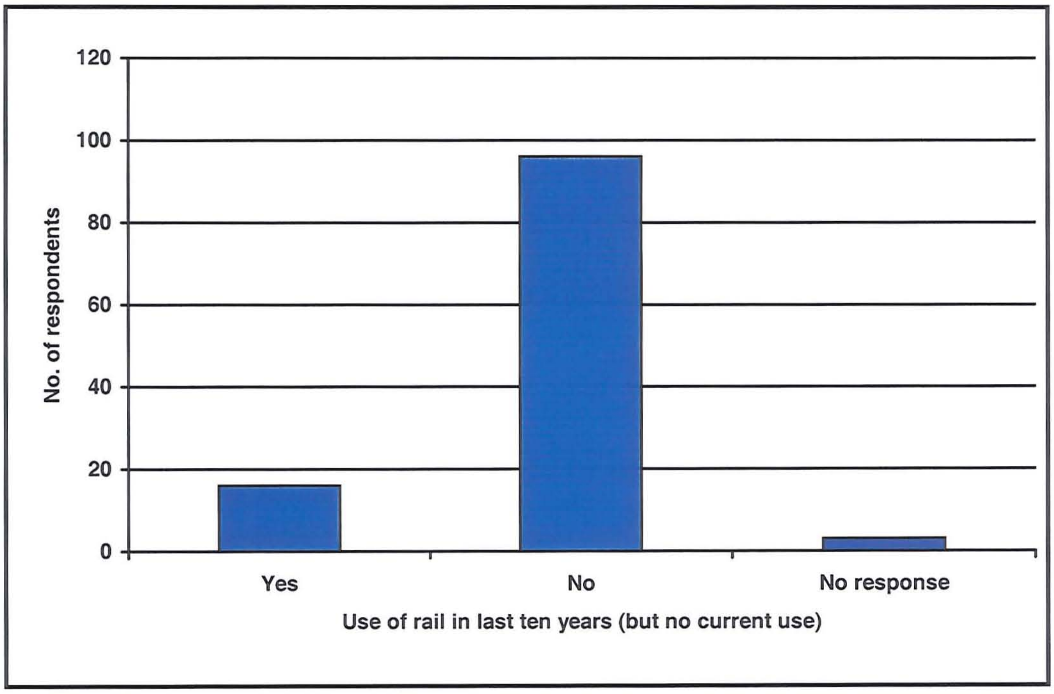
Only 18 respondents (i.e. 14 per cent) are currently using rail freight services in Great Britain, as can be seen in Figure 6.9, though a further 16 (i.e. 12 per cent) companies had been using rail but have ceased this use in the last 10 years. Three quarters of those included in the survey therefore have no experience at all of using rail in the last 10 years.

Figure 6.9: Current Use of Rail Freight by Questionnaire Respondents



Source: author's questionnaire survey (n=133)

Figure 6.10: Use of Rail Freight in Last 10 Years by Questionnaire Respondents not Currently Using Rail



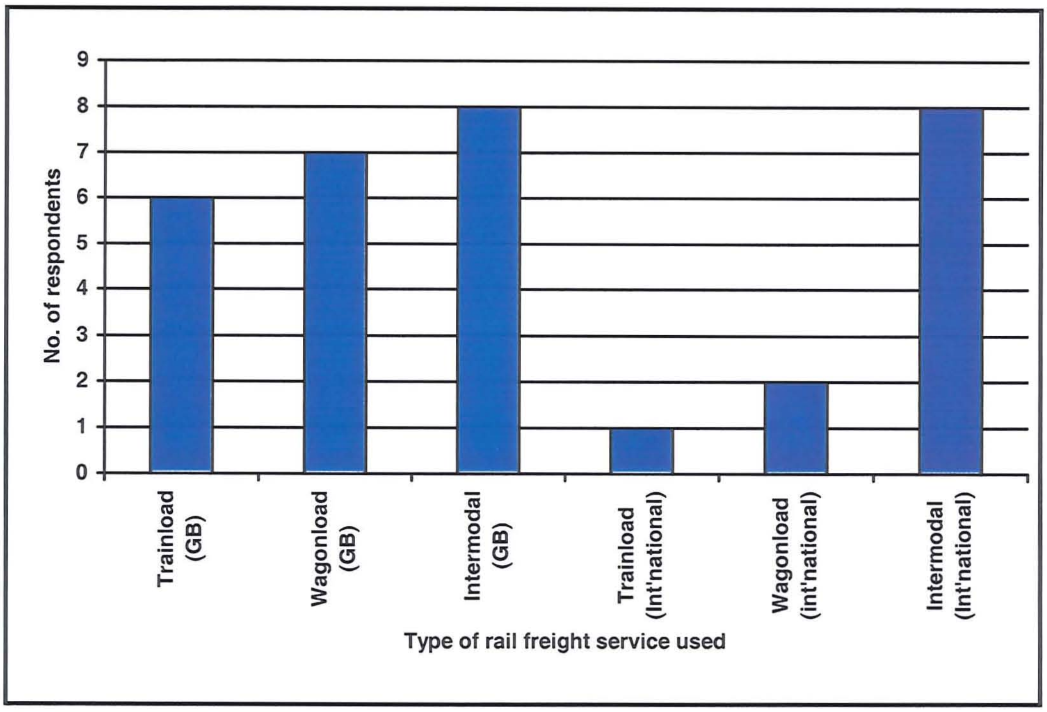
Source: author's questionnaire survey (n=115)

The use of rail is fairly concentrated rather than being uniformly spread across industry, since 17 of the current users are from just three of the industrial sectors (i.e. chemicals, construction and paper/printing), together with some retailers. Of those that have ceased using rail in the last 10 years, just six of the 16 were from these same sectors. Seven of the others were from the food manufacturing sector, which has no current users in the questionnaire sample.

6.3.1 Current Users of Rail Freight Services

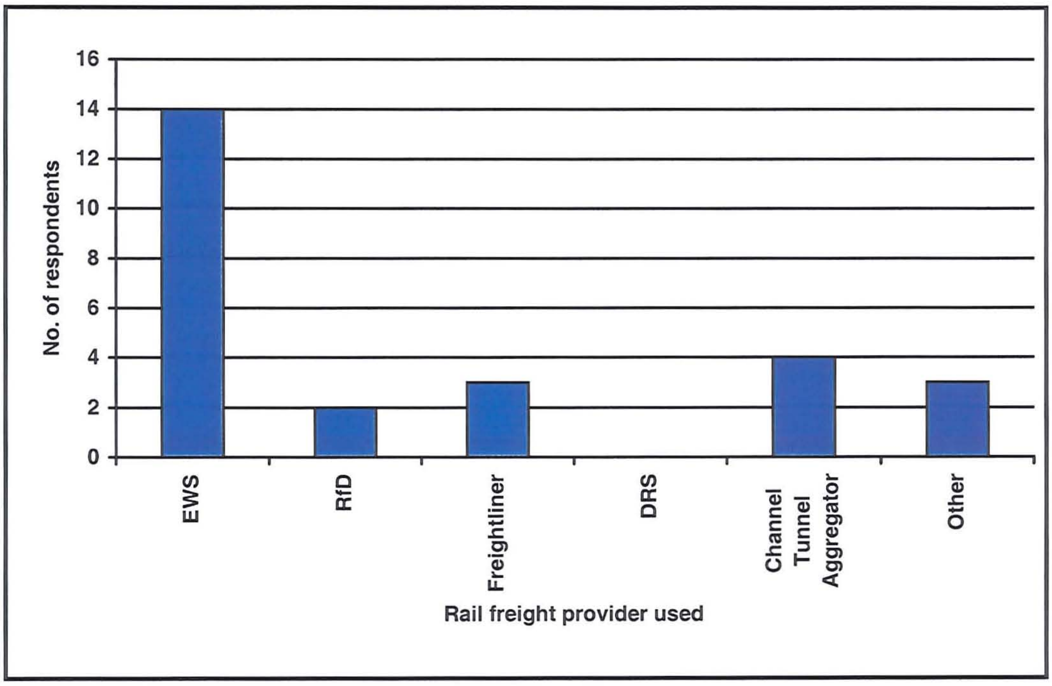
The analysis in Chapter Five of the databases discussed the breakdown of rail freight services into the key categories and analysed the trends over the last 10 years. Given that this highlighted the limited significance of international services through the Channel Tunnel when compared to domestic routes, it is no surprise that the main use of rail by the questionnaire respondents is for domestic movements as can be seen in Figure 6.11. The service providers used to access these services are shown in Figure 6.12. Broadly similar numbers of companies make use of the three categories (i.e. trainload, wagonload and intermodal) of services within Great Britain. While there is minimal usage of either of the traditional types of service for international services, that for intermodal is at the same level as it is for domestic routes. Many companies are involved in more than one category of movement, in the main either using more than one type of service for their domestic requirements or making use of intermodal services both at the domestic and international level.

Figure 6.11 Type of Rail Freight Service Used by Questionnaire Respondents



Source: author's questionnaire survey (n=18)

Figure 6.12: Rail Freight Service Providers Used by Questionnaire Respondents



Source: author's questionnaire survey (n=18)

While intermodal services make up only a small proportion of the total number of services operated on the rail network, even if Freightliner's container services are included, it is clear that they attract a disproportionate number of customers due to the ability to convey small volume consignments and the greater accessibility to these services through third parties. This can be seen from Figure 6.13, where over one third of current users deal with Channel Tunnel aggregators and other third parties for at least some of their rail-based volumes rather than deal solely with the actual service providers themselves. These external agents have not been directly targeted by this research, but potentially they have a considerable amount of influence as the interface between many customers and the rail freight industry. This is discussed in more detail in Chapter Seven when examining the ways in which rail freight service providers can address the demands of a larger section of industry.

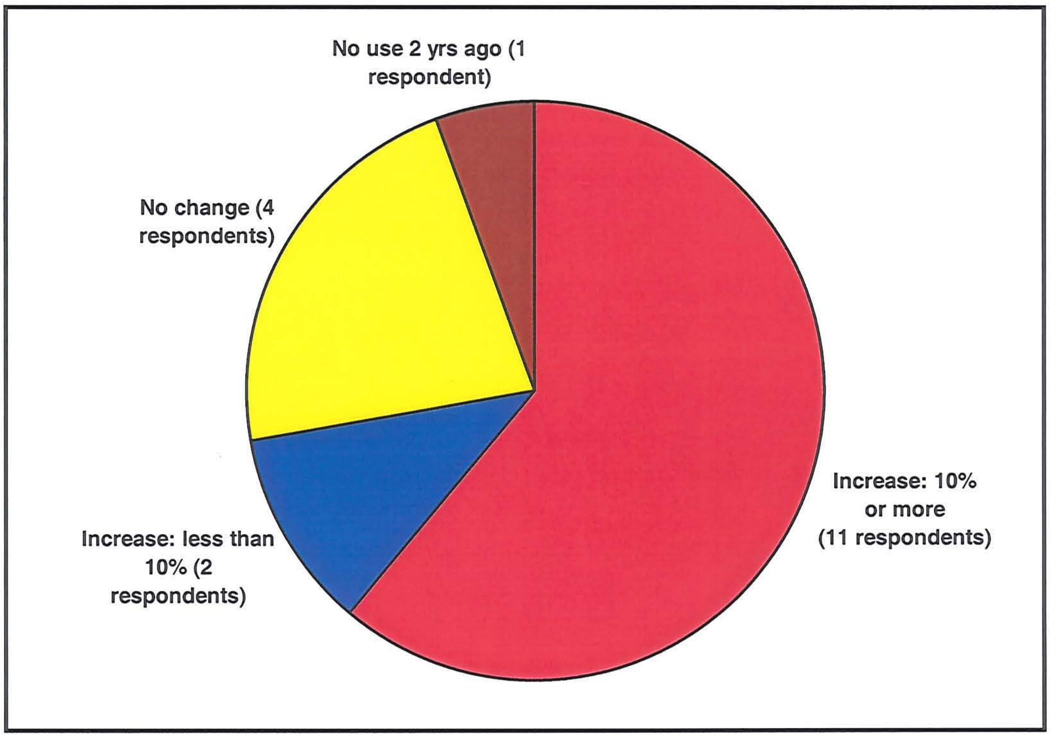
Not surprisingly, almost 90 per cent of rail users make use of the services of EWS (including Railfreight Distribution, which at the time of the survey was still being absorbed into the EWS brand) given its near monopoly position in the provision of most types of rail freight services. This emphasises the significance of EWS' developments in services in attracting new traffic to add to the existing portfolio of services, since in the short-term at least there is little scope for new operators to make major advances into the rail freight industry.

While it is the trainload operations that generate the greatest revenues per customer for the operators, it is in the wagonload and intermodal sectors that the greatest number of customers exists and where the greatest potential for generating new custom can be found. The problem for rail freight operators is to find ways in which they can meet the disparate demands of a more varied customer base than they are used to dealing with, which requires a greater understanding of the logistical issues involved. This is discussed further in Section 6.3.3.

Of those customers currently using rail freight, all but one are established customers, having used rail for at least two years. As Figure 6.13 shows, all of the established customers have at least maintained the volume of goods that they have sent by rail in the last two years, with over three quarters of them having increased their use of rail. The vast majority of them have seen a significant increase (i.e. in excess of 10 per cent) in the volume going by rail.

These figures tend to suggest that the vast majority of rail's increased traffic volume since 1997 has resulted from existing users sending more goods by rail, with only a small proportion of the growth coming from wholly new customers. Quite clearly, though, the sample size from the questionnaire is too small to draw any statistically significant conclusions as to whether or not this is the case. There is no doubt though that rail has to attract a significant number of new customers as well as increasing the volumes it obtains from existing ones if it is to meet its growth targets and have any chance of seriously challenging road haulage for the main markets. However, an understanding of the factors encouraging growth from existing users in the shorter-term should assist in attracting new customers in the longer-term.

Figure 6.13: Change in Volume of Goods Moved by Rail in Last Two Years



Source: author's questionnaire survey (n=18)

The reasons behind these increases are detailed in Table 6.2. One factor that could be of significance, and which is not really related to the supply of rail freight services, is a general growth in the volume of goods moved by the companies involved and where the proportion using rail does not actually increase. This was only mentioned by two of the respondents though. Another two stated that they had increased their use of rail as a result of restructuring, either internally to their company or more generally within their industrial sector. It is not apparent from the questionnaire how significant any changes in the provision and performance of rail services have been in this restructuring, but this is an important issue for the interviews (see Chapter Seven).

Table 6.2: Reasons for Increase in Volume of Goods Moved by Rail in Last Two Years

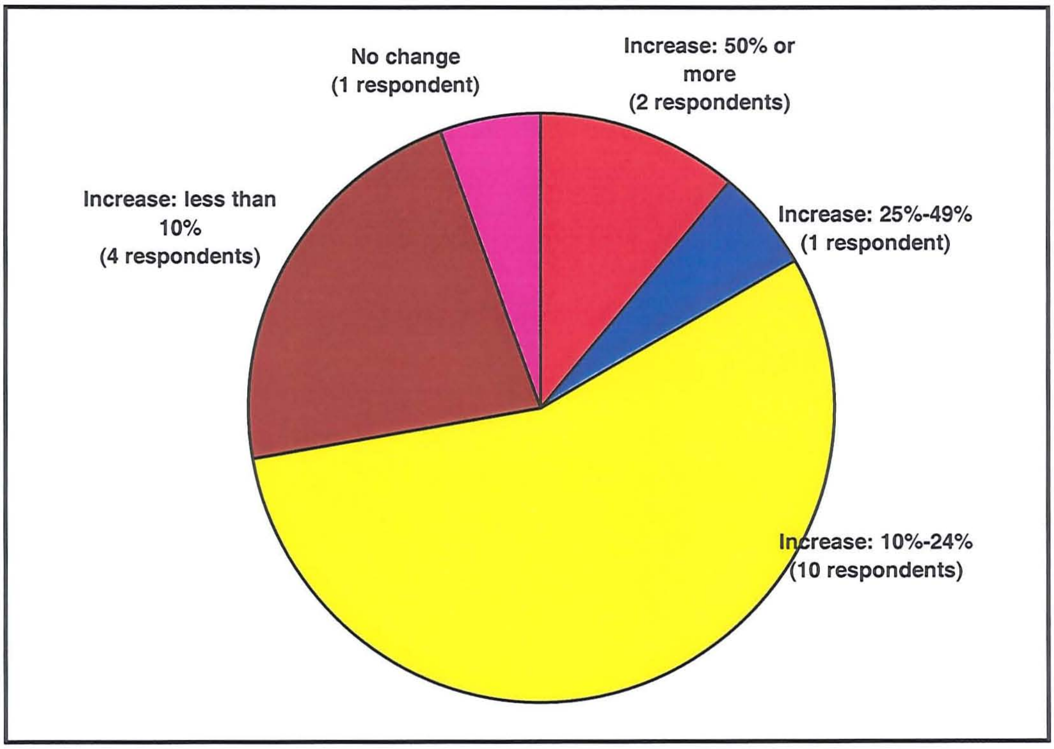
Reason for increased rail freight volume	No. of respondents
Development of new rail services/infrastructure	6
Company policy to switch from road to rail	3
Restructuring within company/industrial sector	2
Company growth	2
TOTAL	13

Source: author's questionnaire survey (n=13)

The prime reason for sending a greater volume of freight by rail is a result of the provision of new freight services and infrastructure, a clear response to the supply-side changes that have occurred in recent years. Furthermore, the second most important reason mentioned concerned it being company policy to switch mode from road to rail. This is unlikely to be significant unless the services on offer from rail meet the requirements and expectations of these companies. Thus the evidence suggests that rail services are becoming more attractive and again this forms an important part of the in-depth interviews with companies that are using rail at present.

Looking to the future, as Figure 6.14 reveals, none of the 18 companies presently using rail predict that they will send smaller volumes by rail in the next five years, though one expects their rail-based volume to remain static. Of the remainder, most predict that they will be sending much increased volumes by rail over this time period. Four companies are likely to increase the volume sent by rail by up to 10 per cent, but the remainder (13) are predicting much more significant increases. Ten do not see their volumes increasing by more than 25 per cent, but two are predicting growth of more than 50 per cent. Of course, the current levels of traffic any of these companies are sending by rail are not known from the questionnaire responses, so in absolute terms the volumes may not be particularly significant. It does, however, show that there is a belief that rail services will become still more attractive an option and this will be explored in greater depth later.

Figure 6.14: Predicted Change in Volume of Goods Moved by Rail in Next Five Years



Source: author's questionnaire survey (n=18)

In a similar manner to the analysis of the recent period, the reasons for the predictions of increased rail volumes in the future can be extracted from the questionnaire responses and these are indeed shown in Table 6.3.

The responses can be categorised into the same four groups, with three of these being of equal importance in terms of the number of times they were mentioned.

Further development of the rail network is predicted by five respondents, with another five citing the likely outcome of the implementation of their company's policy to effect a modal shift away from road in favour of rail. Changes resulting from restructuring of their operations, again either internally or across their industrial sector, is of equal importance to the previous two reasons. This suggests that mode choice is likely to feature more highly both in the formulation of company policy and in logistical restructuring over the next five years than it has done recently.

Table 6.3: Reasons for Predicted Increase in Volume of Goods Moved by Rail in Next Five Years

Reason for predicted increase	No. of respondents
Development of new rail services/infrastructure	5
Company policy to switch from road to rail	5
Restructuring within company/industrial sector	5
Company growth	1
No response	1
TOTAL	17

Source: author's questionnaire survey (n=17)

Many of these issues are returned to in greater detail, both in the remainder of this chapter and more particularly in the analysis of the interviews, where stronger evidence of the recent actions of some of these companies, and their predicted trends, is sought.

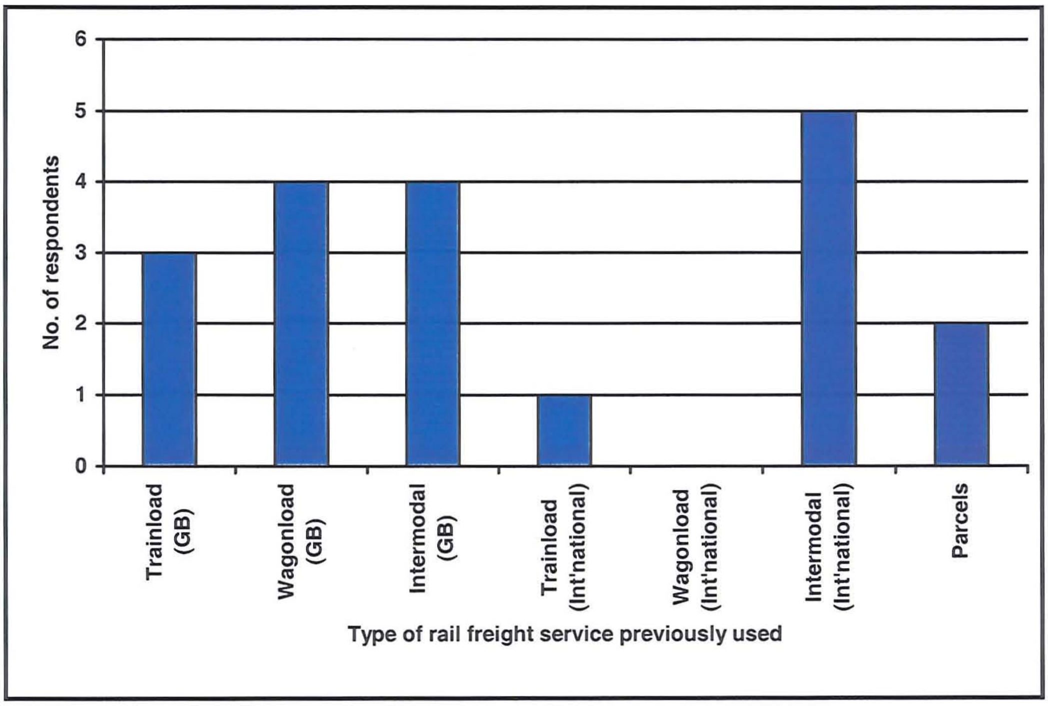
6.3.2 Companies Who Have Ceased Using Rail Freight in the Last 10 Years

A significant minority, 12 per cent, of respondents in the survey have stopped making use of rail freight services in the last 10 years, representing almost as many companies as those currently using rail. Prior to identifying the likelihood that companies in this group of respondents will switch back in the next five years, which is dealt with in Section 6.3.2, this section examines the reasons behind the withdrawal from using rail freight.

Almost half of those who have pulled out of rail freight are from the food manufacturing sector (seven respondents), which now has no current users in the sample. Two each from the construction and paper/printing sectors have withdrawn, though these two sectors are still well represented amongst current users. Five other sectors (i.e. chemicals, transportation equipment, non-electrical machinery, electrical/electronic machinery and retailers) have seen one company each stopping the use of rail, while the textiles/clothing sector has not had any representation in the last 10 years at all. Thus rail freight users in the sample have become more concentrated into fewer sectors over the period in question.

The types of services that had been used by this group of respondents are shown in Figure 6.15. There is no readily apparent trend, which is not surprising given the small sample size. Withdrawal from the range of domestic services has been fairly consistent, though the greatest losses overall have been from international intermodal services, which is quite surprising given that the Channel Tunnel only opened in 1994 and prior to that the opportunities were limited to train ferry traffic and containerised flows to deep-sea ports. Two respondents had previously been using parcels services on the rail network, a type of service not currently used by any of the sample.

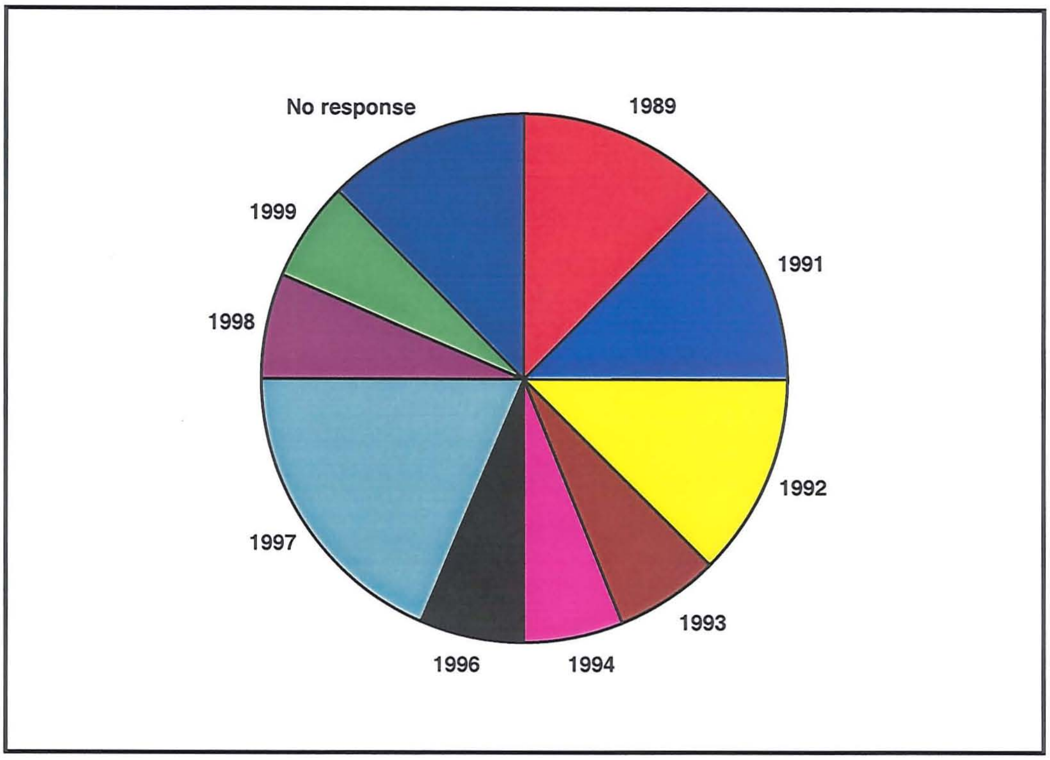
Figure 6.15: Type of Rail Freight Service Previously Used by Questionnaire Respondents



Source: author's questionnaire survey (n=16)

This is a key research area, in terms of identifying whether previous users are more or less likely than others to return to rail in the future, and it is developed later within the interview framework. As can be seen from Figure 6.16, the years in which respondents left the rail network show a gradual withdrawal rather than specific years when large numbers stopped using rail simultaneously.

Figure 6.16: Year in Which Use of Rail Freight Ceased



Source: author's questionnaire survey (n=16)

It is possible to discern two periods when the vast majority of companies stopped making use of rail. Six of the companies left the rail network between 1989 and 1992, mainly the ones who had been using wagonload, trainload and parcels services. This is likely to have resulted from the decline and then subsequent withdrawal of the Speedlink network in the run up to 1991, together with the general focus on only the main profitable trainload flows to the exclusion of many of the more marginal ones that was taking place at the same time.

Between 1993 and 1996, only three further companies left rail, perhaps because this was the period of consolidation and a time when, indeed, marginal users had either willingly switched away or had been forced by the contraction of freight services on offer to them (see Chapter Five). The second major period in which a group of customers has been lost is from 1997 onwards, in particular in 1997 itself where three companies stopped using rail services. This is a quite separate type of users from those leaving rail prior to 1992, in that four of the five recent companies to withdraw were either users of domestic or international intermodal services. These services expanded rapidly, particularly between 1997 and 1999 as was found from the database analysis, presumably based upon the attraction of a number of new users to the new range of services both through the Channel Tunnel and on the domestic Freightliner network. It is likely that some of these new customers found that the services on offer did not meet their companies' requirements and that they subsequently returned to their previous means of moving these goods.

These assumptions of the reasons for the two groups of customers withdrawing would appear to be borne out by examining the reasons behind their decisions to cease using rail, as shown in Table 6.4. The most cited factor, that of poor service quality or too costly service, was fairly evenly represented throughout the time period, but five of the early customers to withdraw mentioned the withdrawal of services by British Rail as being the prime cause.

In contrast, three of the recently departed customers stated that they had only been using rail on a trial basis and had decided not to continue with its use beyond the end of the trial period. Quite clearly, then, the developing intermodal services have not proved to be universally popular with new customers and this too is an important issue that is raised in the interviews.

Table 6.4: Reason for Cessation of the Use of Rail Freight

Reason for cessation	No. of respondents 1989-92	1993-96	1997-99	Total
Poor service quality/too expensive	3	1	2	7
Withdrawal of services by British Rail	5	0	0	5
Use of rail was only on trial basis	0	0	3	3
Poor security for goods	0	0	1	1
Limited facilities on offer	0	0	0	1
Change in production location	0	1	0	1
No reason provided	0	1	0	1
TOTAL	8*	3	6*	19*

* - totals exceeds actual numbers due to three respondents providing two reasons for cessation; two respondents are not included in the detailed breakdown due to no response for year of cessation (see Figure 6.16)

Source: author's questionnaire survey (n=16)

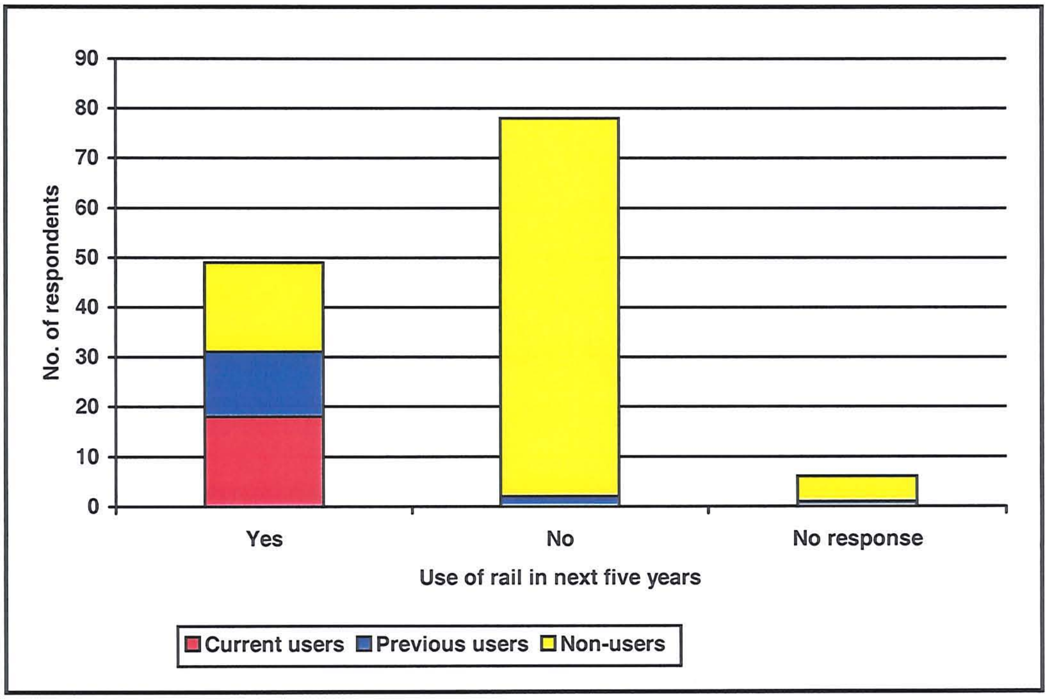
Of the other three reasons provided, which were raised by only one respondent each, only one related to changes internal to the company itself, in that its production location had changed and this had resulted in rail no longer being the preferred option. With this exception, all other reasons cited were concerned with the supply of services by rail freight providers, in terms of the accessibility to the network and its services or the cost and quality of those services.

6.3.3 Use of Rail in the Future

It was established in Section 6.3.1 that all of the current customers plan to continue making use of rail freight, with all but one predicting that the volume of goods they will send by rail will increase in the next five years. Growth from within the existing customer base is unlikely to make a significant difference to the overall freight modal split however; for this to happen, the customer base will also have to expand.

The proportion of the questionnaire sample that expects to be using rail freight services is predicted to increase almost three-fold in the next five years, as can be seen in Figure 6.17. While this still means that the majority of respondents do not believe that their company will start to use rail, it does represent a huge increase in the customer base. Should these predictions be borne out, 37 per cent of the sample will be using rail in five years time, as opposed to just 14 per cent at present. Ten years ago, only 26 per cent of the respondents were rail freight customers, emphasising the dramatic shift that is predicted in the near future.

Figure 6.17: Use of Rail Freight Services in Next Five Years



Source: author's questionnaire survey (n=133)

Of the 16 respondents whose companies have stopped using rail freight in the last 10 years, 13 believe they will return to the mode within the next five years. Only two did not believe they would restart using rail, while one respondent gave no answer. This strongly suggests that, at least from the questionnaire sample, former users of rail freight are a prime target market for future traffic growth as they do not appear to be dissuaded from returning to rail as a result of past circumstances with the mode. In fact, the opposite would appear to be the case, with greater enthusiasm for using rail than amongst the general population. This issue is developed further in Chapter Seven, using additional evidence from the in-depth interviews.

Table 6.5 shows the way in which the predictions break down into the different industrial sectors. This is very revealing, in that it predicts quite different trends for the groupings.

Table 6.5: Predicted Users of Rail in Five Years Time, by Industrial Sector

Industrial Sector	Sample size	% of sector who are current rail users	% of sector who are predicted to be new rail users	Total % of sector predicted to use rail in five years
Food manufacturing	20	0	60	60
Construction	11	36	18	55
Machinery (non-elec.)	8	0	44	44
Retail	19	16	26	42
Chemicals	15	40	0	40
Paper/printing	16	25	12	37
Transport equipment	18	0	28	28
Electrical/electronic machinery	9	12	12	25
Textiles/clothing	17	0	0	0
TOTAL	133	14	23	37

Source: author's questionnaire survey; numbers may not correspond due to rounding (n=133)

In particular, the sector that is likely to have the strongest representation, in terms of the percentage of companies making use of rail, is food manufacturing. 60 per cent of these companies expect to be using rail in five years, as opposed to none at the present time. As was discussed previously, this was the sector that suffered the greatest losses in the number of its companies using rail freight services in the last 10 years, though this predicted growth represents almost double the number of companies in the sector than those who have left rail. Of the seven food manufacturers who withdrew from rail since 1989, all plan to restart in the next five years.

In total five of the sectors are predicted to have above average usage of rail freight in five years time, in terms of the proportion of companies in that sector making use of rail, with three having below average usage. The final sector, paper/printing, is likely to have 37 per cent uptake amongst its companies, which is consistent with the average for industry as a whole.

Only the textiles/clothing sector is predicted to have a lower usage of rail freight services than the current average of 14 per cent. None of the respondents in this sector are current users and none believe that they will start to use rail, primarily because they do not consider it to be suitable for their types of products (see Table 6.7 below). In the chemicals sector, which is the one with the highest proportion of companies currently making use of rail, no further increase in the customer base is foreseen. The construction and paper/printing sectors, which both have a relatively high proportion of respondents who currently use rail freight, predict below average increases in the number of new customers. The other sector currently represented by rail freight users is electrical/electronic machinery, which expects a doubling in usage though only from one to two respondents. Given the small sample size of this sector this statement requires qualification.

The remaining three sectors (i.e. non-electrical machinery, retailers and transportation equipment) are all predicted to see large scale increases with in excess of 20 per cent of companies in each sector starting to use rail. At present, it is only the retail companies that has any presence in rail freight services, so the other two sectors represent new types of business.

While the predictions are not statistically reliable, due to the small sample sizes at the sectoral level, it can be inferred from this analysis that the customer base for rail freight is likely to increase substantially, with some of the greatest growth occurring in sectors that are currently either making no use or only limited use of rail freight services. This would seem to be a reasonable assumption given the changes in rail freight provision that were discussed in Chapter Five, particularly the growth in wagonload and intermodal services rather than solely trainload services for traditional customers.

The questionnaire made no effort to determine the extent to which these new users are planning to make use of rail in the next five years. It is conceivable that the volumes involved may be small, with only a very limited proportion of movements shifting to rail. The extent of the predicted growth in the customer base is a significant finding in itself, though the issue surrounding the likely volumes transferring to rail is one that is raised within the in-depth interviews.

Table 6.6 ranks the reasons given by companies across the complete sample for their predictions that they will be starting to use rail in the next five years. The results are fairly similar to those given by current users who anticipate an increase in their usage in the near future, as was discussed in Section 6.3.1. Of the 35 individual reasons given, seven categories of response have been identified. Over half of them (i.e. 21 responses) fall into the four categories that directly imply that the provision, cost and quality of rail services is expected to improve, either in absolute terms or at least relative to the performance of road haulage and the road network in general.

Table 6.6: Reasons for Starting to Use Rail in Next Five Years

Reason	No. of respondents
Improvements in rail network/infrastructure	7
Due to changes in supply chain/transport operations	7
Reductions in cost of rail freight/increases in cost of road haulage	6
Improvements in quality of service	5
Due to government policy and legislation on transport/environment	4
Company awareness of environmental issues	3
Due to road congestion	3
TOTAL	35*

- total exceeds 31 due to respondents citing more than one reason

Source: author's questionnaire survey (n=31)

This includes, in declining order of significance: general improvements to the rail infrastructure and services; a reduction in cost penalties (or potentially even cost advantages) for rail; quality of service improvements; and increasing road congestion making rail services more attractive. Pressure from government and general environmental issues combined accounted for just seven responses, while another seven mentioned changes in the company's own operations or in its supply chain as being of significance in encouraging the use of rail.

Overall, therefore, it would appear that there is a general opinion amongst this group of respondents that rail's performance will generally improve while road will suffer from increases in costs and congestion, resulting in the differential between the two modes being reduced. Government policy may also play a part in this predicted change. Supply chains are likely to be restructured over time to reflect this, and possibly for other non-transport reasons. These issues are developed further in the interviews.

Given that the majority of questionnaire respondents are still unlikely to be rail users in five years time, it is instructive to examine the reasons for this. Table 6.7 ranks the reasons provided by these 78 respondents and highlights some issues to be addressed if rail is to be able to make further inroads into the majority of companies who do not see any potential, in the near future at least. 113 specific reasons were provided for this question, but as 12 respondents provided no reason at all, those who did respond gave an average of just less than two reasons.

The most important of the reasons quoted was that rail is not considered to be suitable for the type of product or movement that the particular company is involved with. This is a fairly general category, but probably underlines the impression that much of industry rightly or wrongly perceives rail to be fairly restricted in the traffics to which it is suited.

Table 6.7: Reasons for Not Starting to Use Rail Freight in Next Five Years

Reason	No. of respondents
Not suitable for type of product/movement	34
No suitable rail connections/infrastructure	16
Too inflexible/just-in-time required	16
Too slow	14
Too expensive	14
Lack of security for goods/handling problems	7
Poor reliability	5
Don't want to change current set up	4
Customers/carriers dictate mode	2
Have own road fleet	1
TOTAL	113*

- total exceeds 78 due to many respondents citing more than one reason; 12 respondents gave no reason

Source: author's questionnaire survey (n=66)

Of the more specific reasons four had almost equal importance, with 14 to 16 respondents mentioning them. They all related to perceived negative characteristics of rail freight and its operation, basically that the rail infrastructure was not suitable; the services offered are (and are likely to remain) unsuitable; and that they are too expensive, slow and inflexible. It would appear that, not surprisingly, rail is being judged against the more ubiquitous and flexible road haulage industry in these arguments and that the perception of these respondents is that the next five years will not see a significant improvement in rail, or indeed deterioration in road haulage, to result in a shift in mode.

It should be noted that many of these points are exactly the ones that those predicting their switch to rail in the next five years think will improve significantly enough for them to start using rail freight. There is perhaps a continuum along which the respondents lie, with a certain proportion of them believing that changes in the next five years will be significant enough to tip the balance towards rail for some traffic flows, while others are further along the continuum do not see potential changes in five years being of relevance to their mode choice decision-making.

Whether in the longer-term an even greater proportion of respondents would make a switch to rail or would still be resolutely of the opinion that rail had nothing to offer them is not clear from the questionnaire, but again is an issue explored in the interviews with those who see no use of rail in the next five years. It is likely, though, that there may be a further proportion of companies which would decide to start using rail in the longer-term should the provision and quality of services dramatically improve relative to road haulage, but still a proportion who would not perceive rail to be suitable at all due to their particular circumstances. Clearly there are many factors, both internal and external to the rail industry that would affect these potential shifts in mode. These include: the development of the rail network, in terms of coverage, access and capacity; service quality for both road and rail; and costs for both modes. Government policies on infrastructure investment, congestion relief and user charging, for example, would be external factors affecting rail's likely customer base.

Other specific issues were raised by respondents as reasons for not using rail. Seven respondents felt that rail offered poor security for goods in transit or storage at rail premises or that using rail posed other sorts of handling problems, such as damage to the product. This is an area where rail tended to have a poor reputation in the past, particularly for wagonload traffic whilst in marshalling yards and sidings, but where developments have occurred that should ensure these problems are less significant. The greater use of intermodal technologies is a clear example where direct product handling by rail operators can be eliminated and where the product is more easily secured than in traditional wagons. Improved tracking of consignments is also now feasible, so that losses in transit should be minimised.

Service reliability was only mentioned by five companies, though perhaps many others included this in the more general categories on standards of service. Four respondents stated that they were happy with their current arrangements and did not want to make alterations, suggesting that they did not perceive the future to hold any significant changes that would force them into re-examining their transport usage. Two companies said that their lack of responsibility for mode choice decisions meant that they would not start using rail, while just one respondent cited the ownership of an in-house lorry fleet as being a barrier to switching to rail in the next five years.

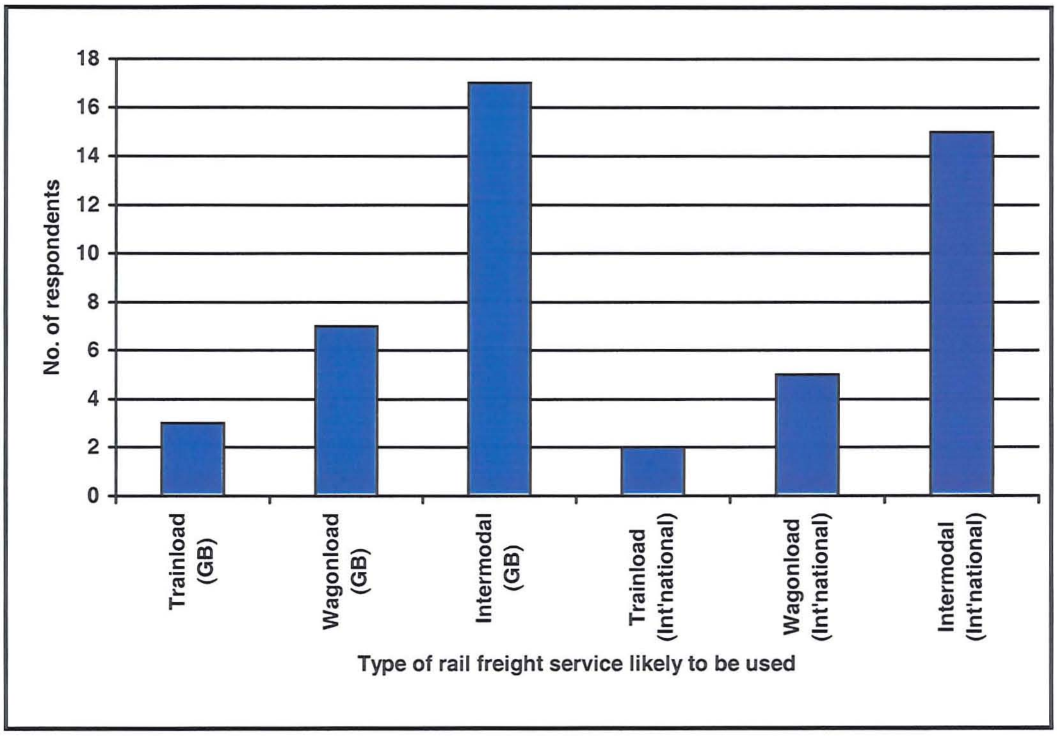
Overall, it would appear that the attitudes of those companies who do not see any potential for rail in the near future are a combination of them believing that rail inherently is not suitable for their transport requirements and that the way in which rail freight services are currently operated and marketed do not suit their requirements. In some cases, these attitudes would seem to be a result of poor experiences of British Rail in the past which is influencing their judgement of rail's potential in the future. This is an issue that will need to be addressed by the rail freight operators, or perhaps through government policy, if these companies are to be attracted back to rail. This equally applies to some of those who have no experience of rail and do not foresee any use, but who are in similar positions to current or likely rail users.

It is clear, and not surprising, that the majority of those companies likely to start using rail freight within five years expect to make use of intermodal services, as can be seen in Figure 6.18.

The 31 companies that expect to commence rail use provided 49 responses to the type of service question. This largely resulted from companies expecting to make use of a specific type of service (e.g. intermodal) at both the domestic and international scale. The dominance of new intermodal customers poses specific problems for rail operators to resolve. These include: the widespread acceptance of larger containers and swapbodies onto the rail network; route and terminal capacity to handle significant growth; and provision of additional rolling stock to cater for these traffics. The growth in intermodal services in recent years is an encouraging sign that this traffic can and will be catered for, though the recent downturn identified in the 2000 database is a potentially significant issue if it turns into a longer-term trend.

In addition to this focus on intermodal services, some new customers are expecting to use more traditional rail freight methods. Both for domestic and international flows, a number of respondents think they will make use of wagonload services, though only a small number are likely to start new trainload operations. This is further evidence for the rail freight operators that their growth markets, if they are to materialise, are going to be in the movement of intermodal and wagonload consignments instead of the bulk trainloads on which rail has focused over the last few decades.

Figure 6.18: Type of Rail Freight Service Likely to be Used by New Rail Freight Customers



Source: author's questionnaire survey (n=31)

Some of these issues were considered in more depth by the questionnaire through other questions on the factors influencing the choice of rail in mode choice decision-making, and this analysis can be found in Section 6.5. There are other issues raised in this section, though, relating to the potential use of rail in the future that cannot adequately be analysed through the questionnaire responses alone, but which form a major part of the interview discussions and analysis in the hypothesis testing in Chapter Seven.

6.4 Nature of Mode Choice Decision-Making

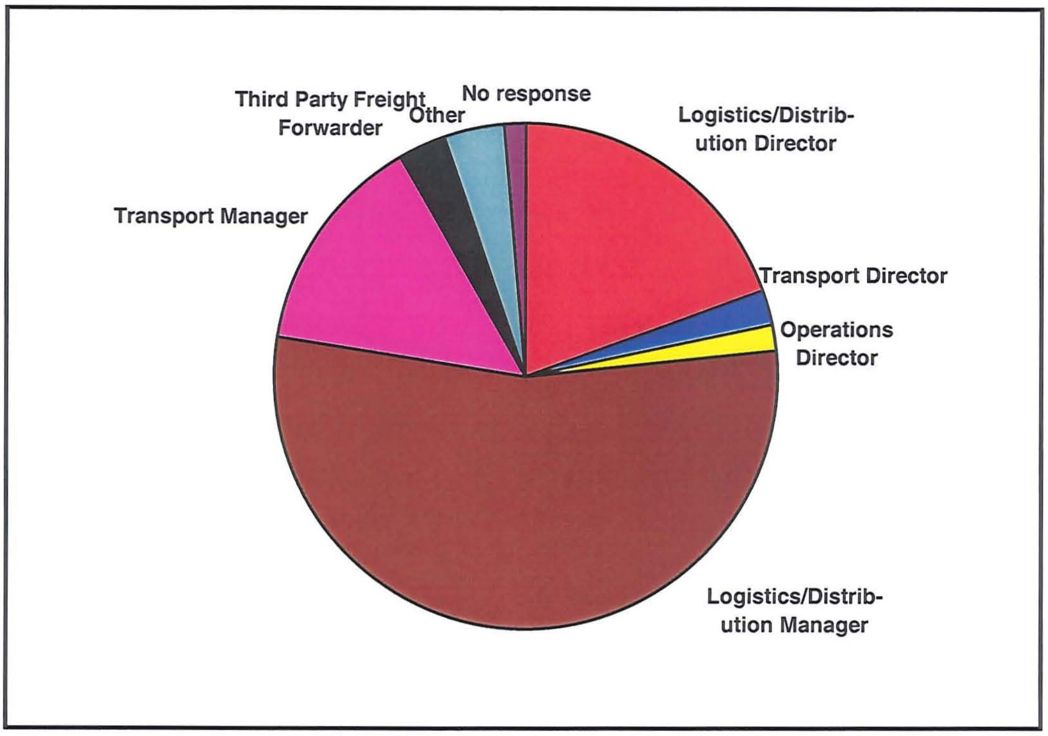
Much of the analysis in the previous section relied upon the opinions of those making the mode choice decisions with the companies in the questionnaire sample. This section therefore focuses upon the characteristics of these employees and the role that they have in their company in terms of making decisions relating to freight movements. In particular, it examines the way in which the mode choice decision-making processes are carried out for new freight flows. The impact that rail privatisation has had on these processes is also incorporated into this analysis.

Firstly, it is of interest to look at who is responsible for deciding on modal choice for each of the companies involved in the survey. From Figure 6.19, it can be seen that this broadly breaks down into the following three categories:

- Specific board level responsibility (i.e. Transport/Logistics/Distribution/ Operations Director): 24 per cent of respondents
- Specific managerial responsibility (i.e. Transport/Logistics/Distribution Manager): 68 per cent of respondents
- Others, including external people: 7 per cent of respondents

A significant minority of companies therefore have direct board level decision-making on mode choice, primarily through Logistics/Distribution Directors. The majority of companies do not have such high level decision-making, with Logistics/Distribution Managers being the most numerous job title represented.

Figure 6.19: Responsibility for Freight Mode Choice Decision-Making

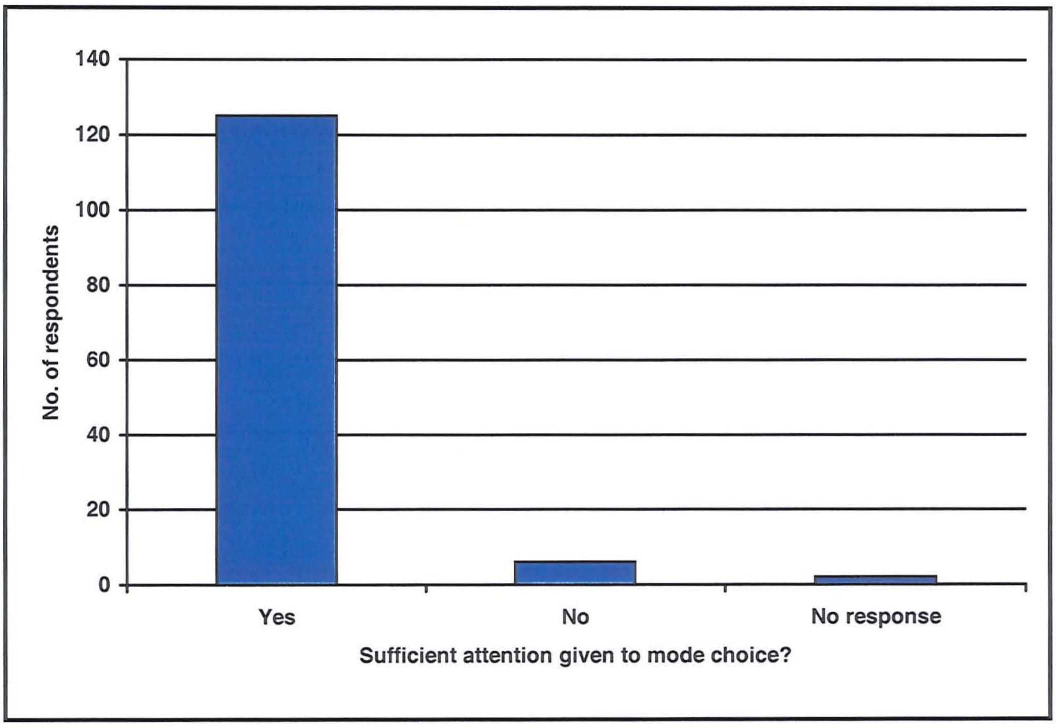


Source: author's questionnaire survey (n=133)

At both managerial and board level, the majority of those involved in mode choice decision-making have logistics or distribution responsibilities, rather than being solely accountable for transport issues. This reflects the general situation whereby transport-based decisions are now a part of the overall logistics operation, rather than focusing solely on the optimal handling of the transport requirements in isolation. In total, three quarters of respondents had these wider-reaching distribution/logistics responsibilities. This trend towards overall logistics operations is likely to have resulted in the mode choice decision-making processes becoming more complex. The key issues involved are dealt with in the remainder of this chapter. The extremely limited proportion of the sample that leaves the decisions on modal choice to third parties is of interest suggesting that, whilst the majority of companies use external service providers, control of the modes used is largely retained by the manufacturers or retailers themselves.

Overall, 94 per cent of the sample were content that the decision-making processes involving mode choice issues received the attention they deserved within their particular organisation, as can be seen from Figure 6.20. Allowing for the non-responses, only five per cent of respondents were unhappy with the attention devoted to mode choice. Of the three people who provided reasons, dissatisfaction with the internal managerial set-up was the cause of this opinion, but clearly this is not a widespread problem across the whole sample.

Figure 6.20: Sufficient Attention Given to Mode Choice Decision-Making?



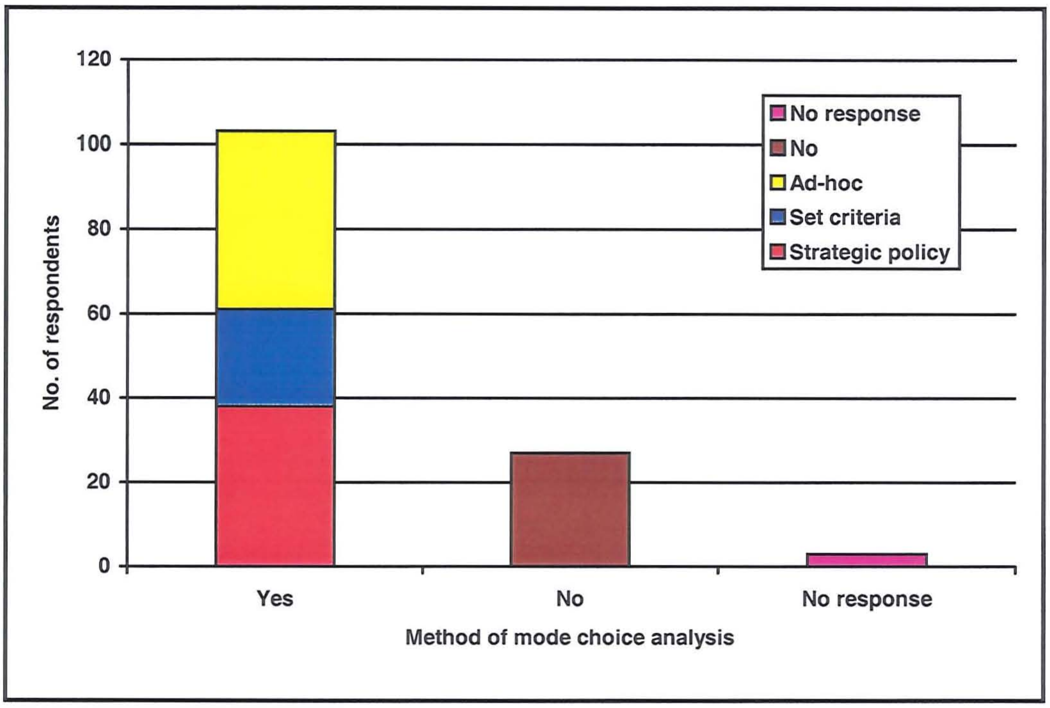
Source: author's questionnaire survey (n=133)

Respondents were asked to provide details of the way in which new freight flows were analysed in order to make decisions on which mode of transport to utilise, if indeed any sort of fixed process was applied at all (see Figure 6.21). For those companies that do have a formalised process, the type is also shown, with the method by which this is implemented being revealed in Figure 6.22.

Just over three quarters of companies do have a formal approach to analysing the mode choice options for new freight flows. The largest proportion of these carry out such analyses on an *ad-hoc* basis, dependent upon individual traffic flows, though an almost equal number make such decisions based upon company strategic policy. The remainder, 23 respondents, apply set criteria but not as part of an overall strategic policy. Thus, of those that do conduct a formal analysis, the majority have guidelines to follow to ensure a consistent approach. Whether this results in a more balanced decision-making process by which all modes are considered is not conclusive from the questionnaires, but is raised in the in-depth interviews.

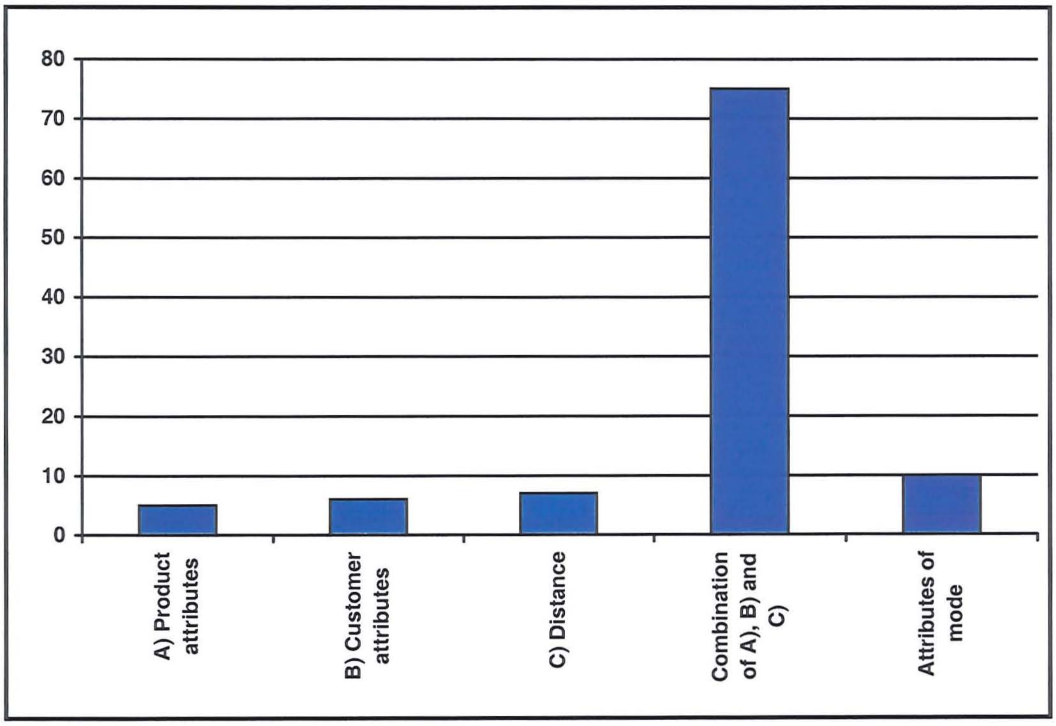
Where the questionnaire responses do shed further light on the criteria by which mode choice is decided is the attributes that are of importance in the decision-making process. Respondents were asked whether it is specifically product, customer or distance attributes that are the crucial factors in deciding upon mode, or indeed whether it is a combination of all of these.

Figure 6.21: Formal Mode Choice Analysis For New Freight Flows



Source: author's questionnaire survey (n=133)

Figure 6.22: Method by Which Mode Choice Analysis is Carried Out



Source: author's questionnaire survey (n=103)

Of these individual attributes, distance is the most important, though clearly none of the three are significant in their own right since they account for only 13 per cent of the sample in total. Eight per cent of the sample added a separate category, this being that it was the specific attributes of the modes themselves that affected the decision, though this is likely to inherently involve a combination of being able to handle different products, address the needs of different customers and provide cost-effective and reliable services over different distances.

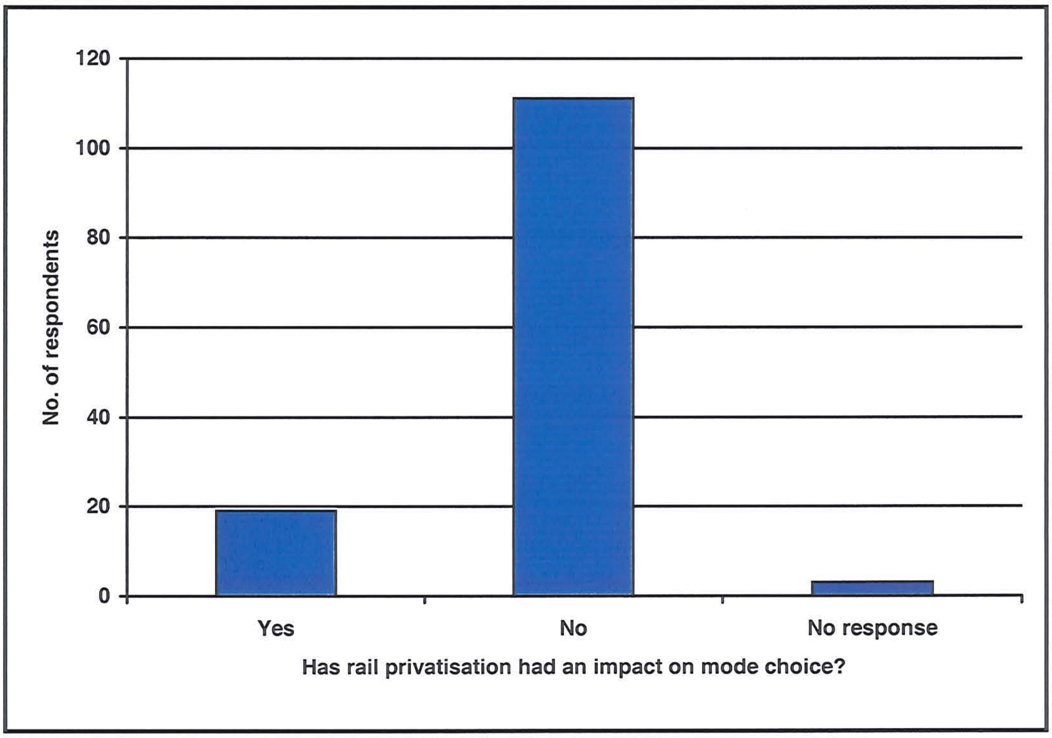
Thus it is apparent that, other than in a very limited number of cases, the criteria affecting mode choice decision-making are complex and cannot easily be identified as being the result of specific factors such as product type or distance between origin and destination. In-depth interviews with many of the companies are used to try to gain a better understanding of these processes.

Finally, in the consideration of the broad issues surrounding mode choice decision-making, respondents were asked if rail privatisation had had any effect on the way they chose between modes. Overwhelmingly this proved not to have been the case as Figure 6.23 displays, with only 19 respondents (14 per cent) stating that privatisation has had an impact.

83 per cent of questionnaire respondents stated that rail privatisation has had no impact on mode choice. Bearing in mind that over 60 per cent of companies do not expect to have any use of rail in the next five years, there is still a sizeable

proportion of the sample who either are already using rail, or expect to start using it, who have not been influenced (directly at least) by privatisation.

Figure 6.23: Impact of Rail Privatisation on Mode Choice



Source: author's questionnaire survey (n=133)

Table 6.8 reveals that the most cited reason, by 12 respondents, for rail privatisation having an impact is that the operations are now more commercial than they were under British Rail. Seven respondents stated that there have been improvements in the services provided and investment in the rail network, which could be interpreted as further evidence of a greater commercial awareness from rail companies.

However there were clearly far more respondents who said that privatisation has had no impact on their choice of mode, and their reasons can be seen in Table 6.9.

Table 6.8: Reasons for Rail Privatisation Having an Impact on Mode Choice

Reason	No. of respondents
More commercial approach	12
Improvements in services provided/investment in network	7

Source: author's questionnaire survey (n=19)

Table 6.9: Reasons for Rail Privatisation Having No Impact on Mode Choice

Reason	No. of respondents
Rail not suitable for movements regardless of ownership	27
Service quality still poor	10
Not familiar with/interested in changes	9
No noticeable effects yet from privatisation	8
Suitable services still not available	5
Privatisation is not a relevant issue	5
Potential for use, but not yet convinced of benefits	3
Satisfied with status quo	3
Rail changes have not been related to privatisation	1

Source: author's questionnaire survey (n=111)

By far the most significant is the fact that they believe rail not to be suitable for their requirements regardless of the nature of its ownership. A number of the other categories have broadly similar meaning, primarily a lack of interest in the changes and privatisation is not a relevant issue, thus making this the most important general factor.

Other factors that are of importance can largely be classed under rail having not improved sufficiently since privatisation for respondents to have formed an opinion of privatised operations as distinct from their general attitudes to rail freight. This embraces reasons such as service quality still being poor, no noticeable effects yet as a result of privatisation, suitable services still not being available, and that there is potential for using rail but the benefits are not yet apparent. Therefore there is much work to be done in addressing the demands of industry and matching this to the services that rail freight operators can realistically provide in the future.

6.5 Factors Influencing the Choice of Rail in Mode Choice Decision-Making

To gain a better understanding of the factors that influence the likelihood of rail being used, a requirement that was highlighted in the previous section, companies were asked to assess the importance to them of a range of factors relevant to their consideration of rail freight as a potential mode for their requirements. The outcome is shown in Table 6.10, ranked by the mean value of responses. This analysis is based upon the five point Likert scale question, where five represented very important and one represented not important.

With one exception, that being private sector operation of services, all the factors were regarded as being more important than neutral (i.e. 2.5 on the scale). This highlights the fact that rail privatisation in itself has not been a major factor influencing mode choice.

Perhaps unexpectedly, service frequency is ranked as the most important factor in terms of its mean value. It also has the lowest standard deviation, suggesting a relatively high degree of uniformity in responses. Service flexibility and cost are ranked second equal, reinforcing the argument that it is the combination of cost and service that is important in attracting traffic, rather than solely one or the other.

Table 6.10: Degree of Importance of Each Factor Influencing the Choice of Rail in Mode Choice Decision-Making (ranked by mean value)

Factor	Mean	Standard Deviation
Service frequency	4.61	0.75
Service flexibility (e.g. flexible departure/arrival times)	4.49	0.91
Cost	4.49	0.92
Door-to-door journey time	4.41	0.97
Supplier/customer requirements	4.34	1.09
Availability of door-to-door package	4.17	1.28
Rail journey time	3.73	1.19
Congestion on road network	3.39	1.11
Availability of intermodal equipment/expertise	3.38	1.28
Financial incentives to use rail (e.g. freight facilities grants)	3.35	1.22
Impact of movements on environment	3.23	1.17
Private sector operation of services	2.19	1.17

Source: author's questionnaire survey (n=128)

Of note is that door-to-door journey time is ranked considerably higher than the rail journey time component itself. The availability of a door-to-door package is also ranked relatively highly. In combination, these would suggest that rail somehow has to manage to provide a complete service akin to that provided by road hauliers, rather than simply improve the rail component. Whether it does this on its own or through partnerships with road hauliers for local distribution is a separate issue.

Availability of intermodal equipment and expertise is ranked fairly low, which is surprising considering that the majority of the predicted new customers expect to make use of this type of service. The relatively high standard deviation results from a group of respondents, primarily those expecting to start to use rail, rating this issue as being of great importance but the vast majority of the remaining companies rating this is being of little importance. Road congestion, financial incentives for rail and environmental issues are all ranked fairly lowly, though again the standard deviations are greater than average. With each of these factors, the existing and prospective rail freight users have a tendency to rate them as being of more importance than those with no plans to use rail in the near future.

Respondents were also given the opportunity to raise specific factors that they felt were important in influencing whether rail was chosen. The additional factors are detailed in Table 6.11, together with the number of respondents raising them and their mean values. Only 20 additional responses were obtained, with eight of them stating that rail's service reliability is of prime importance to them in their decision-making process.

Table 6.11: Additional Factors Mentioned by Respondents as Being Important in Influencing the Choice of Rail in Mode Choice Decision-Making

Factor	No. of respondents	Mean	Standard Deviation
Service reliability	8	5	0.00
Expertise/equipment/capacity for handling particular products	4	5	0.00
Product security	3	5	0.00
Competence/accountability	3	5	0.00
Availability of routes/services	2	5	0.00

Source: author's questionnaire survey (n=128)

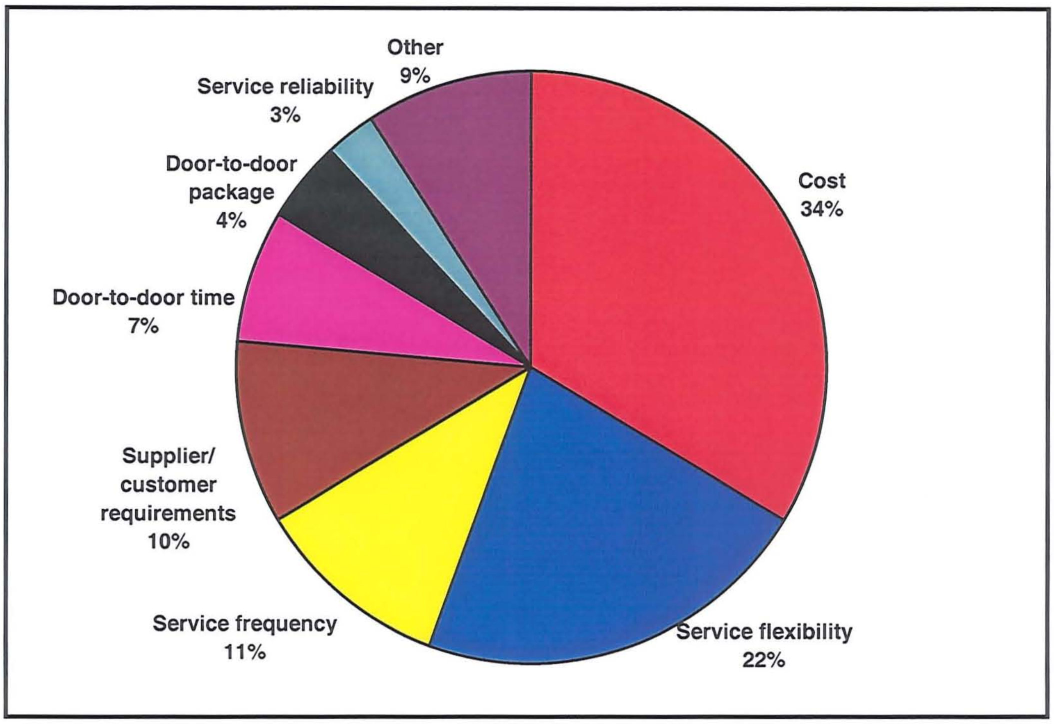
The other factors generally relate to issues already identified, such as the ability to handle certain types of products and the security of goods in transit on the rail network, or issues that reinforce those raised in the main question, for example the availability of routes and services. The numbers of companies raising these specific issues are negligible out of the entire sample.

One potential problem with Likert scale questions is that they provide the opportunity for the respondent to answer in the same way for each factor rather than differentiating between them. Thus it is not necessarily always clear from this type of question as to which of the factors is actually the most important to the respondent.

While the analysis of the Likert scale question above did provide a variation in the mean responses, the survey also asked for respondents to identify and rank the top three factors that influenced their mode choice when considering rail. By weighting the responses to take into account whether they were ranked first, second or third in terms of importance, Figure 6.24 reveals the relative significance of the main factors identified by the companies.

Comparison between Table 6.10 and Figure 6.24 reveals that the six most important factors are consistent, though the rankings differ quite considerably. The top three are the same from both questions, but when asked to specifically identify the three main factors cost is significantly more important than the two service aspects. In fact, even when service flexibility and frequency are combined their weighting is still slightly less than that for cost alone. Service frequency in particular would appear to be of much lower significance when companies are explicitly asked about the most important factors to them than it is when they are asked to rank its importance on a scale.

Figure 6.24: Overall Weighted Importance of Factors Influencing the Choice of Rail in Mode Choice Decision-Making



Source: author's questionnaire survey (n=128)

Similar to the top three factors, the second batch of three occupy the same overall rankings in both forms of analysis, but again the individual placings differ between the two types of question. One of the additional factors raised by a number of respondents, that of service reliability, made it to seventh place in the rankings, with other factors only accounting for nine per cent of weighted responses.

In conclusion, while there is no single factor that appears to have prime importance in terms of what is important when considering the use of rail, the importance both of cost and service is clear from this analysis. Specific demands from companies used as case studies in the interviews will examine these issues further.

6.6 Logistical Factors Affecting The Overall Demand for Freight

Most of the attention thus far has been focused upon the specific nature of the transport requirements and associated decision-making processes. However, the growing significance of logistics-based operations and decision-making as highlighted in Chapter Two, rather than just transport in isolation, requires a clear understanding of the interactions between other logistical factors and the overall level of demand for transport.

The list of logistical factors provided to respondents in the questionnaire is shown in Table 6.12 with factors ranked by their mean value. In this case, a value of one means that the particular factor has led to a large *increase* in the demand for transport in the last five years while a value of five represents a factor that has resulted in a large *decrease* in the amount of transport used; a value of three represents no change as a result of that particular factor.

With only one exception, all of the factors have individually resulted in an increase in the demand for transport in the last five years when aggregated across the entire sample. Not surprisingly, at the aggregate level contraction of market area had resulted in a decrease in demand for transport, but this was extremely slight with a mean value only very slightly greater than that representing no change.

Table 6.12: Degree of Importance of Each Logistical Factor in Influencing Demand for Freight by all Modes in Last Five Years (ranked by mean value)

Factor	Mean	Standard Deviation
Change in customer requirements	1.98	0.87
Adoption of low inventory strategies (e.g. just-in-time)	2.25	1.00
Change in the level of sales	2.25	1.07
Expansion of market area	2.36	0.96
Relocation of warehouses	2.46	0.96
Change in the nature of the product	2.56	0.72
Transfer of responsibility for transport **from** suppliers/customers	2.66	0.77
Production/stockholding centralisation	2.69	1.08
Change in vehicle routing	2.70	0.86
Relocation of factories	2.72	0.74
Contracting-out of transport operations	2.75	1.10
Internalisation of transport operations	2.85	0.51
Change in the choice of mode used	2.85	0.53
Consolidation of loads into larger/ heavier consignments	2.93	1.19
Production/stockholding decentralisation	2.95	0.91
Transfer of responsibility for transport **to** suppliers/customers	2.96	0.86
Contraction of market area	3.06	0.64

Source: author's questionnaire survey (n=126)

The factor with the lowest mean value, suggesting that respondents perceive it to have caused the greatest increase in demand for freight, is a change in customer requirements. This has important implications for mode choice, since it suggests that decisions on the nature and volume of transport used may not rest with the companies themselves but instead with their customers. It is likely that this is related to the factor ranked joint second, i.e. adoption of low inventory strategies (e.g. just-in-time), since the adoption of this type of strategy by a particular company is likely to result in their suppliers (who may, of course, also be respondents to the questionnaire) requiring a greater use of transport to satisfy the changing demands.

It is clear that factors largely external to logistics have been important in leading to an increase in demand for freight. Marketing factors, such as changes in the level of sales and expansion of the market area have been important, as have changes in the nature of the product itself. Of the remaining logistics factors, it is generally the more strategic changes that have increased the demand for freight to a greater extent than the operational-type ones. For example, factors related to the physical nature of the logistical system, such as where warehouses and, to a lesser extent factories, are located are rated more highly than those to do with transport operations such as vehicle routing and mode choice. This suggests that the challenge when attempting to influence modal shift is to consider the potential at the strategic level and not just at the operational level after the strategic decisions have been taken. Many of the key strategic decisions of recent years, such as the location of activity and the centralisation of production and stockholding have increased the demand for freight significantly, with the inference from the questionnaire analysis that these changes have resulted in a slight transfer of traffic from rail to road rather than the opposite. The challenges for rail are therefore serious and are examined in detail in the interviews.

Change in the choice of mode used has had very little impact on the total volume of freight used, which is to be expected given the overwhelming dominance of road freight in the questionnaire sample, reflecting the general picture. Overall, mode choice would appear to have been of far lesser significance in influencing freight demand than the strategic logistical changes already discussed. The fact that mode choice changes have slightly increased the total demand for freight, with a mean value of 2.85, lends weight to the belief that there has been a continuing trend towards smaller volume movements by road as opposed to bulk movements by rail.

Respondents were asked to identify any additional factors that have been important to them in influencing the demand and these factors are shown in Table 6.13.

Table 6.13: Additional Logistical Factors Mentioned by Respondents as Being Important in Influencing the Demand for Freight by all Modes in Last Five Years

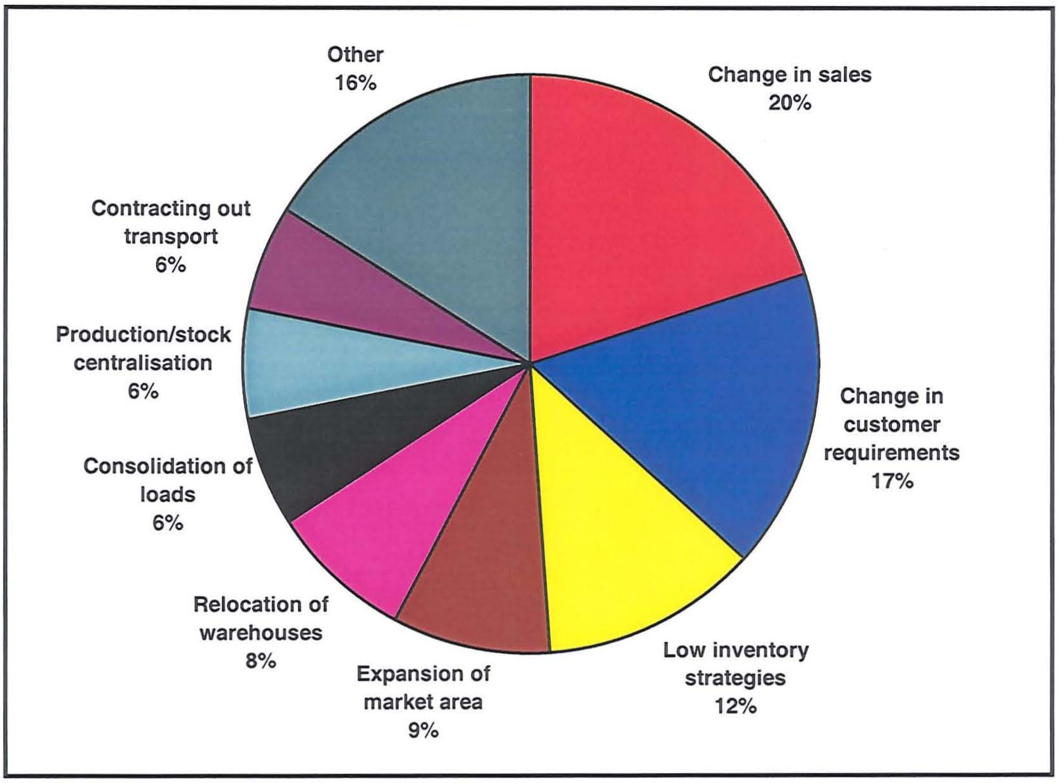
Factor	No. of respondents	Mean	Standard Deviation
Other changes in fleet management/ operation	3	2.33	2.31
Change of management responsibility	1	1.00	0.00
Change in security requirements	1	2.00	0.00
Cost changes	1	2.00	0.00

Source: author's questionnaire survey (n=126)

As can be seen, very few respondents raised any additional points, though those included appear to be generally of a more operational nature rather than strategic. Not surprisingly, the additional factors were rated as having caused a large increase in demand for transport by all but one respondent who found that transport demand had decreased substantially as a result of changes in fleet management and operation.

In a similar manner to that of examining the factors influencing choice of rail, discussed in Section 6.5, companies were asked to provide details of the three most important factors that had influenced their demand for freight in the last five years and the weighted responses are shown in Figure 6.25.

Figure 6.25: Overall Weighted Importance of Logistical Factors Influencing the Demand for Freight by all Modes in Last Five Years



Source: author's questionnaire survey (n=126)

The top five factors, which account for two thirds of the weighted total, are the same as those identified in the analysis of mean responses in Table 6.12, albeit with changes in the level of sales being ranked first in the weighted list. This analysis generally reinforces the points raised above from the mean values. The fact that 20 per cent of the weighting is accounted for by changes in sales volumes would suggest that a large proportion of the increase in demand for freight has not been under the control of those directly involved in logistics and, consequently, mode choice decision-making.

Overall, the evidence suggests that logistical restructuring over the last five years has resulted in a significant increase in the demand for freight and that, rather than countering this trend, the changes in the choice of mode used have actually slightly influenced the greater use of road freight. These issues are explored in greater depth in the interviews to try to gain a clearer picture of how the various factors are inter-related and whether there is scope for rail to assist in future restructuring to try to limit the future increases or, if possible, even to lessen the demand for road freight.

6.7 Significance of Rail Freight in Constraining the Growth of Road Freight

In policy terms, it was highlighted in Chapter Two that a key reason for pursuing pro-rail policies is to try to effect a modal shift away from the road network primarily for environmental reasons and to try to ease the pressure on the congested parts of the road network. As such, respondents were asked to assess the degree of importance of a number of policy-based measures, including the displacement of traffic to rail (and water), in constraining road freight growth in the last five years. The analysis in the previous section, though not addressing the issue in the same manner, suggested that the reverse may actually have been the case when it came to mode choice.

The results can be seen in Table 6.14, ranked by the mean value of degree of importance, the higher the value on a five point scale then the more important that factor has been in constraining the growth of road freight. Quite clearly, the responses to this question suggest that the displacement of traffic to rail has been of very little significance in constraining road freight growth over the last five years, with only displacement to water being of lesser importance. This is perhaps to be expected given the limited modal share that rail has had in this time period. Of much greater importance, relatively at least, have been those factors affecting road freight costs and operational efficiency. The most important factor has been the increase in fuel tax, which is not surprising given that the period under review has seen significant rises as a result of the fuel duty escalator imposed by the British government.

Table 6.14: Degree of Importance of Factors in Constraining the Growth of Road Freight in Last Five Years

Factor	Mean	Standard Deviation
Higher fuel taxes	2.39	1.43
Road congestion	2.17	1.36
Environmental restrictions	2.09	1.17
Increase in oil prices	2.08	1.24
Tighter government controls (e.g. licensing, traffic, vehicle regulations)	1.97	1.14
Displacement of traffic to rail	**1.38**	**0.77**
Displacement of traffic to water	1.24	0.63

Source: author's questionnaire survey (n=124)

The next four factors do not differ greatly (i.e. only by 0.2 between the second and fifth) in terms of their means, suggesting that they have been of almost equal importance in influencing the volume of road freight used by companies. In declining order of importance, these factors are: road congestion; environmental restrictions; increases in oil prices; and tighter government controls. It would appear that it is the increases in road freight costs and restrictions that are having a slight effect on constraining growth rather than the positive attributes of alternative modes. This hypothesis is developed further in the interview analysis.

It is noticeable that none of the factors included in this question are viewed as having been significant enough over the five year period to merit a mean value as great as the median of the Likert scale range (i.e. three). Therefore even the higher fuel taxes have been relatively unimportant in limiting the growth in road freight volumes.

Respondents were then asked to assess the likely importance of the same range of factors in constraining road freight in the next five years. Two additional factors were included, motorway charges and urban road pricing, to reflect the possible implementation of these new forms of charging as a result of changes in government policy. The ranking of the factors in terms of their mean values are shown in Table 6.15, using the same approach as that for the last five years.

For the factors consistent to both questions, all are expected to be of greater importance in the future as opposed to the past, with only slight changes in the rankings. Road congestion emerges as being the most likely constraint on road freight growth in the next five years, though the mean value for higher fuel taxes is almost identical.

Table 6.15: Likely Degree of Importance of Factors in Constraining the Growth of Road Freight in Next Five Years

Factor	Mean	Standard Deviation
Road congestion	3.20	1.45
Higher fuel taxes	3.17	1.34
Motorway charges	3.02	1.27
Environmental restrictions	2.97	1.27
Urban road pricing	2.96	1.28
Tighter government controls (e.g. licensing, traffic, vehicle regulations)	2.77	1.34
Increase in oil prices	2.73	1.30
Displacement of traffic to rail	**1.93**	**1.15**
Displacement of traffic to water	1.49	0.87

Source: author's questionnaire survey (n=123)

As in the last five years, it is the negative aspects associated with road freight that seem likely to constrain its growth rather than positive attributes of the alternatives leading to a modal shift. As before displacement of traffic to rail is ranked second bottom, though with an increase in the mean from 1.38 in the last five years to 1.93 in the next five years, so its importance does show a predicted increase in absolute terms if not relative to the other factors. Displacement to water is still predicted to be of less significance in the future. This provides many issues to be explored in the interviews in order that a better understanding of the effects of these policy measures can be gained.

6.8 Summary

This chapter has presented and discussed the results of the questionnaire survey, resulting in the identification of a number of key trends and issues that are developed more fully in the following chapters, in the context of addressing the series of hypotheses that this research aims to test. At this stage, it seems that logistical restructuring has had an important influence on transport demand in the last five years, though this has largely been related to the use of road. The interrelationships between logistical changes and mode choice are clearly complex and may be two way influences, though no evidence of mode choice influencing logistical restructuring has been found from the questionnaire analysis. There is reason to believe that change may occur in the next five years; at the very least it appears that there is scope for a change in rail's role.

The evidence from the questionnaire responses shows that there is a significant level of interest in rail freight amongst industry, for a variety of reasons, and that there are issues that need to be addressed by various parties if there is to be a sustained increase in the modal share for rail. The remaining chapters focus on these issues, through the combined analysis of the databases, questionnaires and specifically the interviews. Through this process, the hypotheses identified in Chapter Three can be tested and the two key objectives will be satisfied.

CHAPTER SEVEN: HYPOTHESIS TESTING AND ANALYSIS

7.1 Introduction

The previous two chapters have considered in depth the results and analysis of the series of rail freight databases (see Chapter Five) and the questionnaire survey (see Chapter Six). It is the intention in this chapter to utilise the results presented in those chapters, using the framework of research hypotheses identified in Chapter Three, to address the overall research objectives. To avoid repetition, throughout the hypothesis analysis reference is made to the relevant sections in these previous chapters. With most of the hypotheses, as was shown in Table 4.4, the database and questionnaire data have been strengthened by the interview information to provide a more thorough analysis incorporating the more qualitative aspects of the research.

Prior to the analysis based upon the series of hypotheses later in this chapter, the next section provides an overview of the results of the in-depth company interviews that were carried out.

7.2 Overview of In-Depth Company Interviews

The methodology concerning the in-depth interviews was discussed in Section 4.6. This section examines the key outcomes of the interview process and summarises the information gained as a result.

Based upon the methodology used, the matrix shown in Appendix Five summarises the main characteristics of the 39 interviewees and their relationships with each other. To provide the promised anonymity for the interviewees, the companies are identified only by their code which shows the industrial sector to which they belong together with a unique number within that sector.

This summary involves three different methods of categorisation. Firstly, there is their company's position in the supply chain. Interviewees have been classified according to where they fit into the supply chain from raw material to the final customer. Supply chains have been broken down into three categories, representing their start, middle and end. Basically, those classified as being at the start of the supply chain are those involved with raw materials. Those in the middle are dealing with the intermediate manufacturing or handling of goods, while those at the end are involved with the sale and/or movement to the final customer.

This classification is necessarily crude since no two supply chains are identical and certain companies are involved in processes at different stages in a supply chain (or in a number of different supply chains). Therefore it would not have been realistic or accurate to attempt to break down the supply chains in any greater detail. Nevertheless it is a useful means of identifying companies in terms of their propensity to utilise, or be able to utilise, rail freight services.

Secondly, the supply chain links between the companies are shown. Where possible, interviewees were asked to provide details of their key suppliers and customers. Due to the confidentiality promised to all participants in the research, and the reluctance of certain interviewees to provide this sort of detail, the identification of actual linkages proved more difficult than anticipated and the number of clear linkages was lower than anticipated. These problems, and similarly those with the matched pairs below, are discussed in more detail in Section 8.6.

As can be seen from the matrix, linkages both upstream and downstream from each company are shown where they were found to occur. Only a small number of the linkages were explicitly discussed by the interviewees, but many more were inferred (e.g. by interviewee A4 stating that they supplied all major supermarkets, it was assumed that interviewee I1 was directly linked, since it is one of the biggest supermarket chains). In addition, further supply chain linkages are likely to exist between interviewees, but were less apparent. These have not been included in the matrix, but are discussed in more general terms during the hypothesis analysis.

The third type of categorisation involves the identification of matched pairs of companies. With the exception of the paper/publishing and electrical machinery sectors, where most of the interviewees were identified as being paired with others within their sector, the matched pairings were more difficult to identify than expected. In total, 14 pairs of companies were apparent. These pairs were defined as companies at a similar stage in the supply chain who were involved in the production or selling of similar goods.

In total, 32 of the 39 interviewees were identified as being directly either linked or paired with other companies that were interviewed. While this does not provide as comprehensive coverage of supply chains as was desired, it does give a significant volume of original information regarding the operation of significant sections of supply chains and the related interactions with mode choice. By distilling the information in Appendix Five, Table 8.1 shows the extent of the coverage of the key supply chains under examination, as introduced in Section 4.6.1.

Table 7.1: Coverage of Key Supply Chains in Interviews

Supply chain	Coverage of supply chain			Companies involved in supply chain
	Start	Middle	End	
Paper/publishing 1	•	•		A2→F4/F8/F10/F12
Paper/publishing 2	•	•		F7→F1/F3/F6/F9
Food/drink 1	•	•	•	A2→A5/A8→I1
Food/drink 2	•	•	•	A9→A5/A8→I1
Food/drink 3	•	•	•	A2→A1→I1
Food/drink 4		•	•	A6→I1
Food/drink 5		•	•	A3→I1
Food/drink 6	•		•	A4→I1
Transport equip. 1		•	•	G4→D2→D3
Transport equip. 2		•	•	G4→D3
Transport equip. 3		•	•	D1→D3
Transport equip. 4		•	•	D2→D4
DIY products 1	•		•	F11→I3
DIY products 2		•	•	G4→I3
DIY products 3		•	•	H1→I3
Electronic products		•	•	G1/G3→I5

Source: author's interviews

In only three cases was it possible to create multiple linkages within supply chains. Two of these were in the food and drink sector, where in general terms the coverage was from the start to the end of those supply chains. The third was in the transport equipment sector where, due to its greater complexity in supply chains due to more stages of manufacturing, the coverage was only from the middle to end of that supply chain. The only other supply chain with relatively comprehensive coverage, due to its simplicity, was DIY products 1, which involved the production of wood-based products directly from raw materials for onward distribution to DIY retailers.

In these and all the other cases identified, the supply chains were obviously far more complex, with numerous suppliers and customers being involved. However, the identification of the linkages shown in Table 8.1 does allow the analysis of the effects of changes in logistical operations instigated at particular points in those supply chains, as well as the identification of the scope for rail to play a part in the movements under analysis.

From Appendix Five it can be seen that 18 of the companies were involved in matched pairs, though this created only seven different matchings due to some "pairs" having as many as four similar companies. Twelve of these companies also feature in the supply chains shown in Table 8.1. The other three were independent matched pairs that did not form part of a larger supply chain under consideration. Overall, there is thus considerable scope for detailed analysis of the ways in which different supply chains, as well as the differences between companies at the same stage within some of those supply chains.

Appendix Six provides a comprehensive summary of the information provided by each of the interviewees. While the exact focus of each of the interviews was determined by the nature of the discussion with the interviewee, they all followed the basic structure that is shown in Appendix Four. The purpose of Appendix Six is therefore to provide an overview of the key points raised in the interviews as a way of attempting to ensure consistency in analysis. It acts as an easy reference to establish the key issues relating to the companies involved and their likelihood of using rail in the future. In particular, it attempts to identify the proportion of goods that could potentially be moved by rail if the circumstances were suitable.

There was much additional qualitative information, not shown in Appendix Six due to reasons of space, which was provided by specific companies and which provides further insight into the interactions between logistical structure and mode choice. Many companies also provided supporting information, such as detailed distribution details and company newsletters. All of this additional material is incorporated throughout the hypothesis analysis in this chapter.

This section has provided an overview of the information gathered from the in-depth interview process and has discussed the extent to which individual supply chains and matched pair companies have been covered by the interviews. The remainder of the chapter addresses the series of research hypotheses constructed in Chapter Three and is split into the three key sections identified in that chapter. The information required for the testing of each of the hypotheses was shown in Table 4.4. This process of examining each of the hypotheses in turn provides the evidence by which the two key research objectives are satisfied. Unless otherwise stated, the analysis and discussion is concerned with the last five years (i.e. 1994/95 to 1999/2000) and the next five years (i.e. 1999/2000 to 2004/05).

7.3 Developing a Greater Understanding of the Supply-Side of Rail Freight and its Impacts on Mode Choice Decision-Making

This section is concerned with the four hypotheses that aim to establish a better knowledge of the provision of rail freight services and the effects that recent changes have had upon the mode choice decision-making processes. These were formulated and justified in Chapter Three and are now examined individually.

<u>Hypothesis One</u>: *There has been a growth, both in relative and absolute terms, in rail freight services over the last five years, in particular those catering for non-trainload and intermodal traffic.*

In the discussion of the published freight statistics in Chapter Two (see Figures 2.1 and 2.2), it was shown that there has been a significant and sustained growth in the aggregated level of rail freight activity since the mid-1990s, both in terms of tonnes lifted and tonne kilometres. The lack of disaggregated official statistics has been addressed by the original databases of rail freight flows that were analysed in Chapter Five. This analysis of the number of services operated forms the basis of the testing of Hypothesis One and builds on the discussion of the databases in Section 5.8.

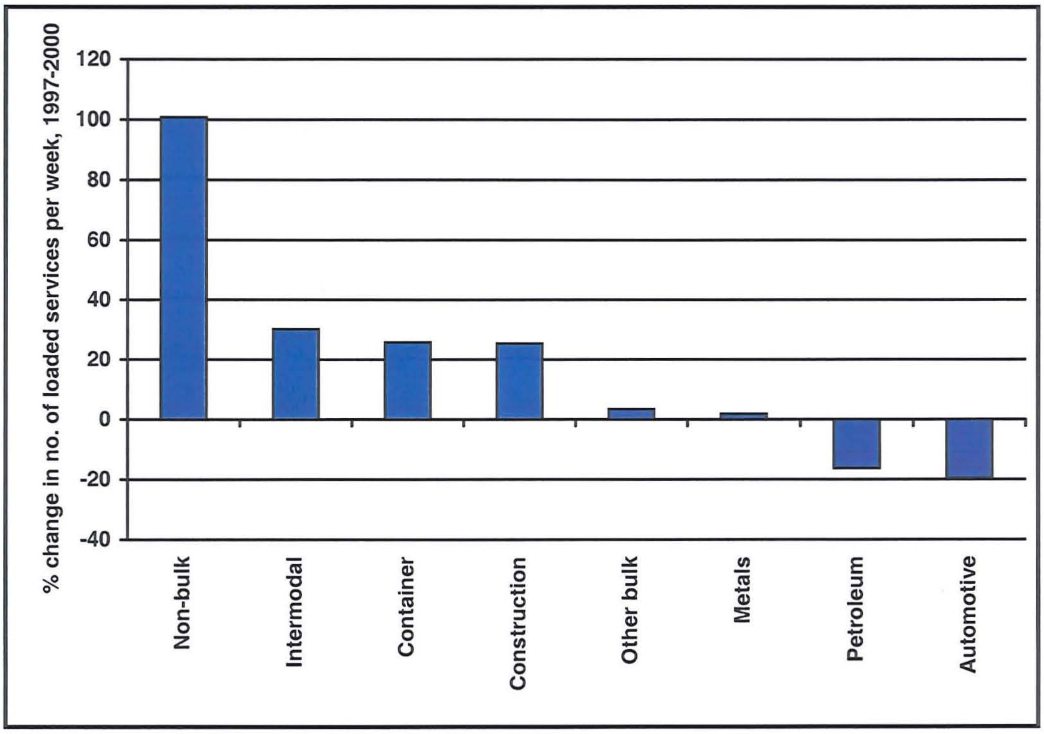
For the reasons discussed in Section 4.4.1, the rail freight databases constructed did not specifically cover the whole of the five year period since 1995. However, in the three year period from January 1997 there was an increase of 33 per cent in loaded services operating comprising year-on-year increases during this period of between six and 16 per cent.

According to the official statistics, since the databases did not (and indeed could not) consider other modes, this increase in rail freight activity lifted rail's mode share of total tonne kilometres in Great Britain from 6 per cent in 1995 to 7 per cent in 1998 (DETR, 1999). More recent official modal split statistics were not available at the time of writing. However, in addition to the absolute increase in rail freight activity, rail has shown a slight increase in its relative share of the total freight market, expressed in tonne kilometres.

The main benefit of the database analysis is its ability to examine the changes at the disaggregated level and thus address the second part of Hypothesis One. Based upon Figures 5.5 and 5.6, Figure 7.1 reveals the trends in the different sectors between 1997 and 2000. There was a doubling in the number of non-bulk (i.e. non-trainload) services between 1997 and 2000, a growth rate more than three times greater than that of any other sector.

The two sectors covering intermodal technologies, i.e. container and (non-container) intermodal, were ranked second and third, with increases of 25 to 30 per cent in the number of services being operated. Only construction out of the bulk sectors registered a significant increase in the number of services.

Figure 7.1: Disaggregated Changes in the Number of Rail Freight Services Provided, by Sector (1997-2000)



Source: author's databases

Comparison of Figures 5.15 and 5.18 revealed that the proportion of services accounted for by these categories of service increased from 53 per cent to 63 per cent between 1997 and 2000. It is clear therefore that there has been a large increase in non-bulk and intermodal services, both in absolute terms and as a proportion of all services operated. All of the evidence from this research thus supports Hypothesis One, with a greater number of rail freight services now being operated and a greater proportion of those services catering for non-bulk and intermodal services.

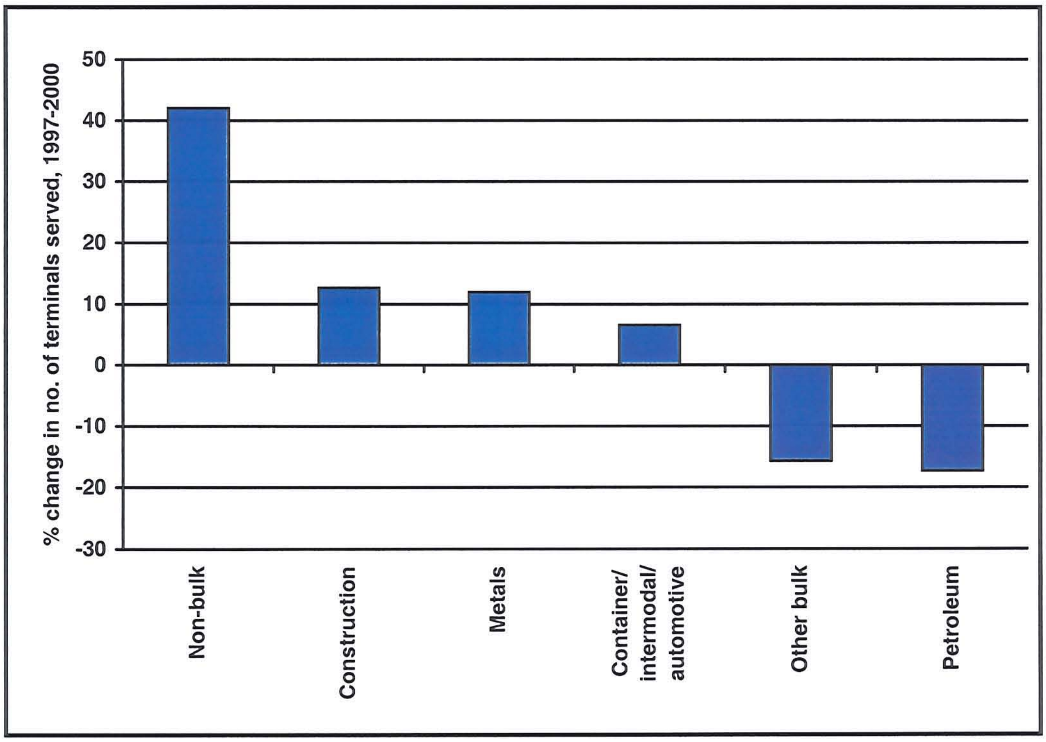
<u>Hypothesis Two</u>: Accessibility to the rail network has improved in the last five years, in terms of the number of operational terminals.

In a similar manner to the first hypothesis, Hypothesis Two is relatively easy to address in a quantitative manner using the rail freight databases, though the same restriction on the time period under consideration applies (i.e. since 1997). Section 5.8.2 discussed and analysed the trends in the number of locations served by rail freight services by different sectors in the different time periods and highlighted the potential inaccuracies in the methodology applied.

Specifically considering Hypothesis Two, Figure 7.2 presents the changes in number of operational terminals by sector between 1997 and 2000. During this time period, there was an overall increase of 13 per cent in the number of active terminals listed in the databases, though the trends for individual sectors differ significantly as can be seen in the diagram.

It would appear that there has been an improvement in the accessibility to the rail network since 1997, particularly with the expansion of the Enterprise wagonload network, which served over 40 per cent more terminals in 2000 than it had done in 1997. Even allowing for the likely effects of the transfer of terminals that had previously been served by dedicated bulk sectors to the wagonload network during this period, the rate of growth has been significant.

Figure 7.2: Disaggregated Changes in Number of Locations Served by Regular Rail Freight Services, by Sector (1997-2000)



Source: author's databases

The increase in the number of container/intermodal/automotive terminals has been far less significant, representing a gain of only three terminals in absolute terms (seven per cent). Given the nature of these types of terminals, with their general usage of road feeder services to the railhead, the absolute number of terminals served will not give as accurate a reflection of the penetration of these services as for bulk services. For example, it is feasible that use of these terminals is spreading to movements originating or terminating at greater distances from the terminal itself than in the past. Anecdotal evidence from the interviews suggested this is the case with, for example, companies based in the North East of England considering the use of either Wakefield or even Manchester as access points to the rail network for intermodal traffic.

For the bulk sectors there has been a mixed pattern, largely reflecting the changes in service provision shown in Figure 7.1. The main exception has been in the metals sector, where there has been a minimal increase in the number of services operated, but a relatively large growth in the number of terminals being served.

In general, as Figure 5.19 revealed, the increase in the number of services being operated has outstripped the growth in the number of terminals, suggesting that the growth in services has resulted more from an increase in traffic to existing terminals rather than a significant increase in the number of terminals *per se*, although both have been important.

Therefore the evidence does support Hypothesis Two, since there has been an absolute increase of 13 per cent in the number of terminals being served on a regular basis. In addition, it would appear that the relatively limited number of intermodal terminals have extended their reach to a wider customer base, which is supported by the large increase in the number of services using these terminals plus the anecdotal evidence from interviewees and railway publications.

<u>Hypothesis Three</u>: *The provision of rail freight services is now more commercially aware than five years ago.*

This hypothesis is more subjective in nature than the first two and relies upon the combination of evidence from the rail freight databases, questionnaire survey and the in-depth interviews. In this context, commercial awareness is defined as having an understanding of and responding to the needs of customers in the broadest sense, both those already being served and those that may potentially be customers. This is related to the likelihood of rail gaining market share in existing markets as well as establishing itself in new markets. This is in contrast to the negative attitude towards users displayed by British Rail in the 1980s and early-1990s discussed in Chapter Five when decline of rail freight volumes was accepted and, indeed, expected.

It could be argued that the evidence provided for the first two hypotheses above supports the assertion that rail freight is now more commercially aware than five years ago. Further, the discussion of the changes in service provision discussed in Sections 5.2 to 5.7 suggested that this was likely to be the case. However further evidence is sought from the combination of information sources.

In a quantitative sense, the databases allowed the analysis of the changes in operating periods (see Section 5.8.3) and operating speeds of freight trains (see Section 5.8.4), both of which could be seen as surrogates for some measure of commercial awareness.

In terms of the operating periods in which freight services are scheduled to run, there has been only a very marginal increase in the proportion of services operating over the weekends, with over 90 per cent of services consistently operating during the traditional five day working week. This may not necessarily reflect a lack of commercial awareness, as there may be no significant demand from industry for services to run at weekends.

Of the interviewees, the only companies to highlight the lack of a 24 hour a day, seven day a week railway as a specific obstacle to using rail were two of the four newspaper publishers, whose daily production and tight timescales for distribution dictate that their delivery mode of transport has virtually 100 per cent availability. The other two newspaper publishers did not specifically isolate this issue, but more generally stated that rail in its current form could not satisfy their requirements. In all four cases, their company's use of rail prior to the mid-1980s had met with difficulties in terms of the then British Rail providing quality services throughout the week. The impression amongst this group of interviewees was that there have certainly been advances in commercial awareness among the privatised rail freight operators, but that these are still far short of what is required to bring newspaper distribution back to the rail network. Other logistical changes, for example in printing deadlines and locations, would also prove to be major obstacles in changing back from road to rail except for exceptional flows.

The second of the surrogate measures, that of operating speeds, also presents an unclear picture from the database analysis. Between 1997 and 2000, there was a 29 per cent increase in the number of Class 4 trains (i.e. 75 miles per hour) being operated, but this was actually less than the 33 per cent increase in the overall number of services. Thus, a slightly lower proportion of services were operating as Class 4 trains in 2000 than had been the case in 1997, though the trend from year to year has been variable and may have been influenced by other factors such as the restructuring of the Freightliner network (see Section 5.8.1.3).

Service speeds, or even origin to destination journey times, were not identified as a major factor by interviewees in their mode choice decision-making, but great emphasis was placed on the overall impression of service quality. With few exceptions, the important attributes here were seen to be punctuality and reliability (as well as cost) rather than journey time itself. For example one of the interviewees, a cardboard manufacturer, who was using rail freight highlighted major shortcomings in service reliability as being the key issue rather than any problems surrounding journey times.

Further, the class of operating speed of a train does not necessarily reflect its journey time in any case, since there are other factors that will be of importance, such as *en route* marshalling and availability of suitable non-stop paths on the rail network, in determining the terminal-to-terminal journey time. In general, though, Class 4 trains do have faster point-to-point journey times due to their greater ability to mix with passenger services and avoid the necessity to be "looped" on the main line or stabled in yards whilst awaiting a path on the network.

It should be remembered that the databases did not collect and examine the services provided on behalf of the Royal Mail, which operate as Class 1 trains at speeds of up to 110 miles per hour. For certain types of potential rail freight traffic (e.g. newspaper distribution), Class 1 services would be required and would be possible due to the different types of rolling stock used for mail/newspapers when compared to traditional freight movements.

Six out of 13 questionnaire respondents who had increased their use of rail in the last two years had done so as a result of the development of new rail services and infrastructure (see Table 6.2), this being the single most important factor that has led to their increased use of rail. Five of the 16 current rail users who expect to increase their use of rail in the next five years stated the same reason as being the likely motivation (see Table 6.3). In addition, three of the four factors most likely to encourage companies to start using rail in the next five years are connected with the supply-side of services (see Table 6.6), revealing confidence that the rail freight industry is becoming more customer aware and more sensitive to the demands of potential customers. However, Table 6.7 revealed that a much larger body of respondents do not, and are unlikely in the near future to, satisfy their requirements.

Specifically examining the influence of rail privatisation, whilst 83 per cent of respondents stated that this had no impact on their mode choice decision-making (see Figure 6.23), Table 6.8 showed that 12 respondents (i.e. nine per cent) mentioned a greater commercial awareness as being an important influence. Seven respondents mentioned more general improvements and investment, which may have been as a result of a more commercial approach. Obviously, as Table 6.9 revealed, there were far more respondents who have not found that privatisation has changed their approach to mode choice.

From the interviews, of which 11 companies were current users of rail, more detailed attitudes and experiences of the quality of rail freight services were gained. The unanimous opinion was that the rail freight service providers still have an extremely long way to go before they are as commercially aware as the road haulage industry. Opinions on the extent of any improvements in the last five years were mixed, although of those who had been using rail throughout this period (i.e. five interviewees) all believed that the operators had become much more customer-focused.

Nine out of the 11 interviewees were EWS customers, while two were using Freightliner. There was no perceptible difference in opinions of the two companies, and indeed two EWS customers had explored the potential of Freightliner's services but had found them to be no more customer-friendly than EWS. The general attitude is that rail freight has far more potential, but that there is still a huge change in management attitude and focus at EWS and Freightliner that is required before the potential will be realised. There is a belief that, over time, there will be further improvement in the focus of the operators.

For example, immediately prior to the interview, one paper manufacturer had just had an emergency meeting with their rail freight service provider to discuss issues surrounding customer focus and service reliability. On a regular basis, inward movements of timber were regularly going missing for 24 hours as a result of the local trip working from the nearby marshalling yard not running due to staffing shortages. One of the matched pair paper manufacturers has had similar experiences, with the distribution of product to South East England regularly being delayed, this time by network capacity problems in the London area. However, both interviewees did have much more faith in rail freight operators actually responding to customer's demands and complaints than they did with British Rail in the past and were confident that, despite these setbacks, their companies' use of rail would increase in the future.

The positive attitude towards rail from those interviewees currently using services was greater than had been anticipated as a result of the analysis of the other components of this research. This highlights the importance of the attitudes of individuals and is analysed further in Hypothesis Twelve. It also provides interesting insights into the ways in which rail can be incorporated into supply chains and this is dealt with in the latter hypotheses.

Overall, the evidence supports the assertion that the provision of services has become more commercially aware and that Hypothesis Three can be accepted. However, this does not mean that the current situation is ideal, or even satisfactory, in the opinions of many existing or potential customers. The extent to which further improvement is required from the rail freight industry to gain further traffic is discussed throughout many of the remaining hypotheses.

<u>Hypothesis Four</u>: *Perceptions of rail freight amongst manufacturers and retailers have improved in the last five years and will lead to greater interest in rail freight services amongst potential customers.*

This hypothesis develops many of the issues raised in Hypothesis Three, by focusing on the more subjective but equally important issue of industry perceptions of changes in the provision of rail freight services that have occurred. The main focus of the previous hypothesis was on actual changes that have taken place in the provision of services, together with the extent to which rail freight users had found services to have become more commercially aware recently.

Hypothesis Four is concerned more generally with whether or not the perceptions of manufacturers and retailers have improved in the last five years, together with the likelihood that this will lead to a greater customer base. The discussion in Section 6.3.3 analysed in considerable detail the opinions of the general questionnaire sample to their likely use of rail in the next five years, much of which was clearly based upon their changing perceptions over the last five years.

The evidence in the discussion of the previous hypothesis suggested that perceptions of rail freight have improved and are likely to lead to new rail customers in the next five years, to the extent that the proportion of questionnaire respondents using rail will increase from 14 per cent at present to 37 per cent in five years time (see Figure 6.17). This will be in addition to significant increases in the volumes being moved by rail predicted by the 14 per cent of companies already using rail freight.

As stated in the previous hypothesis, this issue of perceptions towards rail freight was developed in greater depth in the interviews, since they are of great significance in determining what responses take place. Eight interviewees (i.e. 21 per cent) were clear that rail had nothing to offer their company, regardless of any changes that may have occurred or which may potentially occur in the future. This is discussed further in Hypothesis Nine. The changes in perceptions of the 11 interviewees currently using rail were examined in Hypothesis Three.

Of the 20 remaining interviewees, the vast majority have perceived an improvement in the quality of rail freight services in the last five years. When exploring the reasons for this improvement, very few interviewees were able to provide specific factors that had caused them to change their perceptions. There appeared to be a general "feel good" factor resulting from:

- the renewed emphasis on rail freight in government policy;
- the growing realisation that alternatives to road will become more important, particularly due to the deterioration of road conditions and increases in costs in the future; and
- the growing evidence that rail freight is undergoing a sustained period of growth and is starting to move into new markets that recently have been ignored by rail freight providers.
- greater investment in the rail industry in general, from government, Railtrack, etc.

Only four of the 20 interviewees had actually directly approached or been approached by rail freight operators. For the vast majority, their perceptions of changes in rail quality and ability have largely been formed as a result of general coverage of developments in the media and the trade press or through discussions with their third party providers of their transport/logistics requirements. In fact, seven of the interviewees believed that the commencement of using rail for their freight movements would be as a result of mode choice decisions made by their third party provider rather than by the interviewee company itself. This raises the important issue of who exactly is making the decision on mode choice and the flexibility that they have in making that decision within other logistical constraints. This is addressed further in the hypotheses in Section 7.4.

It also raises questions about just how realistic the questionnaire respondents' and interviewees' expectations are of what rail will be able to offer them, particularly in the next five years. This time period is not likely to see major increases in network and terminal capacity due to the long lead times and high initial costs or, to a lesser extent, locomotive and rolling stock provision. Such a significant increase in the customer base, however, implies a large resource implication. The lack of direct knowledge and experience of rail services may have resulted in unrealistically high expectations among many respondents, which may not be able to be met within that timescale.

This raises important issues relating to the way in which potential customers are dealt with, since there is a huge risk of them becoming disillusioned if their expectations are not met. In particular, if rail cannot reliably fit into the demanding supply chains that most respondents belong to then the long term potential for rail may be damaged. The nature of the logistical requirements of potential customers is key to the analysis in Sections 7.4 and 7.5 and the general issues are discussed in Section 8.5.

Returning to the key question raised in Hypothesis Four, the evidence certainly supports the assertion that perceptions of rail freight amongst manufacturers and retailers have improved considerably in the last five years. While not claiming to be representative of the population at large, the projected increase in usage of rail from 14 per cent at present up to 37 per cent in five years can be seen as a vote of confidence in rail and certainly reflects a growing interest and awareness of what rail can (and perhaps cannot) offer.

This section has established that there have been significant changes in the supply and quality of rail freight services in the last five year period. These have led to a growth in the number of services, particularly in non-traditional rail freight markets, and to a lesser extent an improvement in accessibility to the network. Commercial awareness of rail freight service providers is viewed as having improved, leading to a much improved perception of rail, notably amongst those who have no current or recent experience of the mode.

Thus far, the analysis has not incorporated the key issues of logistical structure and the identification of ways in which changes to logistical operations may be able to encourage the greater use of rail. This forms the basis for the remainder of the analysis, since these are crucial issues that will determine the extent to which rail is able to increase its share of the freight market.

7.4 Identifying the Impacts of Recent Logistical Changes on Mode Choice Decision-Making, Particularly in Relation to Rail Freight

The basis of this research project, as exemplified by the two research objectives identified in Section 1.2, is the importance of the overall concept of logistics in influencing the nature of freight transport, including mode choice. Thus the focus of the analysis in this section is on the second set of hypotheses that were constructed in Chapter Three. In combination, they examine the recent logistical changes that have occurred and assess the impacts of these changes on the mode choice decision-making process, specifically addressing the implications for the use of rail. This therefore builds upon the analysis of the supply side of rail freight in the previous section. Hypotheses Five to Eight are now dealt with in turn.

<u>Hypothesis Five</u>: *Mode choice decision-making has been of low importance in the last five years when companies have been making changes to their logistical operations.*

The logistics-based literature that was reviewed in Chapter Two was found to be lacking in its treatment of mode choice, with the general implicit assumption being that the contemporary complex freight requirements can only be met by road. However, this ignores the changing policy context for transport, raised in Section 2.3, and the significant changes in the provision of rail freight services that were dealt with in Section 7.3. This hypothesis aims to identify the degree of importance that has been attached to mode choice decision-making when making alterations to logistical operations in the last five years and builds upon the discussion in Section 6.6.

Prior to dealing with the direct issue raised in the hypothesis, it is important to gain an understanding of the extent to which logistical operations have actually been changing during the last five years, since if they have been static then they would have had no influence at all on mode choice. This understanding was gained from the questionnaire respondents. It was supplemented by surrogate variables from the in-depth interviews as summarised in Table 7.2.

The breakdown of this information by interviewee can be found in Appendix Six, which reveals that considerable change has taken place in most companies in the last five years. In total, only eight of the interviewees (i.e. 21 per cent) stated that their companies had not undergone any of these changes during this time period. Therefore, this validates the hypothesis as set out above and provides the reason for addressing the issue of mode choice when companies undergo logistical restructuring.

Table 7.2: Logistical Changes Within Interviewee Companies in the Last Five Years

Logistical change	No. of interviewees (and %) experiencing change
Increase in level of sales	11 (28%)
General management reorganisation	11 (28%)
Change in product attributes	10 (26%)
Decrease in no. of company locations	10 (26%)
Increase in no. of company locations	6 (15%)
Decrease in level of sales	5 (13%)
Increase in market area	4 (10%)
Change in location activities	3 (8%)
General change in market area	1 (3%)

Source: author's interviews

Figure 6.19 revealed that only approximately one quarter of companies included in the questionnaire survey had direct Board level representation for the transport function. Of those, only three respondents (i.e. two per cent) had a specific

Transport Director, with the attached senior level responsibility solely for transport. In the rest of the Board level cases, the responsibility for the transport function was subsumed under the banner of Logistics or Distribution Director, the implication being that transport is not of great importance in isolation but may be a major factor as part of the bigger logistical operation.

In over half of the sample, transport-based decisions are handled by a Logistics or Distribution Manager. Given that only 19 respondents (i.e. 14 per cent) had a specific Transport Manager to make these decisions suggests that only fairly low importance is attached to these issues in isolation. Overall, it is quite clear that in the vast majority of cases transport is now just one of a number of areas that are handled by a Logistics or Distribution Manager or Director with a much broader range of responsibilities. Within this, the actual consideration of mode choice appeared to be of even less importance than many other transport issues, mainly relating to the efficiency of the road-based operations.

78 per cent of respondents stated that their company conducted some sort of formal mode choice analysis for new freight flows (see Figure 6.21), although this was often on an *ad-hoc* basis rather than based upon a strategic policy or set criteria. The questionnaire was not able to establish the regularity of this sort of analysis, since it may be the case that new freight flows are relatively infrequent occurrences.

To develop the level of understanding required for this hypothesis, interviewees were probed in greater detail to determine more fully the extent to which mode choice features when making logistical changes. Fifteen of the interviewees (i.e. 38 per cent) stated that, in their opinion, their company's transport operations were represented at the senior level, this being considerably higher than the proportion of questionnaire respondents in general whose companies had Board level representation. It is believed that this was due to the greater interest in this research, and therefore willingness to be interviewed, by those companies who view transport (in isolation or as part of logistics) as being worthy of a Board member.

Only five interviewees (i.e. 13 per cent) were sufficiently worried about transport cost increases, either recent or predicted, to believe that their operations would be fundamentally at risk. The overwhelming majority of interviewees saw transport cost rises as something beyond their control but whose effects could be contained without drastic action. Without exception, companies were of the opinion that they are (and will be) able to cope with any decreases in road-based service quality without having to take major action and that, in any case, their competitors are (or will be) suffering similarly so competitive advantage would not be lost.

The implications for rail freight are discussed later, primarily in Hypotheses Thirteen and Fourteen. However, there was evidence from the in-depth interviews that a growing number of companies are paying more attention to mode choice than they previously have been doing, as a result of the significant increases in road transport costs and, to a lesser extent, road congestion in recent years.

This was supported by comparison with the previous study undertaken at Heriot-Watt University in 1992-94, which found that, in general, very little attention was paid to mode choice issues and that this was unlikely to change in the five year period following that study. More detailed comparisons between the two studies, in the context of logistical structuring and its effects on transport choices, can be found in the testing of Hypotheses Thirteen and Fourteen later in this chapter.

Despite the relatively low level of importance in terms of the representation of transport within companies, both from the questionnaire and interview information in this study, the analysis of questionnaire responses showed that 94 per cent of respondents were satisfied that sufficient attention is given to mode choice decision-making within their company (see Figure 6.20). However this does not make clear whether the hypothesis as stated is untrue, as a result of mode choice actually having a high level of importance attached to it, or whether respondents were happy that the low level of importance is all that is necessary when making changes to logistical operations.

The results of the investigation for this hypothesis have not been as conclusive as the earlier ones, but on balance the evidence tends to suggest that very little attention has been devoted to mode choice when companies have undergone logistical change. The general issue of mode choice is believed by the overwhelming majority of companies to be considered as "fully as required", even though this is apparently not considerable or at a senior level in most cases. This supports the argument that it is low down in the list of priorities for most companies. This does not necessarily rule out the greater use of rail in the future, the likelihood of which will be explored in the later hypotheses.

Hypothesis Six: *The changing relationships between companies at different stages in the supply chain have been detrimental to rail freight and have instead favoured road over the last five years.*

While the previous hypothesis was focused upon the changes within companies, Hypothesis Six builds upon the significance of changes along supply chains. This analysis is based on the general analysis of the questionnaire responses and complete interview sample, with more detailed analysis of those supply chain linkages that were identified in Table 8.1.

From the analysis in Section 6.6, it was seen that the most significant factor responsible for increasing questionnaire respondents' total demand for freight in the last five years was a change in customer requirements (see Table 6.12). This suggests that companies downstream in the supply chain have become more demanding of their suppliers and that this has had major implications for the amount, and possibly nature, of freight transport used.

Of the sample that was interviewed, 22 (i.e. 56 per cent) claimed that their customers had become more demanding in the last five years. Largely this was a result of a combination of reduced lead times for delivery to customers and more frequent deliveries of smaller quantities. A small minority of companies had managed to keep control of these issues, for example managing to retain nominated day deliveries to customers or minimum order sizes to justify a delivery. In the main, though, the interviewees had had no option but to allow these changes dictated by their customers for fear of losing the business to competitors.

Of course, as well as having customers who have become more demanding, the participant companies in this research are generally customers to other companies further upstream in the supply chain. The equal second-most important factor in leading to an increased demand for transport, as shown in Table 6.12, has been the adoption of low inventory strategies such as just-in-time stockholding and production by the participant companies. This will presumably have led to these companies forcing the same sorts of changes onto their suppliers that they themselves have faced from their customers.

Only seven of the companies interviewed (i.e. 18 per cent) had made changes to their sourcing from suppliers in the last five years, although five of those had reduced their stockholding levels and/or lead times demanded of their suppliers. This may be a result of the majority of interviewees coming from the manufacturing stages at the start and middle of the supply chain, as shown in Appendix Five, with the customers that they claim to have become more demanding being located further downstream, who were under-represented in the interview phase.

Overall, when questionnaire respondents were simply asked to rank the top three factors that had influenced their freight demand, these two crucial supply chain measures were ranked second and third with only change in the level of sales placed more highly, as shown in Figure 6.25.

When examining the recent changes in transport efficiency within the interviewee companies, six companies (i.e. 15 per cent) had found that this had worsened while 10 (i.e. 26 per cent) stated that they had improved the efficiency of their transport operations. One further company had experienced a combination of deterioration and improvement in efficiency, with no real significant change on balance. Surprisingly, there was no apparent relationship between the direction of efficiency change and the position of the company within the supply chain. A number of companies towards the start of the supply chain had made significant improvements to their transport operations, while others had experienced declining efficiency. Of the five retailers, however, the three who have experienced change had all improved their efficiency.

Examining this in further detail, using the supply chain linkages, reveals a mixed picture as Table 7.3 reveals. In 10 out of the 25 linkages, there has been no change at all in the efficiency of the two (or three) companies involved. The remainder of linkages revolve around a small number of companies primarily involved in the food and paper industries and thus are not even very representative of the interview sample never mind the population at large. Seven of the 15 involve company A2, a manufacturer of ingredients for the food and paper industries, which is the one that has experienced mixed fortunes in terms of its transport efficiency. Six of the linkages incorporate company I1, a major food retailer, emphasising the relatively limited strength of this part of the analysis.

Table 7.3: Changes in Transport Efficiency Along Supply Chains

Supply chain linkage	Efficiency change for supplier	Efficiency change for intermediary	Efficiency change for customer
A2→A1→I1	↑↓	No change	↑
A2→A5→I1	↑↓	No change	↑
A2→A8→I1	↑↓	↓	↑
A2→F4	↑↓	n/a	↑
A2→F8	↑↓	n/a	↓
A2→F10	↑↓	n/a	No change
A2→F12	↑↓	n/a	↑
A3→I1	↑	n/a	↑
A4→I1	No change	n/a	↑
A6→I1	No change	n/a	↑
A9→A5→A1	↓	No change	No change
A9→A8→A1	↓	↓	No change
D1→D3	↑	n/a	No change
D2→D4	No change	n/a	No change
F7→F1	No change	n/a	No change
F7→F3	No change	n/a	No change
F7→F6	No change	n/a	↑
F7→F9	No change	n/a	No change
F11→I3	No change	n/a	No change
G1→I5	No change	n/a	No change
G3→I5	No change	n/a	No change
G4→D2→D3	No change	No change	No change
G4→D3	No change	n/a	No change
G4→I3	No change	n/a	No change
H1→I3	↓	n/a	No change

Key: ↑ - improvement; ↓ - worsening; n/a - not applicable; supplier→intermediary (where applicable)→customer (e.g. A2 is supplier, A1 is intermediary and I1 is customer in first case)

Source: author's interviews

In a very general sense, it does appear that the transport efficiency of companies nearer the beginning of the supply chain has suffered at the expense of those further downstream. Company A2, which features strongly in this analysis, has found that it has come under tremendous pressure from many of its customers to serve them much more frequently and with less notice of requirements, particularly in the food side of its business. To some extent it has managed to negate the effects of these demands by improving the efficiency of its distribution to the paper industry, which is much less demanding and more inefficient. This has meant that the overall efficiency has not suffered, but it certainly has to the large food customers. It is interesting to note that A2 is a current rail user, but this is only for distribution to non-food customers whose requirements are less time constrained and the volumes involved per movement are far greater which allows the use of rail.

Further down that supply chain, the retailer I1 conceded that its gains in transport efficiency, which have included greater control of the inward movements of products from its suppliers, will in many cases have reduced the efficiency of its suppliers and, indeed, others further upstream. It has, however, begun to work in conjunction with its suppliers to try to remove inefficiencies from the supply chain as a whole, the effect being that movements more suited to rail may be created. This is not the prime motivation for the change, though, which is solely due to retaining or improving profitability through encouraging suppliers to be more efficient in their use of transport and other significant cost items. The extent to which it will be possible for I1 to assist in achieving such supply chain efficiencies is unclear and is made more difficult by issues of confidentiality within companies along the supply chain.

The analysis thus far provides some evidence to support the argument that changes by particular companies in the supply chain, largely towards the customer's end rather than the raw material end, have affected the nature of transport movements throughout the entire supply chain. It has not proved possible to quantify this trend from the interview responses, although the questionnaire evidence lends weight to the general argument that transport efficiency is dictated by supply chain changes to a significant degree.

It is much more difficult to find evidence to test the key part of the hypothesis though, which is that relating to the impacts of these supply chain changes on the use (or potential use) of rail. The fact that so many companies, particularly out of the larger questionnaire sample, have been using an increasing amount of freight transport as a result of changes in their logistical strategies or those of their customers would suggest that this has made it more difficult for rail to become involved in the supply chain.

Only one of the interviewees had had specific discussions with their suppliers regarding ways in which they could restructure the supply chain to allow the use of rail. Perhaps not surprisingly this was I1, but even then it was only related to a negligible proportion of supplies, that being long distance movements of wines from southern Europe into Britain. For its domestic business, I1 has not taken any tangible steps to try to establish the potential that may exist for rail as a result of its changing relationships with its customers.

For the remainder of interviewees, mode choice was something that was not explicitly considered between companies in the supply chain other than in exceptional circumstances. Company C1, which is not linked to any others in the sample, was involved in the movement of waste material into landfill sites and was the only interviewee that considered that rail had become more important in the decisions on how changes to the supply chain were effected. It felt that it had benefited from this, in that it had rail-served landfill sites, though the main reason for incorporating rail into the supply chain was due to the growing inefficiencies of road transport in the South East of England as a result of congestion. This has forced companies in that particular supply chain to consider rail at an earlier stage than was previously the case.

These examples though were undoubtedly fairly exceptional cases and in general there has been a neglect of mode choice issues when supply chains have been restructured in the last five years. The nature of the changes that have taken place have tended to continue the trends towards the greater use of transport, often with decreases in efficiency, in order to satisfy growing customer demands and that these changes have certainly not been of benefit to rail.

The fact that rail has seldom been considered as a fundamental part of supply chain operation when making changes in the last five years, at least in the sample of interviewees in this study, largely supports the premise of Hypothesis Six that the changes have tended to favour road though the evidence is not wholly conclusive. It can certainly be said though that there has not been any significant attempt to integrate rail along supply chains.

<u>Hypothesis Seven</u>: Companies that have high-level logistics/transport representation (i.e. at Board level) are more likely to consider the issue of modal choice at an earlier stage in their logistics decision-making processes.

This hypothesis proved to be one of the more difficult ones to address, primarily due to the lack of information gained regarding the processes of mode choice at the strategic level in the questionnaire sample and hence amongst the interviewees (as was found in the previous two hypotheses).

However, in an attempt to find evidence to support or reject the hypothesis, the relationship between the level of representation and the nature of the mode choice analysis was explored. All of the respondents with Board level representation believed that their companies paid sufficient attention to mode choice decision-making. This was also true for more than 90 per cent of those without such high level representation, so there is no apparent difference between the two sets of companies.

One measure of deducing whether or not there is a formal approach within each company towards mode choice decision-making is through the analysis of the nature of the processes for new freight flows. This was analysed under Hypothesis Five, but Table 7.4 breaks this down to determine whether the level of representation of the transport/logistics function has any influence on the process.

Chi squared testing of this relationship was performed, but there was found to be no significant difference between the groups of companies with and without

Board level representation. In general, it appears that those companies with Board level representation are slightly more likely to carry out a formal analysis of the mode choice options, but this is not significant at the 10 per cent level.

Table 7.4: Influence of Level of Representation on Mode Choice Analysis

Method of mode choice analysis:	Board level representation: Yes	No/no resp.	Total
Strategic policy	11	27	38
Set criteria	6	17	23
Ad-hoc	10	32	42
No formal analysis/no response	4	26	30
Total	31	102	133

Source: author's questionnaire survey

This analysis has only considered the processes that are applied to new freight flows, rather than the means by which existing movements are re-evaluated. In the in-depth interviews, participants were probed in more detail about their processes for evaluating the mode choice options, if indeed such processes existed in their companies.

Just over three quarters of all interviewee companies had some form of formal mode choice analysis process, in line with the proportion of total questionnaire respondents. This was largely found to be a fairly crude, indeed superficial, exercise which did not consider the potential for different modes in much detail. While this generally favoured the use of road haulage, there were actually three companies who currently use rail for certain of their movements and who only cursorily examine the alternatives to this when examining the modal options. In many cases, the choice of mode was interrelated with the negotiation of contracts with third parties to provide transport or logistics packages and the actual choice of mode was in the hands of those third parties instead. Without exception, though, those third parties were solely users of road-based transport. This analysis suggests that past and current issues, such as inertia and sunk costs, are important in limiting changes to transport operations even where the alternatives may appear to be more attractive.

The general pattern that emerged from the interviews is that mode choice analysis takes place relatively infrequently, perhaps every three to five years, generally at the time of contract renewal with service providers or the renewal of own-account lorry fleets. It also tends to involve a relatively crude examination of the alternatives, mainly as a means of ensuring that the renewal being dealt with is offering value for money and quality of service. In those companies with Board level representation, which represented 38 per cent of interviewees (i.e. 15 companies), there was a slightly greater tendency to consider the options in more depth. However, the quality of interview data did not allow detailed interpretation of this apparent difference.

In conclusion, while it would appear that, at least superficially, those companies that have the transport operations specifically represented on their Board do have a more formal and thorough approach to examining mode choice options, it is by no means clear from the information gained that this actually takes place at an earlier stage in their logistics decision-making processes. It may well be that the formal analysis takes place at a relatively late stage in the overall processes, though anecdotal evidence from the interviews suggests that some of the Directors do treat mode choice as a significant variable in their operations.

On this basis, though, Hypothesis Seven cannot be accepted due to inconclusive evidence, but the issues relating to the use of rail are examined more fully in the next hypothesis. The lack of evidence for this hypothesis does not form a barrier to addressing the two key research objectives, since the nature of responsibility within the company does not necessarily relate to actual or potential rail usage. Section 8.7 discusses further research that may prove invaluable in determining the influence of this organisational attribute on mode choice.

<u>Hypothesis Eight</u>: *The earlier consideration of mode choice in those companies with high-level representation has resulted in the structure of the logistical system being more rail-friendly than in other similar companies.*

This hypothesis is concerned with establishing whether level of representation of logistics/transport results in a company's logistical system being more rail-friendly. In this context, the term rail-friendly refers to the extent to which the various logistical elements identified in Section 1.5 have been structured so as to provide conditions more conducive to rail freight use either now or at some point in the future. For example, this may include facility location decisions, choice of suppliers and distribution channels and the timing of product flows.

Given that Hypothesis Seven proved to be inconclusive, this presented problems in addressing this hypothesis since it has not satisfactorily been accepted that

Board level representation does actually result in the earlier consideration of mode choice. However, it is possible to examine whether there is a relationship between the level of representation and current and projected use of rail across the questionnaire sample and this is shown in Table 7.5.

Table 7.5: Influence of Level of Representation on Use of Rail (Questionnaire Respondents)

	Board level representation		
Use of rail	Yes	No	Total
Currently use rail	1	17	18
Likely to start to use rail in next 5 years	9	22	31
Total	10	39	49

Source: author's questionnaire survey

From this data, it would appear that the use of rail amongst companies with Board level representation is currently lower than expected. Over the next five years, though, there is a relatively high proportion of these companies that expect to start using rail when compared to the majority of companies who have lower level representation. Analysis was also undertaken on the smaller interview sample, to assess whether attitudes to mode choice, both current and in the future, differed amongst these participants. This is shown in Table 7.6. Given that the interviewees were a subset of the questionnaire sample, the larger number of interviewee companies with Board level representation and using rail than in the questionnaire sample suggests that caution should be taken in this analysis.

While there is a negligible difference between those currently using rail, in terms of their level of representation (i.e. 25 per cent for non-Board level and 27 per cent for Board level representation), there is more of a difference in terms of their overall attitude when their potential use of rail is incorporated. 87 per cent of those with Board level representation either do use rail at present, or are capable of using it in the next five years. This compares with 75 per cent of those without such representation who either use or could use rail.

Table 7.6: Influence of Level of Representation on Use of Rail (Interviewees)

Use of rail	Board level representation Yes	No	Total
Currently use rail	4	6	10
Could easily start to use rail	3	2	5
Could possibly start to use rail	6	10	16
Could not use rail	2	6	8
Total	15	24	39

Source: author's interviews

At this aggregate level, however, no account is taken of other factors that may influence mode choice such as commodity type, length of haul, consignment size, etc. These other attributes are likely to be of significance and may have more of an influence across the sample than level of representation, which was the basic premise of the hypothesis as stated.

In an attempt to isolate the variable under test (i.e. level of representation), the matched pairs of interviewees were examined to identify whether there similar companies who had different levels of representation. Of the seven groupings of "matched pairs" identified in Appendix Five, three contain companies with differing levels of representation. One pair is in the food sector, while the other two are the large groupings of four companies each in the paper and publishing sector. Despite the small number of "matched pairs" that meet the criteria to allow testing of the hypothesis, the analysis is considered to be worthwhile.

The first pair of companies was A1 and A6, both of which are manufacturers of confectionery. The exact products are slightly different, with A1 specialising in cake production while A6 is primarily a biscuit manufacturer, but they were generally similar in nature. A1 did not see any potential for rail in the next five years whereas A6 considered that it could possibly use rail, albeit for less than five per cent of its requirements. However, it was A1 that had the more senior level of representation.

Both companies had similar logistical operations, with four product-specific manufacturing locations and a central warehouse where all product was consolidated prior to distribution mainly through the supermarket retail distribution networks. A6 perceived a small potential role for rail in moving product between one of its production sites and the central warehouse, a distance of approximately 100 miles, though admittedly the likelihood of this actually being implemented was viewed as slight. Despite the production locations for A1 being more scattered, with greater average distances from factories to the central warehouse, the Logistics Director for that company could not see any circumstances in which rail would be used. Thus, in this comparison, with most other factors being similar the company with the lower level representation is marginally more likely to use rail in the next five years.

The second set of companies consisted of F1, F3, F6 and F9, all of which are publishers of national daily newspapers. None of these companies are current rail users, but all four perceived that they could possibly use rail in the next five years. F1, F6 and F9 all have Board level representation for transport/logistics while F3 does not. All four companies stated that any use of rail that they could make would only include a small proportion of their total movements, in the range of five to 15 per cent. Thus there is no apparent difference in the degree of "rail-friendliness" between the three companies with senior representation, or when comparing these three with F3.

The final grouping was that of F4, F8, F10 and F12, all of which are manufacturers of quality and mid-grade papers for the printing industry. F4, F10 and F12 are all current rail users (though for F10 this is currently only for supplies to the paper mill) and all stated that they could easily make greater use of rail, up to a total of 30 to 50 per cent of their transport requirements. In contrast, F8 makes no use of rail at present and can see no potential for it in the next five years. All four companies serve a predominantly UK-based market, though with a small proportion of product being exported. They all deal primarily with the movement of full lorry loads, often in multiple, rather than smaller consignments. There is a distinct difference in manufacturing locations, with F4 and F8 being sited near to the key markets in the South East of England and F10 and F12 being located near to their raw material supplies in Scotland. The current use of rail for product distribution is largely a function of distance to key market areas.

For this hypothesis, the key factor under consideration is the level of representation of transport/logistics within the company. Both F4 and F12 have Board level positions, while F8 and F10 do not. Given that this and geographical location appear to be the two key variables that differ amongst the four companies, it is perhaps appropriate to focus the analysis on the differences between F4 and F8 since their mills are situated only approximately 20 miles apart.

From the interview transcripts of these two companies, it was apparent that there were some other differences between the companies' operations and perceptions of the key issues facing them. F4 was one of the few interviewees to be seriously concerned about the increasing transport costs, whereas F8 was not concerned and indeed could see considerable scope for efficiencies to be made in its transport operations. On the whole, though, it did appear that the two companies were very similar in their operations and that the more strategic view taken by the Distribution Director in F4 was more open to the use of rail than that of the Transport Manager in F8 who was more tightly focused upon the day-to-day operational aspects of the distribution to customers.

Again, the overall analysis of this particular hypothesis has proved to be inconclusive. From Hypothesis Seven, there was no clear case that Board level responsibility affected the consideration of mode choice and this has been reflected in the analysis of Hypothesis Eight. Across the questionnaire sample, there was no conclusive evidence that level of responsibility was affecting the view of rail. In the detailed analysis of the "matched pairs", only one example of clearly varying attitudes to the use of rail seeming to result from a difference in the level of responsibility was found. Thus it is not possible to accept Hypothesis Eight with any degree of certainty.

The analysis of the four hypotheses in this section has shown that mode choice has not been a significant factor influencing the changes in logistical structure and that most changes have been geared towards the use of road and have made it difficult for rail to break into new markets. The evidence is such that it would appear that very little attention has been paid to the potential of rail in the majority of companies, other than those that already make use of rail, though it would seem that there are signs that greater attention is likely to be given to this in the next five years. This is addressed in the next section.

7.5 Assessing Changes to Mode Choice Decision-Making to Increase Rail's Mode Share as a Result of Logistical Changes in the Future

The focus of this section is on the issues that this thesis aims to address for the second of the key research objectives. This builds upon the analysis in the previous two chapters and that in Sections 7.3 and 7.4. Thus this series of hypotheses aims to identify ways in which logistical changes may be influenced as a tool to assist in increasing the share of freight moved by rail to meet the desired policy objectives of a reduced reliance on road freight. It begins by attempting to establish just what proportion of movements is potentially suitable for rail amongst the sample of companies involved in this research, with the other hypotheses then being dealt with in turn to provide the evidence to satisfy the research objectives.

<u>Hypothesis Nine</u>: *A significant proportion of freight movements is inherently unsuitable for rail, but of the remainder there is great potential for traffic to shift to rail given the right environment.*

It was established in the discussion of Hypothesis Four that there is predicted to be a dramatic increase in the proportion of questionnaire respondents that are likely to be using rail in the next five year period, from 14 per cent at the time of the survey to 37 per cent in five years time. While this would still result in rail users being in the minority, an almost tripling in the proportion of companies using rail in such a short period suggests that there is much potential there to be tapped.

Comprehensive analysis of the predicted changes in the uptake of rail freight services is found in Section 6.3.3. In particular, Table 6.5 presented the likely use of services in five years time classified by industrial sector. This showed that the type of product is extremely important in determining the likelihood of using rail, since there was a wide range in expected uptake from 60 per cent of food manufacturers down to none of the textiles and clothing companies included in the sample.

The features that are of importance in determining whether rail will be considered, and indeed used, were discussed in Section 6.5 and summarised in

Table 6.10. The analysis in Section 6.7 revealed that a shift in traffic to rail is predicted to be a relatively insignificant factor in constraining the growth of road traffic in the next five years, though to a slightly greater extent than over the previous five year period. This suggests that, while significant growth in rail usage is predicted, there is unlikely to be a large modal shift unless more action is taken than appears to be planned by the companies themselves.

This questionnaire analysis has focused upon what is *likely* to happen in the next five years, based upon the changes in service provision and external factors that are foreseen by the respondents. For the purposes of this research, and indeed for the formulation of future transport policies, it is of value to establish the extent to which freight movements could *feasibly* move to rail given the right set of conditions.

Thus, in order to assess the future potential mode share for rail freight, the interviewees were asked to provide an approximation of the proportion of their freight movements that may potentially be sent by rail. This was not intended to result in a highly accurate measure of the potential, but was more designed to provide a ball-park figure of the extent of the future rail freight market given the right conditions. Should there not be a significant potential market then it would affect the nature of policies required to encourage rail in the future.

In total, 31 of the interviewees (i.e. 79 per cent) saw some potential in theory at least for rail to meet some of their transport requirements. This includes the 11 interviewees that were already using rail. Table 7.7 shows the breakdown of responses by industrial sector, showing the proportions of companies in each sector that do, could easily do, or could possibly, use rail. This reinforces the questionnaire analysis, revealing that there are considerable differences between industrial sectors, though with such small sample sizes in many of the sectors any extrapolation of these figures would be open to many inconsistencies.

What is of more interest in addressing the requirements of this hypothesis is the general patterns relating to the ease of uptake of rail services, and proportion of movements that could potentially be shifted to road, as defined by the current use and three other categories shown in Table 7.7.

Table 7.7: Potential Use of Rail in Next Five Years, by Industrial Sector

Industrial sector	Use of rail: Current	Could easily use	Could possibly use	No potential
Food and drink manuf. (9)	1	1	3	4
Chemicals and fertilisers (3)	3	0	0	0
Construct'n/build. Mats. (1)	1	0	0	0
Transport equipment (4)	0	1	2	1
Textiles/clothing/footwear (0)	0	0	0	0
Paper and publishing (12)	5	0	6	1
Electrical/electronic equip. (4)	1	0	3	0
Non-electrical machinery (1)	0	1	0	0
Retailers (5)	0	2	1	2
Total (39)	11	5	15	8

Source: author's interviews; numbers in brackets indicate number of interviewees in sector

The estimates of the total proportion of individual companies' movements that could potentially be moved to rail are shown in Appendix Six. This was based upon the interviewee's overall appraisal of their transport requirements (e.g. in terms of product type, consignment size, distance, customer demands, quality of service required). Across the entire interviewee sample, the average proportion of each company's movements potentially viable for rail was 19 per cent (though with a standard deviation of 19). This reveals a significant potential market for rail, although with large variations between companies. Given that, for ease, interviewees were only asked to approximate the proportion of movements potentially suitable for rail, it would be expected that these would predominantly be longer distance movements so the proportion of tonne kilometres may well be significantly higher. The evidence supports this, since many companies saw potential for long distance British or European flows to transfer to rail. Table 7.8 summarises this information into the different categories of ease of uptake of services.

Table 7.8: Proportions of Movements Potentially Viable for Rail Freight

	Mean proportion of goods potentially viable for rail	Standard deviation
Current rail users (11)	40	16
Could easily use rail (5)	17	8
Could possibly use rail (15)	14	13
No potential (8)	0	-

Source: author's interviews; numbers in brackets indicate number of interviewees in category

These disaggregated results show that those companies currently using rail believe that rail's potential to meet their requirements is significantly greater than that for other companies. While current users did not generally specify their current proportion of movements that were going by rail, the evidence relating to current rail use from the transcripts suggested that across the 11 companies it was well below 10 per cent. Thus, based on the evidence, it would appear that rail freight service providers would be best to target their efforts at growing the business of their existing customer base.

If this was done in tandem with targeting the industrial sectors identified in the questionnaire analysis as showing the greatest likelihood of becoming involved with rail use then the greatest benefits should accrue. The existing users appear to offer the greatest potential in terms of boosting their proportion of movements, though this takes no account of any inherent differences in volumes being moved between different categories of companies. It is clear that there is also considerable traffic potentially on offer to rail from the majority of those companies not currently using the mode.

Overall, the evidence from the questionnaire and interview analysis tends to support each other. Approximately 40 per cent of companies believed they would be using rail in five years. A similar proportion of goods movements has been identified as having potential for rail haulage by those companies who see potential for rail, which was 79 per cent of interviewees. Using these statistics, a rough estimate of at least 30 to 40 per cent of goods could potentially be moved by rail. This is at least four or five times greater than rail's current mode share. Thus, this supports the hypothesised assertion that a significant proportion of freight movements is inherently unsuitable for rail, but of the remainder there is great potential for traffic to shift to rail given the right environment. Hypothesis Nine can therefore be accepted based upon the available evidence.

Hypothesis Ten: The likelihood of using rail freight in the next five years is greater in those companies that have experience of using rail in the last 10 years.

This hypothesis is designed to test whether previous experience of rail freight in the last 10 years has had any influence, either positive or negative, on the likelihood of companies starting to use rail in the next five year period. In combination with Hypothesis Eight, it aims to provide guidance on which types of companies the attention of rail freight service providers and others (e.g. government) should be targeted so as to gain the greatest modal shift using the available resources. The analysis is largely based upon that in Section 6.3.3, with additional evidence from the interviews.

Table 7.9 summarises the likelihood of rail freight usage in the next five years among the questionnaire respondents, dependent upon whether they have been using rail (and are current users or have given up) in the last 10 years. As was discussed in Section 6.3.3, all current users plan to continue using rail with all but one predicting an increase in the volume of goods sent by rail in the future.

Table 7.9: Influence of Previous Rail Use on Likelihood of Future Use

	No. of respondents	% predicting use in next 5 yrs
Current rail users	18	100
Gave up rail in last 10 years	16	81
No rail use in last 10 years	99	18

Source: author's questionnaire survey

This hypothesis is concerned more specifically with the predicted actions of the 16 respondents whose companies have ceased to use rail in the last 10 years. The reasons behind their withdrawal from the use of rail were discussed in Section 6.3.2, as was their likelihood of returning to rail. This found that there were broadly two groups of companies that had ceased to use rail. The first was those that had stopped in the early-1990s, often enforced rather than voluntarily, due to the withdrawal of wagonload services by British Rail and/or the increasing costs and decreasing standards of service. The second group consisted of those who had been primarily using intermodal services and who gave up using rail in the late-1990s. The analysis of the databases and questionnaire responses suggested that they had been companies making use of the expanding network of these types of service but who had not found them of sufficient standard to meet their demands.

In general, the reasons for ceasing the use of rail were because of problems with the supply and quality of rail freight services (see Table 6.4). In only one company was the change related to a factor external to the rail industry. This was due to a change in production location which had led to a shift away from rail.

It is apparent from Table 7.9 that those companies that gave up using rail in the last 10 years are far more likely to start using it in the next five years than are those companies which have not had any recent experience of rail freight. The likely uptake of rail freight services is 4.5 times greater amongst the previous users than it is for those without recent use. With 13 of the 16 former users predicting a return to rail, there appears to be a convincing trend.

Only two of the interviewees had given up using rail in the last 10 years, thus limiting the detailed investigation that could take place during the interview process. Company D2, a car manufacturer, had been a regular user of rail for several decades but had gradually wound down its use from the late-1980s with a complete cessation in 1997. From 1994 through to 1997, it had only been used for very limited inward movements of components from Italy to one of its British manufacturing locations. The distribution of finished cars had dwindled to only a small number of flows by 1990 and none beyond 1994.

In the intervening period, however, there has been no substantial change to either the overall logistics system or the specific transport operations of D2 or its supply chain, so the use of rail is still at least as viable in theory as it had been previously. The main change has been the growth in the use of strategically located vehicle storage centres at three locations across Britain. The interviewee did not believe that this had reduced the potential for using rail. Indeed, the company had been holding talks with its transport provider and directly with rail freight companies in the months before the interview took place. The interviewee was fairly confident that his company would start to use rail again within a matter of months, though probably for different flows than it had previously been used. The expectation was that the volumes that would be transferred to rail would be significantly greater than they had been at any time since the mid-1980s, when much domestic distribution switched to road. Up to 30 per cent of movements may potentially be transferred to rail.

The other company to have stopped using rail was A7, a whisky and white spirit manufacturer. It had regularly used rail until the early-1990s for the long distance movement of grain from East Anglia to its production sites in Scotland. The withdrawal of the Speedlink network resulted in the loss of this traffic, but the reintroduction of wagonload services (i.e. Enterprise) led to the company trialling these movements again in 1998. These trials were not particularly successful due to the excessive costs for rail movement and additional handling, since no company sites remain rail connected. Since 1991, most of these grain movements have been by feeder boats.

During the three years prior to the interview, the company had gradually moved from this long distance sourcing of grain to more local supplies of Scottish barley to cut down on transport costs. Due to the low lengths of haul, these movements are now by road and there are very few long distance flows that could be returned to rail.

The company was still relatively positive about the use of rail in the future, believing that 25 to 40 per cent of its movements could possibly go by rail. The likelihood of this happening within five years was viewed as being slim, though the interviewee was positive about the recent developments in service levels from EWS. The main stumbling block was seen to be the lack of suitable intermodal equipment at an affordable price, since this would be necessary for the flows in mind, generally bulk flows of whisky between northern and southern Scotland (i.e. distances of 100 to 150 miles).

In both these specific cases, there was no reluctance to return to rail as a result of the poor performance or treatment by British Rail in the past. Both companies had been active in trying to return to rail, one with trial movements and the other in active discussions to start regular movements. Both believed that rail could still fit into their logistical operations, despite some changes in the intervening period. D2 was clearly more positive about a short-term switch to rail than A7, who was thinking more of a role for rail in the medium- to long-term.

While this detailed evidence is largely anecdotal, it does appear to fit in with the general trends identified from the larger questionnaire sample. The past experiences with nationalised rail freight appear not to be hindering the opportunities for the privatised rail freight companies. Instead, current opinions of rail freight are positive amongst the former users and their logistical systems appear to be able to effect a return to rail with relative ease. On the basis of the evidence presented, Hypothesis Ten can therefore be accepted, with former rail customers being much more likely to use rail in the next five years than those who have not used rail in the last 10 years.

<u>*Hypothesis Eleven*</u>*: The factors affecting choice of rail in mode choice decision-making are complex and depend upon the unique circumstances of each company.*

This hypothesis aims to provide evidence to test the assumption that the factors affecting the choice of rail in mode choice decision-making are extremely complex. It is the author's belief that a detailed understanding of the specific circumstances of the particular company, and the supply chain(s) in which it is involved, is required before any assessment of rail's potential can be realistically conducted. In order to test this hypothesis, the various "matched pairs" of companies will be scrutinised to identify the extent of common themes and experiences within the pairs.

Appendix Six shows the general coverage and information for all of the interviewee companies, which allows comparison of the matched pair companies. Tables 7.10 to 7.16 show more detailed comparisons of each of the seven "matched pair" groupings of companies, covering key logistical issues that may influence mode choice. This analysis is not intended to be fully comprehensive. Instead, it aims to provide sufficient evidence to test the statement set out in the hypothesis and builds upon the discussion of the "matched pairs" in Hypothesis Eight.

In general, these tables highlight that companies that are similar in many respects have quite different sets of circumstances which have the potential to influence the potential for rail to fit into existing logistical systems. Even at the most basic level, companies that had been identified as being very closely matched based upon the original industrial sectorisation and subsequent questionnaire responses were found to have very different characteristics.

Table 7.10: Matched Pair Analysis (Confectionery Production)

	Company A1	Company A6
No. and location of production facilities	4 factories (3 North England; 1 South England)	3 factories (2 Nth England; 1 Netherlands)
No. and location of distribution facilities	1 Distribution Centre (DC) (East Midlands)	1 DC (Yorkshire)
Customer base	UK; 60% to multiple retailers; 40% to "field order sales"	UK; 80% to multiple retailers; remainder to smaller retailers
Typical order lead times	Day 2 delivery (by 0600 for multiples; 1400 for others)	Day 2 for some big customers; Day 3 or 4 for rest
Typical product shelf life	4 weeks (6 weeks max)	40 weeks
Promotional activity	40% of sales are non-standard, so volatile forecasting	Negligible, so stability for forecasting
Transport equipment	Specialised floating deck trailers	Standard vehicles
Potential for rail (% of movements)	0	<5

Source: author's interviews

Table 7.11: Matched Pair Analysis (Meat Processing)

	Company A5	Company A8
No. and location of production facilities	5 factories (all in Midlands/Sth West)	4 factories (2 Scotland; 2 Nth England)
No. and location of distribution facilities	1 DC (Sth West) and 2 coldstores (by factories)	1 main DC (Nth England)
Customer base	UK; 80% to multiple retailers	UK; over 90% to multiple retailers
Typical order lead times	Day 2 delivery (or less for certain customers)	Day 2 delivery
Distribution operations	Usually 1 or 2 drops	Usually multi-drop
Product characteristics	75:25 fresh:frozen	50:50 fresh:frozen
Transport equipment	Long term contract - 1 dedicated haulier	40% in-house; 60% contracted-out
Transport problems	Big impact of road congestion	Road congestion rarely a problem
Potential for rail (% of movements)	30	0

Source: author's interviews

Table 7.12: Matched Pair Analysis (Newspaper Publishing)

	F1	F3	F6	F9
No. and location of production facilities	3 (across Britain)	2 (Sth East & Nth Eng.)	3 (across Britain)	4 (across Britain)
Customer base	UK, using wholesaler networks			
Product shelf life	1 day			
Product range	3 main daily titles (+ distribution of 1 other)	1 daily title (+ distribution of 1 other)	4 main daily titles	2 main daily titles
Product characteristics	Declining circulation but increasing weight			Both increasing
Transport equipment	3 yr cont-racts with 2 hauliers	5 yr cont-racts with 2 hauliers	3 yr cont-racts with 2 hauliers	Rolling con-tract with 1 haulier
Potential for rail (% of movements)	<10	10	<5	10-15

Source: author's interviews

Table 7.13: Matched Pair Analysis (Paper Manufacturing)

	F4	F8	F10	F12
No. and location of production facilities	2 mills (Sth East)	1 mill (Sth East)	1 mill (Nth Scotland)	1 mill (Sth Scotland)
No. and location of distribution facilities	2 DCs	2 DCs	1 DC (at mill)	4 (across Britain)
Market area	75% UK; 25% export	90% UK; 10% export	90% UK; 10% export	55% UK; 45 % export
Main customer base	Printers, merchants, government	Printers, merchants	Printers, stationers, government	Printers
No. of customers	Hundreds	Hundreds?	Hundreds?	50-70 in UK
Typical order lead time (standard range)	Day 2 delivery	*Immediate* delivery	Day 3 or 4 delivery	Variable
Product characteristics	Reels and pallets	All reels	75% pallets; 25% reels	All reels
Distribution operations	1.4 drops per trip	Generally full loads	70% single drop	Generally full loads
Transport equipment (distribution)	1 dedicated haulier	Numerous hauliers	Many haul-iers; rail	1 dedicated haulier; rail
Potential for rail (% of movements)	<50	0	30+	50+

Source: author's interviews

Table 7.14: Matched Pair Analysis (Electrical Consumer Goods)

	Company G1	Company G3
No. and location of production facilities	1 in UK (Scotland)	1 in UK (Wales); satellite site in Czech Republic
No. and location of distribution facilities	1 UK DC (near factory); others across Europe	1 UK DC (East Mids); others across Europe
Market area	75% exported to Europe; 25% UK	70-75% exported to Europe; 20-25% UK
Customer base (UK)	Generally through dealers' RDCs	Generally through RDCs; starting direct through Internet
Product range	Solely VCRs, plus spares	Range of products (e.g. TVs, VCRs, microwaves); also spares
Supply of components	Only 10% from UK	Much (25-50%?) from local suppliers
Transport equipment (UK distribution)	1 dedicated haulier	1 dedicated haulier
Potential for rail (% of movements)	<10	25+

Source: author's interviews

Table 7.15: Matched Pair Analysis (Lighting Manufacturing)

	Company G2	Company G4
No. and location of production facilities	2 sites, though 1 closing to focus on Nth England	No UK production; 3 sites in mainland Europe
No. and location of distribution facilities	1 National DC next to Nth England factory; 2 satellite facilities	1 UK DC in Sth England
Customer base	UK; through electrical wholesalers	European; through retailers, wholesalers, direct to large customers
Typical order lead times	Day 2 delivery (UK)	Day 3 or 4 delivery (UK)
Product range	10,000 basic lines, plus bespoke production	2,700 basic lines, plus 7,000 made to order
Transport equipment (distribution)	5 yr contract with 1 dedicated haulier; special double-deck vehicles; some courier use	5 yr contract with 1 dedicated haulier, soon to be switched; standard vehicles
Potential for rail (% of movements)	10	50+ (for inter-site); 0 for distribution

Source: author's interviews

Table 7.16: Matched Pair Analysis (Womens Clothing Retailing)

	Company I2	Company I4
No. and location of distribution facilities	1 DC (West Midlands); satellite site in Sth East	1 DC (East Midlands); 5 hubs for break-bulk across Britain
No. and location of retailing facilities	UK-wide; 120 shops	UK-wide; 217 shops
Retailing locations	High Street and new shopping centres	Predominantly High Street
Company ownership	Part of much larger clothing retailing group	Independent
Shop delivery frequency	3 per week average (2 min; 5 max) at varying times	5 per week to all stores, all guaranteed before 1200
Average lead time from DC to store	Day 3 or 4 from order	Day 3 from order
Product characteristics	90%+ hanging; some boxed	70% hanging; 30% boxed
Transport equipment (trunk distribution)	In-house; specialised vehicles for hanging garments	Dedicated haulier on rolling contract; specialised vehicles
Radial distribution to stores	Combined with other group deliveries	Shared-user
Potential for rail (% of movements)	0	0

Source: author's interviews

The two confectionery producers shown in Table 7.10 clearly make products that have some very different characteristics, not least in terms of the shelf life of their goods. This may have implications for the potential for using rail, since a shorter product life leaves less flexibility for the consolidation of transport movements. Company A1 is more dependent than A6 upon promotional activity, resulting in large variations in demand and difficulties in accurately predicting future distribution requirements, again with potential implications for mode choice.

The two meat processing companies compared in Table 7.11 appear to be very similar to each other in most respects, but even then there are key differences. While both companies have relatively peripheral factory and distribution locations, they are several hundred miles apart. There are also other key differences in the factors that are likely to affect rail's potential, such as the nature of the product, typical consignment sizes and problems with road congestion, leading to A5 seeing considerable potential for rail while A8 cannot identify any potential.

From the larger group of companies in the newspaper publishing business, shown in Table 7.12, there is more consistency across the four companies. There are slight differences in printing locations, product range and, more particularly, in the type of contract with transport providers, which may influence mode choice. Overall, though, there is a very consistent assessment of the potential for rail amongst these companies.

For the paper manufacturers, shown in Table 7.13, there is much greater variation in most of the attributes shown. There are also widely differing assessments of the potential for rail, which cannot be identified as resulting from variations in just one or two key attributes but is more likely to reflect the overall set of circumstances facing each company. In this group of companies in particular, it also appeared that the attitudes towards rail of individuals within the companies was an important factor. This is discussed in Hypothesis Twelve.

The two manufacturers of the electrical consumer goods also displayed some quite different circumstances, as revealed in Table 7.14. While both had broadly similar organisational structures, being part of global Japanese manufacturing companies, they had crucial differences that included the sourcing policies for components and the range of products handled by the distribution system.

Similarly, the lighting manufacturers shown in Table 7.15 had crucial differences between their operations. G2 is primarily a UK-based company while G4 has a Europe-wide production and distribution network. They both serve different markets, with G2's products being routed primarily through wholesalers while G4 is more directly involved with the retail trade. Order lead times also differ, as do the types of vehicles used for product movement. These differences would generally favour the use of rail for G4, which is supported by the assessments of the interviewees.

Finally, the clothing retailers dealt with in Table 7.16, while being extremely similar in many respects, again display differences in their operations which result in very different transport systems. I4 has a more transport-intensive operation, making more frequent deliveries to every store and with tighter timescales for making these deliveries. There are other considerable differences in their transport operations, though neither can see any potential for rail.

The evidence from this "matched pair" analysis supports Hypothesis Eleven, since even groups of companies that are extremely similar in many respects (for example the newspaper publishers or the clothing retailers) still have differences in their logistical operations that may affect their mode choice decision-making processes. The evidence from the interview transcripts suggests that these issues are, at least in part, responsible for differing opinions regarding the potential for rail in similar companies. This suggests that the standard industrial classification (SIC) system is not a good method for targeting companies to change mode, since it hides major differences between apparently similar companies. Overall, on the basis of the evidence, Hypothesis Eleven has been accepted.

<u>Hypothesis Twelve</u>: *The attitudes towards (and perceptions of) rail of specific individuals within companies are of great significance in determining whether rail will be considered as an alternative to road.*

The main focus of the analysis thus far has been on the actual rail freight services and logistical systems that exist and on how they have been changing. Previous hypotheses have considered the general perceptions across the research participants of rail freight services (i.e. Hypothesis Four) and the significance of the level of representation of transport within companies (i.e. Hypotheses Seven and Eight). The current hypothesis aims to establish the extent to which the views of individual key employees within a company influences the consideration and subsequent use of rail freight services. This builds upon the previous evidence, with additional analysis from the interview transcripts.

No substantial evidence was found to suggest that interviewees from industrial sectors or stages in the supply chain were considerably out of line than similar companies in terms of being significantly more pro-rail. However it was not expected that, for example, a manufacturer of lightweight confectionery products with tight distribution deadlines would use rail solely because of the enthusiasm of one key person within the organisation. Instead, there were interviewees in some of the companies that had been identified as having rail potential who appeared to either be very pro- or anti-rail and whose attitudes and perceptions seemed to be of prime significance when considering mode choice issues.

Some of the inconclusive evidence from the analysis of level of representation in Hypothesis Eight points to the influence of certain individuals as being of great importance rather than whether their area of responsibility is represented at Board level. Much of the discussion for that hypothesis highlighted that the opinions of individual respondents affected the processes by which rail may or may not be considered. Further, the analysis of the previous hypothesis showed that broadly similar companies had different logistical structures, perhaps influenced by the attitudes of the key decision-makers, and different expectations of the potential for rail. It is feasible that these differences may be partly a result of the attitudes and perceptions of those decision-makers, including their views of rail.

From the interviews with those companies currently using rail, it was clear that many of the interviewees had experienced considerable difficulties with the mode but had persisted. In some cases this had been internal to their company, since they had found it difficult to convince other employees of the benefits of rail, while others had experienced difficulties in achieving the required service standards from the rail freight operators. This evidence is largely anecdotal, but does seem to be representative. Due to the high quality of information and coverage of the paper and printing sector in the interviews, the testing of this hypothesis focuses on those companies.

Company F10 has a specific target to send 20 per cent of its goods by "environmentally friendly" means of transport within six months (of the interview), though half of this total will be made up of goods shipped out through a local port to mainland Europe. The Distribution Manager has persistently been attempting to boost the proportion of goods he sends by rail, despite the rail freight operator's own representatives often being negative about handling the traffic. In order for rail to be used, there has to be cost parity with road and customer requirements must be met. An environmental advantage is not sufficient in itself, but significant attention has been paid to finding new flows for rail. F10 has managed to increase its use of rail largely through the use of a rail-friendly logistics company which operates a rail-served terminal in Southern England. This third party specialist deals with any rail service problems and provides road backup when required.

This rail-friendly approach within the company has been a fairly recent development, since the previous Distribution Manager adopted a confrontational approach with rail operators and transferred flows away to road. The renewed emphasis on rail apparently can be put down to the enthusiasm and beliefs of the incumbent manager. It would appear that Company F4, one of those matched with F10, is still adopting a confrontational approach with the rail freight company, the result being that no product is moved by rail. F4's Distribution Director could see the potential for up to 50 per cent of his product being distributed by rail, but his current attitude towards EWS means that this is not happening.

Of the other paper manufacturers, the Despatch Manager of F8 was very definitely of the opinion that road haulage is a necessity for his company's operations. It is his belief that customer demands dictate the use of road and he has no plans to investigate alternatives, despite the fact that many of his competitors use rail at present. The Logistics Director of F12 had a similar outlook to that of F10, in that he believes there to be a convincing commercial case for using rail, as well as an environmental one. His enthusiasm for rail has led to a target of a 50 per cent mode share for rail being adopted, with proposals being developed in conjunction with the rail freight operator and the Department of the Environment, Transport and the Regions. He is determined to make rail work, despite problems being encountered with rail's customer service levels.

There were three other manufacturers in this industrial sector, these being F5, F7 and F11. Despite all having long distance flows of bulky products, only F5 makes regular use of rail for product distribution. F11 uses rail on a fairly irregular basis, while F7 makes no use of rail at present. F5's Logistics Manager has a pro-rail attitude, though this seem to reflect that of the entire company, whose mission statement is "to have a profitable and sustainable business in its selected markets." Its manufacturing site is located in an environmentally sensitive area, which adds to the pressure for alternatives to road haulage. However, it is clear that he has persisted with the rail freight operator through some difficult times and indeed had just held an extraordinary meeting with them to discuss service problems. He was determined to continue to increase the use of rail despite these problems.

Similarly, the Logistics Manager of F11 is very pro-rail despite experiencing setbacks in his plans to transfer certain flows to rail. He quoted a number of unsuccessful trials that had taken place in recent years, but kept stating his determination to make rail work. On the other hand, the Distribution Director of F7 is very sceptical about rail's abilities, though this seems to be largely due to poor experiences in British Rail's time. While seeing potential for rail in the future, he is not making any attempt to use it at present. His opinion is that it is currently too risky for his business to try to switch to rail since he does not want his company to lose competitive advantage. This seems not to be an issue for the other similar companies that were interviewed.

Of the four newspaper publishers, there was not such a great difference in attitudes and perceptions affecting mode choice, perhaps as a result of none of the companies currently being rail users. However, certain individuals are more positive about using rail in the future, in particular the Distribution Director of F1 who is keen to see what rail freight has to offer. He has not made any attempts to be pro-active in this area as yet. The Distribution Director of F9 is similarly keen to see what rail can offer, but the competitors (i.e. F3 and F6) have individuals who are not so keen to consider what rail could offer them.

In conclusion, there are clearly some individuals who can readily see the benefits of rail (for their company, the environment or society at large) and have been prepared to work with rail freight operators and other specialists to ensure that rail is used where possible. There are others, though, whose attitudes and perceptions are such that their companies are unlikely to use rail, either because they cannot see alternatives to road or because they perceive those alternatives not to meet their needs. Thus, whilst it is largely subjective, there is clear evidence to support Hypothesis Twelve, since the differences in individual's attitudes and perceptions do seem to be a major factor in determining mode choice.

<u>Hypothesis Thirteen</u>: *Future logistical changes are more likely to involve the consideration of modes other than solely road when compared to recent changes.*

This hypothesis aims to consolidate much of the analysis from the previous ones to examine whether alternative modes to road are more likely to be considered in future restructuring than they have been in the past. It relies heavily upon the quantitative analysis of the questionnaire survey, which was discussed in depth in Chapter Six, to add to the qualitative analysis on this topic that has been incorporated into the previous two hypotheses.

It has already been established (see Section 6.3.3) that the proportion of questionnaire respondents using rail is expected to rise from 14 per cent to 37 per cent in the next five years. Growth in rail volumes is also predicted from almost all of the current rail users. Further, analysis of the interviews in the testing of Hypothesis Nine has shown that there is an estimated potential market for rail of a fifth of all movements.

From the analysis in Sections 6.6 and 6.7, as well as throughout this chapter, it has been apparent that mode choice has been rarely considered when making logistical changes in the last five years. The analysis of the predictions of increases in rail freight use in the next five years imply that more attention will be devoted to the consideration of other modes. Comparison of Tables 6.14 and 6.15 reveals that displacement of traffic to both rail and water is likely to be more of a constraint on the growth of road freight in the next five years than it has been in the last five year period.

Appendix Six summarises the predicted general company and supply chain trends across the interviewee sample. Table 7.17 summarises the most frequently mentioned predicted trends, with an increase in customer requirements being twice as significant as any other. While some of the other predicted developments may be compatible with rail, further increases in customer requirements are likely to be very dependent upon road transport.

Table 7.17: Most Significant Predicted Company and Supply Chain Trends

Predicted trend	Percentage of interviewees
Increase in customer requirements	46
Change in product attributes	23
Decrease in number of company locations	21
Increase in number of company locations	21
Change in company location activities	21
Management reorganisation	15
Change in sourcing patterns	15
Increase in market area	13
Decrease in no. of customer delivery locations	13

Source: author's interviews

The analysis of the interview transcripts supports the assertion that a growing proportion of companies will more comprehensively examine the alternative modes, even if it still results in road being used. It is estimated that just over half of the interviewee companies will change their mode choice decision-making behaviour. Some of them, however, seemed to view this as being a fairly hypothetical exercise, with no real intentions of seriously examining or testing the alternatives, but they were in the minority.

There was clearly a growing awareness that factors external to their companies' operations, such as worsening road congestion and the implementation of government policies to increase the costs of road haulage, would provide more of an incentive to consider rail in the future. This is developed further in Hypothesis Fourteen. Many interviewees were keen to point out that it will take considerably longer than five years to restructure logistical systems to become truly rail friendly since the processes of restructuring are lengthy and there has been several decades of adaptation to the flexibility of road haulage. Their more elaborate responses also largely reinforced the general trends in Table 7.17, highlighting the significance of others in the supply chain in restricting the likely use of rail in the near future. There are therefore conflicting pressures on companies, some encouraging the consideration of rail but with others making this much more difficult and unlikely.

There is little doubt from the considerable evidence gathered primarily from the questionnaire survey and reinforced by the interviews that more attention will be paid to mode choice when making changes to logistical operations in the future.

Therefore Hypothesis Thirteen can be accepted with a considerable degree of confidence.

<u>Hypothesis Fourteen</u>: *Negative attributes of road rather than positive attributes of rail will be the main driving force for an increased uptake of rail freight services in the next five years.*

The main focus of this research has been on the assessment of changes in the supply of rail freight services and the other positive reasons for a potential increase in the mode share of rail freight. Section 6.5 examined the degree of importance of a range of factors in the choice of rail in the decision-making processes. This showed that the most important criteria relating to the use of rail were cost, service flexibility and frequency (see Figure 6.24), all supply side factors. Congestion on the road network (i.e. a negative attribute of road haulage) was ranked only eighth and was seen as being considerably less important than the three key criteria.

In the more detailed analysis of the significance of rail freight in constraining the growth of road haulage in Section 6.7, it was found that what can be classified as negative attributes of road haulage (i.e. increased costs and poorer quality of service) are likely to be the main constraining factors in the next five years. Road congestion and higher fuel taxes were viewed as being most significant, with the displacement of traffic to rail ranked eighth out of nine criteria. Thus, these results suggest that there may be other reasons for the predicted growth in rail freight usage rather than simply as a way of coping with worsening road conditions.

The more detailed analysis of the reasons for predicting an increase in rail freight usage has shown that very few companies are prepared to use rail unless it is cost effective and of adequate service quality. 26 per cent of interviewee companies believe that their current transport operations offer scope for efficiency gains, with many mentioning potential changes such as night time deliveries and greater load consolidation as being possible should road conditions worsen significantly.

Appendix Six summarises the likely effects of increased road congestion, increased road haulage taxation and regulation and the introduction of road pricing. It also shows the nature of improvements to the rail network that are necessary to attract new users or greater volumes from existing users. Table 7.18 highlights the main conclusions.

Table 7.18: Likely Effects of Hypothetical Changes to Road and Rail Service Costs and Quality

Change	% of interviewees who would potentially to switch to rail (or use more rail)
Rail service quality improvements	56
Increased road haulage tax/regulation	49
Introduction of road pricing	46
Rail service cost improvements	44
Increased road congestion	38
Rail network access improvements	28

Source: author's interviews

These figures do not necessarily concur with those earlier in the analysis relating to the likely use of rail since interviewees were being asked to respond to hypothetical scenarios in this case, as opposed to their predictions in the previous analysis. The rankings of the importance of the attributes in Table 7.18 is of interest, since it provides a combined assessment of changes in the supply of rail freight and potential negative changes to road freight.

It should be borne in mind that, whilst significant proportions of interviewees have stated that they would be likely to react in this way, only 13 per cent were significantly worried about increasing transport costs and none were seriously worried about declining transport service quality. Shifting from road to rail appears to be one way in which companies anticipate negating any cost increases or quality decreases. However, a greater proportion of companies would be likely to improve their road efficiency in response to these changes, while a significant number would also look to restructure their company's operations. Very few would consider reducing customer service levels.

This analysis shows that it is a mixture of positive rail attributes and negative road ones that is likely to lead to an increased use of rail freight, rather than being predominantly one set of attributes or the other. There is thus a convincing argument for transport policies to address both of these areas as a means of effecting a modal shift from road to rail. This finding is extremely significant in that it reveals that there are many positive attributes of rail that can feasibly attract new users. The worsening of road haulage also assists in encouraging a greater use of rail, but is not the key issue involved. Therefore, Hypothesis

Fourteen has been rejected, since the evidence is that positive attributes of rail will be equally important in attracting new freight flows in the next five years. This was supported by the analysis throughout this research, which showed a more pro-rail attitude than had been suggested by the literature.

These six hypotheses have added considerable insight to the analysis of the questionnaire responses in Chapter Six. In combination, they have addressed the identification of ways in which logistical changes can assist in increasing the share of freight moved by rail in the future. They have identified considerable potential for rail, together with a high level of interest in a significant proportion of companies towards shifting traffic from road.

7.6 Summary

This chapter has considered and tested each of the 14 hypotheses in turn, incorporating the information collected from the rail freight databases, the questionnaire survey and the in-depth interviews. Table 7.19 summarises the outcomes of the testing of each hypothesis.

It can be seen from Table 7.19 that, with two exceptions, the analysis has successfully allowed the testing of the series of hypotheses to take place. In total, 11 hypotheses have been accepted, one has been rejected and two have been inconclusive. For Hypotheses Seven and Eight the testing was inconclusive, yet the analysis did still yield some interesting insights. The shortcomings of the research, which led to these inconclusive results, is discussed in Section 8.6.

Chapter Eight more generally concerns itself with the overall implications of these research findings, relating them to the two fundamental objectives upon which this thesis is based.

Table 7.19: Summary of Hypothesis Testing

Hypothesis	Outcome of Hypothesis Testing
Hypothesis One: There has been a growth, both in relative and absolute terms, in rail freight services catering for non-trainload and intermodal traffic in the last five years.	Accepted
Hypothesis Two: Accessibility to the rail network has improved in the last five years, in terms of the number of operational terminals.	Accepted
Hypothesis Three: The provision of rail freight services is now more commercially aware than five years ago.	Accepted
Hypothesis Four: Perceptions of rail freight amongst manufacturers and retailers have improved in the last five years and will lead to greater interest in rail freight services amongst potential customers.	Accepted
Hypothesis Five: Mode choice decision-making has been of low importance in the last five years when companies have been making changes to their logistical operations.	Accepted
Hypothesis Six: The changing relationships between companies at different stages in the supply chain have been detrimental to rail freight and have instead favoured road over the last five years.	Accepted
Hypothesis Seven: Companies that have high-level logistics/transport representation (i.e. at Board level) are more likely to consider the issue of modal choice at an earlier stage in their logistics decision-making processes.	Inconclusive (rejected)
Hypothesis Eight: The earlier consideration of mode choice in those companies with high-level representation has resulted in the structure of the logistical system being more rail-friendly than in other similar companies.	Inconclusive (rejected)
Hypothesis Nine: A significant proportion of freight movements is inherently unsuitable for rail, but of the remainder there is great potential for traffic to shift to rail given the right environment.	Accepted
Hypothesis Ten: The likelihood of using rail freight in the next five years is greater in those companies that have experience of using rail in the last 10 years.	Accepted

Table 7.19 (cont.): Summary of Hypothesis Testing

Hypothesis	Outcome of Hypothesis Testing
Hypothesis Eleven: The factors affecting choice of rail in mode choice decision-making are complex and depend upon the unique circumstances of each company.	Accepted
Hypothesis Twelve: The attitudes towards (and perceptions of) rail of individuals within companies are of great significance in determining whether rail will be considered as an alternative to road.	Accepted
Hypothesis Thirteen: Future logistical changes are more likely to involve the consideration of modes other than solely road when compared to recent changes.	Accepted
Hypothesis Fourteen: Negative attributes of road rather than positive attributes of rail will be the main driving force for an increased uptake of rail freight services in the next five years.	Rejected

CHAPTER EIGHT: CONCLUSIONS AND DISCUSSION

8.1 Introduction

The previous chapter analysed the evidence gathered in this thesis and tested each of the research hypotheses in turn. In this final chapter, the overall conclusions for the thesis are discussed. This leads on to the discussion of the ways in which the thesis has addressed the two research objectives, which were set out in Chapter One.

The final sections of the chapter identify the implications of these research findings, both for theory and for policy and practice. They then assess the limitations of the findings, together with the identification of ways in which this subject area can be developed further in future research.

8.2 Conclusions about Research Hypotheses

The hypotheses were identified in Chapter Three as broadly falling into three categories, as follows:

- the development of a greater understanding of the supply-side of rail freight and its impacts on mode choice decision-making;
- the identification of the impacts of recent logistical changes on mode choice decision-making, particularly in relation to rail freight; and
- the assessment of changes to mode-choice decision-making so as to increase rail's mode share resulting from logistical changes in the future.

The 14 hypotheses were analysed in Chapter Seven using the mixture of quantitative and qualitative information gathered from the original rail freight databases, the questionnaire survey and the in-depth company interviews. The outcome of the hypothesis testing process was shown in Table 7.19. The main conclusions of this hypothesis testing are discussed in the following three sub-sections, based upon the categories of hypotheses. Again it is emphasised, however, that the hypotheses should be seen as all working towards the research objectives and as such there is considerable overlap between the categories. This is addressed in Section 8.3.

8.2.1 Developing a Greater Understanding of the Supply-Side of Rail Freight and its Impacts on Mode Choice Decision-Making

The first set of hypotheses analysed changes in the provision of rail freight services in Great Britain over the last decade. The first two hypotheses examined the disaggregated changes in the provision of rail services in the last five years. The latter two hypotheses introduced the issues of commercial awareness among rail freight operators and perceptions of existing and potential customers. The relative lack of previous investigation of the impacts of changes in rail freight supply on mode choice decision-making was highlighted in Chapter Two. Indeed there has been a tendency in the literature to focus primarily upon road haulage as being capable of meeting the increasingly more demanding requirements of industry in general.

However, the results of this research have shown that rail freight usage has been increasing since the mid-1990s and that this has constituted an increase in rail's modal share rather than simply absorbing some of the general growth in freight traffic. The analysis for Hypothesis One showed that the majority of the growth has come from the non-bulk and intermodal types of traffic, rather than rail's traditional bulk markets. There has also been an improvement in the level of accessibility to the network, as identified in Hypothesis Two.

This increase in rail freight activity has been accompanied by a more commercial approach from rail freight operators, as shown in the analysis for Hypothesis Three. Hypothesis Four found that there has been a change in the perceptions of a large section of industry towards rail freight and that a considerable increase in the customer base is predicted as a result.

The detailed questionnaire analysis in Chapter Six revealed that most of those expected to start using rail will be using intermodal and wagonload services, with much lower interest in traditional trainload movements. Intermodal services in particular were identified as having the greatest potential. The growth in these services has been considerable. Many of rail's shortcomings identified in the literature (Cooper, 1990; Gwilliam, 1990; Button, 1993) have been identified as being surmountable by many companies involved in this research, particularly by making use of the greater flexibility offered by intermodal services. The doubling of non-bulk (i.e. wagonload) services has also had an impact on attitudes towards the potential for rail, as have the changes in the supply in road haulage services resulting from increasing costs and road congestion. Thus, the evidence is such that the gulf between the needs of industry and the service levels and quality provided by rail freight operators has started to be bridged, though with much still required to allow a significant increase in the uptake of services.

8.2.2 Identifying the Impacts of Recent Logistical Changes on Mode Choice Decision-Making, Particularly in Relation to Rail Freight

The hypotheses in this section examined the recent logistical changes that have occurred and assessed the impacts of these changes on the mode choice decision-making process, specifically addressing the implications for the use of rail. This therefore built upon the analysis of the supply side of rail freight in the previous section.

Hypothesis Five found that mode choice decision-making has been of little significance when companies have made changes to their logistical operations in the last five years. The general issue of mode choice was believed by the overwhelming majority of companies to be considered as fully as required, even though this is apparently not considerable or at a senior level in most cases. This does not necessarily rule out the greater use of rail in the future, but it does suggest that far greater flexibility will be required from rail freight operators as it seems unlikely that companies will consider restructuring their operations in order to better suit rail movements.

The importance of the effects of changes occurring within companies elsewhere in the supply chain was examined in Hypothesis Six. It was found that the most significant factor responsible for increasing questionnaire respondents' total demand for freight in the last five years was a change in customer requirements. This was particularly found to be the case towards the downstream end of the supply chain, though it was also an issue for companies nearer to the start of the supply chain.

The nature of the changes that have taken place have tended to continue the trends towards the greater use of transport, often with decreases in efficiency, in order to satisfy growing customer demands. The fact that rail has seldom been considered as a fundamental part of supply chain operation when making changes in the last five years, in the sample of interviewees in this study, reinforces the evidence that changes have tended to favour road. It can certainly be said though that there have been few attempts to integrate rail along supply chains.

This limited level of consideration of mode choice issues both within companies and along supply chains, particularly at the strategic level, accords with the literature reviewed in Section 2.5.2. This further highlights the difficulty for rail in breaking into new markets, despite the obvious interest in using rail freight from a significant minority of industry.

The latter two hypotheses in this section examined in more depth the relationship between the seniority of representation of transport issues within companies and their consideration (and subsequent use) of rail freight. No evidence was found to support the argument that having Board level representation is likely to result in a more pro-rail approach than in those companies that do not have such senior representation. Of more relevance were the perceptions and attitudes of those responsible for mode choice decision-making, regardless of their level of seniority (i.e. Hypothesis Twelve), since if they had a pro-rail outlook they were more likely to identify ways in which rail could fit in with at least some of their requirements.

From this analysis of the trends over the last five years, there is little to suggest that industry as a whole has made any serious attempts to restructure their logistical requirements in a way that more readily allows rail to cater for at least a share of the transport movements. The considerable interest in the changes that have occurred in the rail industry seem to have had an impact upon respondents' views of rail's potential, but mode choice decision-making has not been given any greater degree of attention to try to allow the use of modes other than road.

The evidence from this thesis supports the dominant position of road in logistics that was identified by the literature (e.g. Kasilingam ,1998; Wood *et al* 1995) and justifies the lack of consideration given to other modes from a purely logistics point of view. In the context of encouraging modal shift as part of a balanced transport policy, this therefore provides a major challenge for rail freight and for those who wish to see rail taking a greater share of the freight market. This is discussed in Section 8.5.

8.2.3 Assessing Changes to Mode Choice Decision-Making that may Increase Rail's Mode Share as a Result of Logistical Changes in the Future

The final set of hypotheses set out to identify ways in which logistical changes can be influenced as a tool to assist in increasing the share of freight moved by rail to meet the desired policy objectives of a reduced reliance on road freight. This has been found to be a considerable challenge, due to the lack of attention paid to mode choice decision-making as highlighted throughout the hypothesis testing.

While a significantly greater potential market for rail than is currently being served undoubtedly exists, it is unlikely that its full potential will be realised with the changes that are predicted in the next five years. Hypothesis Nine found a large latent market that could feasibly be addressed by rail freight service providers. This would result in an expansion away from rail's traditional narrow customer base, encompassing a broader range of industrial sectors and companies from along the entire length of supply chains. However, Hypothesis Ten found that the actual likelihood of using rail in the next five years is far greater in those companies who used rail in the last 10 years. Thus, without considerable logistical restructuring, it is likely that rail will primarily regain the sorts of flows that it lost in the late-1980s and early-1990s rather than making a breakthrough into other types of movement. Given that much of the growth in overall freight transport volumes has been in non-traditional rail markets (e.g. food manufacturing, consumer goods), any switch to rail under current logistical operations is likely to be limited.

The matched pair analysis used to test Hypothesis Eleven, together with the analysis in Hypothesis Twelve of the influence of individual people within companies provided insight into the difficulties of taking an aggregate level approach to attempting to influence modal shift. The unique logistical circumstances in which companies find themselves, including the attitudes and perceptions of individual employees, are significant. This means that simplified aggregate approaches to encouraging changes in mode behaviour are unlikely to be as successful as those which are based upon an understanding of the actual logistical operations and issues facing a particular company or, more importantly, the supply chain(s) in which it operates. This is not to say that aggregate approaches are not appropriate, but instead that their impacts upon mode choice are likely to be less significant than those which are more targeted.

It was found in Hypothesis Thirteen that more attention will be paid to mode choice when making changes to logistical operations in the future. This is just as likely to be a result of real and perceived improvements in rail service quality as it is to result from attributes of the road haulage service worsening, as the evidence for Hypothesis Fourteen concluded.

The results of this final set of hypotheses revealed that there is great potential for rail to play a much increased role in freight movement within Great Britain, though it is certainly not likely to challenge road for supremacy in the way it once did. Road is still seen as the natural mode by most, if not all, respondents due to the combination of positive attributes it enjoys being more than enough to outweigh the problems. Even allowing for the possibilities of growing road congestion, increased road haulage taxation and road pricing, road is likely to remain by far the dominant mode. Attitudes towards rail freight have improved however and there is a growing awareness that it will be beneficial to at least consider the potential for rail in the future to a greater extent than has occurred in the recent past.

In general, though, the lack of active consideration and subsequent action within most companies towards the use of rail broadly supports the review of the literature which found that the mode choice issue had received very little attention during the development of a logistics-based approach encompassing freight movements. These conclusions are developed further in the remainder of this chapter.

8.3 Conclusions about Research Objectives

The hypotheses that have been tested for this thesis were constructed so as to ensure that, when considered as a whole, their results were able to satisfy the main objectives of the research. These were identified in Section 1.2 and were:

- ***to determine the major interactions between logistical structure and choice of rail as a mode for freight movement; and***
- ***to identify means by which logistical changes may assist in increasing the share of freight moved by rail.***

By addressing these two key objectives, this thesis has explored the issues relating to freight mode choice under current and predicted logistical structures in considerable depth. The conclusions of the research in relation to satisfying the two objectives are now dealt with in turn.

8.3.1 The Major Interactions Between Logistical Structure and Choice of Rail as a Mode for Freight Movement

The overwhelming evidence from this research is that individual companies have rarely considered mode choice when making strategic changes to their logistical operations, certainly in the last five years. At the supply chain level, where the actions of one company may affect a number of others, it is not surprising that mode choice has had even less attention devoted to it. Most logistical changes have taken place independently of the transport mode to be used, though with the general assumption that road will be the natural mode. The lack of interest from British Rail even to maintain its market share resulted in this road domination strengthening until the mid-1990s.

It is clear from the research results that rail will only be used as a mainstream mode if it meets the much more stringent requirements from industry than it ever had to meet when it was the dominant mode in the past. Without exception, the companies involved in this research primarily use road haulage and have become used to it being flexible and relatively cheap.

Even in those companies currently using rail, it does not tend to account for a significant proportion of their movements and, at the most optimistic, very few companies interviewed (i.e. eight per cent) saw rail's potential as being in excess of half of their transport movements. Indeed, over half of the companies interviewed believed that rail could feasibly handle less than 10 per cent of their movements, while just 37 per cent of the questionnaire sample expects to be using rail freight in five years time. Changes of this magnitude would still represent a very considerable increase in the uptake of rail freight services though.

It would appear that rail freight service providers have recently started to adapt to try to suit the requirements of a broader industry base and have indeed been successful in attracting new users and further traffic flows from existing users. The disaggregated analysis of changes in service provision in recent years, based upon the original rail freight databases, has shown that the changes have been largely positive and have primarily been focused upon growth of the non-trainload markets.

Thus there is evidence from the thesis that rail freight companies are now starting to address the demands of contemporary freight transport, which in turn are largely dictated by the broader logistical changes. The growth in traffic that has taken place in rail freight since the mid-1990s has resulted from a recognition amongst the service providers that there needs to be a far stronger focus upon meeting the requirements of the customer, rather than expecting them to adapt their operations to fit in with the rigid provision of rail freight services that had characterised British Rail.

Most logistical changes in recent years have been influenced by increasing customer demands and the impacts that this has had on companies trying to become more efficient overall to remain competitive. Industry has generally been continuing to move towards a just-in-time (JIT) style of operation, at least adopting the basic principles of leaner production and reduced stockholding if not full JIT operation. These have tended to result in smaller volume flows of goods at more frequent intervals, reducing the transport efficiency of the companies supplying these customers and providing limited scope for rail to play a part.

This evidence thus presents an enormous challenge to the rail industry in its attempts to try to serve markets that have traditionally been captive to road. The longer-term changes that have taken place in both the provision of rail freight services and the growing dominance of logistics-based systems across industry as a whole have created a difficult set of circumstances for rail upon which to build significant growth in its customer base and effect a sizeable modal shift from road. There are clearly big expectations amongst manufacturers and retailers that rail will be able to rise to the challenge and meet their demands in the future.

8.3.2 Means by which Logistical Changes can Assist in Increasing the Share of Freight Moved by Rail

This research has identified that there is considerable potential for a shift in freight from road to rail without any substantial restructuring of logistical operations. However, this depends crucially upon the rail service provided being able to fit in with requirements that traditionally rail has not been very strong at managing to handle successfully. A great deal of interest in rail has been identified amongst the companies that have taken part in the research and many of them have high expectations that services to suit their demands will be available within the next five years. Much of the potential traffic has been identified as being fairly easily accessible to rail freight operators as long as they can meet the quality requirements in particular.

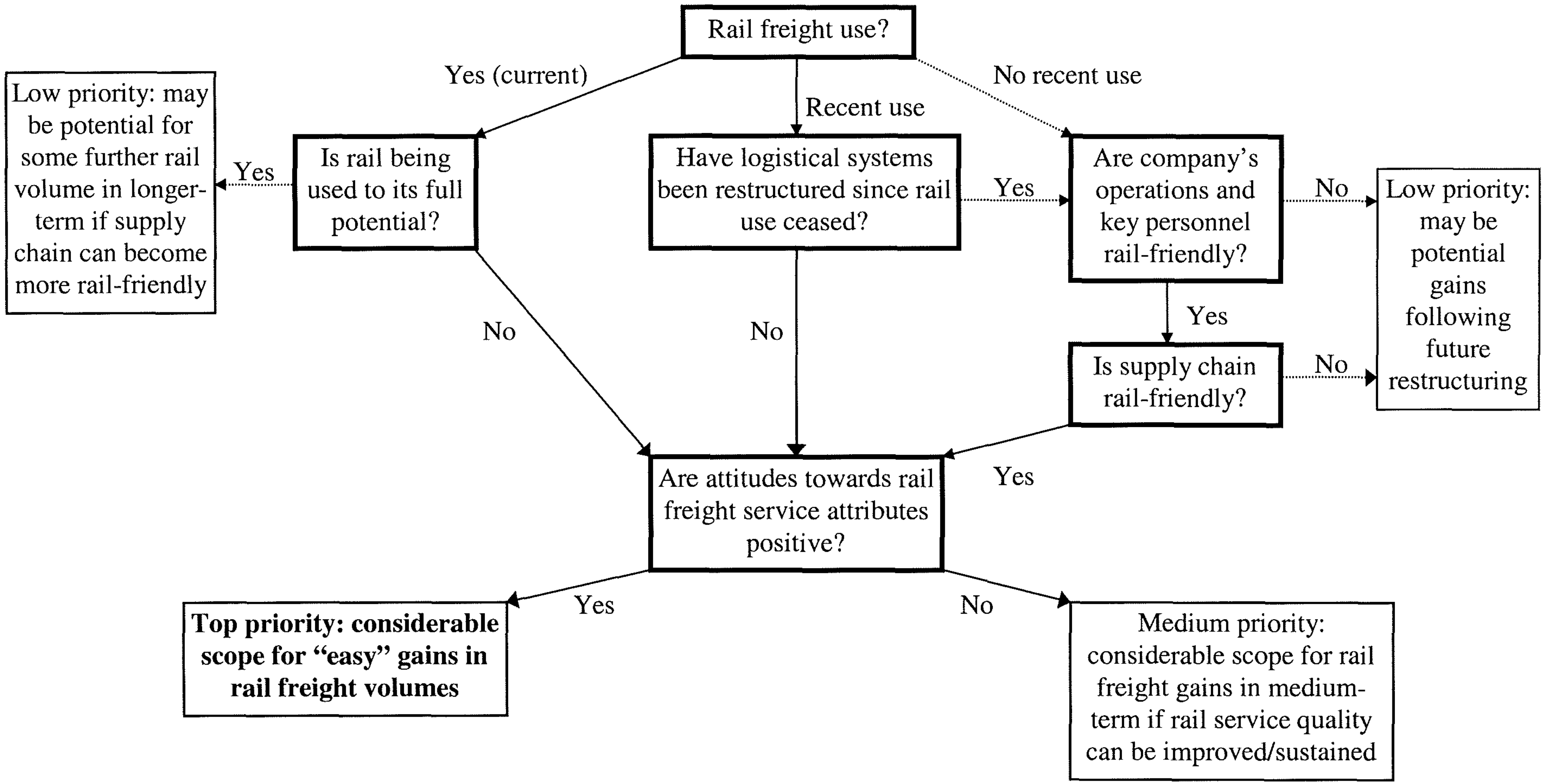
Figure 8.1 provides a simplified representation of the key issues that have been identified in this thesis as having a major impact on the use of rail in the future. It identifies and prioritises the means by which companies should be targeted in order to maximise the modal shift to rail, using three key issues that have been established in this research as being of prime importance:

- experience of rail freight use, either currently or in the last 10 years;
- degree of "rail-friendliness" of the company's operations and, equally importantly, the operation of the supply chain as a whole; and
- attitudes of the key personnel within companies who have the responsibility for mode choice decision-making and, more generally, logistics- and transport-based decisions.

Companies can be identified as being high, medium or low priority targets dependent upon the combination of these three issues. Top priority targets, meaning that they offer considerable scope for relatively easy gains for rail, fall into the following three categories:

- companies which are current rail users, but who are not utilising rail to its full potential, even under their current logistical structure. Particularly if these companies are populated by key individuals with positive attitudes towards rail, there is likely to be scope for extra rail volumes without too much difficulty.

Figure 8.1: General Model to Prioritise Target Companies to Maximise Modal Shift to Rail



- companies which have recent experience of rail freight use, since they have been found to generally have a pro-rail attitude despite past experiences and their logistical systems still tend to be suited to rail movements without requiring significant restructuring.
- companies which have not had any recent experience of rail freight, but do have systems and people that can generally be described as "rail-friendly", as well as supply chain linkages that offer similarly positive approaches to rail freight use. These companies are likely to be the most difficult out of the three groups to attract to rail, but scope does exist given the right set of circumstances.

Medium priority target companies have been identified as those with similar characteristics to the high priority ones, but whose attitudes towards rail are at present negative. This includes non-users who are not convinced that the quality of service is currently of a suitable quality to encourage them to try, but may also include others who have not considered the use of rail. In these cases, their companies may be able to fairly easily use rail, but this is dependent upon changing the attitudes and perceptions of those responsible for the decision-making. It is also possible that this category of companies may include some who currently use rail but are not impressed with the overall quality of service they receive. This may be preventing them from making greater use of rail, but again may offer scope for the medium-term if they can be convinced of the benefits of rail or if the quality of road declines in the meantime.

Certain company characteristics are such that they have led them to be classed as low priority targets. It may be that there are some current rail users who are using rail freight to its full potential, at least under current their logistical structures. If so, then there are unlikely to be any benefits in attempting to gain new rail-based flows from them. None of the rail freight customers who participated in this research actually identified themselves as being in this position.

More common are companies whose combination of the three key issues identified above as being of importance result in there being no readily identifiable scope for rail to have a role. In these companies, the attitudes of individuals towards rail freight are largely irrelevant because the companies and their supply chains have developed in such a way that they are structured so as to basically exclude easy gains for rail freight. These companies are unlikely to have had any recent experience of rail freight and do not present many opportunities for rail to be used, in the near future if at all. Unfortunately for rail freight, these companies are in the majority and are likely to be beyond rail's reach for the foreseeable future.

It appears that rail can potentially fit into a large proportion of companies' logistical set-ups, primarily if the combination of road and rail's differing attributes can be utilised to the maximum advantage with intermodal systems. It is doubtful from the evidence gathered that a company's desire to shift goods to rail would be significant enough in itself to lead to restructuring of production and distribution systems to allow this to take place. This sort of reaction will possibly result from a combination of a desire to use rail and the problems of the current road-based system to maintain quality standards at a cost affordable to the company. In general, though, companies appear to be reluctant to undergo major logistical restructuring simply because of changes in transport costs and efficiency, since this has major implications for the ways in which they can satisfy the demands of their customers.

In conclusion, it has been found that there is significant potential for growth in mode share for rail freight, but that this is dependent upon a complex set of issues. The key ones were identified in Figure 8.1. This research has identified the main criteria that influence freight mode choice and analysed attitudes towards rail freight, with estimates of the potential market for rail and the types of movement that are most likely to be viable. This has considered product attributes, the nature of the transport requirements within companies and along supply chains and attitudes to rail freight.

For rail freight to become a serious competitor to road haulage would require considerable restructuring of either the whole logistical operations of companies within supply chains or far-reaching changes to the capabilities of the rail industry to cope with the demands placed upon it. However, should the potential increases that have been identified be realised then this will place rail in a good position to have a sustained increase in its modal share in the longer term. The policy implications of these findings are discussed in Section 8.5.

8.4 Implications for Theory

This research has in the main supported the existing literature identified in Chapter Two, by highlighting the limited degree of importance that has been attached to mode choice decision-making in the past. It has also accorded with the literature as to what key logistical issues are actually facing companies. However, the expectations that rail freight will feature more strongly in the future does suggest that more consideration should be taken of its potential at the theoretical level. Ways in which rail could be incorporated into logistical planning at an earlier stage may prove beneficial in meeting the policy targets (see Section 8.5) for modal split, otherwise it will always be in the position of being marginalised at the key decision-making stage and then only able to fit in to a lesser extent into the structures that are set up largely to satisfy road haulage.

In terms of rail freight services themselves, the disaggregated approach to analysing freight flows through the use of the original rail freight databases has assisted in identifying the ways in which the rail freight industry has been adapting to the demands placed upon it. The published statistics provide very little in terms of disaggregation and would have made it extremely difficult to gain a detailed understanding of where the growth in rail freight has actually been taking place in the last few years. With these databases, it has been possible to show that the growth has indeed largely been taking place in the key areas identified by the research participants as offering scope for the future (i.e. intermodal and non-bulk services).

The attempts to provide both "matched pair" and supply chain analyses have been important in addressing the objectives of the thesis, by considering the specific issues surrounding freight mode choice in more depth than has previously been the case. The construction of a framework within which mode choice outcomes can be assessed is of importance if a significant transfer to rail is to be effected. The policy implications are discussed in the next section.

The key implication for the theory of freight mode choice decision-making resulting from this research is the potential for the use of matched pair analysis to assist in the development of a greater understanding of the processes involved in mode choice. This could form the basis for establishing a more detailed methodology for assessing the potential for rail freight in the future as a development of this research. While its full potential may not have been realised in this study due to the limitations on the interview sample size and the selection of well-matched pairs of companies, the usefulness of this theoretical approach in this context would appear to be significant and worthy of more detailed investigation.

8.5 Implications for Policy and Practice

The findings of this research provide clear guidelines on effecting a shift of traffic from road to rail. The prime focus should be on increasing volumes from existing customers and trying to entice recent former users back to rail in the short- to medium-term, since this offers great potential to build up volumes and encourage a shift of traffic from road. These companies are aware of the benefits and disadvantages of rail and are more likely to be able to withstand quality problems in the interim as long as they perceive long-term improvements in the mode. For the longer-term, attempts must be made to have a sustained improvement in service quality so that new customers will not be disappointed in what rail can offer.

Not surprisingly, there is evidence of a resistance to change mode, due to the uncertainties that this brings. Where rail has been identified as being a serious option for flows for particular companies, it is often not being used at present due to the inertia that exists for road. The predictions of rail use in the future may require a push to ensure that they actually take place. This provides an ideal opportunity for government policy to be utilised to make rail more attractive, preferably through improvements to rail but possibly also backed up by measures to decrease the attractiveness of road haulage. However, such negative measures will affect all companies, including those which are not readily able to shift to rail or other modes.

Without significant government intervention, not least in investment in the rail network and terminals, the 20 per cent mode share target for rail set by the Royal Commission for Environmental Pollution (1994) and previously endorsed by government seems unlikely to be met. Likewise, the tripling of rail freight volumes in ten years as advocated by EWS in 1996 has now been accepted by the company as having been too optimistic and a revised target of at least doubling volumes between 2000 and 2010 has been adopted (EWS, 2000d). More recently, the Government's Ten Year Plan for Transport (DETR, 2000d) has set out an aim to increase railfreight tonne kilometres by 80 per cent by 2010.

While the more recent targets are less ambitious, perhaps even representing a decline rail's mode share depending upon total freight growth by all modes, there is still a limit to what the rail industry is capable of doing within its current framework of management and funding. More specifically, growth from within the industry is unlikely to meet the expectations of the participants in this research. Indeed, it is questionable as to whether the rail network in its current form would be able to cope with such a growth in volumes as that which has been identified as potentially attainable or even realistically achievable within the next five years. The modal shift to rail identified in this research as being feasible would far exceed the recently stated government target of 80 per cent growth over ten years.

The importance of rail service quality, even more so than cost, has important policy and practical implications. Quite simply, unless rail can achieve the standards generally achievable by road, then it will not be used other than at the margins for consignments where service quality is not of prime importance. Rail will not be used simply for environmental and social reasons, even in pro-rail companies. There is a clear need for external guidance and, further, action in order for significant change to occur, since it is unlikely to occur as a result of continuing with present policies. Whilst pursuing policies that increase the costs for road haulage and, to a certain extent, decrease its efficiency may result in a shift from road to rail, this is likely to lead to an overall decrease in transport efficiency. The evidence that the vast majority of movements will continue to be by road despite these potential changes suggests that pro-active measures to improve rail freight would instead be more beneficial.

8.6 Limitations

The general limitations of the research were identified in Section 1.4 and are not repeated here except to emphasise that the research findings relate specifically to the situation in Great Britain. They may well also be of relevance in other countries, but care should be taken when interpreting the results and trying to extrapolate them to other countries.

Much of this research has used qualitative research methods and as such has not attempted to find statistically significant relationships. It has instead focused upon gaining a more detailed understanding of the complex issues surrounding the interactions between logistical structures and freight modal choice. For example, the research methodologies cannot be used to provide accurate predictions of the total potential market for rail, but have been used to assess the magnitude of growth that is feasible. As discussed in Chapter Four, the research participants were largely self-selecting and no claim is made that they are necessarily representative of industry. Therefore care should be taken not to attach too much weight to specific detail of the findings. With the sample sizes involved, in particular for the in-depth interviews, the research has been able to successfully gain evidence as a means of developing the understanding of the key issues, without necessarily claiming to be wholly representative of the population at large.

Due to the particular methodological approach that was used, there were some problems with the matched pair and supply chain analyses not being as comprehensive as would have been desirable. This was largely a function of the in-depth interviewees being selected from the questionnaire sample, which limited the scope for incorporating as many supply chains and "matched pairs" as had been intended. Despite this, a considerable volume of information was gathered that allowed these analyses to take place and they did provide quality information that allowed the hypothesis testing to take place.

8.7 Implications for Further Research

The focus of this thesis has been on the interactions between logistical structure and mode choice, particularly in terms of addressing the extent to which policy targets for increasing rail freight's modal share can be achieved. It would be beneficial to conduct further research with a more specific focus on how mode choice decision-making is actually addressed. This could be carried out through the use of more detailed case studies of particular companies as they make logistical changes, tracing the developments over a period of time to see the effects on mode choice. Alternatively the matched pair methodology could be developed to address these issues.

There is further scope for examining the significance of the attitudes and perceptions of the decision-makers, perhaps making greater use of the "matched pair" analysis methodology to more comprehensively isolate the effects of the individuals within the companies under study. It would be beneficial to do this with better matched pairs or groups, since the methodology used in this research resulted in the similarities between the companies not always being as strong as had been anticipated.

Similarly, there is great potential for more comprehensive analysis of complete supply chains, though this has proved difficult to do. Given the increasingly global nature of supply chains, they are extremely difficult to trace from start to finish given the crossing of national boundaries. Confidentiality issues between companies trading with each other would also make this difficult, but nonetheless it would be worthwhile to conduct such an analysis if possible.

The trends identified in this research, both in terms of the changing supply of rail freight services and the actions and attitudes of companies towards the use of rail will continue to be important in future in order to assess the measures required to satisfy policy objectives. In particular, the detailed analysis of the supply of rail freight services made possible from the construction of the original databases has provided fresh detail about rail freight services and further databases would allow the trends to be monitored and analysed in the future to provide greater detail than that from the published aggregate statistics.

Finally, this thesis has relied on detailed analysis from a relatively narrow set of participants, in particular for the in-depth exploration in the interview phase which tended to focus upon just a few supply chains. It was also likely to be over-populated by those companies with an interest in rail freight. The findings would therefore benefit from a broader based, more representative study that would be able to generalise the findings and provide more substantive evidence on the likely actions of the population as a whole.

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APPENDIX ONE:

SAMPLE SHEETS FROM RAIL FREIGHT DATABASES

1991 Database

ID	Code	Dep	From	To	Arr	Via	Frequency	M	T	W	Th	F	Sa	Su	Commodity
1779	6A15	0544	Aberdeen	Elgin			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1786	6A27	1324	Aberdeen	Elgin			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1781	7A03	0813	Aberdeen	Inverurie			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1785	8A01	1212	Aberdeen	Local trips			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1782	6A01	1025	Aberdeen	Local trips			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1780	6A01	0625	Aberdeen	Local trips			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1175	6B84	0010	Aberdeen	Millerhill Yard	0433		5 per week	No	Yes	Yes	Yes	Yes	Yes	No	
1742	6D03	2340	Aberdeen	Mossend Yard	0453		5 per week	No	Yes	Yes	Yes	Yes	Yes	No	
1538	6E89	1530	Aberdeen	Tees Yard	0306		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1482	6M64	1250	Aberdeen	Willesden Yard	0400		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
488	6B10	0945	Aberthaw	Cardiff Tidal Yard	1050		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
338	6F79		Aberystwyth	Stanlow	2129		1 per week	No	No	Yes	No	No	No	No	
1027	7A20	2200	Acton Yard	Brentford	2300		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1032	7O90	0345	Acton Yard	Chislehurst			3 per week	Yes	No	Yes	No	Yes	No	No	
1046	7L41	1245	Acton Yard	Harlow Mill			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1023	6A21	1920	Acton Yard	Merehead	2230		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1033	6O73	0345	Acton Yard	Tolworth			1 per week	No	Yes	No	No	No	No	No	
491	6V32	1045	Albion	Waterston			2 per week	No	No	Yes	No	Yes	No	No	
103	6D70	0915	Aldwarke	Scunthorpe	1016		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
97	6D45	1009	Aldwarke	Shipley			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
85	6N14	1739	Aldwarke	Tees Yard	2030		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
27	6M72	2203	Aldwarke	Warrington	0038		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
104	6M62	1300	Aldwarke	Washwood Heath Yard	1715		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1021	6V17	1000	Allington	Whatley	1840		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
604	7D05	0915	Amlwch	Llandudno Junc.	1031		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
968	6M54		Angerstein Wharf	Bardon Hill			2 per week	No	Yes	No	Yes	No	No	No	
1039	7E12		Angerstein Wharf	Kings Cross			5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1041	7E62		Angerstein Wharf	Kings Cross	2315		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1022	7V79		Angerstein Wharf	Paddington	1545		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1017	7V78		Angerstein Wharf	Park Royal	1145		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
1142	6A43		Appleford	Whatley	1030		5 per week	Yes	Yes	Yes	Yes	Yes	No	No	
880	6J75	1000	Appley Bridge	Dean Lane	1115		4 per week	No	Yes	Yes	Yes	Yes	No	No	
881	6J77	1830	Appley Bridge	Dean Lane	1945		3 per week	Yes	No	Yes	No	Yes	No	No	
873	6H63	1045	Appley Bridge	Northenden			1 per week	No	No	No	No	No	Yes	No	
874	6H63	1400	Appley Bridge	Northenden			4 per week	No	Yes	Yes	Yes	Yes	No	No	

Loaded	Sector	Notes
y	Speedlink	
y	Speedlink	
y	Speedlink	
y	Speedlink	
y	Speedlink	
y	Speedlink	
n	Construction	
y	Speedlink	
n	Chemicals	
y	Speedlink	
n	Petroleum	Operates as required
n	Petroleum	
y	Construction	
y	Construction	
y	Construction	
y	Construction	
y	Construction	
n	Petroleum	
n	Metals	
n	Metals	
n	Metals	
y	Metals	
y	Metals	
n	Construction	
y	Chemicals	
n	Construction	
y	Construction	Operates as required
y	Construction	Operates as required
y	Construction	Operates as required
y	Construction	Operates as required
n	Construction	Operates as required
n	Construction	
n	Construction	
n	Construction	
n	Construction	

1997 Database

ID	Code	Dep	From	To	Arr	Via	Frequency	M	T	W	Th	F	Sa	Su
254			Aberdeen	Harwich			Fortnightly	No	No	No	No	No	No	No
913	6H55	0925	Aberdeen Craiginches Y	Inverness Yard	1457	Inverurie (1008-1043)/Elgin (1228-13	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
915	6D03	2200	Aberdeen Guild St	Mossend Yard	0403	Millerhill Yard (0143-0223)	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
908	6D52	1005	Aberdeen Guild St	Mossend Yard	1356		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
231	6B90	1904	Aberthaw PS	Cardiff Tidal Yard	2011		1 per week	No	No	No	Yes	No	No	No
697	7A00	1130	Acton Terminal	Acton Yard			3 per week	Yes	No	No	Yes	Yes	No	No
681			Acton Terminal	Angerstein			1 per week	Yes	No	No	No	No	No	No
687			Acton Terminal	Grain			2 per week (Q)	No	Yes	No	Yes	No	No	No
729	7Z91	1900	Acton Terminal	Merehead	2300		2 per week	Yes	No	Yes	No	No	No	No
696	7A00		Acton Yard	Acton Terminal	0600		3 per week	Yes	No	No	Yes	Yes	No	No
704	6087	0320	Acton Yard	Allington	0600		4 per week	Yes	Yes	Yes	No	Yes	No	No
714	6066	1250	Acton Yard	Angerstein	1415		4/5 per week	Yes	Yes	Yes	Yes	Yes	No	No
706	6047	0420	Acton Yard	Ardingly	0630		1 per week	No	No	No	Yes	No	No	No
698	6A30	0558	Acton Yard	Brentford	0650		3 per week	Yes	No	Yes	No	Yes	No	No
716	7053	2237	Acton Yard	Crawley	0000		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
708	7Z31	1221	Acton Yard	Crawley	1400		1 per week	No	Yes	No	No	No	No	No
712	6L15	2144	Acton Yard	Dagenham	2300		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
724	7L54	0530	Acton Yard	Harlow Mill	0700		2 per week	No	Yes	No	Yes	No	No	No
700	6A26		Acton Yard	Hayes	0718		2 per week	No	Yes	No	Yes	No	No	No
702	6057	0258	Acton Yard	Hothfield	0630		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
695	7C23	2253	Acton Yard	Merehead	0151		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
693	7C75	1253	Acton Yard	Merehead	1610		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
722	7L57	1209	Acton Yard	Purfleet	1400		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
720	7052	0446	Acton Yard	Purley	0600		4 per week	No	Yes	Yes	Yes	Yes	No	No
718	7055	1221	Acton Yard	Purley	1315		1 per week	Yes	No	No	No	No	No	No
710	6085	1221	Acton Yard	Salfords	1330		1 per week	No	No	Yes	No	No	No	No
692	6C29	0540	Acton Yard	Whatley	0834		5 per week	No	Yes	Yes	Yes	Yes	Yes	No
726	7004	0504	Acton Yard	Woking	0700		3 per week	Yes	No	Yes	No	Yes	No	No
355	6J51	2320	Aldwarke	Deepcar	2355		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
365	6M15	0200	Aldwarke	Handsworth	0615		1 per week	No	No	No	No	Yes	No	No
363	6D14	0414	Aldwarke	Shipley	0615		1 per week	No	No	No	Yes	No	No	No
361	6N14	0400	Aldwarke	Stockton	0615		1 per week	No	Yes	No	No	No	No	No
359	6M91	0400	Aldwarke	Tyseley	0730	Kingsbury (0615)	1 per week	No	No	Yes	No	No	No	No
357	6M91	0147	Aldwarke	Tyseley	0730	Beeston (0325)	1 per week	Yes	No	No	No	No	No	No
705	6V17	0958	Allington	Southall Yard	1217		4 per week	Yes	Yes	Yes	No	Yes	No	No

Commodity	Loaded	Operator	Sector	Notes
Carless (lub oil)	No	EWS	Petroleum	Operates as required
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	Conveys empty cement wagons for Oxwellmains (detached at Millerhill)
Enterprise	Yes	EWS	Enterprise	
Minimet (fuel oil)	No	EWS	Petroleum	
Yeoman (stone)	No	MendipRail	Construction	Conveys empties for Merehead on 7C75
Marcon (sand)	No	EWS	Construction	May operate TO (early am)
Yeoman (granite)	No	EWS	Construction	Operates as required; days of operation may be different
Yeoman (stone)	No	MendipRail	Construction	
Yeoman (stone)	Yes	MendipRail	Construction	Conveys stone from Merehead on 7A71
ARC (stone)	Yes	MendipRail	Construction	Conveys stone from Whatley on 6A20
Yeoman (stone)	Yes	EWS	Construction	Conveys stone from Merehead on 7A09; may operate MSX or ThSX
ARC (stone)	Yes	MendipRail	Construction	Conveys stone from Whatley on 6A20
Yeoman (stone)	Yes	EWS	Construction	Conveys stone from Merehead on 7A71
Yeoman (stone)	Yes	MendipRail	Construction	Conveys stone from Whatley on 7A15
ARC (stone)	Yes	MendipRail	Construction	Conveys stone from Merehead on 7A09
ARC (stone)	Yes	MendipRail	Construction	Conveys stone from Whatley on 7A15
Yeoman (stone)	Yes	EWS	Construction	Conveys stone from Merehead on 7A71
ARC (stone)	Yes	EWS	Construction	Conveys stone from Merehead on 7A71
ARC (stone)	Yes	EWS	Construction	Conveys stone from Whatley on 6A20
Yeoman/ARC (stone)	No	MendipRail	Construction	Conveys portions from Angerstein (SX), Purley (MO), Crawley (TO), Salfords (WO) & Purfleet (
Yeoman (stone)	No	MendipRail	Construction	Conveys portions from Acton (MThFO), Purley (MSX), Harlow Mill (TThO) & Woking (MWFO)?
Yeoman (stone)	Yes	MendipRail	Construction	Conveys stone from Merehead on 7A09
Yeoman (stone)	Yes	MendipRail	Construction	Conveys stone from Merehead on 7A71
Yeoman (stone)	Yes	MendipRail	Construction	Conveys stone from Merehead on 7A09
ARC (stone)	Yes	EWS	Construction	Conveys stone from Merehead on 7A09
Yeoman/ARC (stone)	No	MendipRail	Construction	Conveys portions from Dagenham (MX) & Crawley (MX)?
Yeoman (stone)	Yes	EWS	Construction	Conveys stone from Merehead on 7A71
Scrap metal	No	EWS	Metals	May operate Sun to Thurs?
Scrap metal	No	EWS	Metals	
Scrap metal	No	EWS	Metals	
Scrap metal	No	EWS	Metals	
Scrap metal	No	EWS	Metals	
Scrap metal	No	EWS	Metals	
ARC (stone)	No	MendipRail	Construction	Conveys empties for Whatley on 6C18

1998 Database

ID	Code	Dep	From	To	Arr	Via	Frequency	M	T	W	Th	F	Sa	Su
26	6H55	0925	Aberdeen	Elgin	1228	Inverurie (1008-1043)	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
31	6H54	1312	Aberdeen	Inverness	1730		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
43	6E43	1355	Aberdeen	Tees Yard	0200	Montrose (1453-1541); Millerhill (1942-2005); Tyn	1 per week	Yes	No	No	No	No	No	No
42	6E43	1242	Aberdeen	Tees Yard	0200	Montrose (1340-1423); Millerhill (1847-2005); Tyn	4 per week	No	Yes	Yes	Yes	Yes	No	No
30	6D52	1538	Aberdeen Guild St Yar	Mossend Yard	1940		5 per week (Q)	Yes	Yes	Yes	Yes	Yes	No	No
910	6B90	1904	Aberthaw PS	Cardiff Docks			5 per week (Q)	Yes	Yes	Yes	Yes	Yes	No	No
518	7O79	0357	Acton	Angerstein			1 per week	No	No	Yes	No	No	No	No
557	6L26	1430	Acton	Dagenham			5 per week	Yes	Yes	Yes	Yes	Yes	No	No
587			Acton	Grain			5 per week (Q)	Yes	Yes	Yes	Yes	Yes	No	No
560	7C20	1903	Acton	Merehead	2215		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
531	6O87	0320	Acton Yard	Allington	0600		4 per week	Yes	Yes	Yes	Yes	No	No	No
539	6O66	1250	Acton Yard	Angerstein	1415		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
533	6O47		Acton Yard	Ardingly	0630		1 per week	No	No	No	No	Yes	No	No
541	7A19		Acton Yard	Brentford	1415		3 per week	Yes	No	Yes	No	Yes	No	No
555	7O53	2238	Acton Yard	Crawley	2355		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
543	7O55	1202	Acton Yard	Crawley	1400		1 per week	No	Yes	No	No	No	No	No
545	6L15		Acton Yard	Dagenham	2300		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
549	7L54		Acton Yard	Harlow Mill	0700		2 per week	No	Yes	No	Yes	No	No	No
644			Acton Yard	Hayes			1 per week	Yes	No	No	No	No	No	No
529	7A26		Acton Yard	Hayes	0648		2 per week	Yes	No	Yes	No	No	No	No
535	6O57		Acton Yard	Hothfield	0630		4 per week	No	Yes	Yes	Yes	Yes	No	No
525	7C23	2235	Acton Yard	Merehead	0130		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
553	7L57	1210	Acton Yard	Purfleet	1338		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
547	7O52		Acton Yard	Purley	0618		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
537	6O54		Acton Yard	Salfords	0600		1 per week	Yes	No	No	No	No	No	No
527	7A23		Acton Yard	West Drayton	0700		3 per week	No	Yes	No	Yes	Yes	No	No
526	7C29	0540	Acton Yard	Whatley	0900		5 per week	No	Yes	Yes	Yes	Yes	Yes	No
523	7C75	1250	Acton Yard	Whatley	1600		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
551	7O04	0504	Acton Yard	Woking	0700		3 per week	Yes	No	Yes	No	Yes	No	No
818	6J51		Aldwarke	Deepcar	2355		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
829	6M15		Aldwarke	Handsworth	0615		1 per week	No	No	No	No	Yes	No	No
827	6D14		Aldwarke	Shipley	0615		2 per week (Q)	No	No	No	Yes	No	Yes	No
825	6N14	0400	Aldwarke	Stockton	0615		2 per week (Q)	No	Yes	No	Yes	No	No	No
822	6M91	0146	Aldwarke	Tyseley		Beeston	2 per week	Yes	No	Yes	No	No	No	No
1194	6M47	0855	Aldwarke	Wolverhampton			2 per week	No	No	Yes	Yes	No	No	No

Commodity	Loaded	Operator	Sector	Notes
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	Operates as required
Petroleum (Minimet)	No	EWS	Petroleum	
Sand (Marcon)	No	EWS	Construction	
Sand	No	EWS	Construction	
Granite (Yeoman)	No	EWS	Construction	
Aggregate (Yeoman)	No	MendipRail	Construction	
Aggregate (ARC)	Yes	MendipRail	Construction	
Aggregate (Yeoman)	Yes	MendipRail	Construction	
Aggregate (ARC)	Yes	MendipRail	Construction	
Aggregate (Yeoman)	Yes	EWS	Construction	
Aggregate (ARC)	Yes	MendipRail	Construction	
Aggregate (Yeoman)	Yes	MendipRail	Construction	
Aggregate (ARC)	Yes	MendipRail	Construction	
Aggregate (Yeoman)	Yes	EWS	Construction	
			Construction	
Aggregate (Yeoman)	Yes	EWS	Construction	
Aggregate (ARC)	Yes	EWS	Construction	
Aggregate (Yeoman)	No	MendipRail	Construction	
Aggregate (Yeoman)	Yes	MendipRail	Construction	
Aggregate (Yeoman)	Yes	MendipRail	Construction	
Aggregate (ARC)	Yes	EWS	Construction	
Aggregate (Yeoman)	Yes	EWS	Construction	
Aggregate (ARC)	No	MendipRail	Construction	
Aggregate (Yeoman)	No	MendipRail	Construction	
Aggregate (Yeoman)	Yes	EWS	Construction	
Scrap metal	No	EWS	Metals	
Scrap metal	No	EWS	Metals	
Scrap metal	No	EWS	Metals	
Scrap metal	No	EWS	Metals	
Scrap metal	No	EWS	Metals	
Steel	Yes	EWS	Metals	

1999 Database

ID	Code	Dep	From	To	Arr	Via	Frequency	M	T	W	Th	F	Sa	Su
1198	6A09	1245	Aberdeen Guild Street	Aberdeen Guild Street		Waterloo Goods	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
292	6E43	1355	Aberdeen Guild Street	Doncaster	0605	Montrose, Millerhill Yard, Tyne Yard, Te	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
298	6H54	1312	Aberdeen Guild Street	Inverness Yard	1700	Inverurie, Elgin	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
293	6D52	1538	Aberdeen Guild Street	Mossend Yard	1940		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
1169	6B90	1904	Aberthaw PS	Cardiff Tidal Yard	2015		5 per week (Q)	Yes	Yes	Yes	Yes	Yes	No	No
692			Acton	Acton Yard			2 per week	Yes	No	Yes	No	No	No	No
581	7079	0357	Acton	Angerstein			1 per week	No	No	Yes	No	No	No	No
534	7C20	1903	Acton	Merehead	2225		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
691	6A00		Acton Yard	Acton	0930		2 per week	Yes	No	Yes	No	No	No	No
517	6087	0320	Acton Yard	Allington	0600		4 per week	Yes	Yes	Yes	Yes	No	No	No
525	6066	1250	Acton Yard	Angerstein	1450		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
519	6047	0515	Acton Yard	Ardingly	0630		1 per week	No	No	No	No	Yes	No	No
697	7A19		Acton Yard	Brentford	1415		3 per week	Yes	No	Yes	No	Yes	No	No
693	6Z89		Acton Yard	Brentford	0733		1 per week	No	No	No	No	Yes	No	No
521	7055	1150	Acton Yard	Crawley	1400		1 per week	No	Yes	No	No	No	No	No
523	7053	2238	Acton Yard	Crawley	2355		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
565	6L26	1430	Acton Yard	Dagenham			5 per week	Yes	Yes	Yes	Yes	Yes	No	No
699	6L15		Acton Yard	Dagenham	2300		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
701	7L54		Acton Yard	Harlow Mill	0705		2 per week	No	Yes	No	Yes	No	No	No
703	7A26		Acton Yard	Hayes & Harlington	0648		2 per week	Yes	No	Yes	No	No	No	No
457			Acton Yard	Hayes & Harlington			1 per week	Yes	No	No	No	No	No	No
705	6057		Acton Yard	Hothfield	0630		4 per week	No	Yes	Yes	Yes	Yes	No	No
514	7C23	2235	Acton Yard	Merehead	0140		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
531	7L57	1210	Acton Yard	Purfleet	1326		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
527	7052		Acton Yard	Purley	0618		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
709	7A23		Acton Yard	West Drayton	0700		3 per week	No	Yes	No	Yes	Yes	No	No
695	6A24		Acton Yard	West Drayton	1136		2 per week	No	Yes	No	Yes	No	No	No
511	7C75	1250	Acton Yard	Whatley	1600		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
509	7C29	0540	Acton Yard	Whatley	0900		5 per week	No	Yes	Yes	Yes	Yes	Yes	No
529	7004	0504	Acton Yard	Woking	0630		3 per week	Yes	No	Yes	No	Yes	No	No
341	6M10	1512	Aldwarke	Bescot Yard	1840		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
916			Aldwarke	Deepcar			5 per week	No	No	No	No	No	No	No
928			Aldwarke	Handsworth			1 per week	No	No	No	No	Yes	No	No
918			Aldwarke	Shipley				No	No	No	No	No	No	No
913	6N14	0400	Aldwarke	Stockton			3 per week (Q)	No	Yes	No	Yes	No	Yes	No

Commodity	Loaded	Operator	Sector	Notes
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Minimet (petroleum)	No	EWS	Petroleum	Operates as required
Sand	No	EWS	Constructio	
Marcon (stone)	No	EWS	Constructio	
Yeoman (stone)	No	MendipRail	Constructio	
Sand	Yes	EWS	Constructio	
ARC (stone)	Yes	MendipRail	Constructio	
ARC (stone)	Yes	EWS	Constructio	
ARC (stone)	Yes	MendipRail	Constructio	
Yeoman (stone)	Yes	EWS	Constructio	
Sand	Yes	EWS	Constructio	
Yeoman (stone)	Yes	MendipRail	Constructio	
ARC (stone)	Yes	MendipRail	Constructio	
Sand	No	EWS	Constructio	
ARC (stone)	Yes	MendipRail	Constructio	
Yeoman (stone)	Yes	EWS	Constructio	
Yeoman (stone)	Yes	EWS	Constructio	
Tarmac (stone)	Yes	EWS	Constructio	Day of operation unknown
Yeoman (stone)	Yes	EWS	Constructio	
Yeoman (stone)	No	MendipRail	Constructio	
Yeoman (stone)	Yes	MendipRail	Constructio	
Yeoman (stone)	Yes	MendipRail	Constructio	
Yeoman (stone)	Yes	EWS	Constructio	
Sand	Yes	EWS	Constructio	
Yeoman (stone)	No	MendipRail	Constructio	
ARC (stone)	No	MendipRail	Constructio	
Yeoman (stone)	Yes	EWS	Constructio	
Enterprise	Yes	EWS	Enterprise	
Steel	Yes	EWS	Metals	
Steel scrap	No	EWS	Metals	
Steel scrap	No	EWS	Metals	
Steel scrap	No	EWS	Metals	Operates as required

2000 Database

ID	Code	Dep	From	To	Arr	Via	Frequency	M	T	W	Th	F	Sa	Su
1107			?????????	Redmire			(Q)	No	No	No	No	No	No	No
4	6E43	1500	Aberdeen Guild Street	Doncaster Yard	0600	Montrose, Millerhill Yard, Tees Yard,	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
2	6H54	1312	Aberdeen Guild Street	Elgin		Inverurie	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
1188	6A03	0628	Aberdeen Guild Street	Inverurie		Aberdeen Waterloo	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
3	6D52	1342	Aberdeen Guild Street	Mossend Yard	1715		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
829	6B90	1904	Aberthaw PS	Cardiff Tidal Yard	2010		5 per week (Q)	Yes	Yes	Yes	Yes	Yes	No	No
552	6Z43	1110	Acton	Angerstein			1 per week	No	Yes	No	No	No	No	No
590	6L26	1430	Acton	Dagenham			5 per week	Yes	Yes	Yes	Yes	Yes	No	No
586	6Z46	1110	Acton	Grain	1325		1 per week	No	No	Yes	No	No	No	No
638	7C20	1900	Acton	Merehead	2230		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
603	6087		Acton Yard	Allington	0600		4 per week	Yes	Yes	Yes	Yes	No	No	No
605	7066	1250	Acton Yard	Angerstein	1450		3 per week	Yes	No	Yes	No	Yes	No	No
607	6047		Acton Yard	Ardingly	0630		2 per week	Yes	No	No	Yes	No	No	No
609	7A19		Acton Yard	Brentford	1415		3 per week	No	Yes	Yes	No	Yes	No	No
613	7055	1150	Acton Yard	Crawley	1400		2 per week	No	Yes	No	Yes	No	No	No
611	7053		Acton Yard	Crawley	2355		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
655	7054	1019	Acton Yard	Crawley	1145		1 per week	Yes	No	No	No	Yes	No	No
615	6L15		Acton Yard	Dagenham	2300		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
617	7048	1150	Acton Yard	Godstone	1335		2 per week	No	No	Yes	No	Yes	No	No
619	7L54		Acton Yard	Harlow Mill	0700		5 per week (Q)	Yes	Yes	Yes	Yes	Yes	No	No
621	6Z33		Acton Yard	Harwich	0555		2 per week	No	Yes	No	Yes	No	No	No
623	7A26		Acton Yard	Hayes	0648		2 per week	Yes	No	Yes	No	No	No	No
625	6057		Acton Yard	Hothfield	0630		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
598	7C23	2235	Acton Yard	Merehead			5 per week	Yes	Yes	Yes	Yes	Yes	No	No
627	7L57	1210	Acton Yard	Purfleet	1326		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
629	7052		Acton Yard	Purley	0618		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
1255	7093	0421	Acton Yard	Sevington	1100		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
659			Acton Yard	Stud Farm			1 per week	No	No	No	No	No	No	No
631	7002	1302	Acton Yard	Tolworth	1500		2 per week	Yes	No	No	Yes	No	No	No
633	7A23		Acton Yard	West Drayton	0700		3 per week	No	Yes	No	Yes	Yes	No	No
602	7C29	0540	Acton Yard	Whatley	0900		5 per week	No	Yes	Yes	Yes	Yes	Yes	No
600	7C75	1250	Acton Yard	Whatley	1600		5 per week	Yes	Yes	Yes	Yes	Yes	No	No
635	7004	0504	Acton Yard	Woking	0618		5 per week (Q)	Yes	Yes	Yes	Yes	Yes	No	No
20	6M10	1358	Aldwarke	Bescot Yard	1700	Toton Yard	5 per week	Yes	Yes	Yes	Yes	Yes	No	No
1056			Aldwarke	Corby			1 per week (Q)	No	No	No	No	No	No	No

Commodity	Loaded	Operator	Sector	Notes
MoD	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Enterprise	Yes	EWS	Enterprise	
Petroleum (Minimet)	No	EWS	Petroleum	
Sand (Marcon)	No	EWS	Construction	
Sand (Foster Yeoman)	No	EWS	Construction	
Granite (Foster Yeoman)	No	EWS	Construction	
Aggregates (MendipRail)	No	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Sand (Tarmac)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	No	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (Tarmac)	No	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Aggregates (MendipRail)	No	EWS	Construction	
Aggregates (MendipRail)	No	EWS	Construction	
Aggregates (MendipRail)	Yes	EWS	Construction	
Enterprise	Yes	EWS	Enterprise	
Scrap metal	No	EWS	Metals	

APPENDIX TWO:

QUESTIONNAIRE USED FOR INDUSTRIAL SURVEY

Napier University
Transport Research Institute

Freight Transport in Britain

Notes for completing this questionnaire:

While this questionnaire primarily deals with rail freight issues, we are interested in the views of business as a whole. Therefore even if you have no experience of using rail freight, please answer as many questions as possible.

The questionnaire should be completed by the distribution/logistics manager or nearest equivalent and should take approximately **10 minutes of your time** to complete. Your responses are highly valuable to this study and any information you provide will be combined anonymously in a research report. You may respond either in terms of the company as a whole or the division for which you have responsibility; however please be consistent throughout the questionnaire. We are interested in freight moved **both** directly by your company/division **and** by outside contractors on your behalf.

THANK YOU for assisting us and contributing to this important research project. We would be grateful if you would complete this questionnaire within two weeks of receiving it if possible and return it in the enclosed FREEPOST envelope.

YOUR NAME: ________________________________

JOB TITLE: ________________________________

COMPANY/DIVISION NAME: ________________________________

COMPANY/DIVISION ADDRESS: ________________________________

____

____

☎ (WORK): ________________________________

<u>SECTION A: This section to be completed by *all* respondents</u>

1. Are you responding to this questionnaire in terms of:

your company	your division

2. Please give an indication of the total number of locations (e.g. factories, retail outlets, distribution facilities) that your company/division has responsibility for.

	Please ring one
1	1
2 - 5	2
6 - 10	3
11 - 20	4
21 - 50	5
51 - 100	6
More than 100	7

3. What was the turnover of your company/division in 1997?

	Please ring one
Less than £10m	1
£10m - £19m	2
£20m - £29m	3
£30m - £39m	4
£40m - £49m	5
£50m - £99m	6
£100m or more	7

4. How much does your company/division currently spend on transport as a percentage of turnover?

	Please ring one
0 - 1.9 %	1
2 - 3.9 %	2
4 - 5.9 %	3
6 - 7.9 %	4
8 - 9.9 %	5
10 % or more	6

5. Which of the following best describes the geographical spread of the activities of your company/division?

	Please ring one
One British region	1
Several British regions	2
National (i.e. Great Britain)	3
European	4
Global	5

6. Which of the following types of freight movements are you responsible for?

Please ring all those that are applicable

Inward movements of raw materials from suppliers	1
Inter-site movements within your company	2
Distribution of products to customers	3
Other (please specify):	4

7. What is the approximate value of one tonne of goods moved for your company/ division? *If this varies significantly, please provide an average value followed by the minimum and maximum values (e.g. £25; £10-£40)*

____

8. Does your company/division make any use of the national rail network for freight movements within Great Britain?

Yes **(Please go to Section B)**

No **(Please go to Section C)**

SECTION B: This section to be completed by those whose company/division *does* currently use rail for freight movements, otherwise please go to Section C

9. Which of the following types of rail freight service does your company/division make use of? (* - standard rail wagons on trains carrying freight for several customers)

Please ring all those that are applicable

Trainload (i.e. bulk) within Britain	1
Traditional wagonload* within Britain	2
Intermodal/containers within Britain	3
Trainload (i.e. bulk) - international	4
Traditional wagonload* - international	5
Intermodal/containers - international	6

10. Which of the following rail freight service providers does your company/division make use of?

Please ring all those that are applicable

English Welsh and Scottish Railway (EWS)	1
Railfreight Distribution (RfD)	2
Freightliner 1995	3
Direct Rail Services (DRS)	4
Channel Tunnel consolidator (e.g. ACI, CTL)	5
Other (please specify):	6

11a. Over the last 2 years, has the volume of goods moved by your company/division by rail:

	Please ring one
Increased by 10% or *more*?	1
Increased by *less* than 10%?	2
Remained the same?	3
Decreased by *less* than 10%?	4
Decreased by 10% or *more*?	5
No use of rail freight 2 years ago	6

b. Please briefly explain any changes.

____

____

____

____

12a. Over the next 5 years, do you think that the volume of freight moved by rail by your company/division will:

	Please ring one
Increase by 50% or *more*?	1
Increase by between 25% and 49%?	2
Increase by between 10% and 24%?	3
Increase by *less* than 10%?	4
Remain the same?	5
Decrease by *less* than 10%?	6
Decrease by between 10% and 24%?	7
Decrease by between 25% and 49%?	8
Decrease by 50% or *more*?	9

b. Please explain why.

____

____

____

____

Please go to Section D

<u>SECTION C: This section to be completed by those whose company/division *does not* currently use rail for freight movements, otherwise please go to Section D</u>

13. Has your company/division made any use of rail freight in the last 10 years?

Yes	**(Please go to Question 14)**
No	**(Please go to Question 17)**

14. Which of the following types of rail freight service did your company/division make use of? (* - standard rail wagons on trains carrying freight for several customers)

	Please ring all those that are applicable
Trainload (i.e. bulk) within Britain	1
Traditional wagonload* within Britain	2
Intermodal/containers within Britain	3
Trainload (i.e. bulk) - international	4
Traditional wagonload* - international	5
Intermodal/containers - international	6

15. In which year did your company/division cease using rail freight? _________

16. Why did your company/division cease using rail freight?

____

____

____

____

17a. Do you think your company/division will start to use rail at all for freight movements in the next 5 years?

Yes No

b. Please explain why/why not.

____

____

____

____

18. If you think your company/division will start to use rail, which of the following types of services are likely to be used? (* - standard rail wagons on trains carrying freight for several customers)

	Please ring all those that are applicable
Trainload (i.e. bulk) within Britain	1
Traditional wagonload* within Britain	2
Intermodal/containers within Britain	3
Trainload (i.e. bulk) - international	4
Traditional wagonload* - international	5
Intermodal/containers - international	6

<u>SECTION D: This section to be completed by *all* respondents</u>

19. Who makes the decision on which mode of transport to use for freight consignments? *N.B. Choose nearest equivalent if title/responsibility is similar; if not, choose other.*

	Please ring one
Logistics/Distribution Director	1
Logistics/Distribution Manager	2
Transport Director	3
Transport Manager	4
Third Party Freight Forwarder	5
Other (please specify):	6

20a. Do you believe that decisions relating to mode choice for freight transport are given the attention they deserve within your company?

Yes　　　　No

b. If no, please briefly explain why not.

____

____

____

21. Does your company/division conduct a formal analysis of the mode options prior to commencing new freight flows?

Please tick one box

Yes, based on company strategic policy	**(Please go to Question 22)**
Yes, based on set criteria, but not part of a strategic company policy	**(Please go to Question 22)**
Yes, on an ad-hoc basis	**(Please go to Question 22)**
No	**(Please go to Question 23)**

22. If yes, how is this modal choice analysis generally carried out?

	Please ring one
Based on product attributes	1
Based on customer attributes	2
Based on distance	3
Combination of the above	4
Other (please specify):	5

23a. Has the recent privatisation of the rail freight network and its services had any impact on the decisions that your company/division has taken when deciding on which mode of transport to use for your freight requirements?

Yes No

b. Please state why/why not.

____

____

____

____

24a. How important are each of the following factors are to your company/division when choosing whether or not to use rail as a mode of transport for freight movements within Great Britain? *For each factor, please ring one number*

	Please rate how important using the scale 1 = not important to 5 = very important				
Cost	1	2	3	4	5
Service frequency	1	2	3	4	5
Service flexibility (e.g. flexible departure/arrival times)	1	2	3	4	5
Rail journey time	1	2	3	4	5
Door-to-door journey time	1	2	3	4	5
Availability of door-to-door package	1	2	3	4	5
Private sector operation of services	1	2	3	4	5
Financial incentives to use rail (e.g. freight facilities grants)	1	2	3	4	5
Impact of movements on environment	1	2	3	4	5
Congestion on road network	1	2	3	4	5
Supplier/customer requirements	1	2	3	4	5
Availability of intermodal equipment/expertise	1	2	3	4	5
Other (please specify):	1	2	3	4	5

b. Of the factors listed in Question 24a, please rank the three most important ones to your company/division *(where 1 is the most important)*:

1. ....
2. ....
3. ....

25a. What has been the effect of each of the following factors on your company/ division's demand for freight transport (by all modes) in Great Britain over the last 5 years? *For each factor, please ring one number*

	Effect on Demand for Transport					
	Increase		No	Decrease		Not
	Larg	Sligh	Chang	Sligh	Larg	Appli
Change in the level of sales	1	2	3	4	5	0
Expansion of market area	1	2	3	4	5	0
Contraction of market area	1	2	3	4	5	0
Production/stockholding centralisation	1	2	3	4	5	0
Production/stockholding decentralisation	1	2	3	4	5	0
Relocation of factories	1	2	3	4	5	0
Relocation of warehouses	1	2	3	4	5	0
Adoption of low inventory strategies (e.g. just-in-time)	1	2	3	4	5	0
Transfer of responsibility for transport **to** suppliers/customers	1	2	3	4	5	0
Transfer of responsibility for transport **from** suppliers/customers	1	2	3	4	5	0
Change in the nature of the product	1	2	3	4	5	0
Change in customer requirements	1	2	3	4	5	0
Change in the choice of mode used	1	2	3	4	5	0
Contracting-out of transport operations	1	2	3	4	5	0
Internalisation of transport operations	1	2	3	4	5	0
Consolidation of loads into larger/ heavier consignments	1	2	3	4	5	0
Change in vehicle routing	1	2	3	4	5	0
Other (please specify):	1	2	3	4	5	0

b. Of the factors listed in Question 25a, please rank the 3 that have been most important to your company/division *(where 1 is the most important)*:

1. ....
2. ....
3. ....

26. How important have each of the following factors been in constraining the growth of lorry traffic for your company's operations in Great Britain in the last 5 years? *For each factor, please ring one number.*

	Please rate how much of a constraint using the scale 1 = no constraint to 5 = major constraint				
Road congestion	1	2	3	4	5
Higher fuel taxes	1	2	3	4	5
Increase in oil prices	1	2	3	4	5
Tighter government controls (e.g. licensing, traffic, vehicle regulations)	1	2	3	4	5
Environmental restrictions	1	2	3	4	5
Displacement of traffic to rail	1	2	3	4	5
Displacement of traffic to water	1	2	3	4	5
Other (please specify):	1	2	3	4	5

27. How important do you think each of the following factors will be in constraining the growth of lorry traffic for your company's operations in Great Britain over the next 5 years? *For each factor, please ring one number*

	Please rate how much of a constraint using the scale 1 = no constraint to 5 = major constraint				
Road congestion	1	2	3	4	5
Motorway charges	1	2	3	4	5
Urban road pricing	1	2	3	4	5
Higher fuel taxes	1	2	3	4	5
Increase in oil prices	1	2	3	4	5
Tighter government controls (e.g. licensing, traffic, vehicle regulations)	1	2	3	4	5
Environmental restrictions	1	2	3	4	5
Displacement of traffic to rail	1	2	3	4	5
Displacement of traffic to water	1	2	3	4	5
Other (please specify):	1	2	3	4	5

28. Does your company/division have any form of environmental policy or statement that relates to its transport operations? *(If yes, please attach a copy if possible)*

Yes No

29. Are there any other comments that you would like to make regarding the issues raised in this survey? (Continue on a separate sheet of paper if necessary)

As part of this research, we would like to interview some distribution/logistics managers to discuss in greater detail the issues raised in this questionnaire. This interview should take approximately 45 minutes of your time. It would be helpful if you could indicate below whether or not you would be willing to be interviewed.

Are you willing to be interviewed as part of this study? Yes No

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE. PLEASE RETURN IT IN THE ENCLOSED FREEPOST ENVELOPE.

APPENDIX THREE:

QUESTIONNAIRE USED FOR 1993 HERIOT-WATT UNIVERSITY INDUSTRIAL SURVEY

1. What are the main problems that you encounter in running your company's transport operations at present? *For each factor, please ring one number*

	No Problem	Minor Problem	Major Problem
Increasing vehicle operating costs	1	2	3
Road congestion	1	2	3
Lorry weight restrictions	1	2	3
Local traffic regulations	1	2	3
Restrictions on drivers hours	1	2	3
Poor service from contractors	1	2	3
Inadequate rail services	1	2	3
Other (please specify):	1	2	3

2. How concerned is your company about these possible developments over the next five years? *For each factor, please ring one number*

	No Concern	Minor Concern	Major Concern
Increasing road congestion	1	2	3
Imposition of motorway charges	1	2	3
Introduction of urban road pricing	1	2	3
Higher fuel taxes	1	2	3
Increase in oil prices	1	2	3
Tighter government controls (licensing, traffic and vehicle regulations)	1	2	3
Rising environmental standards	1	2	3
Other (please specify):	1	2	3

3. What has been the **approximate** percentage change in each of the following measures over the last five years in your company? *In each box, please indicate the percentage and direction of change, i.e. increase (+) or decrease (-).*

	% change
Vehicle miles by lorry	
Tonnage transported by road	
Expenditure on road freight transport	
Total sales revenue	

4. Has the change in vehicle mileage been mainly due to:

	Please ring one
Change in the number of journeys	1
Change in the average length of journeys	2
Similar changes in the number and length of journeys	3

5. What has been the effect of each of the following factors on your company's demand for road transport over the last five years? *For each factor, please ring one number*

	Effect on Demand for Road Transport		
	Increase	No Change	Decrease
Change in the level of sales	1	2	3
Change in market area	1	2	3
Change in the nature of the product	1	2	3
Change in customer requirements	1	2	3
Production/stockholding centralisation	1	2	3
Production/stockholding decentralisation	1	2	3
Relocation of factories	1	2	3
Relocation of warehouses	1	2	3
Adoption of low inventory strategies (e.g. just-in-time)	1	2	3
Shedding of responsibility for transport **to** suppliers/customers	1	2	3
Taking over responsibility for transport **from** suppliers/customers	1	2	3
Contracting-out of transport operations	1	2	3
Internalisation of transport operations	1	2	3
Change in the use of alternative modes	1	2	3
Consolidation of loads in larger/ heavier vehicles	1	2	3
More efficient vehicle routing	1	2	3
Other (please specify):	1	2	3

6. Which of the following statements do you think is most likely to reflect the change in your company's use of road transport over the next five years?

		Please ring one
Lorry mileage will:	grow in line with sales	1
	grow at a faster rate than sales	2
	grow at a slower rate than sales	3
	remain stable	4
	decline	5

7. In your opinion, what factor(s) **other than sales** will be most important in determining the amount of road freight transport that your company will use over the next five years?

____

____

____

8. How do you think your company would respond to a 50% **increase** in road transport costs?

____

____

____

____

____

____

9. How much does your company currently spend on transport as a percentage of sales revenue?

	Please ring one
0 - 1.9 %	1
2 - 3.9 %	2
4 - 5.9 %	3
6 - 7.9 %	4
8 - 9.9 %	5
≥ 10 %	6

As part of this research, we would like to interview some distribution/logistics managers to discuss in greater detail the issues raised in this questionnaire. It would be helpful to us if you could indicate below whether or not you would be willing to be interviewed. Even if you are not willing to be interviewed, we would be grateful if you could either attach your business card or fill in your name and your company's address. This information will remain confidential and will be used only for general statistical analysis. In addition, please indicate whether or not you would like to receive a summary of the survey results.

Are you willing to be interviewed as part of this study? Yes/No

Would you like to receive a summary of the survey results? Yes/No

YOUR NAME: _______________________________

JOB TITLE: _______________________________

COMPANY/DIVISION NAME: _______________________________

COMPANY/DIVISION ADDRESS: _______________________________

____

____

☎ (WORK): _______________________________

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE. PLEASE RETURN IT IN THE PRE-PAID ENVELOPE PROVIDED

APPENDIX FOUR:

INTERVIEW SCHEDULE USED AS BASIS FOR IN-DEPTH INTERVIEWS

Interview Schedule

This information is additional to that already supplied by the companies in their questionnaires. They will be used to filter out questions below that are not relevant for particular respondents.

General Company Information

1. What is the range of supplies/products that you are responsible for within your company?
2. Have there been any significant changes in the range of supplies/products handled by your company in the last 5 years? If so, explain.
3. Are there any other ways in which your responsibilities are defined? (e.g. geographically, by customer)
4. Which aspects of the supply chain do you deal with? (i.e. inward movements of raw materials/products, movements of materials/products between company sites, distribution of products to customers/retail outlets, waste movements)
5. Are there other people within your organisation who deal with other stages in the supply chain? If so, what responsibilities do they have?
6. Have there been any changes in the last 5 years in the parts of the supply chain that your company is responsible for?
7. Do you contract-out any of the logistics functions (e.g. transport, warehousing, stock control)? If so, how much control does your company exert over modal choice and other transport issues?

Design of Logistical Systems

Changes in Internal Industrial Structure

1. How many production locations does your company have within the UK?
2. How many did you have in 1994?
3. Has there been a shift in the location of production (e.g. development of 'greenfield' sites/sites with good access/room for expansion, etc.)? If so, explain the changes and why they were made.
4. Have there been any changes in the production processes that take place at each location (e.g. plant specialisation; integration of different production stages at one site, etc.)? If so, explain the changes and why they were made.
5. If there have been changes in 3 and 4, what effects have they had on the operation and efficiency of the transport network?
6. Do you foresee any changes that may affect the number, scale or location of your production sites in the next 5 years?
7. Do you foresee any changes that may affect the operation and efficiency of your transport network in the next 5 years?

Changes in the Internal Stockholding System

1. How many warehouse locations does your company have? (distinguish by purpose, e.g. storage of components to be used, central mixing, distribution)
2. How many warehouse locations did you have in 1994? (distinguish by purpose)
3. Has there been any change in the average storage area/throughput of your warehouses (i.e. level of inventory centralisation)?
4. Are the warehouses at the same locations as the production facilities? Has there been any change in this respect in the last 5 years?
5. What factors are most important to you in deciding upon the location of a warehouse? (e.g. importance of transport costs/modal choice). Do you foresee any changes in the next 5 years? If so, why?
6. Are you planning to make any changes to the number, location or size of your warehouse facilities in the next 5 years? If so, why?

Trade Relationships

Upstream Supply Chain: Sourcing of Materials

1. Has there been any change in the contracting out of different stages in the production process in the last 5 years (e.g. increase in sub-contracting or acquisition of suppliers)?
2. If yes, how has this affected the volume of freight transport (e.g. location of sub-contractors production sites)?
3. Do you foresee any changes in the level and nature of external sourcing of different activities in the production process? Explain why/why not.
4. Do you source supplies from more, fewer or the same number of suppliers as you did 5 years ago? Explain any changes.
5. Are you likely to change the number of suppliers from whom you source materials? If yes, why and what effect will this have on the amount and mode of transport required?
6. Has there been any change in the geographical area from which you source supplies (i.e. sourcing from a wider or smaller area)?
7. At what stage in the decision process relating to potential suppliers do you consider the effects of transport costs/modal choice?
8. Do you think there will be any change in the importance of transport costs and modal choice issues in the next 5 years when choosing who to obtain supplies from?
9. Do you impose any restrictions on when deliveries can be made to your premises (e.g. time windows) or on when you will collect supplies from suppliers? If yes, why and what impact does this have on the transport system?
10. Are there any ways in which the upstream supply chain (i.e. through from source) can be adapted to provide greater opportunities for movements by rail? If yes, please explain and estimate the potential volumes that could transfer.

Downstream Supply Chain: Deliveries to Customers

1. Has there been any change in the last 5 years in the geographical size of your company's/division's market area? (i.e. the area that you directly deal with?). If yes, explain.
2. Has there been any redistribution of sales/deliveries to customers within your existing market area? If yes, explain.
3. To what extent has there had to be restructuring of the distribution network to take account of these changes? What impact has this had upon the total amount of transport used and the use of different modes?
4. Is any (further) restructuring likely to take place in the next 5 years, so as to make the transport operation more efficient? If yes, explain.
5. Do you think that there will be any significant changes to your market area in the next 5 years? If yes, explain.
6. If so, how will you adapt your transport operations to cope with these changes? What are the likely impacts on the total amount of transport used and the mode choice?
7. Do you impose any restrictions on when you will make deliveries to customers (e.g. 'nominated day' deliveries? If yes, why and what impact does this have on the transport system?
8. Are there any ways in which the downstream supply chain (i.e. through to customers) can be adapted to provide greater opportunities for movements by rail? If yes, please explain and estimate the potential volumes that could transfer.

<u>Scheduling of Product Flow</u>

Just-in-Time

1. Have you introduced JIT (or a similar process) for any of your operations? If yes, explain.
2. If so, what proportion of movements is accounted for by JIT?
   - in terms of percentage of the volume of goods, and
   - in terms of percentage of tonne/vehicle kilometres
3. What mode(s) of transport are used for your JIT movements?
4. Has JIT been of benefit to your company? If yes, in what ways? (e.g. reduction in transport costs; improved customer service/reliability; better working relationship with suppliers). Quantify benefits where possible.
5. Have there been any negative aspects? (e.g. increase in transport costs; lack of flexibility in transport system/mode choice; poorer customer service/reliability; problems with suppliers). Quantify costs where possible.
6. Are you likely to i) increase, ii) decrease, or iii) maintain the use of JIT in the next 5 years? If i) or ii), to what extent?
7. Do you consolidate your JIT supplies (e.g. by use of a supply house)? If yes, explain.
8. Has the introduction of JIT in your company had any effects that you are aware of upon the transport operations/mode choice of your suppliers and/or customers? If yes, explain.

9. Have any of your suppliers or customers introduced JIT in the last 5 years? If yes, how has that affected your transport operations/mode choice?
10. Has the use of JIT at any point in the supply chain had any effect on the potential for rail to be used for transport movements? If yes, explain.

Load Consolidation

1. Is load consolidation an important factor in your distribution operations? If yes, explain.
2. Have you made, or are you likely to make any changes to the minimum order size of your supplies or product deliveries? If yes, why? (i.e. for transport-related reasons or other reasons?)
3. Do you, or are you likely to, make use of transhipment depots, so as to maximise trunking operations and thus reduce vehicle movements? If yes, does this affect mode choice? Why?
4. Considering inter-plant movements, are these centrally co-ordinated (e.g. with a central mixing plant) or are they only arranged as required? Why do you use the system that you do? Does it have any impact on mode choice?

Use of Logistics/Transport Specialists (if applicable - see earlier question)

1. Do you make use of logistics/transport specialists for:
- all aspects of the logistical operation? (i.e. distribution and warehousing)
- consolidating supplies and/or the deliveries of products?
- obtaining return loads? (i.e. use of clearing houses)
- other aspects of the transport system? If yes, explain.
2. What criteria are used for the selection of logistics service providers?
3. Specifically, how much emphasis is placed on the minimisation of transport movements and costs and modal choice issues?
4. Do you think this will become more or less important in choosing a logistics/transport specialist during the next 5 years? If yes, explain why.
5. How often do you review the performance of logistics/transport service providers? Is efficiency of the transport operations an important issue?
6. Do you foresee logistics/transport providers as becoming more or less important in terms of your company's operations in the next 5 years? If yes, why? Is this likely to have any impact on mode choice (e.g. through specialists having greater use/knowledge of rail freight)?

Choice of Transport Mode

1. Which modes(s) of transport do you use for your operations? If more than one mode, please explain how modal choice is carried out.
2. Have there been any changes in the use of different modes in the last 5-10 years?
3. If yes, why were these changes made?
4. Have they been beneficial? If yes, in what way?
5. Have there been any problems? If yes, what?

6. Do you foresee any changes in the next 5 years? If yes, why?
7. Have any of the changes in regulation and taxation over the last 5 years had an effect upon your use of different transport modes or on the total amount of transport you use? If yes, explain.
8. Do you think future government policies will have any impacts on your use of different transport modes or on the total amount of transport you make use of? If yes, explain.
9. Is road congestion a problem for your operations? If yes, how are you dealing with the problem or how do you propose to alleviate it in the next 5 years?
10. What do you think should be done by others (particularly government) to alleviate road congestion?
11. How much would you be willing to pay (per mile and per vehicle per year) to use congestion-free roads?
12. How closely linked are transport movements and transport costs?
13. Do you operate an in-house fleet of vehicles or do you use dedicated or shared-user transport provided by a third party (if not already found out in first section)? Has this changed in the last 5 years or is it likely to change in the next 5 years (in terms of efficiency)? If yes, explain.
14. Do any of your production or distribution locations have access to the rail or waterway networks?
15. Have any rail or waterway links been installed or closed in the last 5-10 years? If so, give details/reasons.
16. Are there any plans to open or close any links in the future?
17. What would make you consider the use of rail/waterways? How extreme would conditions have to be/how much change in different modes would be required to make you consider rail?
18. If you would consider the use of the rail network, what movements (by type of goods, length of haul, customer requirements, etc.) would you envisage switching to rail? Give details of the conditions required for this shift. What proportion of your total movements in Britain would this account for, in terms of tonne-kms and value of goods?

Other useful information:

1. Who do you see as your main competitors in Britain?
2. Who are your main suppliers/customers?

APPENDIX FIVE:

POSITION IN SUPPLY CHAIN AND "SUPPLY CHAIN"/"MATCHED PAIR" LINKAGES BETWEEN INTERVIEWEES

Company	Position in supply chain:			Supply chain links:		Matched pair with:
	Start	Middle	End	upstream	downstream	
A1	-	•	-	*A2*	I1	A6
A2	•	-	-	-	*A1, A5, A8,* F4, *F8, F10, F12*	-
A3	-	•	-	-	I1	-
A4	-	•	-	-	*I1*	-
A5	•	•	-	*A2, A9*	*I1*	A8
A6	-	•	-	-	I1	A1
A7	•	•	-	-	-	-
A8	•	•	-	*A2, A9*	*I1*	A5
A9	•	-	-	-	*A5, A8*	-
B1	•	-	-	-	-	-
B2	•	-	-	-	-	-
B3	•	-	-	-	-	-
C1	-	-	•	-	-	-
D1	-	•	-	-	D3	-
D2	-	•	•	G4	*D3, D4*	-
D3	-	•	•	D1, *D2, G4*	-	-
D4	-	-	•	*D2*	-	-
F1	-	•	-	F7	-	F3, F6, F9
F2	-	•	-	-	-	-
F3	-	•	-	F7	-	F1, F6, F9
F4	•	•	-	*A2*	-	F8, F10, F12
F5	•	-	-	-	-	-
F6	-	•	-	F7	-	F1, F3, F9
F7	•	-	-	-	F1, F3, F6, F9	-
F8	•	•	-	*A2*	-	F4, F10, F12
F9	-	•	-	F7	-	F1, F3, F6
F10	•	•	-	*A2*	-	F4, F8, F12
F11	•	-	-	-	I3	-
F12	•	•		*A2*		F4, F8, F10
G1	-	•	-	-	I5	G3
G2	-	•	-	-	-	G4
G3	-	•	-	-	I5	G1
G4	-	•	-	-	D2, *D3, I3*	G2
H1	-	•	-	-	I3	-
I1	-	-	•	A1, A3, *A4, A5, A6, A8*	-	-
I2	-	-	•	-	-	I4
I3	-	-	•	F11, *G4*, H1	-	-
I4	-	-	•	-	-	I2
I5	-	-	•	G1, G3	-	-

- where a company appears in italics, this indicates that the linkage is assumed or implied by respondents rather than being directly mentioned

Key to company codes:
A - food and drink; B - chemicals and fertilisers; C - construction and building materials; D - transport equipment; F - paper and publishing; G - electrical and electronic equipment; H - non-electrical machinery; I - retailers; subsequent numbers represent individual interviewees within that sector.

APPENDIX SIX:

SUMMARY OF INFORMATION PROVIDED BY INTERVIEWEES

Key to company codes:

A - food and drink
B - chemicals and fertilisers
C - construction and building materials
D - transport equipment
F - paper and publishing
G - electrical and electronic equipment
H - non-electrical machinery
I - retailers

- subsequent numbers represent individual interviewees within that sector.

Other symbols:

*	or more use of rail if already a user
( )	some information, though not comprehensive (e.g. international distribution of products in that division of company as part of a European manufacturing/ distribution network, but no information on activities of other divisions)

Superscripts:

1 - suitable for own company but not at customer locations
2 - was used on a trial basis only
3 - only if intermodal
4 - dependent upon source of flows though, so variable
5 - trial basis, not regular
6 - greater for inward movements
7 - inter-site movements only; no scope for distribution

	Coverage of information						Recent general company trends						Recent supply chain trends			
Company	Sourcing info	Inter-site info	Distrib-ution info	Plant-based info	UK-based info	Europe wide info	Δ in market area	Δ in product attributes	Δ in level of sales	Δ in no. of locations	Δ in location activities	Manag-ement reorgn.	Δ in sourcing pattern	Sourcing lead time & stock	Customer require-ments	Δ in delivery locations
A1		☺	☺		☺					↓					↑	
A2	☺		☺		☺	(☺)	↑	•	↑						↑↑	•
A3	☺	☺	☺		☺										↑	↓↓
A4		☺	☺		☺				↑						↑	
A5		☺	☺		☺					↓		•			↑	
A6		☺	☺		☺			•	↓		•				↑	↓
A7	☺	☺			☺								•		↑	
A8	☺	☺	☺		☺				↑↑	↑					↑	
A9	☺	☺	☺		☺				↓	↓	•		•		↑	
B1	☺	☺	☺		☺				↓							
B2	☺	☺	☺			☺			↑			•			↑	
B3	☺	☺	☺		☺		↑			↓↓		•	•	↓	↑	↑
C1	☺				☺											
D1	☺	☺	☺	☺						↓				↓	↑	•
D2	☺	☺	☺			(☺)			↑					↓	↑	
D3			☺					•	↑	↑↑		•			↑	
D4	☺		☺		☺										↑	
F1			☺		☺			•	↓							↓
F2			☺		☺											↓↓

	Coverage of information						Recent general company trends						Recent supply chain trends			
Company	Sourcing info	Inter-site info	Distrib-ution info	Plant-based info	UK-based info	Europe wide info	Δ in market area	Δ in product attributes	Δ in level of sales	Δ in no. of locations	Δ in location activities	Manag-ement reorgn.	Δ in sourcing pattern	Sourcing lead time & stock	Customer require-ments	Δ in delivery locations
F3	☺		☺		☺			•	↑							↓
F4	☺		☺		☺					↓					↑	
F5		☺	☺			(☺)	↑								↑	
F6			☺		☺			•	↓							↓
F7	☺		☺		☺	(☺)				↓↓						•
F8			☺	☺						↓↓					↑↑	
F9			☺		☺			•		↑						
F10			☺	☺					↑	↓					(↑)	
F11		☺	☺		☺			•	↑	↑		•			↑	
F12		☺	☺	☺			•					•				
G1	☺	☺		☺		(☺)		•	↑				•	↓		↓
G2		☺	☺		☺										↑	↑
G3	☺	☺		☺		(☺)				↑		•		↓		↓↓
G4		☺	☺	☺		(☺)	↑				•	•				
H1		☺	☺	☺		(☺)						•				↓↓
I1	☺	☺	☺		☺	☺										
I2			☺		☺					↓		•				•
I3	☺	☺	☺		☺											
I4		☺	☺		☺			•							↑	
I5	(☺)	☺	☺		☺				↑	↑		•				

	Predicted general company trends						Predicted supply chain trends				Importance of transport				
Company	Δ in market area	Δ in product attributes	Δ in level of sales	Δ in no. of locations	Δ in location activities	Manag-ement reorgn.	Δ in sourcing pattern	Sourcing lead time & stock	Customer require-ments	Δ in delivery locations	Senior level rep-resent'n	Worried about cost ↑	Will adapt to cost ↑	Worried about quality ↓	Will adapt to quality ↓
A1									↑		•		•		•
A2									↑		•		•		•
A3		•							↑				•		•
A4									↑↑				•		•
A5		•		↓						↓			•		•
A6		•		↑					↑	↓			•		•
A7		•			•	•			↑	↓			•		•
A8									↑				•		•
A9			↓	↑								•			•
B1			↓	↓		•						•			•
B2				↑	•		•	↓	↑			•			•
B3	↑			↓							•		•		•
C1				•									•		•
D1													•		•
D2											•		•		•
D3				↑			•		↑		•		•		•
D4									↑		•	•			•
F1				(↑)							•		•		•
F2													•		•

	Predicted general company trends						Predicted supply chain trends				Importance of transport				
Company	Δ in market area	Δ in product attributes	Δ in level of sales	Δ in no. of locations	Δ in location activities	Manag-ement reorgn.	Δ in sourcing pattern	Sourcing lead time & stock	Customer require-ments	Δ in delivery locations	Senior level rep-resent'n	Worried about cost ↑	Will adapt to cost ↑	Worried about quality ↓	Will adapt to quality ↓
F3		•											•		•
F4									↑		•	•			•
F5	↑		↑		•	•	•	↓	↑				•		•
F6		•	↓								•		•		•
F7									↑		•		•		•
F8	(↑)								↑				•		•
F9		•		↓	•		•			•	•		•		•
F10	↑			(↑)	•	•			↑				•		•
F11		•		(↑↓)					↑				•		•
F12	↓			↑		•					•		•		•
G1		↑					•	↓					•		•
G2				↓	•				↑	↑			•		•
G3										↓			•		•
G4									↓↑	•			•		•
H1	↑									↓↓			•		•
I1				↓	•	•					•		•		•
I2						•							•		•
I3				↑	•		•				•		•		•
I4													•		•
I5			↑	↓				•			•		•		•

	Issues involving transport operations (and particularly mode choice)													
Company	Transport is demand led	Transport is production led	Recent Δ in transport efficiency	Scope for efficiency gains	Operate own road fleet	Long-term transport contracts	Short-term contracts/ spot hire	Currently use rail	Stopped using rail	Could easily use rail*	Could possibly use rail*	Direct access to rail network	Suitable rail access for needs	Est of max % of goods for rail
A1	•	•			•	•								0
A2	•		↑↓			•		•		•		•	•[1]	30+
A3	•		↑	•	•		•							0
A4	•					•								0
A5	•	•				•					•			30
A6	•				•	•					•			<5
A7	•		↑			•			•[2]		•[3]			25-40
A8	•	•	↓	•	•	•								0
A9	•	•	↓		•		•			•	•			10
B1	•						•	•		•				60
B2	•						•	•		•				50
B3		•	↓				•	•		•		•	•	40-50
C1	•				•	•		•		•		•	•[4]	20+
D1	•		↑			•					•			<5
D2	•	•			(•)	•			•	•			•	30
D3	•			•	•	•					•		•	2
D4	•				•									0
F1	•	•				•					•			<10
F2	•					•					•			<10

	Issues involving transport operations (and particularly mode choice)												
Company	Transport is demand led	Transport is prod-uction led	Recent Δ in transport efficiency	Scope for efficiency gains	Operate own road fleet	Long-term transport contracts	Short-term contracts/ spot hire	Current-ly use rail	Stopped using rail	Could easily use rail*	Could possibly use rail*	Direct access to rail network	Suitable rail access for needs	Est of max % of goods for rail
F3	•	•			•	•					•			10
F4	•		↑			•		•		•[3]		•		<50
F5	•	•	↑			•		•		•				60
F6	•		↑			•					•			<5
F7	•						•				•			10
F8	•		↓	•			•							0
F9	•			(•)		•					•			10-15
F10	•						•	•		•		•		30+
F11	•			•		•	•	•[5]		•				20-25[6]
F12	•		↑	•		•		•		•		•		50+
G1	•	•		•		•					•			<10
G2	•		↓			•					•		•	10
G3		•				•		•		•				25+
G4	•					•					•			50+[7]
H1	•	•	↓	•		•	•			•				20
I1	•		↑	•		•				•				10-20
I2	•		↑		•	•								0
I3	•					•					•			5
I4	•		↑	•		•								0
I5	•					•				•				<10

	Likely to consider rail* after improvements in:			Likely effects of increased road congestion				Likely effects of increased road haulage taxation/regulation				Likely effects of road pricing			
Company	Rail network access	Rail service quality	Rail service cost	Improve road efficiency	Reduce customer service	Restructure firms' operations	Shift to rail	Improve road efficiency	Reduce customer service	Restructure firms' operations	Shift to rail	Improve road efficiency	Reduce customer service	Restructure firms' operations	Shift to rail
A1				•											
A2		••	•	•			•	•			•	•			•
A3						•	(•)			•				•	
A4						•				•				•	
A5	•	•	•		•		•		•		•		•		•
A6	•			•		•		•		•		•		•	
A7	•	•	•	•				•				•			
A8				•	•			•				•			
A9	•	•	•	•		•	•	•		•	•				
B1			•			•	•			•	•			•	•
B2		•	•		•		•		•		•		•		•
B3	•	•				•	•			•	•			•	•
C1	•	•	•				•				•				•
D1			•		•		(•)		•		(•)		•		(•)
D2		•	•				•				•				•
D3													•		
D4				•		•		•				•		•	
F1		•													
F2		•	•												

	Likely to consider rail* after improvements in:			Likely effects of increased road congestion				Likely effects of increased road haulage taxation/regulation				Likely effects of road pricing			
Company	Rail network access	Rail service quality	Rail service cost	Improve road efficiency	Reduce customer service	Restructure firms' operations	Shift to rail	Improve road efficiency	Reduce customer service	Restructure firms' operations	Shift to rail	Improve road efficiency	Reduce customer service	Restructure firms' operations	Shift to rail
F3		•		•			(•)	•			(•)	•			(•)
F4		•	•	•				•				•			
F5		•		•			•	•			•	•			•
F6		•													
F7		•	•	•				•				•			
F8				•				•		•		•		•	
F9	•	•						•				•			
F10	•	•	•	•		(•)		•			(•)	•			(•)
F11		•	•			•	•			•	•			•	•
F12	•					•	•				•				•
G1															
G2		•						•			(•)	•			(•)
G3	•			•				•			•	•			•
G4						•				•				•	
H1			•				(•)	•			(•)	•			(•)
I1	•	•	•	•		•	•	•		•	•	•		•	•
I2				•				•				•			
I3	•	•	•	•				•			•	•			•
I4															
I5		•		•				•			•	•			•