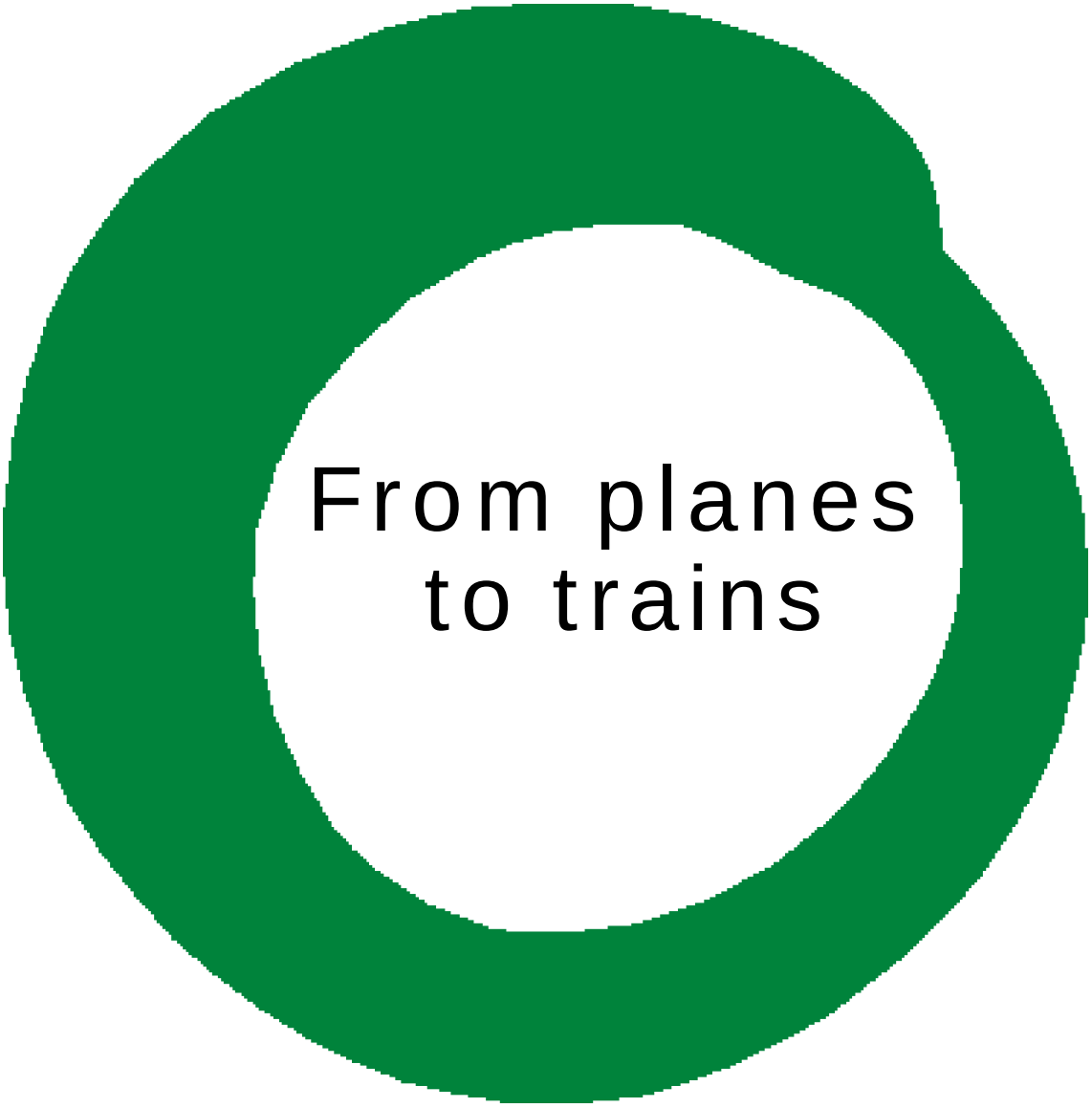
From planes
to trains

FROM PLANES TO TRAINS: Realising the potential from shifting short-haul flights to rail

A study prepared by the
Aviation Environment Federation (AEF)
for Friends of the Earth

October 2000

Contents

Summary

This study examines the potential for shifting short haul flights, both domestic and to destinations within Europe, onto rail and the environmental benefits this would bring.

Its findings suggest that the existing rail routes in the UK that offer the greatest scope to cut large volumes of air traffic are the West Coast Main Line and the East Coast Main Line, although there is also potential to develop the Midland Main Line and the Great Western Main Line. Rail links between many regional airports outside of London currently appear to offer less scope for substitution as these only represent a small proportion of the total air traffic in the UK. The majority of domestic air traffic is between the regions and London.

From Planes to Trains shows that there is potential for significant environmental benefits from transferring short haul flights to rail. This is particularly so in terms of reducing harmful greenhouse gas emissions of carbon dioxide and nitrous oxide. For instance the transfer of domestic flights to rail could bring reductions in carbon emissions of between 118,000 to 362,000 tonnes and reductions in nitrous oxide emissions of between 18,000 to 58,000 tonnes by 2015. Similarly transfer to rail of flights to nearby European destinations could bring reductions in carbon emissions of between 145,000 to 402,000 tonnes and reductions in nitrous oxide emissions of between 23,000 to 64,000 tonnes by 2015.

The extent to which passengers can be attracted to rail depends on many factors including:

- the level of investment made in the UK railway network and rolling stock to maximise the potential reductions in travel times by rail;
- the provision of rail links to all major domestic airports to allow trains to operate as feeder services;
- the extent to which market forces may push domestic traffic out of congested airports;
- the level of regulation or fiscal policy introduced by the government to encourage such a transfer.

There are clear environmental advantages to support such a transfer, especially in relation to the emission of greenhouse gases, although a comparison of the effects of noise and land take will be required for each route under consideration.

By 2015, the reduction in demand for air travel facilitated by transferring all mainland domestic passengers to rail is equivalent to the capacity of one new runway (ie. 40 million passengers per annum). Even under a 'business as usual' approach, with no more investment in the rail system than is already envisaged, more than 20% of all domestic air passengers (ie. nearly 12 million passengers per annum) could be transferred to rail. As this reduction in air traffic would be spread across a number of UK airports a shift to rail may affect the timing, but not the need, for additional infrastructure at existing UK airports if future demand is to be met.

A different picture emerges in the South East of England where access to European destinations is more viable. A number of European destinations are already accessible by rail using Eurostar services from London via the Channel Tunnel. Improvements to the European high-speed rail network already promised are likely to make even more destinations easily accessible by 2015.

If we also consider the potential transfer of air traffic to rail for all domestic flights and all flights to nearby European destinations from Gatwick and Heathrow combined this is equivalent to building a new runway in the South East. Considering even current investment envisaged in the rail networks we could potentially transfer up to 14 million air passengers per annum in the South East to rail by 2015. This could significantly delay the need to build Terminal 5 or indeed another runway in the South East for some time.

Whether regional airports can further benefit from a transfer to rail of some near-European routes in the future will depend on whether or not direct Eurostar services are extended to the regions.

Recommendation

Based on the findings of this study, it is recommended that the Government undertakes a detailed assessment of the potential environmental and capacity benefits of transferring domestic and some European air routes to rail.

Any assessment should include any fiscal and regulatory measures needed to encourage the transfer of air traffic to rail including:

- introduction of an environmental fuel tax or charge on aircraft emissions,
- slot allocation at air ports,
- air traffic distribution rules.

The findings of this assessment should form an integral part of the forthcoming National Aviation Policy.

Objectives

The objectives of this study are:

- to assess the impact on forecast airport capacity in the UK of policies to encourage people to use trains instead of planes for short flights, and

- to outline the social, economic and environmental benefits of such policies.

For the purpose of this report, a short-haul flight is defined as a flight between two cities that does not exceed a distance of 1000km. The focus of the report is domestic air travel in the UK although reference is also made to short-haul flights to Europe from airports in the South-East of England.

Without access to detailed information on aircraft type and load factors for specific routes, several assumptions have been made in this report based on comparable published data for fleet or sectoral averages. Similarly there is no universal consensus on the relative environmental effects of air and rail travel: assumptions have been made, therefore, based on the general midpoint of a range of values. Other factors outside the scope of this report could also influence the findings: for example, the introduction and uptake of cleaner technology by both modes or more efficient operating practices. Obviously, this introduces a certain margin of error into the results of the report. However, the purpose of the study is to highlight the scale of the **potential** capacity and environmental gains that would result from modal substitution. Measured against this objective, the margin of error is unlikely have any significantly impact on the report's conclusions.

Background

In 1998, the Government's White Paper on Transport announced its intention to develop a national aviation policy for the next 30 years. In common with its policies for other modes of transport, the Government is aiming to formulate a policy based on sustainable principles and which encourages the development of an integrated transport system. At the same time, the Government is in an advanced stage of formulating the UK's climate change strategy to meet its Kyoto commitments. While emissions from international aviation are excluded from the provisions of the Kyoto Protocol, emissions from domestic aviation are included within the UNFCCC process and national targets.

By definition, both a sustainable aviation policy, and the UK's climate change programme, should favour and encourage travel by the least polluting mode of transport for any given route (as well as addressing the extent to which modes can complement each other). There is already much evidence to suggest that, in terms of door-to-door travel time and cost, rail and air compete over distances of up to 1000km. For the UK, this effectively means that air and rail compete for domestic traffic, especially on routes within mainland Britain. This has been witnessed in recent rival media campaigns, most notably between Virgin West Coast trains and EasyJet over the latter's low-cost operation between (London) Luton and Liverpool.

In terms of energy use, rail's performance is better than that of air by an order of magnitude. Yet there are other advantages for rail that warrant further consideration. Airport capacity in the South East is quickly running out. The industry expects demand to double within 12 years, and many of our airports have plans to seek additional terminals and runways, while developers speculate over new greenfield developments. Would a policy which encouraged a shift of domestic air traffic to our railways alleviate some of this pressure?

This report sets out to provide an overview of the potential for such a transfer, and to highlight some of the obstacles that need to be addressed if it is to be effective.

Competition: consumer and operator issues

For intercontinental travel, aviation has little competition as a mode of travel. Within Europe, however, many countries are developing high-speed rail networks that could eventually connect across the entire region.

Under present conditions, the aircraft and the train compete over distances between 500km and 1000km. Under 500km, a study by the European Commission concluded that rail has distinct advantages over air for the consumer, especially in relation to travel times. While flying to a destination has a shorter direct travel time, rail can offer:

- easier access: most stations are located in city centres and are well connected to local public transport networks. In contrast, airports are often located several tens of kilometres outside of a city, often with poor public transport provision;
- shorter check-in times: without the need to check-in and out with baggage, trains can be boarded minutes before departure, with onward travel to the final destination commencing immediately after disembarking;
- greater flexibility: it is not always necessary to book rail tickets in advance, and trains provide more frequent connections;
- greater scope for the business traveller to use their time productively: few trains have restrictions on the use of mobile telecommunications and electronic equipment.

These advantages already exist for domestic travellers in the UK. Nevertheless, the rail sector could retain or extend its market share of passengers if it made better use of these advantages. Such measures, many of which can be implemented at little cost, include:

- ensuring that bus and train schedules at interchange locations provide good connections;
- providing new stops/links;
- improving marketing;
- improving rolling stock.

New high-speed trains can significantly reduce travelling times. However, these may also require new track or track upgrades to maximise the potential benefit. Virgin Rail and Stagecoach have announced plans to run trains capable of speeds up to 205 mph between London and Edinburgh (reducing the current travel time by an hour, to three hours) if they should win the contract to run the East Coast Main Line (currently held by Great North Eastern Railways(GNER), which proposes investing £1.5 billion to run trains at speeds of 140 mph). The Virgin/Stagecoach trains would require the construction of around 100 miles of high-speed track if the trains are to operate at their full capability. The existing Eurostar services on the UK section of track are a good example of high-speed trains having to restrict their operating speeds in order to comply with track and signalling conditions. On rail sections that already permit a relatively high speed (130 - 160 km/h), further gains in travel speed through investment in new rolling stock would be hugely expensive and are likely, therefore, to be unprofitable. But where the lines and operating technology are no longer "state of the art" there is considerable scope.

However, further investment in rail is also required to maximise the benefits of the introduction of new technology. Yet, even planned improvements in the UK are still surrounded by uncertainty. Much of the investment forecast for the rail network in the Government's ten-year plan is to be privately financed. However, the announcement that £4 billion of Government funds will go toward rail renewal, especially on the West Coast Main Line, is welcome.

Similarly, there is much uncertainty about the extension of Eurostar services to the regions. Although the initial rolling stock for services on these routes has been built, Eurostar believes that it is not economically justifiable to start operating direct services without Government subsidy. A recent report commissioned by the government ("Review of Regional Eurostar Services" Arthur D. Little Ltd., February 2000) agreed that *"on purely financial grounds, … Regional Eurostar would not be viable"*, citing competition from low cost airlines as one of the reasons why it would not easily compete. Perhaps more significantly, it argued that *"any social, environmental or other non-financial benefits from the introduction of a Regional service would be too small to compensate for failure to make a profit"*. In terms of the environmental effects of air to rail substitution, this may be valid since rail's better environmental performance (see next Chapter) would largely be offset by longer travelling distances on some routes (for example, Manchester to Amsterdam where the route by rail via the Channel Tunnel is approximately two-thirds longer than by air, assuming that an aircraft flies a direct route).

Routes between regional airports and continental Europe are outside the scope of this report (since the majority of journey lengths are considered to be too long), although it is relevant that it advocates using the train sets earmarked for Regional Eurostar to improve domestic rail capacity on the West Coast and East Coast Main Lines.

Air and rail modes can also be partners. Lufthansa has announced that it will be transferring all its domestic air operations to rail by 2002. While this shift will bring environmental benefits in the form of lower emissions, the catalyst behind the decision has been a lack of slot capacity at some of Germany's airports. By releasing the slots currently occupied by domestic flights, Lufthansa can concentrate on more profitable long-haul routes whilst maintaining its domestic connections through an integrated rail system. Could the adoption of similar practices at other airports avoid the need for future runway and terminal development? Certainly there would be few losers: with a privatised railway system in the UK it is possible for airlines to run, or jointly operate, rail services, thus:

- freeing slots for more profitable long-haul routes at congested airports;
- retaining an airline company's market share.

This approach changes the relationship between the two modes from a situation where air and rail compete for market share, to one where rail complements the provision of air services, allocating traffic in the most effective way. To facilitate this partnership approach, and maximise its potential, Government policy decisions need to consider rail links between the national network and airports, as well as rail connections between cities. The box below gives several examples of how such partnerships have already been developed in Europe.

Examples of European Air/Rail Partnerships

(a) France American Airlines(AA) and Air France have recently agreed a through ticketing agreement with SNCF: the AA deal allows passengers to extend their journey to Paris Charles de Gaulle to either Lille, Lyon or Nantes via the TGV high-speed rail network; while the Air France agreement extends to Lyon, Lille, Angers, Le Mans, Poitiers, Tours and Brussels. Lufthansa and United already have similar agreements with SNCF. SNCF says that 850,000 passengers already use the TGV station at the Paris airport and this could rise to 2 million by expanding the TGV network to serve up to100 cities directly, every day. SNCF has also added that there is increasing interest in "plane-train" co-operation as major airlines in Europe focus on developing international alliances and higher-yield routes. Air France acknowledges that its recent agreement with SNCF may see a future reduction in its domestic and regional services. The airline's Chief Operating Officer is quoted as saying that "the market will have to vote on its preference for train or aircraft", although an analysis of the most competitive route, between Paris and Lille, shows that rail already holds almost 90% of the market share.

(b) Germany Lufthansa has experimented with the opportunities presented by rail in the past. In the early 1990s, it operated dedicated carriages on some mainline rail services centred on Frankfurt and Dusseldorf. This was eventually abandoned, largely due to the greater flexibility offered by dedicated trains that could be timetabled to connect with flights offered by the airline Several years on, and Lufthansa is again focusing on rail as an alternative to domestic flights. As previously mentioned, its decision is influenced primarily by the lack of available slots at the heavily congested Frankfurt airport. With a scarcity in peak slots, the company has decided that it should free the slots taken up by domestic routes in order to develop and expand more profitable longer-haul routes. Consequently, it has adopted a policy to transfer its domestic operations to rail by 2002. Whether this is achievable depends chiefly on establishing a good working relationship with the German rail authority and other operators.

(c) Switzerland Swiss airlines have operated connecting rail services to the main airports for many years. In fact, the success of this arrangement can be measured by the fact that around two thirds of the passengers arriving by rail at Zurich Airport originate from outside the region. Seamless interchanges, and remote baggage check-in for connecting flights, contribute to this success, but it is also interesting to note the manner in which these services are promoted: several domestic routes which use rail have been assigned flight numbers by their respective airlines and these appear in the world airline schedule directories.

(d) Airports Many of the major hub airports in Europe are currently developing links to high-speed rail networks. For example, Amsterdam Schipol already labels itself a Mainport, as opposed to an airport, and includes rail passengers within its defined capacity.

For the consumer, the choice of transport mode is probably influenced by three factors: price, travel time and convenience. It has already been shown that rail has the potential to compete with, or complement, air services in respect of the latter two of these considerations, but the subject of price warrants further discussion.

At present, airlines are often able to offer substantially lower full-price return fares than rail (although both remain very competitive in the discount market, especially with respect to low-cost airline operations, and APEX tickets offered by both scheduled airlines and rail companies). Given the greater liberalisation of air services within Europe, increasing competition between airlines is likely to maintain this trend, at least in the short to medium term. However, neither sectors have to pay for the full environmental or social costs of their operations.

A wide range of regulators, including the European Commission and the UK Government, have said that to achieve "fair and efficient" pricing, these externalities should be paid for by users and the industry, rather than by society. In particular, the Government has said in its Integrated Transport White Paper that *'aviation should meet the external costs, including environmental costs, which it imposes'* as part of the new national aviation policy.

Given the relative environmental performance of these two modes (see next Chapter), especially in relation to greenhouse gas emissions, internalising these costs would significantly increase the ability of the rail sector to compete for all sectors of the market.

Environmental Performance

Comparisons between different modes of transport are always difficult, largely due to the fact that there can be a wide range of impacts on different routes as a result of the infrastructure, rolling stock or aircraft type, and load factors common to each. In particular, comparisons in terms of noise and land-use will vary from route to route depending on the location of an airport or railway line, and the density of the surrounding population which is overflown, or through which the railway line passes. Consideration must also be given to the ability to mitigate the noise impact: ground-based noise sources are usually easier to control than airborne sources. Many social surveys also suggest that people are more highly annoyed by aircraft noise than by rail noise at the same level. Other confounding factors include measuring the difference between landing and take-off noise for aircraft, compared with train movements which are generally constant, and the inclusion of low frequency noise (which can cause vibration) from both sources. Accurate comparisons of these environmental indicators can only be made by undertaking an environmental assessment of each route under consideration.

It is easier, however, to measure the environmental performance of rail against air by considering their respective unit consumption of energy or emissions. The specific fuel consumption of aircraft depends greatly on distance: generally this improves over longer distances. The European Commission (1992) calculated that an aircraft on a flight of around 500 km has a specific fuel consumption of 10.5 litres per 100 passenger-km. Trains consumed only 2.3 litres per 100 km, although the figure for high-speed trains is higher at around 3.0 litres/pkm.

Although other studies have produced varying results, rail always performs better than air travel by approximately the same order of magnitude. A review of several studies by Pavaux et al (1991), Hofstetter (1992), CEC (1992) and IFEU (1992) found the differences in primary energy requirements between modes (based on a benchmark of 100 for a 500 km flight) were as shown in Table 1.

As a general conclusion, taking all these studies together, high speed rail has approximately one third of the energy requirements of air travel over distances between 500 and 1000km. For those domestic journeys in the UK which are under this distance (for example, London to Manchester), the benefits of rail may be even greater.

The most recent comparison of rail and air transport was compiled for the IPCC Special Report on "Aviation and the Global Atmosphere" (1999). The Report shows that short-haul air travel emits up to 98 grams of carbon per passenger-km compared to almost 50 by a high-speed train using coal-fired electricity and only about 2 gC/pkm for trains using non-fossil electricity (e.g. hydroelectric). This is for passenger aircraft only: the differential for freight aircraft can be considerably higher. These figures also only represent the upper end of a range. British Airways point out that some typical short-haul aircraft produce fewer emissions: for example an ATP and Boeing 737-200 produce up to 35 and 50 grams of carbon per passenger-km respectively.

Table 1. Comparison of Energy Requirements for Air and Rail		
	500km	1000km
Aircraft		
Pavaux	100	79-83
Hofstetter	100	70
IFEU	100	76
High-speed train		
Pavaux	20-43	20-43
CEC	24-35	24-31
Train		
CEC	11-14	11-14
Hofstetter	20-31	20-31
IFEU	22	21

Source:T&E 1993

Comparisons of nitrogen oxides (NOx) do not take account of the greater impact that this greenhouse gas has when emitted at altitude as opposed to ground level. The IPCC report pointed out that "aircraft emissions of NOx are more effective at producing ozone in the upper troposphere than an equivalent amount of emission at the surface". Even without taking account of the need to apply a multiplier when looking at aviation's impact on climate change, rail still performs much better than air in terms of unit NOx emissions:

Table 2. N0x emissions in grams per km for a 500km journey	
Aircraft (T&E)	0.8-3.6
Aircraft (SAS)	0.6-1.63
Train (IFEU)	0.11
Train (Hofstetter)	0.10-0.30
Train (SAS)	0.01-0.03 (assumes only 4.5% of electricity is fossil-fuel based)
Diesel Train (SAS)	1.67

Source: SAS Environment Report 1995 & T&E 1993

In 1997, INFRAS/IWW published "External Effects of Transport" which calculated a number of externalities for transport modes based on climate change, noise, air pollution and safety factors. These are shown in Table 3.

Table 3. External costs of rail and air transport (EUROS per 1000 passenger/tonne kilometres)	
Rail Passenger	10
Rail Freight	6
Air Passenger	20
Air Freight	90

Source: INFRAS/IWW 1997

Again different studies can produce varying results. Mauch (1999) estimates the external costs of air transport at 48 EUROS per 1000 passenger km. The external costs for rail were also higher at around 25 EUROS per 1000 p/km, but the proportional differential remains the same as in the first example: the costs of rail being approximately 50% of those associated with air transport.

A Policy Context

A study by the European Commission shows that the aviation sector would lose approximately 4% of its EU traffic to rail if a high-speed rail network was developed on a large scale. The IPCC Special Report is more optimistic about a modal shift: it estimates that up to 10% of European passengers could eventually be transferred to rail and coach. Some individual routes that are already competing with rail have witnessed more dramatic results. French domestic carrier, Air Inter, has lost 50% of its Paris-to-Lyon traffic to the TGV, while the Eurostar service between London and Paris has succeeded in capturing a significant part of the scheduled air transport market. Forecasts by the UK government show that as many as 11.9 million passengers may divert from air to rail by 2015 as a result of rail services through the Channel Tunnel (this is based on an assumption that for rail journey times of 3 hours, rail travel will account for approximately 60% of the business market and 70% of the leisure market – see later section).

The European Commission has recently launched three initiatives to promote the use of railways. A draft Directive and Communication is addressing the differences between national systems with a view to making it easier for cross-border operations (for example, by overcoming incompatible energy and signalling systems, and technical standards such as track gauges, track running direction which hinder the development of a single rail market). At present, trains between Paris and Cologne have to carry up to six kinds of signalling equipment and cost around 60% more than similar trains designed for operation in a single EU member state. The Commission also suggests that it could give £126 million in support for Trans European Networks to help remove bottlenecks in the rail system. Thirdly, it has improved existing proposals to make rail freight more competitive and maintain safety standards.

Last year, the European Commission published its Communication on Air Transport and the Environment. The Communication supports the idea of a transfer to rail:

> ***"The Role of other Modes***
>
> *"63. From an environmental perspective, other modes are relevant for air transport in two ways. First, for many short to medium distance flights rail, in particular high-speed rail, can offer a realistic alternative. Second, air transport generates other traffic to and from airports, which highlights the role of airports as intermodal terminals.*
>
> *"64. The interconnection of different modes of transport is being pursued in the context of the trans-European transport networks (TEN-T). The Commission is currently working towards a revision of the TEN-T Guidelines, in which the linkage of airports to other modes of transport – notably rail – will receive particular attention in order to create the conditions for efficient connections.*
>
> *"65. Provided that infrastructural preconditions do exist there is a significant potential for enhancing rail/air intermodality, thus easing pressure on ATM-systems and facilitating the situation at congested airports. This would free air transport infrastructure capacity for (longer) flights where competitive alternative transport modes do not exist.*

> ***Action:*** *The Commission will press for more effective air/rail connections in the future development of the TEN-T and continue to accelerate its efforts to make rail transport more competitive and better integrated facilitating replacement of shorter flights by rail transport. In order to enable transport authorities to develop environmentally advanced public transport systems around airports, the Commission will work towards public procurement rules that allow and encourage procurement officers to purchase environmentally advanced equipment. Existing activities to disseminate best practice in local transport solutions will be strengthened."*

This is not the first time that such a policy has been advocated. In 1994, the Royal Commission on Environmental Protection (Eighteenth Report, 1994) said:

> *"We recommend that policy on air services should be based on discouraging air travel for domestic and near-European journeys for which rail is competitive, and that the Government should support the upgrading of rail links to the main international airports in order to avoid the need for development of air feeder services from regional airports."*

Whilst it is not suggested that all European flights under 1000 km could shift to rail, the concept has much potential for Europe-wide application. Figures for the air traffic handled in European airspace in 1997 show that over 68% of the total 7.5 million flights were for trips under 1000 km. More significantly, 3.4 million flights flew distances of less than 500km (this equates to 45% of the total). The top airport pairs, in terms of two-way traffic, in Europe in 1997 are shown in table 4 below.

Table 4. Europe's Busiest Airport Routes

	No of Flights (1997)
Madrid (Barajas) – Barcelona	41,026
Rome (Fiumicino) - Milan (Linate)	25,989
Paris (Orly) - Toulouse (Blagnac)	23,416
Paris (Orly) - Marseille (Provence)	21,775
Paris (Orly) – Nice	21,328
Barcelona - Palma de Mallorca	20,768
London (Heathrow) - Paris (CDG)	18,084
Copenhagen (Kastrup) - Stockholm	17,191
London (Heathrow) – Amsterdam	16,841
Oslo (Fornebu) - Bergen (Flesland)	16,536
Dusseldorf – Munich	16,473

Source: EuroControl, 1998

An analysis of domestic traffic and routes in the UK is given in the next section.

Domestic Air Travel in the UK

Using the airport data requested annually from operators by the Civil Aviation Authority[1], appendices 1 to 3 show all UK airports which currently handle domestic passenger traffic; domestic freight traffic and domestic mail traffic. This includes a quantification of the volume of passengers, freight and mail handled by each airport, the rate of growth over the last 5 and 10 year periods, the number of associated aircraft movements, and the extent to which some freight and mail will be carried on passenger aircraft.

In 1997, UK airports (excluding the Channel Islands) handled 146.8 million passengers, compared with 106.1 million in 1992 and 86 million in 1987: an increase of 38.4% and 70.7% respectively. In the same year, the UK's airports handled 1.95 million tonnes of freight. Air transport movements at UK airports during the same period were 1.76 million in 1997, 1.45 million in 1992 and 1.19 million in 1987: an increase of 21% over the last 5 years and 47.9 % over the last 10 years. Of the total movements in 1997, almost 79% were scheduled flights, and over 73% were undertaken by UK operators. Domestic flights in 1997 accounted for 38.6% of all movements at UK airports in 1997. Flights to and from destinations in the rest of the European Community account for a further 41%. Of the 1.95 million tonnes of freight handled in 1997, domestic freight accounted for 0.1 million tonnes. Over 25% of the total domestic freight was carried on passenger aircraft.

Heathrow has not seen a significant growth in domestic traffic over the 5 year and 10 year period examined, largely due to runway slot constraints. Consequently, the market favours the use of any available slots by aircraft operating on high-yield routes. Equally, this partly explains the rapid growth of domestic services at Gatwick, Luton and Stansted.

It is clear from the appendices that certain UK airports will probably not have sufficient domestic traffic, either now or in the future, to warrant any serious consideration in this study. Such airports include: Southend, Benbecula, Bournemouth, Humberside, Islay, and Wick (all under 50,000 passengers per annum). Some domestic routes only operate one or two flights a day, often by small aircraft having between 20 and 50 seats. Trains are unlikely to offer a viable alternative for such routes. However, improvements in railway routes designed to attract passenger traffic away from domestic flights may have a 'knock on' effect at some of these airports.

The geographic location of some regional airports also presents barriers to the operation of a viable rail alternative to short-haul air services. These airports include: Belfast City, Belfast International, Benbecula (Outer Hebrides), Islay, Isle of Man, Isles of Scilly, Kirkwall (Orkney Islands), Londonderry, Scatsta (Shetland Islands), Stornoway (Hebrides), Sumburgh (Shetland Islands) and Wick. Traffic at Penzance Heliport is almost exclusively to the Isles of Scilly so it should also be included in this section.

Taking account of the above, the remainder of this study focuses on mainland airports in the UK with significant domestic passenger flows. These are Gatwick, Heathrow, London City, Luton, Stansted, Aberdeen, Birmingham, Bristol, Cardiff, East Midlands, Edinburgh, Exeter, Glasgow, Inverness, Leeds Bradford, Liverpool, Manchester, Newcastle, Norwich, Plymouth, Prestwick, Southampton, and Teeside.

[1] "UK Airports: annual statements of movements, passengers and cargo 1997 [CAP684], CAA

Detailed Study of Selected Domestic Routes

In order to gain more insight into the potential for transfer, a detailed analysis has been made of a selection of routes. Eight of the biggest airports (in terms of the volume of domestic passenger traffic) were selected: Aberdeen, Birmingham, Edinburgh, Glasgow, London/Stansted, London/Gatwick, London/Heathrow, and Manchester.

Using published schedules[2], details of all the domestic routes from these eight airports to other mainland airports were examined. Routes to airports outside mainland Britain were excluded as the numbers of passengers are smaller than those on the mainland and, more importantly, the inherent geographical barriers mean the potential for transfer is much lower (in terms of passenger volumes, the most important non-mainland airport is Belfast). In most cases only one direction of the route was analysed. For example, if Aberdeen to Manchester was analysed, Manchester to Aberdeen was not. It was assumed that the number of flights and passengers would be similar each way (the validity of this assumption was tested and confirmed by examining a few routes).

The proportion of total UK domestic flights that were 'captured' by this selection is about 50%, while the proportion of UK domestic passengers was about 70% (the figure for passengers is much higher because of the high density routes, and the use of larger aircraft). If the flights to domestic airports outside the mainland are excluded from the total, however, the proportion of flights and passengers (i.e. the proportion of mainland-to-mainland trips) captured by this analysis rises to over 90%.

For each route, the schedule was examined to determine the number of flights and the type of plane. The schedule varies according to the day of the week, although in many cases the Monday to Friday schedule is the same. From this information, the total number of flights were summed to give weekly and yearly totals.

The type of plane used on each route gives an approximate guide to the number of seats, but this is not precise because the plane type listed may be generic and because a variety of seating arrangements within one aircraft may be used by the airline. As a consequence, an assumption had to be made about the average size of some aircraft. From the number of flights of each type of plane, and the size of that plane, the total number of available seats was obtained for each route. No information was available on fill or 'loading factor' specifically for these domestic flights. In the absence of any evidence to the contrary, this study has assumed the same load factor as that applicable to international flights, namely 68%[3].

[2] World City to City Schedules, 1999

[3] However, a subsequent comparison of the various statistics in this study suggests that a lower figure is probably more accurate for domestic flights. However, there is insufficient data to adjust the figures accordingly, but it should be assumed that the figures presented in Appendix 1 could be 10% too high. However, this only represents a few year's growth at the rates predicted, and is insufficient to affect the conclusions of this report.

A summary of the passenger/route flows is shown in Table 5 below:

Table 5. Estimated passengers numbers on selected UK domestic routes (thousands pa)

To/From	Aberdeen	Birmingham	Edinburgh	Glasgow	Manchester	Stansted	Gatwick	Heathrow
Aberdeen	-	-						
Birmingham	24	-						
Bournemouth			10					
Bristol	32		48	48	6		7	
Cardiff			15	16				
Edinburgh	2	216						
Exeter		31		29				
Glasgow	14	237	2					
Inverness				31			78	
Leeds	16							151
Manchester	76		108	117				
Newcastle	40	28				28	81	271
Newquay								38
Norwich	28		15		14			
Nottingham	19		53	67				
Sheffield			17					
Southampton			35					
Teeside								134
London/SE								
Stansted	85		285	284	16			
Gatwick	129		177	201	227			
Heathrow	298		971	837	772			
City			67	30	28			
Luton	65		145	121				

This table supports the view that a large proportion of passengers are concentrated on a small number of routes. The 56 routes in the table account for about 90% of intra-mainland traffic in the UK, with the busiest 10 routes alone accounting for around 70%. This suggests that a detailed analysis of a modest number of routes, taking account of aspects such as catchment areas, timetables, journey time, and cost, would provide a useful guide to the potential for transfer to train nationally.

From this, it might be concluded that upgrading a small number of railway lines to make them more attractive in terms of speed, reliability, frequency and price could have an appreciable effect on the overall domestic market. The obvious target lines would be those connecting London[4], Birmingham, Manchester, Glasgow, Edinburgh and Aberdeen. This corresponds to the East and West Coast Mainlines on the existing UK rail network.

Domestic transfers

In addition to the domestic flights analysed above, a number of domestic transfer flights are shown in the airline schedules. Since the advertised transfer flights use the same plane as scheduled direct flights, it is not possible to say how many transfer passengers have been captured in this study (although the proportion is likely to be under 3%). It should also be noted that passengers can choose to change plane without a transfer flight being specifically shown as such (i.e. passengers taking a domestic flight may be connecting with an onward international flight. This is often cited by airlines as a reason for keeping domestic slots between regional airports and hub airports).

There are also a number of "domestic" flights which are scheduled for the purpose of "international connections only" (it is not clear from official statistics, whether or not these flights have been recorded as domestic). These are separate flights, unlike domestic transfers, and they are significant numerically. Some 30% of the passengers identified in this study are transfers, all to Heathrow as shown in the table below.

Table 6 Estimated "international transfer" passengers on selected routes to Heathrow (thousands p.a.)

Aberdeen	Birmingham	Edinburgh	Glasgow	Manchester	Stansted	Gatwick	Others
294	0	348	514	564	0	0	430

The potential for transferring passengers to train for these international connections is unclear. Convenience of the local airport compared with the local train station and the quality of the rail links from the local station to the international airport will be important factors in making this decision.

[4] However it should be noted that the "London airports" are really SE England ones. There are often routes from provincial towns to several of these SE airports – Edinburgh has routes to Stansted, Gatwick, Heathrow, London City and Luton. This show that the catchment area is all-important and suggests that improved train services will need to connect to a number of stations in the SE outside central London.

No further conclusions on domestic transfers can be drawn from this study, but it would appear that the omission of transfers is unlikely to be a major limitation in considering air to rail transfers (especially if airports have direct rail links, giving trains the ability to act as feeder services). It should also be noted that the proportion of transfer flights is expected to decrease. With the increasing volume of air traffic overall, it becomes economic to provide more direct routes from the regional airports or even to develop new airports. At Heathrow for instance, it has been forecast that the proportion of (international) transfers would decrease from 30% in 1995 to about 20% by 2016.

The Forecast Growth in Demand for Domestic Services in the UK

The previous chapter highlighted the potential for developing services on the East and West Coast mainlines as a viable alternative to domestic air travel. With the growth in air travel being forecast over the next 15 years, rail's potential in this respect is likely to increase, and may offer an alternative to the development of additional airport infrastructure. This section attempts to quantify the likely growth in demand for regional services and the implications this has for the UK's airports.

The Department of Transport's Air Traffic Forecasts (1997) provide an assessment of the likely demand for airport capacity up until the year 2015, for both domestic passenger traffic in the UK, and international traffic to and from the UK (this assessment includes the likely diversion of traffic to the Channel Tunnel over the same period). These forecasts are shown in Table 7.

Table 7. Forecast Demand for International and Domestic Air Services in the UK (million of passengers)

Year	Forecast	International	Domestic	Total
1995		101.5	28.1	129.6
2000	Low	119.7	34.2	153.9
	Mid	131.5	35.8	167.2
	High	143.3	37.4	180.6
2005	Low	136.3	39.8	176.1
	Mid	162.2	43.1	205.3
	High	188.2	46.4	234.6
2010	Low	159.8	46.0	205.8
	Mid	202.6	50.5	253.1
	High	245.4	55.0	300.4
2015	Low	189.3	52.7	242.0
	Mid	251.7	58.4	310.0
	High	314.0	64.0	378.1

Air traffic is forecast to grow at an average rate of 4.5% per annum between 1995 and 2015 (based on the mid-point: the low growth rate is 3.2% p.a and the high growth rate is 5.5% p.a.). Domestic traffic is expected to grow at a slower rate as can be seen from Table 8, below (where the mid-point is 3.7% p.a., the low is 3.2% p.a., and the high is 4.2% p.a.):

Table 8. Forecast Demand for Domestic Services in the UK (millions of passengers)					
Year	Forecast	London-Regional	Intra-Regional	UK-Channel Island	Total
1995		18.3	8.0	1.8	28.1
2000	Low	21.7	10.5	2.0	34.2
	Mid	22.6	11.1	2.1	35.8
	High	23.4	11.8	2.2	37.4
2005	Low	25.4	12.4	2.0	39.8
	Mid	27.0	13.8	2.3	43.1
	High	28.6	15.2	2.5	46.4
2010	Low	29.3	14.4	2.3	46.0
	Mid	31.5	16.4	2.6	50.5
	High	33.6	18.4	2.9	55.0
2015	Low	33.5	16.6	2.7	52.7
	Mid	36.2	19.1	3.0	58.4
	High	39.0	21.7	3.4	64.0

These forecasts are confined, however, to passenger demand and are expressed in million passengers per annum (mppa). No Government forecasts are available for aircraft movements. For the purposes of this study an assumption about the likely increase in aircraft movements up until 2015 has been made on the basis that aircraft size on regional routes will not increase: load factors are not expected to change dramatically over the period addressed in this study, nor are there likely to be any significant new entrants to the world aircraft fleet in terms of new design. Although there is an argument that airport congestion issues might force airlines to consider using larger aircraft, past experience has shown that small aircraft tend to dominate on domestic and other short-haul routes. It is assumed that this practice will continue, at least in the short to medium term. Hence, the increase in movements is likely to be proportional to the increase in passenger numbers.

The Government's figures also make assumptions for the proportion of traffic that is diverted from air through the Channel Tunnel (by rail), as shown in Table 9. The analysis is based on the assumption that rail will account for approximately 60% of the business market and 70% of the leisure market on competing routes where the journey time by rail is less than 3 hours.

Table 9. Channel Tunnel rail service diversion (millions of passengers)				
Year	Forecast	Leisure	Business	Total
1995		0.8	0.4	1.2
2000	Low	1.6	0.9	2.5
	Mid	1.8	0.9	2.7
	High	2.0	1.0	2.9
2005	Low	3.5	2.3	5.8
	Mid	4.3	2.6	6.9
	High	5.0	2.9	8.0
2010	Low	3.9	2.6	6.5
	Mid	5.1	3.1	6.5
	High	6.2	3.6	9.8
2015	Low	4.5	3.0	7.4
	Mid	6.0	3.7	9.7
	High	7.5	4.4	11.9

Note: in calculating these diversions, the forecast assumptions acknowledge that there may be developments on some rail routes that have not been foreseen.

In 1997, the major destinations for air travellers "crossing the Channel" were:

- Spain (14 million passengers);
- Germany (7.1 million passengers);
- France (6.4 million passengers) - on the London to Paris route, three operators (namely British Airways, Air France and British Midland) currently schedule nearly 500 weekly slots.

Of all cross-Channel air passengers, business accounted for approximately a quarter of all trips, with the most important business destinations being in Belgium, Luxembourg, Germany and the Netherlands.

The DETR forecasts provide a useful indication of the likely increase in demand for domestic services in the UK. However, there are a number of problems in allocating this increased traffic to airports. Firstly, assumptions have to be made about airport capacity and the availability of slots. Most domestic routes require access to London and there is particular pressure from regional airlines and airports to ringfence slots for this purpose at Heathrow. As previously mentioned, the limited number of slots at Heathrow has meant only a small increase in domestic passengers over the past ten years (around 18%), while the other London airports have seen above average growth rates. However, the implications for some airports have been considered in the next section.

Transferring to Rail: the implications for demand for domestic air services and airport capacity in the UK

Due to the problems of allocating the future growth in domestic services to particular airports, as outlined in the previous section, this section concentrates on the potential for transfer only in terms of the overall 'market' (i.e. existing and forecast domestic air traffic in the UK). The possible extent of transfer and its impact are shown with a number of illustrative examples.

A number of cases have been developed based on assumptions about the proportion of traffic that could be transferred. Forecasts have been based on the DETR's mid-growth scenario for 2015 (this timescale is realistic for physical improvements to railways to be realised). The four cases are:

Case 1: "Best" scenario. It is assumed that 100% of all normal domestic passenger traffic within mainland UK is transferred to rail. In addition, 50% of dedicated international connections are also transferred. It is assumed there is no transfer of domestic flights that have one or both destinations outside mainland Britain. Achieving this level of transfer will probably require some form of regulation or slot rationing.

Case 2: "Optimistic" scenario. This assumes that 50% of normal mainland domestic traffic is transferred to rail and 25% of international connections (representing half the level of transfer in case 1). This level of transfer could conceivably be achieved with improvements in railways services and significant changes to the relative prices of air and train travel.

Case 3: "Realistic" scenario. Here it is assumed that a significant transfer is made only on the major routes that already have reasonable (direct) rail services, and where significant investment is already envisaged. These routes are:

- Manchester - London
- Edinburgh – Newcastle – London
- Glasgow – London

It is assumed that 50% of the flights serving these routes could be transferred, and 25% of dedicated international connections. Importantly, it is assumed that the upgrades would facilitate these transfers to all of the 'London' airports.

Case 4: Route scenarios. These examples are subsets of Case 3, where just a single route, or set of routes, is targeted for transfer. The examples chosen are:

- Manchester – London: Heathrow
- Edinburgh – London: all airports
- Newcastle – London: Heathrow

It is assumed that 50% of the flights are transferred to rail in each case.

Table 10 below shows:

- the number of trips ends transferred (note. there are two trip ends for every flight);
- the share of trips ends transferred, expressed as a percentage of all domestic trips by air (i.e. including international connections and non-mainland) that would be transferred in each case;
- the share of trips ends transferred, expressed as a percentage of total domestic and international trips by air. The results should be regarded as approximate because the detailed data, such as forecast trips for individual routes, is not available.
- ? the environmental impact of these transfers, estimated using the data in section 4 of this report (Column 5 shows the amount of carbon saved per annum; Column 6 the amount of NOx , while; Column 7 gives the estimated reduction in the 'external' economic cost). These figures should be regarded very much as 'ballpark' because of the uncertainty related to estimating emissions and costs from transport modes (especially in variable operating conditions), and the need for strategic environmental assessments of each route. Attention is also drawn to the need to take account of the additional environmental impact of freed airport slots being used to serve long-haul destinations.

Table 10. Estimated Environmental Benefits and External Cost Savings from Transfer of Domestic Air to Rail in 2015

Scenario	Trip Ends transferred (millions)	Share of domestic trip ends by air (per cent)	Share of all trip ends by air (per cent)	Carbon saved (1)	NO_x saved (1)	External cost saved (£m) (2)	External cost saved (£m) (3)
Case 1	36.3	65.5	11.7	362	58	44	101
Case 2	18.1	37.7	5.8	209	33	26	60
Case 3	11.8	21.3	3.8	118	18	15	35
Case 4a	1.7	3.1	0.6	15.0	2.4	1.8	4.1
Case 4b	3.6	6.5	1.1	36.0	5.7	4.4	10.1
Case 4c	0.7	1.1	0.2	6.8	1.1	0.8	1.8

Notes: (1) in kilotonnes, (2) based on INFRAS/IWW, (3) based on Mauch

Although the savings in these cases are substantial in absolute terms, they are relatively small in the context of the total demand forecast. For example, the forecast increase in total passenger demand between 2000 and 2015 is 142.8 mppa, which represents the traffic on 4 heavily used runways (the maximum capacity of a full length single runway is assumed to be about 40 million passengers per annum). At best, assuming that all domestic mainland traffic is transferred (case 1 scenario), this would barely amount to the equivalent capacity of one runway (although if freight and mail were also taken into account, then this figure would be exceeded). To have a real impact, any programme to encourage the transfer of domestic flights to rail needs to be regarded as part of a package which seeks to influence the growth and impact of the whole air travel market.

Similar conclusions can be drawn from looking at individual airports. Heathrow's total domestic traffic in 1997 amounted to 7,236,208 passengers and 67,700 movements. While these are not insignificant figures, they represent approximately 12.5% of total passengers and 15.4% of total movements at the airport respectively. These percentages are likely to become smaller in the future. In contrast, Edinburgh Airport (the second largest airport in the UK in terms of domestic passenger throughput) accounted for 3,222,548 domestic passengers and 56,225 domestic movements in 1997. These represent 77.4% of all terminal passengers and 56.6% of all movements. While a transfer of domestic flights to rail could have a significant impact on operations at Edinburgh, its relatively low level of traffic means that this may have little impact on future infrastructure needs, especially runways.

So far the analysis has only considered the role of rail in relation to domestic services. The opening of the Channel Tunnel, and the start of the Eurostar services, means that rail can now compete with air on cross-Channel routes as well. As there are no definite plans yet to extend Eurostar services directly to the regions, and because of the increased travel time, the remainder of this section only considers the implications for passengers and services currently using Heathrow and Gatwick.

Table 11 shows the passenger flows between Heathrow and Gatwick and selected European destinations in 1997. The destinations have been chosen on the basis that rail services could provide a realistic alternative in the future (based on travel times).

Table 11. Passenger Flows Between Heathrow/Gatwick and European Airports (1997)

	Heathrow	Gatwick
Antwerp	173,807	50,388
Brussels	1,068,698	7,455
Paris CDG	1,839,086	305,433
Paris Orly	433,607	188
Frankfurt	1,425,287	171,837
Dusseldorf	597,298	47,260
Cologne	220,944	55,581
Luxembourg	125,150	30,232
Amsterdam	1,961,324	396,626
Rotterdam	122,120	69,898
Total	**7,967,321**	**1,134,898**

Source: CAA CAP 684

Using the scenario approach outlined above, a number of cases for transfer have been developed for these international routes:

Case 1: "Best" scenario. It is assumed that 100% of all passenger traffic on these routes is transferred to rail.

Case 2: "Optimistic" scenario. This assumes that 50% of passenger traffic on these routes is transferred to rail.

Case 3: "Realistic" scenario. Here it is assumed that a significant transfer is made only on the major routes that already have reasonable (direct) rail services, and where significant investment is already envisaged. These routes are:

- London - Paris
- London - Brussels

It is assumed that 50% of passenger traffic on these routes could be transferred.

Table 12. Estimated Environmental Benefits of Air to Rail Transfer on Selected European Routes in 2015

Scenario	Trips transferred (millions) (1)	Share of all international trips by air	Passenger km - millions in 2015 (2)	Carbon saved in 2015 (3)	N0 x saved in 2015 (3)
Case 1	20.1	8%	8040	402	64.3
Case 2	10.0	4%	4000	200	32.0
Case 3	8.3	3.3%	2905	145	23.2

(1) Notes: Assuming an annual growth rate of 4.5% based on the Department of Transport's mid-growth scenario, 1997.

(2) Assuming an average trip length for the 10 selected routes of 400km (350km for case 3), and that only 50% of the market share is allocated to the UK.

(3) In kilotonnes

The benefits of these scenarios for traffic in 2015 are shown in Table 12. In Case 1, the transfer of traffic on these routes represents half the capacity of a full length runway, although this decreases significantly in Cases 2 and 3. Furthermore, a caveat needs to be exercised in that an unquantifiable proportion of the trips identified in Table 12 are likely to be transfers of passengers who had previously flown in from regional airports. The scenarios outlined in Table 10 assumed a lower level of switch to rail of transfer passengers and a similar assumption should be applied to transfer passengers on these routes. However, the number of these transfers is not thought to be high, especially as there are an increasing number of direct flights from British regional airports to these continental destinations.

If the traffic on these routes from Heathrow and Gatwick is looked at in combination with domestic services, the potential capacity "savings" become even greater, as shown in Table 13, below. These savings begin to have serious implications for infrastructure demand, especially for airports in overcrowded South East. Although some of the transfers in the "best" and "optimistic" scenarios in Table 10 would be of people flying from one regional airport on the British mainland to another, it is estimated, based on Table 8, that four-fifths would pass through one of the 'London airports'.

Table 13. Potential Diversion of Passengers from South East Airports to Rail for both Domestic and European flights in		
	Trips (millions)	Share of all Trips by air
"Best" case	38.25	12%
"Optimistic" case	19.05	6%
"Realistic" case	14.2	4.5%

Obviously all of the trips identified in Table 12 involve South East airports and it is therefore estimated that about 85% of the trips identified in the "best" and "optimistic" cases in Table 13 do so. All of the trips identified in the "realistic" scenario pass through the South East.

In the "best" case, therefore, the transfer of trips from plane to train is enough to forgo the need for any consideration of another runway in the South East. In the more likely "optimistic" scenario, the transfer of trips from South East airports to trains is more than two thirds of the number of people expected to use the fifth terminal at Heathrow. If we consider only the 'realistic' case, then better use of the existing rail network will clearly bring environmental benefits in terms of greenhouse gas emissions as well as relieve pressure on existing airports to expand.

Experience in Europe has shown that with more investment in rail we could easily achieve the transfer from air envisioned in the realistic scenario, and probably much more. However, this will require significant investment upfront from both Government and industry to ensure that the opportunity is not lost.

Appendices

Appendix 1: Domestic Passenger Traffic (Pax) at UK Airports in 1997						
Airport	Pax (1997)	Pax 1992 (1)	Pax 1987	Change 1992-1997 per cent	Change 1987-1997 per cent	Aircraft Movements 1997 (2)
Gatwick	2 408 188	1 150 951	1 131 559	109	112	40 432
Heathrow	7 236 208	6 710 908	6 128 365	7.8	18	69 700
London City	98 373	2 755	409	*	*	2 489
Luton	725 659	185 426	28 001	291	2492	10 690
Stansted	1 158 863	276 350	87 009	319	1232	23 934
All London	**11 627 291**	**8 326 390**	**7 375 343**	**39.6**	**57.7**	**147 245**
Aberdeen	1 701 231	1 341 314	884 544	26.8	92.3	40 108
Belfast City	1 270 065	611 905	279 524	107.6	354.3	31 188
Benbecula	36 773	32 672	29 322	12.6	25.4	3 165
Belfast Int.	1 794 209	1 728 567	1 602 363	3.8	12	29 886
Birmingham	1 057 656	740 010	526 049	42.9	101	24 288
Blackpool	55 701	63 464	68 167	-12.2	-18.3	3 510
Bournemouth	28 530	33 619	72 344	-15.1	-60.5	3 443
Bristol	337 293	156 459	34 281	115.6	883.9	15 432
Cardiff	112 840	63 955	52 234	76.4	116	7 082
East Midlands	356 890	294 405	287 323	21.2	24.2	15 933
Edinburgh	3 222 548	2 030 652	1 567 670	58.7	105.6	56 225
Exeter	89 084	75 909	87 069	17.4	2.3	6 246
Glasgow	3 217 453	2 326 279	1 854 403	38.3	73.5	58 717
Humberside	29 410	39 062	60 837	-24.7	-51.7	2 261
Inverness	363 987	211 326	167 563	72.2	117.2	8 601
Islay	19 500	18 365	15 147	6.2	28.7	1 402
Isle of Man	634 611	431 094	380 191	47.2	66.9	20 249
Isles of Scilly	155 568	122 763	107 661	26.7	44.5	12 707
Kirkwall	88 186	104 632	88 270	-15.7	-0.1	9 804
Leeds Bradford	473 502	346 727	293 433	36.6	61.3	15 370
Liverpool	310 867	231 655	260 524	34.2	19.3	17 001
Londonderry	55 193	25 965	10 470	112.6	427	3 049
Manchester	2 450 418	1 929 714	1 568 167	27	56.3	42 692
Newcastle	830 288	583 215	426 276	42.4	94.8	23 409
Norwich	66 950	77 635	84 819	-13.8	-21.1	4 362
Penzance Heli.	108 805	84 892	86 416	28.2	25.9	5 490
Plymouth	75 901	61 695	106 206	23	-28.5	6 668
Prestwick	313 922	1 639	17 145	19053 *	1731	5 845
Scatsta	55 876	14 097	13 195	296.4	323.4	1 605
Southampton	477 466	329 908	418 170	44.7	14.2	18 961
Stornoway	94 217	85 860	65 382	9.7	44.1	4 590
Sumburgh	230 981	254 910	172 571	-9.4	33.8	8 861
Teesside	250 937	247 953	210 978	1.2	18.9	7 327
Wick	24 837	31 597	21 851	-21.4	13.7	3 919
All Others	66 320	-	-	-	-	-
Total	**32 099 379**	**23 173 162**	**19 470 699**	**38.5**	**64.9**	**681 997**

Source: Civil Aviation Authority *"UK Airports: annual statements of movements, passengers and cargo 1997"* [CAP684]

(1) The impact of the Gulf war on fuel prices meant many figures for 1992 were lower than for 1991

(2) Including freight movements

(*) Base case too small to be statistically significant

Appendix 2. Domestic Freight Handled at UK Airports (minimum 1,000 tonnes p.a.) for 1997	
Airport	**Domestic Freight (tonnes)**
Gatwick	2681
Heathrow	6943
Luton	1097
Stansted	2267
London Total	**12988**
Aberdeen	3111
Belfast City	1204
Belfast International	22047
Birmingham	7347
Bournemouth	5524
Coventry	2357
East Midlands	13891
Edinburgh	6186
Glasgow	5584
Isle of Man	4464
Liverpool	12454
Manchest er	1421

Note: Domestic traffic is counted at both arrival and destination airports

Appendix 3. Domestic Mail Handled at UK Airports (minimum 1,000 tonnes p.a.) for 1997	
Airport	**Domestic Mail (tonnes)**
Gatwick	9270
Heathrow	8878
Stansted	11319
Aberdeen	1660
Belfast International	12717
Bournemouth	4383
Bristol	7255
Cardiff	2550
Carlisle	13177
East Midlands	12708
Edinburgh	31148
Exeter	3616
Glasgow	3096
Isle of Man	2022
Liverpool	17181
Newcastle	3488
Norwich	1445

Note: Domestic traffic is counted at both arrivl and destination airports. Less than 10% of domestic mail is carried on passenger aircraft.

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