Rail Research UK

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The Role of Rail in Integrated Transport

Prepared for The Railway Safety and Standards Board

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1.0 INTRODUCTION

1.1 Background

Railways are an important mode of transport for both people and goods within the UK and between the UK and the continent. The main alternative to rail is road, and factors such as door-to-door operation, flexibility of timing, route choice, and security often make road transport more attractive to users. But rail continues to play an important part in certain transport markets, including commuting into large cities, inter city passenger transport and transport of bulk goods and containers. High profile rail crashes and unreliable services have led to railways being viewed in a negative light by users and potential users of all types. However, travel by rail is six times safer than travelling by car per km travelled, even before counting fatalities to other road users, such as pedestrians and cyclists (Transport Trends 2002). Thus, if more users can be attracted to rail, there would be likely to be fewer casualties whilst travelling.

1.2 Objectives

The general aim of this brief scoping study is to identify the potential for improved modal integration to attract users to travel by rail rather than road and thereby improve the overall safety of travel. Specific objectives are to:

i) Determine the extent of knowledge of users needs for travel involving rail.
ii) Examine alternative strategies that have been suggested for development of the rail network.
iii) Consider the relative safety records of the different modes and the likely consequences of diverting traffic from other modes to rail.
iv) Define areas of research to better understand the processes and potential of integration.

1.3 Structure of the Report

The report provides an introductory review of user needs in the context of passenger and freight demand. Issues relating to the future of rail operation are outlined. Accident statistics and safety implications are discussed. The report outlines further research needs.

2.0 REVIEW OF BACKGROUND MATERIAL

2.1 User Needs

2.1.1 Introduction

In the White Paper for Transport (DETR, 1998) and the Ten Year Plan for Transport (DETR, 2000), rail was seen as having an increasingly important role to play in a more integrated transport system. Since then, there has been a clearer understanding of the large scale of the effort needed to enhance the network to a satisfactory standard of safety and operation. Whilst some rail users are effectively captive to rail, e.g. many commuters to London, most users have alternative travel choices, largely road based. Understanding and addressing the user needs for those actual and potential rail travellers with mode choices is essential.

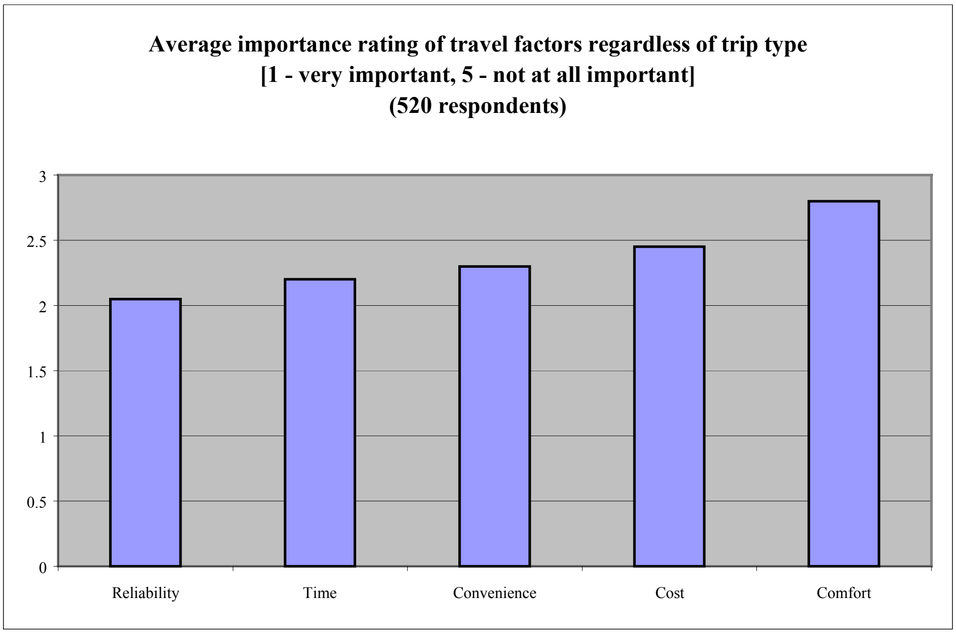
2.1.2 Modal Choice

Researchers have identified six areas as commonly influencing modal choice (Journal of the Urban Transportation Corp, 1968; Spear 1976; Neveu et al, 1979 and de Ortuzar and Willumsen, 1994):

i. Time
ii. Cost
iii. Reliability
iv. Convenience
v. Comfort
vi. Security

Most work has been carried out on the influence of time and cost upon modal choice. Of the other factors, considerable research has been conducted on the reliability of services, or, as it is commonly associated within the railway industry, punctuality (Noland and Small, 1995; Carey, 1999; ATOC, 2000b; James, 2000; Mutanen et al, 2000; Bates et al, 2001). Bock established that both comfort and convenience were amongst the most important factors affecting modal choice, but was unable to account for these attributes in a travel demand model (Bock, 1968). In some work, security has been included as part of comfort (Nicolaidis, 1975 and Neveu et al, 1979).

Survey work carried out by the Transportation Research Group of the University of Southampton identified convenience as being the third most important travel factor regardless of trip type amongst 520 respondents (TRG, 2000).



Source: TRG 2000

Figure 1: Travellers' Collective Rating of Five Travel Factors

In work carried out on behalf of DETR, key elements of consumer need were identified: *Individualism, reassurance, flexibility, convenience and immediacy (*URS Thorburn Colquohoun, 2001). The study found that the car was the best mode of transport available to meet these needs and was considered the most 'convenient' means of transportation (URS Thorburn Colquohoun, 2001). These findings are supported by work from Hine and Scott who found that the car is strongly associated with offering flexibility and convenience (Hine and Scott, 2000). In contrast, public transport is perceived as being inconvenient in a large number of places throughout the UK, the most notable exception being London (CfIT/MORI, 2001). Public transport will always struggle to match fully the perceived convenience of the car, but an important first step in addressing the issue is to identify elements that impact upon the convenience of public transport.

Work by Golob et al (1972) defined convenience with regard to a public transportation system as:

i. Having a seat
ii. Calling without delay
iii. Shelters at pick-up
iv. Choose pick-up time
v. Easy fare paying
vi. More phones in public places
vii. Ability to ask questions of a system representative
viii. Coffee, newspapers on board

There is some overlap between what travellers and planners may regard as the travel factor of comfort in the above definition. Watson simplified this somewhat by only defining it as the number of journey units in a trip i.e. a function of the number of transfers (Watson, 1972). The danger of this approach is that a journey unit difference measure of convenience may produce a variable that rather than just measuring inconvenience, measures discomfort, additional time taken, and inconvenience of transfers (Stopher et al, 1974). Stopher et al suggest that any measure of convenience should include all time attributes of a trip including:

i. Access
ii. Egress
iii. Line-haul
iv. Walking
v. Waiting

If some or all of the above attributes are included in a definition or measure solely based around the factor of convenience then considerable overlap and ambiguity will result with the quantitative factor of time. In an attempt to remove any ambiguity from the term convenience Neveu et al represented it through a small set of nonambiguous attributes:

i. Transfers required
ii. Stops required
iii. Frequency of service
iv. Accessibility of means of travel

Each of the above describes a facet of the overall concept of convenience. This process avoided any overlap between the various qualitative factors the team were assessing including reliability and comfort (Neveu et al, 1979).

The number of stages involved in trips by each main mode of travel in the UK is shown in Table 1.

No. of Stages	Car	Rail	Local Bus	LU	Total
One	**99.5%**	35%	**96.8%**	70.6%	97.9%
Two	0.4%	**46%**	3.0%	**26.3%**	1.7%
Three	0.0%	**18%**	0.2%	3.1%	0.4%
Journeys/Person/Year	571	1	62	6	687
% Journeys	83.1	0.1	9	0.9	100

N.B. Excludes walking and cycling

Source: National Travel Survey 1995

Table 1: Percentage of Journeys by Number of Stages and Main Mode 1995

Rail services are characterised by a number of changes of service or mode. The National Travel Survey produces measures for pedestrian access to both local bus services and for access to the national railway network. Table 2 shows the time taken to walk to the nearest rail station by area type.

	% of households									
	Time in minutes 1989/1991					Time in minutes 1998/2000				
	6 or less	7 - 13	14 - 26	27 or more	All house-holds	6 or less	7 - 13	14 - 26	27 or more	All house-holds
London Boroughs	*27*	*31*	*31*	*11*	*100*	*23*	*35*	*30*	*13*	*100*
Met. Built-up areas	*10*	*16*	*29*	*46*	*100*	*6*	*12*	*24*	*57*	*100*
Large urban over 250K	*5*	*7*	*23*	*65*	*100*	*5*	*9*	*22*	*64*	*100*
Medium urban 25 to 250K	*6*	*11*	*30*	*53*	*100*	*4*	*11*	*28*	*57*	*100*
Small urban 3 to 25K	*4*	*10*	*21*	*65*	*100*	*4*	*6*	*15*	*74*	*100*
of which 10K to 25K	..	..	..	..	..	*5*	*7*	*19*	*70*	*100*
of which 3K to 10K	..	..	..	..	..	*3*	*5*	*11*	*81*	*100*
Rural	*3*	*3*	*7*	*87*	*100*	*3*	*3*	*3*	*91*	*100*
All areas	*8*	*12*	*25*	*55*	*100*	*7*	*12*	*22*	*59*	*100*

Source: National Travel Survey 2000

Table 2: Time taken to walk to nearest rail station by area type: 1989/1991 and 1998/2000

Findings from the CfIT/MORI survey in 2001 indicate that the number of places the railways can be accessed is not a prime concern, with only 16% considering access to be poor. The prime concern of the traveller is not increasing the amount of places the network can be accessed, but improving the means of accessing the existing stations. Considering access purely by means of walking time will not provide a suitable measure of accessibility for rail stations, as it is not necessarily the prime mode of access. The modal split for access to stations is likely to vary considerably between different station types with city/town centre, parkway, commuter and rural stations all displaying different characteristics. Under differing circumstances the convenience of accessing and egressing the station may depend upon the ability to find a car parking space at the station, the availability of connecting bus services within the vicinity of the station, provision of cycling infrastructure at or near the station or the crossing of busy main roads for pedestrian travellers.

Table 3 below shows the stage modes by main mode of trip. Where national rail was the main mode of transport the car was used as a mode of access for nearly a third of all trips. In addition almost one quarter of all these trips included a stage by London Underground whilst a sixth involved local bus services. In contrast only 4% of car trips included a walking stage when this was the main mode and other modes were only used for 50% of all bus journeys with virtually all of these being accounted for by a walking stage. On average the number of stages when national rail was the main mode used was 2.9 as opposed to 1.0 for car travel and 1.8 for bus travel.

Percentage/number

	Walk	Car Driver	Car Passenger	Other private	Stage bus	LT Under ground	Surface rail	Taxi/ minicab	Other public	Average no. of stages per trip
Main mode:										
Walk	100	-	-	-	-	-	-	-	-	*1.0*
Car driver	4	100	-	-	-	-	-	-	-	*1.0*
Car passenger	4	-	100	-	-	-	-	-	-	*1.0*
Other private	7	-	1	100	-	-	-	-	-	*1.1*
Stage Bus	50	-	1	-	100	-	-	-	1	*1.8*
LT Underground	79	4	3	-	18	100	4	1	1	*2.5*
National rail	73	16	15	1	17	24	100	6	2	*2.9*
Taxi/minicab	3	-	-	-	1	-	-	100	-	*1.0*

Source: DTLR Focus on Personal Travel: 2001 Edition

Table 3: Stage modes of trip by main mode of trip: 1998/2000

Key themes relating to convenience and rail travel can be summarised under the broad headings of:

- Interchange
- Frequency of Service
- Access and Egress

Attitudinal surveys have suggested that if these key themes are improved then members of the public will be more inclined to use public transport instead of the car (CfIT/MORI, 2001). The area of interchange and in particular the physical design of interchanges has received considerable attention over recent years. Historically studies have shown a great resistance to interchange, and that it is perceived as a disadvantage of public transport use in comparison to the car (Elmberg and Quarmby, 1981). This is illustrated by the findings of a report by the Chartered Institute for Transport which stated: "Interchange fosters uncertainty in the mind of the traveller" (Chartered Institute for Transport, 1998). Where possible, people will avoid journeys with interchange if a suitable alternative is available. Costs associated with interchange can be minimised through a number of simple measures:

i. Improved design and organisation within the physical confines of the interchange facility
ii. Improved sub modes that feed into the existing interchange facility
iii. Improved locations for interchange with the existing transport system
iv. Improved total transport systems which reduce the need for interchange (Buchanan and Nevell, 1999)

Further work on interchanges has been carried out by the Institute of Civil Engineers (2000), Hine and Scott (2000), Commission for Integrated Transport (2000) and Date, Tajiri and Hashimoto (1999).

Whilst much work has focused on the physical design of interchanges and improving the experience of interchange relatively little work in the UK has focused specifically on access and egress from public transport and in particular the railways. As can be seen earlier in the work of Stopher et al and Neveu et al access and egress to the transit stop would appear to play a major role in the convenience of travelling by public transport.

"The market potential of railway services depends to a considerable extent on the quality of the total chain from residence to place of activity and vice versa" (Rietveld, 2000)

Van der Waard concluded that travel times in the access mode to or from a railway station are weighed more heavily than travel times in the train (Van der Waard, 1989). This would suggest that it is not the use of rail for the main leg of the journey that is the major cause of inconvenience as opposed to car travel but rather the accessing and egressing of the rail network. Both at the home and activity end travellers face the difficulty of how to get to the station (Rietveld, 2000). Accessibility in the sense used in this work is therefore associated with the ability of travellers to reach the station quickly and efficiently and thereby minimise the total travel time and inconvenience of their trip, door-to-door by rail. This is a very important factor in influencing people's choice of the rail mode (Giannopoulos and Boulougaris, 1989).

Work by Rietveld identified the following elements that cause inconvenience (Rietveld, 2000).

i. Low speeds of entry modes
ii. Bad connections
iii. Uncomfortable waiting
iv. Probability of missing a connection
v. Uncomfortable departure times.

McLay questioned passengers on the South West Trains network on how they access the station (McLay, 2000). The work obtained results from 550 respondents on services running between Weymouth/Bournemouth and London Waterloo, passing through Southampton. The results are presented in Table 4:

Mode of Access to the Station	**%**
Car	34
Car (lift)	23
Taxi	6
Bus	7
Walk	18
Cycle	1
London Underground	7
Other	4

Source: McLay, 2000

Table 4: Access Mode to the Station, Weymouth/Bournemouth to London Waterloo services, March 2000

Evans et al (1997) identified a number of elements of pedestrian access to bus stops/stations that influenced transit friendliness:

i. Pavement conditions/availability
ii. Pedestrian crossings
iii. Transit amenities (environmental and services)
iv. Proximity of destination (walking distance from transit stop)
v. Safety
vi. Age of structure
vii. Aesthetics
viii. Terrain (gradients etc.)

Some empirical work to estimate the impact of these various factors on rail demand in Britain has been undertaken; most of it is unpublished but that relating to passengers can be found in the Passenger Demand Forecasting Handbook (ATOC, 2002).

2.2 Passenger Demand

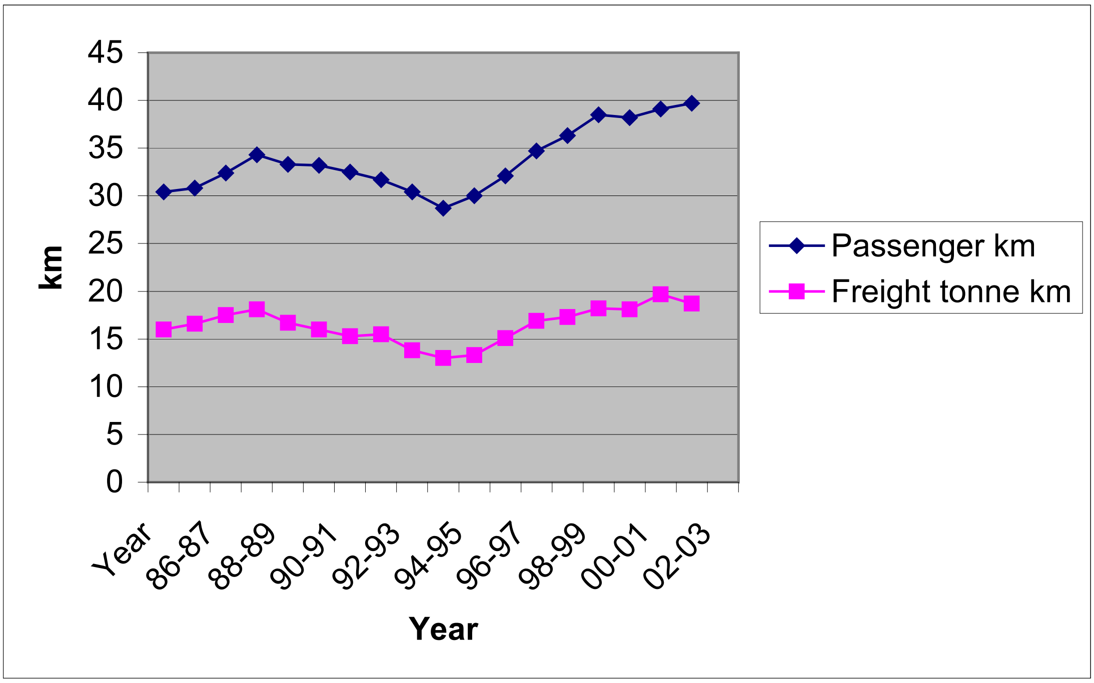
Travel is usually a means to an end rather than an end in itself, few trips are made just for the pleasure of travelling. Table 5 provides information on the average amount of travel by people in Great Britain, broken down by journey purpose. For rail travel, it is usual to divide trips into commuting (including education), business travel (i.e. travel in the course of work, as opposed to commuting, which is travel to and from work), personal business and leisure (which in the table is further split into shopping, visiting friends and relatives, social/entertainment and holidays/day trips). Most journey purposes are dominated by car travel, and most journeys are under 10 km; it is where many trip lengths are longer - namely commuting, business, holidays and visiting friends - that rail has a greater market share.

	All modes	Main mode rail	% rail
Commuting	1329	129	9.7
Business	703	56	8.0
Education	199	13	6.5
Shopping	884	23	2.6
Visiting friends	1416	55	3.9
Escort	493	4	0.8
Social/entertainment	447	13	2.9
Holidays/day trips	822	55	6.7
Other personal business	467	17	3.6
Other	48	1	2.1
All purposes	6806	367	5.4

Source: Transport Statistics Great Britain (2000)

Table 5: Average Distance Travelled Per Person Per Year (miles) 1997/9 National Travel Survey

Figure 2 shows how British rail passenger traffic has developed over the last 15 years or so. It is heavily cyclical, but with a strong underlying positive trend. In 2002, the Institute for Transport Studies at the University of Leeds undertook a project to revise the Rail Passenger Demand Forecasting Handbook (ATOC, 2002) to take account of this strong growth. A number of reasons for the growth were discovered. Firstly, a strong growth in city centre employment, particularly in London, had generated big increases in rail commuting, very much the opposite of the picture of decentralisation and reliance on the car that had been expected only a few years earlier. Secondly, strong growth in incomes had generated more rail travel, and the offsetting effect of increasing car ownership had weakened as car ownership approaches saturation. Thirdly, rapidly worsening road congestion was a major factor, with an elasticity of rail traffic to car journey times of around 0.3. There is also a quite strong cross elasticity with car cost of 0.2 – 0.3, except for commuting into London and first class travel, where it is lower. Finally, rail traffic is generally very sensitive to the fares and service quality on rail, with fares elasticities of around –1 for leisure travel although in the range - 0.3-0.6 for business and commuting, and generalised time elasticities of the order of –0.9 (generalized time allows for service frequency as well as speed). Following privatisation, services had improved in frequency, although not reliability, and fares regulation had reduced the previous upward trend in real rail fares.



Source: SRA – National Rail Trends 2002-3 Quarter 4

Figure 2: Rail Traffic on the British Rail Network

In Great Britain, strong growth in the demand for passenger rail services appears likely even without major improvements in services. Major improvements in speed would also generate further substantial growth. This is particularly true of routes where road congestion is a worsening problem, or where air is the dominant carrier, but improvements in rail speed can yield comparable door-to-door journey times. The experience of routes like Paris-Lyons, Paris-Brussels and London-Paris may be cited, where rail has replaced air as the major public carrier. Perhaps the major question is whether the cost of providing the necessary capacity and quality of service to provide for this growth is worthwhile.

2.3 Freight Demand

In the freight market, rail generally offers four distinct products:

- bulk trains run for specific customers, usually between privately owned sidings
- traditional wagonload services, with intermediate marshalling and possible transfer to/from road at depots at each end
- inter modal services, with containers, swap bodies, trailers or complete road goods vehicles being loaded on to trains for the trunk haul
- express services for parcels and other small consignments

Road transport is the main competitor and offers door to door service, with no intermediate loading or unloading or remarshalling. Bulk rail trains run for a single customer offer the same sort of service, and where volumes are sufficient the cost savings for rail make rail the dominant mode, although road has advantages in terms of reliability, flexibility and consignment size (smaller individual consignments mean less risk of an interruption to supplies in the event of failure of one delivery, smaller stocks and easier day to day adjustment of consignments to demand). Thus rail is eminently suitable for large volumes of bulk goods between a single pair of points. Such traffic has tended to decline in much of Europe with the decline of heavy industry such as coal and steel; for petroleum the even cheaper option of pipelines has been widely implemented and construction materials (a part of bulk haulage that has continued to boom) represents the best long term market for this type of service, although in Britain large volumes of imported coal for power stations are still handled by rail.

Whenever transfer or remarshalling is involved, there is a cost and time penalty to the use of rail. This may be countered if rail is cheaper and/or faster for the trunk haul part of the journey, but only if the trunk haul is long enough to outweigh the cost of the transfer. Such transfers and remarshalling are usually seen as being best handled using inter modal equipment. Traditional wagonload services are in decline all over Europe; their main chance of survival is for handling smaller consignments of goods between private sidings with no inter modal transfer and limited intermediate marshalling.

Thus the main option for smaller volumes of goods is inter modal services. Such services enjoy a particularly strong market at ports, where goods are already containerised and need to be transferred to/from ships. Smaller consignments of express traffic offer a further market opportunity; again because of the need to transfer goods between road and rail, rail is generally more competitive over longer distances, although it then faces competition from air for very time sensitive goods.

Customers' decisions depend on cost and on a range of quality variables, of which speed, reliability, flexibility and security appear to be the most important. For instance, a survey of shippers of freight between Britain and the continent (Tweddle, Fowkes and Nash, 1995) found that they were on average willing to pay some 2.5% more per hour of daytime transit time saved, and some 5% more to reduce by 1% the number of consignments arriving late. Even if rail offered the same journey time and reliability as road, shippers were willing to pay some 10% more to use road for its unquantified advantages such as flexibility and control. Thus rail will usually need to offer a discount relative to road prices to win traffic, leading to a higher breakeven distance for rail than would otherwise be the case.

The volume of rail freight is traditionally measured in (billions of) net tonne kilometres. The quarterly SRA publication, *National Rail Trends*, records that GB rail freight moved amounted to some 37bn net tonne-km in 1952, fell rather steadily to some 13 bn net tonne-km in 1995, with recovery to some 19bn net tonne-km (SRA 2003c).

Most of British Rail's freight activities were sold off to just one company: English Welsh and Scottish Railways (EWS). Initially, they announced ambitious plans to return rail freight to a comprehensive network and triple the companies tonne-km moved within ten years. Things began well, with little competition and with pricing freedom allowing many flows priced off by BR to be recaptured for rail. The road freight sector was suffering from the effects of the government's fuel duty escalator, with shippers being surprisingly reluctant to accept the passing on of these extra costs. EWS placed orders for 280 large locos and 2000+ wagons, whereas BR had forced most of its customers to provide its own wagons. Because open access had been allowed, BR had had to begin dropping its rates for previously captive traffics, such as pit to power station coal. EWS continued that policy, with the result that longer distance coal movements were encouraged and the only coal open access operation, by National Power, sold out to EWS.

In an attempt to prevent all BR's freight activities falling into single hands, the deep sea container operation, Freightliner, (now Domestic Intermodal) was sold to its management at a very low cost, with a favourable track access agreement and with a limited degree of protection from competition in the first couple of years. This company was much weaker than EWS, but immediately saw that EWS's traffic was potentially more profitable and so set about acquiring some. The privatised infrastructure company, Railtrack, was amenable to providing Freightliner with a large fixed contract to move infrastructure trains, since it feared EWS gaining monopoly power. This started a trend whereby companies signed contracts for Railtrack, on the back of which they ordered new locos (identical to EWS's) which they were able to use to gain new business when not needed for Railtrack's uneven duties. It became the pattern for freight shippers to send tender documents to a range of freight TOC's, both for new flows and at the end of EWS contracts. Companies other than Freightliner involved in this were GB Railfreight, a new entrant, and Direct Rail Systems (DRS), a subsidiary of British Nuclear Fuels set up to undercut the previously high monopoly charge for moving nuclear fuel etc.

The 50% increase in tonne-kms between 1995 and 2000 was not associated with any increase in tonnes lifted, and so relied solely on increased length of haul. The increase in tonne-kms has ceased in the last year or two, probably due to the ending of the fuel duty escalator, allowing 44 tonne GVW lorries to be used in general traffic, and other pro-lorry measures taken by the government following the 2000 fuel duty protests. One specific additional factor has been the curtailment of Channel Tunnel traffic due to the inability to prevent asylum seekers from attempting to board the trains in France. Many of the new flows won to rail have been helped by more generous payments under the Freight Facilities Grant and Track Access Grant schemes, but new awards under these schemes were temporarily halted as part of the financial crisis faced by SRA. The Rail Regulator has also cut the track access charges. However, there is a worry that it is all costing too much to the public purse. Consequently, whilst rail freight remains at a level not previously seen since 1980, there is concern as to whether the traffic gains are sustainable.

Anecdotal evidence suggests that new flows are being won by rail very regularly, but losses may not be getting so much publicity. Part of the difficulty in predicting the future is that coal is so dominant – some 30% of the total. One reopened power station, Fifoots, was only open a few months before closing. Many of the well established coal-fired power stations have closed recently. The economics of using coal will be affected by the closure of the large Selby coal field and several smaller pits. Coal tonne-kms will depend crucially on which ports are used for the vast quantities of imports now required. Immediately after privatisation this favoured rail as Scottish and Scottish-landed coal was used in place of closer supplies. This is now seen as wasteful, and suitable deep port facilities have been constructed closer to power stations. The net effect of these changes is hard to predict.

Turning to the other sectors, metals movements have been buoyant, again boosted by imports that have replaced domestic production. However, the industry is in crisis. The main GB producer, Corus, is closing several plants, and another major rail user, Allied Steel and Wire, has gone bankrupt. Construction traffic has been depressed with the limited amount of new building and the governments curtailed road building programme. However, the future looks brighter, as higher house prices encourage house building and the government's motorway widening programme begins. The railways own renewals work has already seen a big increase in railborne infrastructure traffic, but this is traditionally not counted in the railfreight totals. Chemical and Fertiliser traffics are at a very low ebb, having been very badly hit by safety legislation requirements. Oil and petroleum movements by rail have been hit by similar considerations, but also by the greater use of pipelines for traffic previously moved by rail. Some traffic has recently been regained, but the prospects do not look particularly strong. Most interesting is the area of general merchandise. Much is moved in containers, but almost exclusively as an international movement. Rail has long had very little involvement in general merchandise traffic. If the SRA and DfT targets of 80% growth in tonne-kms between 2000 and 2010 is to be met, this area must be broken in to. SRA have plans to assist this, but funding appears to be uncertain, witness the current suspension of Freight Facilities and Track Access Grants. The future is therefore genuinely very uncertain.

2.4 Alternative Visions for the British Rail System

The Government's Ten Year Plan set out the overall targets for rail growth and the Strategic Rail Authority's (SRA) Strategic plan focussed on how to deliver these targets. The Ten Year Plan (DETR, 2000) put forward a strategy for major growth in rail transport, with a 50% increase in passenger kilometres and an 80% increase in rail freight tonne kilometres. These targets have yet to be formally changed, although the most recent SRA Strategic Plan (SRA, 2003a) makes it clear that they are unlikely to be fulfilled and the network utilisation strategy (SRA, 2003b) uses planning assumptions of 20-30% growth in passenger kilometres and 25-30% growth freight tonne kilometres. The basis of the Ten Year Plan was a strong underlying increase in the demand for rail transport propelled by economic growth and road pricing and/or congestion, plus very major investment in expanding the capacity and improving the quality of the rail system. The main reason for revising these expectations downwards is the reduction in enhancement investment resulting from cost increases and a need to divert a substantial part of the planned expenditure into renewals; at the same time, only in Central London has road pricing so far been implemented, and taxes on heavy goods vehicles have been substantially reduced.

In terms of rail, the Ten Year Plan broadly proposed the following improvements: (DETR, 2000)

- 50% increase in rail use measured in passenger kilometres
- 80% increase in rail freight measured in freight tonne kilometres
- Improvements in service quality, by more punctual and reliable trains, and less overcrowding
- Installation of new train safety systems such Train Protection and Warning Systems across the network and full automatic train protection on the high speed passenger network
- Modern trains and more attractive and secure stations, including improved information systems and personal security with greater CCTV coverage at stations and car parks
- Modernisation and increased capacity on west coast and east coast main lines
- High speed Channel Tunnel Rail Link, also serving Kent and the Thames Gateway
- Improved commuter services in London and other cities through schemes such as completion of Thameslink 2000 and construction of East London Line extensions
- Upgrading of freight routes to major ports such as Felixstowe and to the Channel Tunnel, through gauge and capacity enhancements
- Better integration with cars, buses, taxes, bicycles and better links to airports
- Replacement of old slam-door carriages and making new rolling stock accessible for the disabled
- Schemes to tackle strategic bottlenecks on the rail network, including those in the West Midlands and in the Manchester commuter area.

The aims of the plan for rail were to increase passenger and freight rail use, provide new capacity to meet demand, improve the quality of service to customers and reduce most currently regulated fares in real terms. DETR (2000) explained that real practical progress had been made over the last few years and progress would continue in order to achieve the objectives they set out. During the period of 1997-2000 there had been a 17% increase in rail passenger journeys, 1,300 more trains running daily to meet demand, private sector investment more than doubling, the Channel Tunnel Rail Link being rescued, nearly 2,000 stations improved and 17 new stations built, 50 new freight terminals, 22% increase in rail freight traffic and the enforcement that all new rolling stock had to be accessible for disabled people. Models were developed to forecast future trends. Based on current forecasts, rail passenger demand is expected to increase by 34% over the next ten years, but actual growth would be limited to 23% due to capacity constraints. The 50% target set out by the plan would be achieved by providing additional capacity and improving services.

Investing in rail safety was a priority for the government and the rail industry according to the Ten Year Plan. The industry was committed to halving the annual number of train accidents measured in fatalities per million train miles. Safety had been improving over the years and rail remains to be the safest form of land transport, but due to recent train accidents, more has to be done to restore public confidence in rail safety. ATOC believe that rail travel is already 16 times safer than road and future investment will make it even more safe (ATOC 2000d).

Clearly continuing this pattern of growth beyond 2010 would require major further investment in new infrastructure. Rail was found to be close to full capacity and without investment to meet the growing demand; future growth in rail use and the quality of service may be constrained. The House of Commons Transport Committee (2003) stated there was a constant need for additional rail services but there was clearly no room for implementation, therefore more investment in infrastructure was needed. The Railway Forum (2003) believed that the structural problems were now being tackled but the rail industry also had to control significant cost increases and improve performance following past underinvestment. The continued increase in demand for rail, stimulated further by congestion charging had to be recognised and new capacity was needed to meet this growth in demand. However budgets were found to promise investments but not actually deliver the required amounts. In the short term, withholding investment and excessive fare increases could obstruct the growth in rail demand and push more traffic onto the roads. Dr Rana Roy (Roy, 2003) believed that efficient pricing across all transport modes and sufficient investment to accommodate demand was needed.

The SRA has already sponsored a study of the possibility of building a new high speed rail route from London to the North, probably building in stages in order to provide both further capacity and increases in speeds**.** The Railway Forum advocated building a whole network of new high speed lines. (Railway Forum, 2003).

In a recent report, the European Rail Research Advisory Council published a somewhat similar vision for rail in Europe in 2020 (ERRAC, 2002). It foresees rail taking its market share back up to 15% for freight and 12% for passenger, which – allowing for growth in the overall market – means a growth in rail traffic of 200% for passenger and more than that for freight. This traffic would be carried by a network including around 15000km of dedicated high speed passenger routes and a similar length of dedicated freight routes, whilst there would be a doubling of urban light rail routes and an extension of urban heavy rail. Door to door rail journey times would halve, and rail productivity rise by between 200% and 400%. Seamless international services would be offered by a mix of individual undertakings operating in a variety of countries, and alliances of existing operators.

ATOC explained that massive investment was needed to improve rail performance and enhance capacity to achieve the objectives set out in the Ten Year Plan (ATOC 2000a). To handle the 50% forecast in rail demand growth over the next decade would require expanding infrastructure and providing additional train capacity, through possible remodelling to provide additional track capacity, lengthening platforms to accommodate longer trains, and using double deck trains to provide additional capacity, but this may require enlargement of bridges and tunnels. The Ten Year Plan (DETR, 2000) proposed to spend around £60 billion on railways, which was approximately made up of £15 billion from public investment, £34 billion from private investment and £11 billion from other public sector spending. Of the £60 billion, £38 billion was expected to be spent on enhancement and renewals for passenger services, £7 billion on new and replacement rolling stock (6,000 new vehicles), £4 billion on rail freight and £11 billion on subsidies to train operators. In January 2002, the government increased the investment total to £64.5 billion over the ten years. ATOC (September, 2000) believed that various transport benefits could be achieved through rail spending. These benefits include reducing the need for expenditure on roads by £20 billion over 10 years, generating social and environmental benefits of £15 billion over 10 years and at least doubling freight volumes, lowering long run private costs of making a journey to 8.5p per passenger kilometre for rail compared to 11.7p for road. Improving rail may also help manage demand for road travel and reduce public opposition to demand management measures such as road tolling by providing an attractive alternative mode of transport to the car.

ATOC explained that investment in rail was necessary due to its economic importance (ATOC 2000c). Rail investment was seen as a cost effective way to reduce congestion and increase mobility. This has already been done through various schemes, such as the Manchester Metrolink cutting road traffic by 10% in the corridor it serves. Rail could take the pressure off the roads that are heavily congested at peak times around various cities in the UK, and was found to be relatively less damaging to the environment than road transport. A rail network required less land to build than a road network and CO_2 emissions per passenger kilometres were found to be 100 times less on passenger rail than in a private car. ATOC explained that a twin-track railway could carry the same amount of traffic as a six-lane motorway, but more safely and with less environmental damage. Rail was found to be more energy efficient than road and air.

The Railway Forum (2003) stated that over the years, growth in rail was not completely positive as it led to increased operating costs and lower performance. Heavier and faster trains caused greater wear and tear on the tracks and therefore needed more maintenance. Increased traffic on the network led to greater pressure on congested ‘pinch points’. Costs were driven by track renewals, backlog of maintenance, external influences such as skilled labour shortages and policy effects, and increases in the costs of regulation. Performance deteriorated due to the fragility of the infrastructure requiring increased maintenance and renewal and an increasingly tight timetable which made it difficult to recover following delays. It was stated that all parts of the industry must work together to alleviate cost and performance problems and a long term government-backed strategy was needed. The Railway Forum advocated High Speed Lines (HSL) for the future as they believed HSLs could play a significant role in overcoming capacity limits, allowing more efficient use of the existing network and supporting regional regeneration.

Friends of the Earth (Foe, 2002) believed that the proposed investment of £64.5 billion was not enough to ensure a safe, efficient, reliable and affordable railway for Britain. Based on the SRA's strategic plan and the government's investment, Foe believed that the proposed level of investment was inadequate and it was unlikely that many of the major projects could be done before 2010, the private sector contribution may not be achieved as it was based on predicted ticket sales and freight charges and the collapse of Railtrack has compounded the problem of attracting private capital, investment was biased towards the south east and integrated transport may be undermined. Additional investment would be needed in order to ensure the rail industry's prosperity and growth. Additional investment would allow regions to develop purpose built railways, achieve the 2010 objectives, build the rail schemes proposed by the multi modal studies rather than delaying them until possibly after 2010 due to the financial position, make a start on the rail electrification programme and implement recommended safety measures. Foe felt strongly that without the additional investment, transport problems through congestion, air pollution and rising emissions of greenhouse gases would continue to grow. The government was seen as the main source of investment whilst private sector contributions were encouraged but not relied upon. ATOC (September, 2000) explained that funding rail was very expensive for the private sector due to the long lives of rail infrastructure and rolling stock which do not allow for depreciation. ATOC stated "the government's access to relatively cheap capital means that its investment in rail represents the best value for the nation."

However, the argument is increasingly heard that that investment on this scale cannot be justified, and that the rail industry needs to concentrate on its core markets (Glaister, 1998)

2.4.1 The Multi Modal Studies

Following on from the Ten Year Plan, the government initiated a series of multi modal studies for different parts of the country, each with heavy involvement from local stakeholders. The multi modal studies looked at the contribution that all modes could make to alleviating transport problems such as congestion and improving transport choice and facilitating modal shifts. DETR (2000) characterised the studies by five main principles: to address the most severe problems in specific transport corridors or areas, be driven by regional and integrated transport objectives, deliver long term and sustainable solutions, provide an open process with the opportunity to build consensus, and consider ways to minimise the environmental impacts. The studies began in September 1999 and used the New Approach to Appraisal (NATA) criteria based on the objectives of integration, safety, economy, environmental impact and accessibility. There was no single pattern to these studies, but they recommended that there should be an increase in revenue support for providing new rail services, new bus services, safety measures etc. Revenue support was forecasted to increase for rail by £0.1 billion to £1.5 billion in 2010 but the robustness of this forecast remains unclear as the secretary of state decided on a cut of £312 million to the SRA. (House of Commons Transport Committee, 2003)

The multi modal studies covered the various regions which had already implemented many improvements to public transport and the roads since 1997 and proposed to implement the following improvements to rail by 2010, as shown in Table 6.

1. Region	1. Proposed Improvements to Rail by 2010
The North East region (Durham, Northumberland, Teesside, Tyne & Wear)	Upgrading the East Coast Main Line (ECML) which would increase capacity enabling better rail services, new Express Rail service between Tyneside and Teeside, re-franchising of ECML, Trans Pennine and Northern Spirit services securing private sector investment therefore leading to more frequent, faster and higher quality services, possible reintroduction of passenger services on the Ashington, Blyth and Tyne railway line, more frequent local rail services in the Tees Valley and new and improved stations.
The North West region (Cheshire, Cumbria, Greater Manchester, Lancashire, Merseyside)	Upgrading the West Coast Main Line (WCML) to increase rail capacity and provide better links to the West Midlands and London, the new Trans-Pennine Express Franchise including rail route improvements, improved interchange with local bus services, improved waiting environment and information systems at stations, improvements to local and regional rail services through new franchising procedures, and new stations to serve existing or new services and demand.
The Yorkshire and Humber Region (West Yorkshire, South Yorkshire, North Yorkshire and Humberside)	Upgrading the ECML, improving the Trans-Pennine rail routes, improving suburban rail services as part of the refranchising process, improving Sheffield rail station and enhanced rail freight capacity to Humber ports.
The East Midlands region (Derbyshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire and Rutland)	The possible reinstatement of the Matlock to Buxton rail link, improved suburban rail services and improved rural access to main line rail services.
The West Midlands region (Hereford, Worcester, Shropshire, Staffordshire, Warwickshire)	Upgrading the WCML and additional improvements, increasing rail terminal capacity in the centre of Birmingham to aid modal transfer and the expansion of the Birmingham New Street station.
The East region (Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Sussex etc)	The completion of Thameslink 2000, channel tunnel rail line (CTRL) development at Stratford, upgrading ECMLs and WCMLs leading to improved services and interchanges between intercity and regional services at Watford, Milton Keynes, Stevenage and Peterborough, the East West rail scheme, new link lines to the north

	and south of London, upgrades at Peterborough, Watford and Cambridge Central stations, new stations at Chesterton and Addenbrookes, redevelopment of Luton Central station and Croxley rail link.
The South East region (Cornwall, Devon, Dorset, Gloucestershire, Somerset, Wiltshire, Bristol etc)	Upgrading and major infrastructure works on the Paddington to West of England main line, improved rail access through up to five new railway stations, capacity improvements at Paddington and Waterloo stations leading to increased rail patronage and journey reliability, moving existing rail stations to locations where they provide grater access by walking and cycling to achieve greater interchange potential, new infrastructure at Reading and between London Paddington and Reading, upgrading of Swindon to Gloucester rail line to enable greater freight use, strategic improvements to the Salisbury-Exeter line including double tracking to ensure an hourly service between Exeter and Waterloo, rail improvements from Weymouth to Waterloo and Bristol, and improved capacity Taunton-Exeter rail line with the removal of a level crossing and replacement with a road overbridge.
The South East region (Berkshire, Buckinghamshire, Hampshire, Kent, Surrey etc)	Completion of CTRL to St Pancras and completion of Thameslink 2000, new East-West rail link through London and improved links from Oxford to Ipswich, WCML improvements, improved access to Heathrow including Airtrack proposals, increased rail capacity from Paddington to Reading, reducing overcrowding on rail commuter services into London, capacity expansion on the Chiltern Line and Brighton Main Line capacity improvements.
The London region	A public private partnership to reduce the backlog of maintenance and renewal work on the Underground, completion of the Thameslink 2000 project, an increase of 15% in morning peak capacity on the Underground with a new east-west rail link such as CrossRail, rail franchise replacements and research into developing a new Wimbledon-Hackney rail link.

Source: Adapted from Department for Transport, Regional Factsheets, 2000

Table 6: Summary of rail proposals emerging from the Multi Modal Studies

Table 6 shows that there were many common schemes for rail that were proposed for implementation by various regions, such as upgrading the East Coast and West Coast Main Lines and improving the Channel Tunnel Rail Link. Each region was concerned with increasing capacity to enable better services that are more frequent and reliable.

The Multi Modal studies consist of different projects/studies in the different regions. Table 7 explains the various schemes proposed by the different multi modal studies, in terms of investment into public transport.

Study	Main Public Transport Schemes	Total Cost (£m)	Expenditure Profile (£m)

			Up to 2010	2011-2020	Beyond 2020
Access to Hasting (A2H)	▪ More frequent local rail services ▪ Quality Bus Partnerships ▪ Electrification of Hastings-Ashford railway ▪ Ore-Bexhill metro rail service ▪ New station at Glyne Gap ▪ Improvements to Wadhurst-Tunbridge railway	7	7		
Cambridge-Huntington (CHUMMS)	▪ New guided busway with bus priority ▪ Reopening of the disused rail line between the two cities	55	45	10	
South East Manchester (SEMMMS)	▪ 3 metrolink lines including links to the airport ▪ Orbital rail services ▪ Urban metro rail services ▪ Eastern and Western rail links ▪ LRT station upgrades ▪ Clockface timetables for rail ▪ Area wide Quality Bus contracts	727	145	425	157
West Midlands Area (WMAMMS)	▪ RER urban metro rail network ▪ 4 tracking Wolverhampton-Coventry ▪ 11 light rail lines ▪ City centre rail tunnel ▪ Super Showcase Bus routes	6000			
West Midlands to North West (MIDMAN)	▪ Stafford bypass rail line ▪ Sanbach-Northwich line reopening ▪ Fare reductions ▪ Bus lanes M6-town centres ▪ Grade separated junctions ▪ Additional services on west coast main line (WCML) between Midlands and North West	600			
London to South West and South Wales (SWAMMS)	▪ Remodelling of Swindon, Didcot and Reading stations ▪ Upgrade Great Western mainline rail ▪ Rail freight enhancements ▪ Motorway coachways	2309			

	▪ Double track Exeter-Salisbury ▪ Interchange and service improvements			
North South Movements in the M1 corridor in the East Midlands (M1MMS/EMMMS)	▪ New services to Birmingham and Manchester ▪ 15 minute turn-up and go services ▪ Nottingham tram extensions and 2 additional tram routes ▪ 10% reduction in bus and rail fares ▪ LRT line for Leicester ▪ Reopening of 4 lines ▪ New stations ▪ Express couch services	1115	453	662
A1 North of Newcastle (A1MMS)	▪ New Newcastle to Berwick service ▪ Ashington Blyth & Tyne passenger railway			
Hull East West corridor (HUMMS)	▪ 4 guided busway schemes ▪ Quality Bus Corridors ▪ New rail station	132		
London to South Midlands (LSMMMS)	▪ Capacity and service improvements to Heavy rail ▪ New East-West rail link ▪ Thameslink Extension Bedford to Northampton	500-1000		
Tyneside Area (TAMMS)	▪ Extensions to Tyne & Wear metro ▪ Minor improvements to Heavy rail			

Source: Adapted from the House of Commons Transport Committee Report (2003), Marsden (2002) and CfIT (2002). Note: where only total costs are available, costs have been allocated over time in the same proportions as in those where a profile is given.

Table 7: Summary of proposed investment in public transport as set out in the Multi Modal Studies

Some of the scheme's proposals for rail in the different studies are described below. The south east Manchester study (SEMMMS) understood that the capacity of rail infrastructure was critical. The study recommended the move towards clock-face timetables (standard patterns of train departure times at every hour such as 10 to or 20 past the hour) for rail services. Three metrolink line extensions were recommended including links to the airport. Also proposed were orbital and urban metro rail services, and eastern and western rail links. However most of the improvements to rail services relied on the SRA's Manchester Hub upgrade which was not expected to happen before 2010.

The M1 study (M1MMS) proposed 15 minute turn-up and go rail services, new services to Birmingham and Manchester, LRT line for Leicester and a decrease in bus and rail fares by 10%. The House of Commons Transport Committee (2003) explained that major investment in light rail and bus schemes was proposed for Nottingham, Derby and Leicester and on rail schemes within the region and surrounding areas. The study director explained that a lot of their public transport proposals were heavy rail schemes, which were not good value for money in terms of appraisal.

The London to southwest and south Wales study (SWARMMS) found that significant expenditure was needed in rail infrastructure and services, and this expenditure would allow use of the rail network to grow by nearly 70% by 2016 compared to current levels, but will remain a relatively small proportion of total travel across the study area. Schemes proposed included upgrading Great western mainline rail, double track Exeter to Salisbury, interchange and service improvements and rail freight enhancements.

The west midlands area study (WMAMMS) proposed the network Regional Express Rail (RER) rail services costing £4.2 billion and raising rail mode share in the morning peak from 3.2% to 7.9%. Also proposed were a city centre rail tunnel, eleven light rail lines and 4 tracking Wolverhampton-Coventry.

The west midlands to north west conurbations study (MIDMAN) recommended a Stafford bypass rail line, the reopening of the Sanbach-Northwich line and fare reductions. No extra rail freight capacity was expected beyond 2011 levels.

Marsden (2002) explained that most of the studies showed a strong reliance upon rail improvements, including rail infrastructure, new rolling stock and enhanced service frequencies.

The Commission for Integrated Transport (2002a) found that of total investment costs, nearly 70% was earmarked for public transport projects and the rest for roads. Most of the expenditure for public transport was expected to be spent between 2011 and 2020.

It has been argued that the multi modal studies do not fit in well with the Ten Year Plan, as the first tranche of studies commenced in September 1999 before the plan was introduced in July 2000 and the majority of the studies were at the final stages or complete before guidance was given on how to achieve and work with the Ten Year Plan objectives. There have been many changes in the rail industry since the multi modal studies began, such as the establishment of the SRA in 2001 and the emergence of Network Rail in place of Railtrack. The SRA was critical of some of the schemes proposed by the multi modal studies and it believed that some of the major schemes could not be achieved until after 2010. There were increases for major infrastructure developments and it was said that when looking at the schemes in detail, it would actually cost more than first envisaged. The SRA was experiencing increasing costs of railway construction and had a limited budget. Also rail may have a limited role in solving road congestion problems in areas where road traffic is local and involves dispersed flows that cannot be effectively served by public transport. The House of Commons Transport Committee (2003) stated that there were contradictory views on whether funding was available to carry out the multi-modal study improvements before 2010. The Ten Year Plan in 2000 proposed flexibility between budgets to pay for the study but the first SRA plan in 2002 believed there was no funding available for the study improvements before 2010. Councillor Stacey, Chair of the West Midlands Local Government Association's Regeneration Conference insisted that the SRA was primarily working towards fulfilling the government's targets in passenger kilometre growth and was not as concerned with funding the outcomes of the multi modal studies. He believed the SRA would favour funding long distance rail schemes rather than short distance rail schemes in dense urban areas, each carrying large numbers of passengers.

There was criticism over the SRA's concentration on growth in passenger kilometres. Professor Begg said that the SRA 'focuses very myopically on increasing rail and freight patronage and on reducing overcrowding and it does seem to us that there is disconnect between the direction and guidance to the SRA and the outcomes the government has set in the Ten Year Plan to reduce congestion, less social exclusion and an improved environment.' He felt that the lack of rail funding could lead to a very seriously unbalanced programme. (House of Commons Transport Committee, 2003)

2.4.2 Passenger Transport Executives

Passenger Transport Executives and local authorities are often particularly concerned with the need to improve local services. These aspirations vary from major new city centre investment to facilitate a big growth in frequency and capacity of suburban services (WMPTE proposal for a tunnel under Birmingham New St) to widespread reopenings of rural branch lines (Countryside Agency, 2003).

Passenger Transport Executives (PTEs) implement the Passenger Transport Authorities policies to set local authority's transport policies and administer the funding for public transport. PTEs have the power to secure rail services in their areas and contracting with the local franchised passenger train operators to provide additional train services. They also subsidise bus services, finance local rail services, ensure information is available about local transport services, provide special-needs transport services to assist people with disabilities, provide investment to refurbish and update the local public transport system and offer assistance on how to provide, plan and pay for local public transport services. There are seven PTEs in Great Britain outside London. In conjunction with the Ten Year Plan, they outline the following plans in Table 8 for the future of rail in the different regions:

PTE	Plan

Nexus (Tyne and Wear region)	The following rail schemes were proposed to be started or achieved by 2016: Improving the East Coast Main Line by decreasing journey times, new park and ride schemes and increasing capacity, for the Durham coast line and Morpeth to Middlesborough Link increased frequency of trains and services extending to other regions by 2004, Ashington Blyth and Tyne line, and Learnside line reopenings by 2007, Newcastle central station improvements by 2007, Newcastle airport links, Metrocentre third platform by 2010, and improvements to the Tyne Valley line through increased frequency and reduced journey times for trains operating between Newcastle and Carlisle, and park and ride facilities developed at Hexham and the Metrocentre.
Centro (West Midlands area)	Centro's targets for 2006 were to increase the number of rail passengers in the west midland region by 25% to 39 million per annum, increase the volume of yearly passenger journeys by every 100,000 people from the current level of 1.0 million to 1.4 million journeys, and to improve rail punctuality (% of journeys operating within 5 minutes of timetable) from 70.4% to 75.4%.
GMPTE (Greater Manchester Passenger Transport Executive): (Moving forward, 1999)	Railtrack proposes to resignal most of the rail network both to the north and south of Manchester, backlog maintenance at most stations and upgrade the West coast main line infrastructure. First North Western aims to achieve the following by 2004: provision of 70 new trains vehicles, improved service frequencies on the Manchester/Bolton/Wigan corridor, improved or additional parking facilities such as cycle parking at stations, improved passenger information, improved passenger security, passenger facilities and station improvements, and access improvements at core stations. Northern Spirit aims to increase the Manchester/Leeds service frequency from 3 to 4 per hour and refurbish rolling stock by 2004. Virgin Trains aimed to replace the West coast and cross-country Inter city trains, achieve journey time reductions and service frequency improvements, and station improvements at Stockport and Wigan North Western, all by 2012. Overall, fare levels have been fixed over seven year franchise period and only inflation related increases apply.
Merseytravel (Merseyside area):	Merseytravel proposed complete refurbishment of rolling stock on the Northern and Wirral lines by 2004, ensure 99.3% of scheduled journeys run by 2005, ensure 97% of trains run no more than 5 minutes late by 2005, increase train users by 5% per year, increase car park use by 7.5% and cycle rack use by 2% year, reduce complaints by 5% a year, upgrade Lime Street Station Gateway by 2005/06, upgrade all underground stations by 2005/06, ensure better station standards and passenger facilities are achieved by 2005/06, develop Liverpool South parkway by May 2005, open a new station at Carr Mill by 2005/06, upgrade or

	develop 2 bus-rail interchanges a year, increase park and ride spaces to 5,000 by 2005/06 for all Merseyside public transport, upgrade access/circulation areas and passenger facilities by 2005/06 and complete implementation of Merseyrail Electrics local concession in July 2003.
Metro (West Yorkshire):	Metro invested in various rail projects including new light rail routes between 2006-2010, Leeds/Bradford International Airport rail link between 2006-2010, new rail stations by 2010, expansion of local rail park and ride provision by 2005, all rail stations meeting DDA standards by 2005, CCTV coverage and PIDS for all rail stations by 2005. Metro aims to increase total rail patronage by 40% in the period 1999-2006, and increase accessibility, punctuality and reliability by at least 12% of 2000 levels by 2010.
SYPTE (South Yorkshire Passenger Transport Executive):	SYPTE proposed to improve rail services through the Northern franchise replacement which would improve reliability and provide better rolling stock by 2006/7, improve Adwick station providing better passenger facilities and park and ride schemes by 2004/5, major developments to Doncaster and Sheffield stations to relieve capacity constraints by 2006/7, and improve the Sheffield-Barnsley-Leeds rail service to enable more frequent and faster services by 2005/06. SYPTE aims to improve Barnsley's links to the National Network, Woodhead reopening, and station improvements through passenger facilities and car parks etc. Heavy rail targets for 2006 include increasing passenger journeys from the current level of 4.3 million to 4.9 million per year, increasing punctuality from 8.3.1% to 90% and increasing reliability from 97.5% to 99%.
SPTE (Strathclyde Passenger Transport Executive):	SPTE has already completed some of these improvements and proposes to achieve the rest in the near future: CCTV at rail stations and car parks, park and ride schemes, new rail stations to increase capacity, Barrhead/Kilmarnock route upgrade, improved rail capacity between Kilmarnock and Glasgow, and higher rail capacity on Kilmarnock/Carlisle line to provide for improved freight. Also proposed eight additional new trains by 2004/05, construction of a rail link to Glasgow airport, redevelopment of Partick interchange, refurbished and upgraded trains on Glasgow subway, subway tunnel and station improvements, upgraded passenger information systems, improved bus/rail interchange sites.

Table 8: PTE proposals for regional rail services

Some of the PTE proposals for regional rail services are described below. The Nexus plan aimed to improve rail links to Newcastle city centre and to other regional towns and cities. It proposed to increase the number of public transport passenger journeys per annum by 16% in 2016 by raising the quality of public transport. It also planned to make public transport easier to use by ensuring public transport services are accessible to all, providing information that is easily available, ensuring the safety and security of passengers (through CCTV at all Metrostations etc) and improving ticketing systems (through ticket booking and purchase available on the internet etc).

The Centro plan set out the objectives in the 20 year public strategy to deliver a high quality integrated transport network to support the west midland's economic regeneration via easy to use public transport and high standards of quality which make public transport a realistic alternative to cars.

The key issues for improvement according to the Best Value Review for Merseytravel included reliability and punctuality, greater personal security, improved information, cleaner stations and trains, toilet facilities at stations and investigation of new routes. Merseytravel aims to maintain passenger growth by re-launching through the awarding of a local concession to run rail services and a new franchise.

2.5 Accident Statistics

Table 9 shows the comparative casualty rates across all transport modes in Great Britain in the period 1997-2001. In terms of both fatalities and all casualties per passenger kilometre air is the safest mode of transport. For most modes, there is considerable variability in casualty rates, particularly for bus and rail where there are few accidents, but where each can result in a large number of casualties. Care is therefore needed in monitoring trends. Travel by two-wheeled motor vehicle, pedal cycle, or on foot, has continued to be significantly less safe than travel by other modes. However, whilst pedestrian and pedal cyclist safety has improved in recent years, the casualty rate for two-wheeled vehicles has worsened.

The number of car users killed or seriously injured fell by 42 per cent between 1980 and 2001 (Transport Trends 2002). They accounted for nearly half the total 41,000 people killed or seriously injured in road accidents in 2001. The Government has a target to reduce the number of people killed or seriously injured in Great Britain in road accidents by 40%, and the number of children killed or seriously injured by 50 per cent, by 2010 compared with the average for 1994-98, tackling the significantly higher incidence in disadvantaged communities.

The number of passengers killed in train accidents is in most years very small, unless there has been a major accident. Fatalities can also occur as a result of train movement (for example as passengers enter or alight from trains) but where the train itself is not involved in an accident. After peaking around the late 1980s/early 1990s, the number of fatalities from train movement accidents has fallen fairly steadily since. There were seven such deaths in 2001. Travelling by train is six times safer than travelling by car (in terms of fatalities), even before counting fatalities to other road users, such as pedestrians and cyclists. (Transport Trends 2002).

The number of signals passed at danger (SPADs) fell by about a third from their 1996/97 level, to 436 in 2001/02. A serious SPAD occurs when there is a significant overrun past the signal, or when the overrun causes track damage, derailment, collision, or injury or a fatality. The number of serious SPADs has also been falling. In 2001/02 they accounted for 40 per cent of all SPADs (Transport Trends 2002).

Mode	Casualty type	Average casualties per billion passenger kilometres 1997-2001
Air	Killed	0.00
	All casualties	0.14
Rail	Killed	0.46
	All casualties	16.80
Water	Killed	0.40
	All casualties	36.40
Bus or coach	Killed	0.28
	All casualties	194.40
Car	Killed	2.92
	All casualties	349.00
Van	Killed	1.00
	All casualties	112.40
Two-wheeled motor vehicles	Killed	118.00
	All casualties	5702.80
Bicycles	Killed	38.80
	All casualties	5448.60
Pedestrian	Killed	50.00
	All casualties	2443.40

Source: Transport Statistics Great Britain 2002

Table 9: Passenger casualty rates by mode 1997-2001

2.6 Safety Implications

Safety is a prime concern of the British Railway industry, especially following recent crashes at Ladbroke Grove, Hatfield and Potter's Bar. The Uff/Cullen Report following the Ladbroke Grove crash of 1999 advocated a range of rail safety improvements including the introduction of TPWS, ERTMS and the replacement of rolling stock.

TPWS (Train Protection Warning System) - to be installed on trains and infrastructure across the country, work started in Spring 2000 and is on schedule for completion by the end of 2003 (SRA, 2003a). This is to help prevent SPAD's such as at Ladbroke Grove.

ERTMS (European Rail Traffic Management System) - an advanced train control system which also provides ATP (Automatic Train Protection) which helps to eliminate SPAD's, a number of possible implementation levels with various safety, capacity and performance implications. The potential to either encourage or discourage rail patronage and consequently road demand is there depending upon the chosen methodology. This was a recommendation of the Uff/Cullen Joint Inquiry and is being pursued by the SRA and Rail Safety & Standards Board. Level 1 ERTMS introduction would lead to reductions in capacity on the network, reduced capacity could mean reduced passenger numbers and a consequent modal shift from rail to road. This most rapid implementation may reduce the capacity of the rail network by 12.5% at a time when there is a great demand for increased train paths for both passengers and freight. Modelling has shown that this level of implementation would cause approx 700 more road fatalities as opposed to the preventable equivalent rail fatalities which would be avoided of 83 over a 40 year operation period. However implementation of Level 2 System D would increase capacity by up to 10%, modelling has shown that this could save up to 300 road fatalities in addition to the 74 equivalent rail fatalities it would save over the 40 year period (SRA & Rail Safety 2003).

Rolling Stock – Mark 1 rolling stock operating on routes south of London primarily on South Central and South West Trains services is being completely replaced – expected completion delayed due to power supply problems now 2007, improved safety in collisions of new rolling stock and improved performance, comfort, convenience and amenities may all attract new patronage/modal change on what are already popular services especially in the morning peak.

Concentration of so much investment upon the issue of safety may mean other areas of importance to passengers and vital in attracting new rail patronage may be being consequently under funded. If this potential new patronage is instead therefore encouraged to travel by road then this may have some serious implications. Increased road traffic may lead to an increased risk of accidents and subsequent injuries/fatalities on Britain's roads. Indeed, the Commission for Integrated Transport has stated that the capacity reductions resulting from the introduction of ERTMS level 1 would encourage greater road use. Based on a 10 to 15% reduction in capacity, 7 to 10% of the current rail patronage of 47billion passenger kilometres would be expected to transfer to road. Transferring this amount of rail patronage on to road would equate to an additional 2 to 3 billion road passenger-kilometres. Consequently, there would be an additional 820 to 1230 accidents per year, of which between 14 and 22 would be fatal. System wide implementation of ERTMS level 1 could therefore increase annual road and rail fatalities by between 13 and 21 (CFIT 2002).

3.0 FINAL COMMENTS

3.1 Conclusions

In this paper we have briefly reviewed trends in rail passenger and freight traffic and potential for the future, as well as alternative visions for the future of the rail system in Great Britain. It is seen that the development of both passenger and freight traffic has been very encouraging in recent years. Underlying growth in passenger traffic is expected to continue whilst there is more uncertainty about freight. However, the level of growth in traffic that will actually be realised is heavily dependent on government and Strategic Rail Authority policy in a number of respects:

- investment, where there have been calls for an increase in investment to enhance capacity and quality whilst delaying with the backlog of vehicle and infrastructure replacement, and other arguments saying that it would be more beneficial to invest this money in roads

- capacity allocation, where the concentration of the SRA on major flows of London commuters and long distance traffic conflicts with many of the plans of the multimodal studies and the PTEs for improvement in local rail passenger services

- policy towards other modes, where the assumptions about the development of road pricing and other policies to restrain road traffic in the 10 year plan are not currently being realised.

3.2 Directions of Future Research

This paper reports on the start-up phase of two projects which are being undertaken by RRUK, on user needs and on the role of rail in integrated transport strategy. It sets the scene for the work in these projects which will:

- examine in more detail user needs and the extent to which meeting them better would attract additional traffic to rail

- examine alternative strategies in terms of technology and service provision for better meeting user needs

- in the light of these findings, evaluate alternative future strategies for rail service provision.

REFERENCES

Association of Train Operating Companies. (2000a) *Improving performance and enhancing capacity,* Briefing Sheet May 2000, London: ATOC

Association of Train Operating Companies. (2000b) *Punctuality and Reliability,* Briefing Sheet May 2000, London: ATOC

Association of Train Operating Companies. (2000c) *Investing in rail transport,* Briefing Sheet September 2000, London: ATOC

Association of Train Operating Companies. (2000d) *Ten Year Transport Plan – What will it mean for rail,* Briefing Sheet September 2000, London: ATOC

Association of Train Operating Companies. (2002) *Passenger demand forecasting handbook*, London: ATOC.

Bates J., Polak J., Jones P. and A. Cook. (2001) *The Valuation of Reliability for Personal Travel* Transportation Research Part E pp. 191 – 229

Bock F. C. (1968) *Factors Influencing Modal Trip Assignment* NCHRP Report 57

Buchanan M. and J. Nevell. (1999) *Interchange in the UK* European Transport Conference Proceedings of Seminar E Public Transport Planning and Management Cambridge 27 – 29 September 1999

Carey M. (1999) *Ex ante Heuristic Measures of Schedule Reliability,* Transportation Research Part B pp. 473 – 494

Chartered Institute for Transport. (1998) *Passenger Interchanges – A Practical Way of Achieving Passenger Transport Integration* Report by the Passenger Integration Working Party, CIT UK

The Commission for Integrated Transport. (2000) *Physical Integration*
Available at: www.cfit.gov.uk/reports/physical/index.htm

The Commission for Integrated Transport/MORI. (2001) *The CfIT Report 2001 Public Attitudes to Transport in England*
Available at: www.cfit.gov.uk/reports

The Commission for Integrated Transport. (2002a) *A review of the Multi Modal Studies, 10 year transport plan monitoring strategy*
Available at: http://www.cfit.gov.uk/research/10year/mms/pdf/mms.pdf

The Commission for Integrated Transport. (2002b) *The implementation of rail safety measures: implications for overall safety on the UK transport system*
Available at: www.cfit.gov.uk/factsheets/10/index.htm

The Countryside Agency (2003) *Transport in tomorrow's countryside*
Available at:
www.countryside.gov.uk/publications/files/15042003150959_CA143%282MB%29.pdf

Date S., Tajiri K. and T. Hashimoto. (1999) *Breaking Down the Barriers: Access and Interchange* European Transport Conference Proceedings of Seminar E Public Transport Planning and Management Vol. P433 pp. 1 – 10

DETR. (1998) *The Government's White Paper on the Future of Transport: A New Deal for Transport: Better for Everyone*, The Stationary Office, London

DETR. (2000) *Transport 2010: The 10 Year Plan,* London: DETR

Department for Transport. (2002) *The government's response to the transport, local government and the regions select committee report: 10 year plan for transport,* UK: The Stationary Office

DTLR. (2001) *Focus on Personal Travel 2001 Edition* DTLR Transport Statistics
Available at: www.transtat.dtlr.gov.uk/tables/2001/fperson/fpers01.htm

The European Rail Research Advisory Council (2002) Strategic Rail Research Agenda 2020
Available at: www.unife.org/docs/errac/ERRAC_SRRA_Official.pdf

Evans J. E., Perinchory V., and G. D. Douglas III. (1997) *Transit Friendliness Factor: Approach to Quantifying Transit Access Environment in a Transportation Planning Model* Transportation Research Record No. 1604 pp. 32 – 39

Friends of the Earth. (2002) *Paying for rail: Funding the railway of the future,* London: FOE

Giannopoulos G. A. and G. Boulougaris. (1989) *Definition of Accessibility for Railway Stations and its impact upon Passenger Demand* Transportation Planning and Technology Vol. 13 No. 2 pp. 111 – 120

Glaister S. (1998) *What new strategy for the railways?* London: Imperial College

Golob T. F., Canty E. T., Gustafson R. L. and J. E. Vitt. (1972) *An Analysis of Consumer Preferences for a Public Transportation System* Transportation Research Vol. 6 Issue 1 pp. 81 – 102

Hine J. and J. Scott. (2000) *Seamless, accessible travel: user's views of the public transport journey and interchange* Transport Policy Vol. 7 Issue 3

The House of Commons Transport Committee. (2003) *Jam Tomorrow?: The Multi Modal Study Investment Plans,* Third Report of Session 2002-03, Volume I, London: The Stationary Office Limited

Institute of Civil Engineers. (2000) *Passenger Interchange - How do we make integrated transport work?* ICE

James, M. (2000*) The Factors Affecting Bus Reliability,* Colin Buchanan and Partners on behalf of the Confederation of Passenger Transport

Journal of Urban Transportation Corp. (1968) *Passenger Psychological Dynamics – Sources of Information on Urban Transportation, Report #3* Journal Urban Transportation Corp

Marsden, G. (2002) *The Multi Modal Studies: How they all add up,* Transport Planning Society Bursary Paper

McLay G. D. (2000) *Understanding the Role of Information in the Passenger Rail Industry* University of Southampton PhD Dissertation

Mutanen J., Seimala K., Anderson J., Mulley C., Nelson J., Sammer G. and R. Klementshcitz. (2000) *EQUIP 3: State of the Art Benchmarking of Quality in Public Transport* CORDIS

Neveu A. J., Koppelman F. S. and P. R. Stopher. (1979) *Perceptions of Comfort, Convenience and Reliability for the Work Trip* Transportation Research Record No. 723 pp. 59 – 63

Nicolaidis G. (1979) *Quantification of the Comfort Variable* Transportation Research Vol. 9 No. 1 pp. 55 – 66

Noland R. and K. A. Small (1995). *Travel time uncertainty, departure time and the cost of the morning commute* Paper presented to the 74th Annual Meeting of the Transportation Research Board, Washington

Ortuzar J. de D and L. G. Willumsen. (1994) *Modelling Transport 2nd Edition* Wiley & Sons

The Railway Forum. (2003*) Building the railway for the future,* London: The Railway Forum

Rail Passengers Council. (2002) *Future Fares Policy: Response to SRA Consultation,* London: RPC

Rietveld P. (2000) *The Accessibility of Railway Stations: The Role of the Bicycle in The Netherlands* Transportation Research Part D Vol. 5 pp. 71 – 75

Roy, R. (2003) *Postponing the future: a critique of short-termism,* London: The Railway Forum

Spear B. D. (1976) *Generalised Attribute Variables for Models of Mode Choice Behaviour* Transportation Research Record No. 592 pp. 6 – 11

SRA. (2003a) *The Strategic Plan 2003: Platform for Progress,* London: SRA

SRA. (2003b) *Capacity Utilisation Policy: Network Utilisation Strategy,* London: SRA

SRA. (2003c) National Rail Trends, London: SRA

SRA and Rail Safety. (2003) *ERTMS Summary Report,* London: SRA

Stopher P. R., Spear B. D. and P. O. Sucher. (1974) *Towards the Development of Measures of Convenience for Travel Modes* Transportation Research Record No. 527 pp. 16 – 32

TRG. (2000) *Establishing User Requirements from Traveller Information Systems* TRG University of Southampton

Tweddle, G., Fowkes, A.S. and Nash, C.A. (1995), Impact of the Channel Tunnel – A Survey of Anglo-European Unitised Freight: Results of Phase I Interviews, ITS University of Leeds, Working Paper 443 (prepared for ESRC).

URS Thorburn Colquohoun. (2001) *Transport Choices of Car Users in Rural and Urban Areas* Research Study for the DETR
Available at: www.local-transport.dtlr.gov.uk/research/caruse/index.htm

Van der Waard J. (1989) *Ondezoek weging tijdelementen* Delft University of Technology, Delft

Watson P. L. (1972) *The Value of Time and Behavioural Models of Modal Choice* University of Edinburgh PhD Dissertation

Websites

Department for Transport (2000) Transport 2010: The Ten Year Plan regional factsheets. http://www.dft.gov.uk/trans2010/factsheets.htm

Transport 2000. http://www.transport2000.org.uk

SRA http://www.sra.gov.uk

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