High Speed Rail (HS2)

Justifying HS2: a case of myths not reality

Paper prepared by HS2 Action Alliance

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This paper is the core of a letter that in August 2010 was sent by HS2AA to the Secretary of State for Transport, MPs, Transport Select Committee members, DfT, and HS2 Ltd. The material will continue to be kept up to date and used for briefing stakeholders.

Summary

'The great enemy of the truth is very often not the lie - deliberate, contrived and dishonest - but the myth - persistent, persuasive, and unrealistic' JFK 1962

Myth 1: HS2 is 'green' – it's part of the low carbon economy

Untrue: even DfT say it doesn't reduce CO_2 emissions, but is 'broadly neutral' (and HS2 Ltd's sums flatter HS2). 360km/h trains use more than twice the power of 200km/h trains. 84% of journeys on HS2 will indisputably create more emissions – all the new journeys (27%) and those switching from conventional rail (57%).

A showcase transport investment should contribute to our target to reduce emissions by 80%

Myth 2: HS2 will deliver wider economic regional benefits

Untrue: DfT/HS2 Ltd say there are benefits (worth £3.6bn) but this is mainly from additional local transport using freed-up existing capacity not faster connectivity.

The redistributive effects will benefit London – not the regions. London is dominant: it's seven times bigger than the next biggest city, unlike other major West European capitals that are only twice as big. DfT assumptions imply that trips to London will grow at 3 times the rate of those from London to the regions – taking money from the regions and spending it in London

Myth 3: HS2 is a sound investment – over £2 benefit for £1 cost (NBR = 2.7)

Untrue: commercially it loses money: it has £25.5bn of extra costs, but only £15bn of extra fares. The Net Benefit Ratio (NBR) depends on time-saving benefits that are greatly overestimated eg all time on trains is assumed to be wasted. The case is driven by huge (267%) projected increases in demand. HS2 Ltd say if demand drops more than 20% below forecast, the NBR will not reach 2 (ie below an acceptable level).

The cost of damaging the environment and property blight on the route is excluded.

Myth 4: Only HS2, ie a new railway, can solve the rail capacity problem

Untrue: can get 65% extra capacity with just extra rolling stock on WCML and there is massive potential on Chiltern. These improvements come without disruption.

DfT's own alternative to HS2 (Rail Package 2) de-bottlenecks WCML, delivering required capacity by running more and longer trains (for just £2bn) and gives a better (3.63) NBR than HS2. Everything can be done incrementally against need – not relying on long-term forecasts.

Myth 5: HS2 will eliminate domestic air

Untrue: to get enough modal shift from air (8% of HS2 journeys) HS2 Ltd assume a 178% increase in domestic air by 2033: but it assumes a third runway at Heathrow. They ignore the declining domestic air traffic for London, including with the NW and Scottish Lowlands. Opportunities to displace air by HS2 have been reducing, not increasing.

Experts agree that for rail journeys longer than 3hrs, air is preferred. HS2 Ltd say that rail wins some air market at 4hrs.

Myth 6: UK lacks a fast national railway network

Untrue: UK – unlike Europe – has had one for a long time.

As Eddington said, the UK has extensive fast inter-city services. We have routes capable of 200km/h (125mph) – with quicker rail journey times between the capital and the five largest cities than in other major West European countries (averaging 145 mins in UK, 151 mins Spain, 184 mins Italy, 221mins France, and 244 mins Germany).

'When the facts change, I change my mind. What do you do, sir?' John Maynard Keynes

Justification for HS2: a case of myths not reality

There is a gulf between the case being made by the Government (eg in letters to MPs and members of the public, the press and on television) and other supporters for HS2, and the best available facts.

Many of the purported justifications for HS2 have a long history, predating serious analysis, and highly dependent on work done for Greengauge 21 in 2008 and 2009. This work falls well short of the standards required to justify a major government project, and HS2AA are concerned about its currency and influence – despite HS2 Ltd's own findings that contradict it.

HS2 would be one of the largest commitments of public funds. It is imperative that it is based on facts and sound analysis, not myths established by self-interested pressure groups.

HS2AA set out below six of these myths and a presentation of the facts. The Annex gives the supporting detail.

Myth 1: 'HS2 is part of the low carbon economy'

While Greengauge 21 have stated that high speed rail would result in a reduction in carbon emissions based on work done by ATOC, the work undertaken for HS2 Ltd and used in the Command Paper 7827, concludes that HS2 is 'broadly carbon neutral' – ie makes *no contribution* to reducing carbon emissions. This is inconsistent with the official Government line that repeatedly states HS2 is part of a low carbon economy.

In fact if the HS2 Ltd analysis is corrected for using inappropriate data, HS2 would be shown to *increase* carbon emissions. Car emissions are overestimated, due to not using the vehicle occupancy figures for long distance travel, and capping emissions reductions at well above achievable levels. It would be expected that HS2 emissions be based on marginal (rather than average) emissions for electricity generation.

It is unsurprising that HS2 is not 'green' because:

- Speed is not 'green'. Most of HS2's forecast passengers (ie 57%) would otherwise be travelling on less energy consuming conventional rail (on HS2 Ltd's own forecasts).
- Encouraging *more* travel is not 'green'. 27% of the 145,000/day journeys on HS2 would not otherwise have happened (on HS2 Ltd's own forecasts). This increase represents 87% of the 2008 total of long distance journeys on the southern end of WCML.
- HS2's only means of reducing emissions is winning traffic from air. Domestic air passengers have been reducing from Heathrow since 1997, domestic passengers from all London airports to the North West and Scotland (lowlands) has been declining since 2004, and total domestic passengers have been reducing since 2005. There is no London/Birmingham air market and rail already has 80% of the Manchester-London flow. The forecast gain from air exceeds the entire of the current flow of air passengers between these places and Heathrow.

Government are committed to reducing emissions by 80% by 2050. Can it be sensible to have the showcase transport investment make no contribution?

Myth 2: 'HS2 will lead to economic regeneration of the West Midlands and the North'

The strategic importance of HS2 (and of the wider high speed network) is presented as creating economic growth and regeneration of the regions.

Unfortunately this is an area rife with poor analysis and inapposite analogies, again extensively originating from Greengauge 21. And again HS2 Ltd's own work and other work done for DfT is ignored.

HS2AA note that the 2010 Spending Review prioritises transport investments that support economic growth. On HS2 Ltd's own analysis, confirmed to HS2AA at a meeting with HS2 Ltd/DfT (on 29 June, and 17 August), HS2 itself leads to very limited economic growth:

- The agglomeration growth benefits that come from faster connectivity between two centres are tiny (ie about £10m/a as Imperial College work commissioned by HS2 Ltd demonstrates).
- HS2 Ltd ascribes £3.6bn to wider economic benefits, of which £2.0bn is for agglomeration and does not depend on high speed but the re-use of freed-up conventional capacity to run more local services. Such additional local services could be provided without HS2. They are not provided because they would require more subsidy than the existing £5.2bn/a already spent on rail services. Only part of the remaining £1.6bn for reducing imperfect competition relates to high speed connections per se.
- The demand forecasting work implies important redistributive effects that favour London not the West Midlands. The demand elasticities used in the HS2 Ltd forecasts show the major growth in travel will be in journeys into London – not starting from London – with nearly three times as many having London as their destination. This implies that expenditure will move from the regional centres to London – not the reverse – with more passengers taking trips to London and spending in London shops and amenities.

This tendency to reinforce the dominance of London is confirmed by other work and is a consequence of London being an exceptionally large city (more than twice the size of other West European capitals). London is also seven times the size of the next largest UK city – other major West European capitals are about twice as big as their next largest city.

Faster travel is claimed to improve productivity, through less time being wasted on travel. This is an increasingly outdated view for long distance train journeys, as discussed below.

The examples of high speed rail's benefits drawn from foreign examples are not valid. The UK, unlike most other countries, already has a rapid intercity train service. We have a small densely populated country. Journey times between major cities are already comparable to those achieved by high speed rail in other countries (see Myth 6). Further reductions in time would have only a minor effect, as explained in the Imperial College work above.

Myth 3: 'HS2 is a sound investment, delivering a Net Benefit Ratio of 2.7'

HS2 does not have a sound business case. It:

- Has no commercial case and it is justified on a partial cost benefit analysis
- Relies on excessively high demand growth of 267% (discussed in Myth 4)
- Relies on exaggerated time saving benefits (that presumes all travel time is currently wasted) and unit values for time saved
- Ignores the effects of competition

- Is inferior to some of alternatives considered in cost benefit terms (see Myth 4).

No commercial organisation would consider HS2 without subsidy. The 'business case' shows that the incremental fares (£15bn) do not cover the (£25.5bn) total costs it absorbs.

HS2 is in fact justified on a *partial* cost benefit analysis, where the uncharged consumer surplus (£28.7bn) arising from faster journey times and less congestion, and the 'wider economic benefits' (£3.6bn) are put forward to justify the cost. The analysis is partial as it does not include either the damage to the environment of its route, or the reduction to property values from its negative impacts. HS2AA understand that this is a DfT decision.

The largest benefit attributed to HS2 is the time savings to travellers (£13bn, or nearly 40% of the benefits). This is plainly overestimated (and DfT have conceded as much) on two counts. It assumes that all time on a long distance train is wasted and uses out of date data on business travellers. It neither takes into account current practices and improving information systems, nor changing patterns of employment. Together these effects reduce the £13bn to perhaps less than a quarter of the sum.

The case for HS2 takes no account of competition between HS2 and conventional rail services. Competition will result in lower prices for high speed and conventional rail, lower passenger volumes for HS2 or both. HS1 experience is relevant, where apparently no account was taken of cut-price airlines.

Finally, the handling of the alternatives to HS2 that were developed is unsatisfactory. Two packages of alternatives (Rail Package 2 and Road Package 2) had better Net Benefit Ratios than HS2 (3.63 and 3.66 respectively). DfT neither recommend the options with the best Net Benefit Ratio, nor used these options for assessing the *incremental* costs with *incremental* benefits of HS2. If they had, the case for HS2 would be exceedingly weak.

Myth 4: 'Only HS2, ie a new railway, can solve the rail capacity problem'

A major argument for HS2 is the need to create more capacity, as expressed by the previous CEO of HS2 Ltd (David Rowlands). The Secretary of State for Transport made this argument in a BBC television interview on 20 August, responding to a question by HS2AA. But extra capacity does not require a new railway, nor one capable of speeds of 400km/h, nor does it have to mean disruption on existing lines (as was claimed).

HS2AA are also surprised by the observation in a letter from the Secretary of State for Transport to Caroline Spelman MP (of 30 July):

'We believe that high speed rail offers overall benefits unmatched by any other option, while its costs are comparable with those of alternative approaches to increasing rail capacity. …'

If more capacity is needed it can be created at a small fraction of the cost of HS2, and incrementally without having to gamble on demand forecasts. The capacity needed to meet the demand that HS2 Ltd forecast for conventional rail (133%) could be met for a little over £2bn (Rail Package 2) – as compared to £11.9bn (£25.5bn less incremental fares, etc) for HS2 (with just over £1bn to be spent on planning for it in this term of parliament). This alternative also meets the requirement to be high speed, as under the EU Directive high speed rail is 125mph (201km/h).

To a great extent capacity can be increased without disruption to existing services, contrary to what was said in the BBC interview on 20 August. This is because there is potential to increase the number of carriages per train following minor infrastructure improvements that are already underway and planned to be complete within 2 years (permitting a 65% increase in WCML capacity, almost half what is said to be needed).

The demand estimates made in support of HS2 by DfT/HS2 Ltd total 267%: 133% on conventional rail and a further 133% resulting from HS2 itself. They ignore the saturation of demand for domestic travel (per capita journeys and distance travelled per annum have

plateaued at the 1995 level), and project massive increases in demand driven by a relationship with GVA (GDP and population) when this relationship with GDP no longer exists. As the 2007 White Paper 'Delivering a Sustainable Railway' wisely observes

'Forecasts have been wrong before, and any strategy that tried to build a rigid investment programme based on fixed long-term forecasts would inevitably be wrong again.'

The experience of HS1 is testament as to how wrong the demand estimates can be.

Myth 5: 'HS2 will eliminate domestic air travel'

HS2 Ltd/DfT project a 178% increase in domestic air passengers by 2033. This assumes the third runway at Heathrow. It ignores the reality of the declining domestic air market for London. The forecasted volumes expected to transfer to HS2 (11,000 journeys/day – 8% of all HS2 journeys) could not occur.

HS2 could only replace air journeys served by its route. Domestic air routes that are poorly served by rail or road connections may well continue to grow (eg Aberdeen-Exeter was started in 2006 and has grown rapidly), and will not be affected by a high speed rail network.

Reductions in domestic flights for London are likely to be replaced by more polluting long-haul services.

It is agreed amongst experts that passengers may switch from air to rail when journeys times by train are less than about 3 hrs. This excludes domestic air flights from northern Scotland.

Myth 6: 'The UK lacks a fast national railway network.'

The UK's intercity services are already fast. Services on the East Coast, West Coast and Great Western are so fast that lines uprated to their existing maximum speed (125mph or 201km/h) can qualify as high speed railways under the European Directive.

As the Eddington Study found, our rail network already provides journey times comparable to or better than those of the four largest West European countries. In 2010, the capital city has rail connections with their five largest cities that for their quickest journeys, average:

- 145 mins for UK
- 151 mins for Spain
- 184 mins for Italy
- 221 mins for France
- 244 mins for Germany

A modern signalling system (already under development in the UK and planned for implementation from 2014) would allow trains to travel faster on the existing UK track in some places.

Annex

Myth 1: HS2 as part of the low carbon economy

HS2 is not expected to reduce carbon emissions by DfT – DfT assess the overall impact as being 'broadly neutral'[1]. This is not consistent with statements that HS2 is part of the low carbon economy.

HS2 passengers are from various sources: conventional rail (57%); entirely new journeys (27%); car (8%); and air (8%). Reductions in emissions from car and air are claimed, in reality it should only be air.

1.1 Effect of speed

Speed is not green. Former rail minister Tom Harris said that increasing speed from 200km/h (125mph) to 350km/hr increased carbon energy consumption by 90%[2]. DfT in Cmd 7827 muddy the water, quoting energy consumption of some light-weight high speed trains, as do Greengauge21. HS2 will not compete in energy efficiency and carbon emissions terms against *current* conventional trains, cars, and aircraft. New conventional speed electric trains will use less electricity than HS2.

It is a question of fundamental physics that higher speeds require more energy. To deny this is simply disingenuous. The Institute of Mechanical Engineers estimate that travelling at 360km/h instead of 200km/h increases energy consumption by over 200%[3].

1.2 Passengers switching from conventional to high speed rail

On HS2 Ltd estimates 57% of journeys on HS2 (or 85,000 journeys/day) transfer from conventional rail. These will require more energy.

1.3 New journeys

It is also not green to encourage people to make more journeys, when none otherwise would have occurred. 27% of journeys on HS2 or 38,000 journeys per day, on HS2 Ltd's forecasts, would not otherwise have occurred. This is equivalent to 84% of the total journeys currently made on the HS2/WCML route. A 'green' approach to travel would focus on helping people avoid unnecessary travel, as recommended by Norman Baker, MP and as part of 'Delivering Sustainable Transport Systems', not encourage them to make more journeys.

1.4 Underestimating HS2's emissions

Eventually power generation is likely to emit little or no carbon, and the additional power consumption of high speed rail will be of reduced environmental importance. However, electricity is not expected to be de-carbonised for a considerable time.

Although the approach used by HS2 Ltd to assessing the carbon impacts of HS2 has been defended in letters by the Secretary of State for Transport, it is notwithstanding inappropriate.

The HS2 Ltd approach to carbon emissions attributable to a technology using electricity is indeed the standard one for comparing emissions impacts (taking the generating mix average). It has the virtue of allocating total emissions in a sensible manner between uses. However, it is not appropriate for a decision about whether to increase electricity demand, as HS2 would do. In the case of such a decision, what matters is the difference in emissions that arises from the options.

HS2 will not itself give rise to building additional non-carbon emitting capacity in time for its operation, but simply extend the generation of the marginal station, which can be anticipated

[1] Cmd 7827, 5.95 page 95
[2] Letter to Liberal Democrat MEP Chris Davies, June 2008. He also says that ''the argument that high speed rail is a green option does not necessarily stand up to close inspection'.
[3] 'Transport Policy Statement 09/03, High Speed Rail', Table 1

to be non carbon capture coal or gas. HS2 Ltd indicates[4] that they use the ***average*** emissions for all generation. The correct sums would use the emissions of ***marginal*** generation and attribute larger carbon emissions for HS2 until CO_2 emitting power plant is entirely eliminated.

1.5 Overestimating car emissions

HS2 Ltd overestimate the carbon emissions that will result from cars. In fairness to HS2 Ltd, the DfT are responsible for the Webtag guidance produced, but in the circumstance of HS2 the Webtag assumptions are inappropriate.

Webtag starts from the average car occupancy of 1.63 in 2000, and projects this average occupancy to decline at about 0.5% per annum until 2036. This will understate future car occupancy, and hence overstate emissions per car passenger, for two reasons:

- Long distance car journeys have a higher than average car occupancy. Work done for DfT[5] shows that car occupancy increases with distance. HS2 will only compete with car journeys in excess of 100 miles, for which the actual occupancy is over 1.81 (which is the value for journeys of 160-240km, so the average for all long distance car journeys is higher).

- Growth in long distance rail travel is partly at the expense of car journeys. Hence future rail growth will off-set any tendency to reducing car occupancy, as multi-occupant car journeys are generally less likely to shift to rail. This means that the car occupancy reduction factor (of about 0.5%/a) is inappropriate.

Webtab assumptions on car emissions are also unsuitable for a project starting in 2025 and assessed over 60 years (ie to 2085). Following Webtag, on average each car is expected to produce 41% less emissions (as they consume 41% less fuel) in 2036 than at 2010. This would seem to meet the EU's requirements on new cars already planned for 2020, (which achieves for new cars in 2020 only the levels of fuel efficiency already achieved by the current most efficient hybrid drive cars). No improvements in emissions are assumed to occur post 2036. This is blatantly an unfavourable assumption to cars and unlikely to reflect reality.

The assessment of modal shift from car takes no account that electric or hydrogen powered cars may well be achieving significant market share before HS2 is even built, let alone before 2085 – the end of the appraisal period. In either form cars will be non-carbon emitting in advance of trains, as the energy for cars will be produced from base load (as it will be stored).

The average age of road vehicles is 7 years and of a car 6.9 years[6], which is half that of a rail vehicle (15.05 years)[7], and less than half the time before HS2 services might start. So improvements in technology will reach the road faster than the rail.

HS2 Ltd, even estimating emissions as they do, see little carbon saving from modal shift from cars – totalling 0.2MtCO_2 over 60 years[8]. Construction carbon (estimated by HS2 Ltd at 1.2m tonnes[9]) is six times more than the total saving over cars.

So transferring traffic from road to high speed rail would most likely actually ***increase*** emissions (rather than slightly reduce them).

1.6 Displacement of air travel

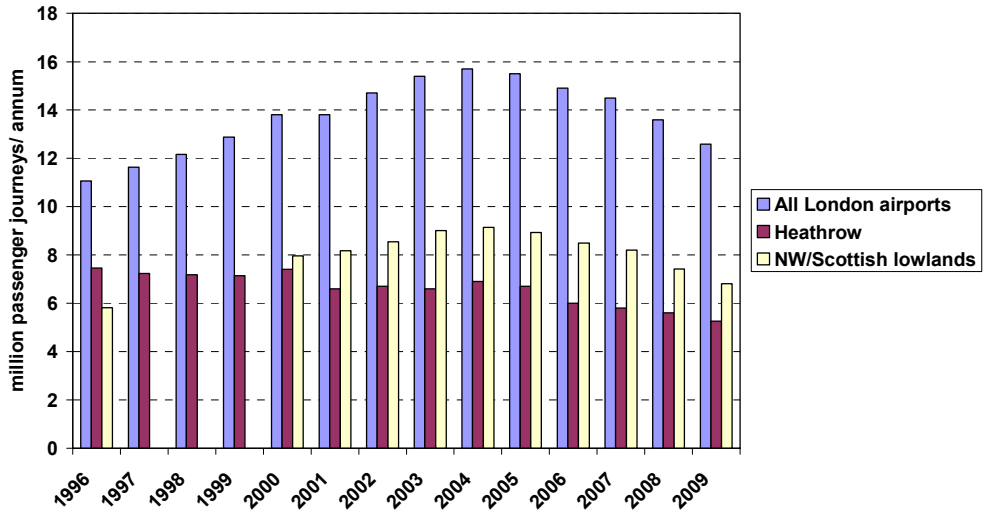
The only area where HS2 will displace modes of travel more carbon emitting than itself is with aircraft. The key issue is how much air traffic might HS2 replace? HS2 Ltd estimate that 8% of journeys on HS2 will transfer from air. This is equivalent to 57% of the 2009 level of total passengers between all London airports and the North West and Lowlands of Scotland, and

[4] HS2 Ltd Main Report 4.2.29-30 page 179/180
[5] NTS data tabulated by Scott Wilson and Rand Europe
[6] DfT 2008 Vehicle licensing information
[7] National Rail Trends 2008/09 Q1
[8] HS2 Ltd Main Report Figure 4.2c
[9] HS2 Ltd Main Report 4.2.35

117% (ie more than the total) of the 2009 number of passengers between Heathrow and the NW and Scottish Lowlands. Such estimates look high in the context of recent trends in the numbers of domestic London air travellers. However HS2 Ltd assumed that there would be a third Heathrow runway![10]

Domestic flights to/from London are no longer above the level of a decade ago (CAA figures[11]), peaking in 2004. The same applies to trips between London and the North West and the Scottish Lowlands. Total domestic passenger flights peaked in 2005. (See graph).

London domestic air passenger numbers



Domestic air passengers for Heathrow have been reducing since 1997. Without the third runway, it is hard to see how domestic passenger volumes from Heathrow can grow sufficiently for HS2 to displace the projected number of air passengers.

Such domestic flights as are eliminated are likely to be replaced by more polluting long-haul fights, as recognised by HS2 Ltd, saying:

'c) Since landing slots are constrained – particularly in the South East – slots freed up as a result of airlines reducing domestic flights are likely to be re-used. This will off-set or potentially even increase net aviation emissions.'[12]

While the extra carbon emissions resulting from replacing less energy intensive conventional rail may be partly off-set by reductions in air travel, this on any scale is implausible, as:

- Rail has already won the bulk of the Manchester London market (source Virgin Trains).
- Transferred journeys would need to be from Scotland but rail journey times will still be more than 3.5 hours[13]. Three hours is generally the threshold for switching from air to rail, with rails percentage falling off sharply above 2.5 hours[14].
- Domestic air travel is expected to get cheaper, while rail more expensive.

[10] HS2 Ltd Main Report section 4.4.12, page 189
[11] CAA UK airport statistics, Table 10 2 Domestic terminal passenger traffic, Table 12 2 Domestic air PAX route analysis
[12] HS2 Ltd 'Outline for HS2 Technical Annex' giving the conclusion of the HS2 Analytical Challenge Panel, discussed at 27 November 2009 meeting, and released under FOI request 'FOI 10/078'
[13] HS2 Ltd 'Demand Model Analysis' Section 4.2.7
[14] Step Change Transport Improvements: An Assessment of the Potential for 'Step Change' Transport Improvements to Generate Wider Economic Benefits' Michael Mann, 2006

1.7 Other environmental impacts

The most blatant area in which HS2 is not green is in the destruction and disturbance of the Chiltern ANOB and the tranquil countryside of South Northamptonshire and Warwickshire. In a crowded island, the loss of natural beauty and tranquillity is irreplaceable.

Myth 2: Wider economic benefits

2.1 Economic growth

Faster connectivity

Work by Imperial College[15], commissioned by HS2 Ltd applies established urban economic theory to the High Speed Rail circumstance and, as such, are supported by a body of theory and empirical evidence[16].

The minutes of the HS2 Ltd Challenge Group (2 September 2009) show that expert opinion anticipated the result obtained by the Imperial College work, indicating that it represents mainstream thought.

Command Paper 7827 misrepresents the Imperial College work that was commissioned by HS2 Ltd as supporting there being agglomeration benefits from high speed rail. In reality the study merely reports that they are theoretically possible, but after a consideration of the particulars concludes:

'Thus, while urban economic theory does not preclude the existence of agglomeration benefits across inter-regional distances, the empirical evidence suggests that these may be very small indeed.'

The Imperial College work accredits something of the order of £10m/annum of benefit for faster connectivity for HS2.

HS2AA have sought clarification from HS2 Ltd and DfT (in meetings on 29 June and 17 August) on their views on wider economic benefits, and they confirm that their view is that the £3.6bn of benefits is mainly from improvements to local transport – not high speed long distance connectivity. High speed connectivity is, apparently, associated with better inter-regional business connectivity leading to reduced market imperfections, and this contributes to part of the £1.6bn (of the total £3.6bn) benefits (from reduced market imperfections). In the age of the internet, it sounds as out of date as travelling salesmen.

The Mann study (op cit) reviews the body of work and concludes that high speed rail does not deliver material regional benefits. The Eddington Transport Study[17]:, confirms this:

- *the UK's compact economic geography means that most major urban areas are already close together when compared to many European and international competitors;*
- *for those economically important connections that are more distant, such as London to Edinburgh and Glasgow, air services already provide fast, frequent connections serving business needs and other markets at relatively low cost. The new rail link, therefore, would not be a step change as the link is already there and there is very little evidence that high-speed rail links help regional performance;*

HS2 Ltd/DfT and Greengauge21 together with other HS2 supporters presume that released capacity will be used for additional local services, and it is these that have positive effects on local economies.

There is evidence that HSR can have a negative effect on conventional services for example in Spain[18].

[15] 'Advice on the assessment of Wider Economic Impacts: a report for HS2' Daniel Graham and Patricia Melo, March 2010
[16] see Mann op cit
[17] Eddington Transport Study: Main Report (December 2006), Volume 3 page 209

To have a positive economic impact it is not sufficient to have the capacity, as additional services will only happen if either there is a business case for running them (which is unlikely) or government provides more subsidy, which is the current basis for the majority of rail services. It is not clear that the costings of HS2 include the additional annual subsidies needed to deliver the wider economic benefits. Rail subsidy for 2009/10 is stated as £4.2bn[19]. The latest figures published by ORR are for 2008/09, and show a £5.2bn subsidy.

Greengauge 21 work

Greengauge21 (or KPMG who did the analysis for Greengauge)[20] apply their own approach to analysis. This approach lacks support from urban economic theory or other research. KPMG look for correlations between earnings levels and the degree of rail connectivity, and report these correlations as elasticities between rail connectivity and productivity.

There is no time series analysis, and no attempt to discern how changes in rail connectivity affect either earnings or productivity. No changes are analysed at all, the analysis is simply of the distributions of earnings and rail connectivity at a single time.

The KPMG findings themselves are unremarkable – there is of course a relationship between earnings and rail connectivity – but its interpretation as a causal relationship between rail connectivity and productivity lacks basis, and is, in fairness to KPMG, presented as an assumption. Consequently its use by KPMG and Greengauge 21 to estimate the additional productivity from HS2 is, to say the least, speculative.

2.2 Redistribution effects

It has been suggested (eg by Greengauge 21) that high speed rail will redress the dominance of London.

In fact HS2 may well take money from the regions to London, not the reverse. The reason is that London is already the dominant city in the UK. It is considerably larger than other West European capital cities both in absolute size and relative to other cities in its state. London is seven times larger than Birmingham (the next largest city), while Paris, Berlin, Rome and Madrid are about twice the size of the next largest city. (See data tables at Myth 6). London's good connectivity to other major cities in the UK may well have contributed to this dominance.

If growth in long distance transport occurs as suggested by the asymmetric elasticities in Webtag (showing GVA elasticities of 0.7 from London and 2 to London), then trips from regional centres to London will increase much more than the reverse. These elasticities were reported by MVA in work for DfT[21].

The effect of growth that results in three times the number having London as their destination (rather than the reverse) will be to cause additional spending and greater usage of amenities in London at the expense of the regions.

Hector et al (op cit) conclude of a high speed network:

'This is expected to further strengthen the position of London as the 'centre' of the UK (economically, socially and politically).'

This is perhaps not what the regions are hoping for from high speed rail.

[18] analysed in 'The accessibility impact of a new High-speed Rail line in the UK – a preliminary analysis of winners and losers' Dr Héctor S. Martínez Sánchez-Mateos, Universidad de Castilla-La Mancha: Dr Moshe Givoni, Transport Studies Unit, University of Oxford. Working Paper N° 1041, December 2009
[19] HS2 Ltd Main Report, section 5.1.34
[20] 'Greengauge 21, High Speed Rail, Consequences for employment and economic growth, Technical report', KPMG LLP, 9 March 2010
[21] 'UK DfT Rail Passenger Demand Forecasting Study' John Segal and Adam Mason (MVA Consultancy), Neil Jackson and Jake Cartmell (Rail Service Analysis, Department for Transport). Paper to the European Transport Conference17 - 19 October 2007

Myth 3: HS2 is a sound investment

In business terms HS2 would lose money. In current money it has an investment of £17.8bn and a running cost of £7.6bn (giving a total cost of £25.5bn), but yields only £15bn of additional fares revenue, with a net inflow of £11.9bn. HS2 is not commercially viable. It is justified in terms of non-charged benefits to travellers (time savings, greater reliability and reductions in crowding) and wider economic benefits arising from the uses of released conventional rail capacity and reduced road crowding.

It is not a business case but a form of cost benefit analysis. But while it includes non-charged benefits it excludes some non-charged costs. It ignores two important costs

- The environmental damage to the countryside through which it passes
- The reduction to property values that it causes in the vicinity of its route. This cost is met by the individuals who are unfortunate enough to live in the vicinity of the route.

3.1. Demand

The cost benefit assessment is based on massive increases in demand – demand with HS2 on the WCML route is forecast to increase by 267% to 2033. And large forecast increases are not restricted to long distance rail journeys, with a 44% increase in long distance car journeys and 178% increase in domestic air passengers.

HS2 Ltd's forecasts are out of line with other estimates. It forecasts growth in rail demand without HS2 of 133% to 2033. This compares with, for example:

- DfT estimate of 65.5% increase in long distance passenger kilometres from 2006 to 2027 in work for their 2007 White Paper[22]).
- Network Rail forecast of 70% increase in long distance passengers to 2034[23].
- Prof J Dargay[24], for the Independent Transport Commission, forecast a 35% increase in long distance rail travel from 2005 to 2030, against a 30% increase for cars and 34% overall growth in long distance domestic travel. This equates to a rail annual rate of increase of 1.2%, in contrast to the 3.3% forecast by HS2 Ltd without HS2.

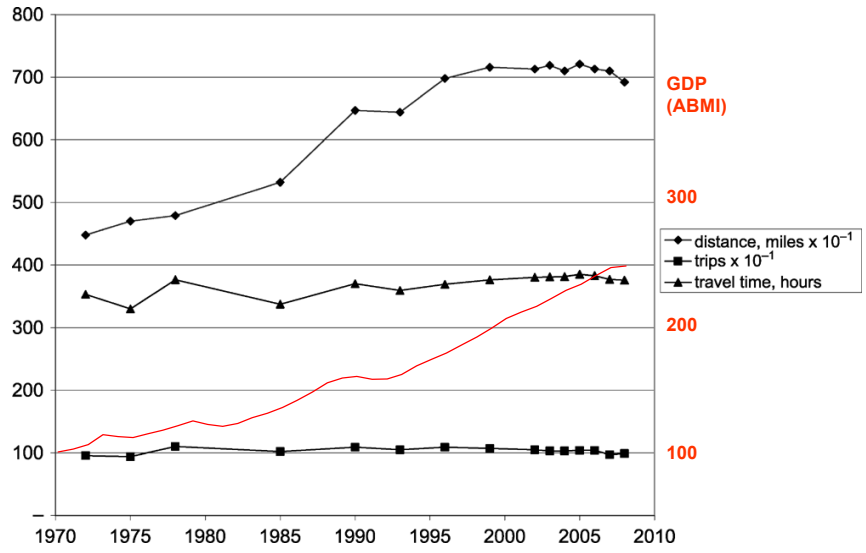
HS2 Ltd recognise that demand is crucial, and that a 10% shortfall in demand from their estimates reduces the Net Benefit Ratio (NBR) to 2 (from 2.4 when the wider economic benefits are excluded), and a 20% shortfall to a 1.5 NBR[25]. DfT's 2007 estimate, and Network Rail's and Dargay's 2010 estimates represent much larger reductions than 20%. A NBR of 2 is the Government's threshold for 'high value for money' above which most projects are acceptable; below 1.5 ('low value for money') very few projects should proceed[26].

HS2 Ltd's estimates are impossible to square with recent historical evidence. Their models simply do not reflect what has actually been happening in the outside world. Their demand model relates travel demand to economic growth, so higher GDP drives more travel.

What has been happening is that total domestic travel (from all modes) has saturated, (see graph below) with per capita total domestic travel static for 15 years (on National Travel Survey data), and long distance domestic travel similarly saturated. This is dominated by the reduction in the growth of car travel, but also applies to coach travel and, in recent years, domestic air travel. This no doubt relates to the growth of international travel, road congestion, as well as some element of simple demand saturation.

[22] 'Delivering a Sustainable Railway: Summary of key research and analysis' July 2007, slide 27
[23] 'Planning ahead: The long distance planning framework', August 2010, section 2.10 page 6
[24] 'The prospects for longer distance domestic coach, rail and car travel in Britain,' January 2010, Table 37
[25] HS2 Main Report, section 4.4.9 page 189
[26] DfT web site: http://www.dft.gov.uk/about/howthedftworks/vfm/guidanceonvalueformoney?page=1

Travelling time, journey numbers and distances per person (compared with GDP)

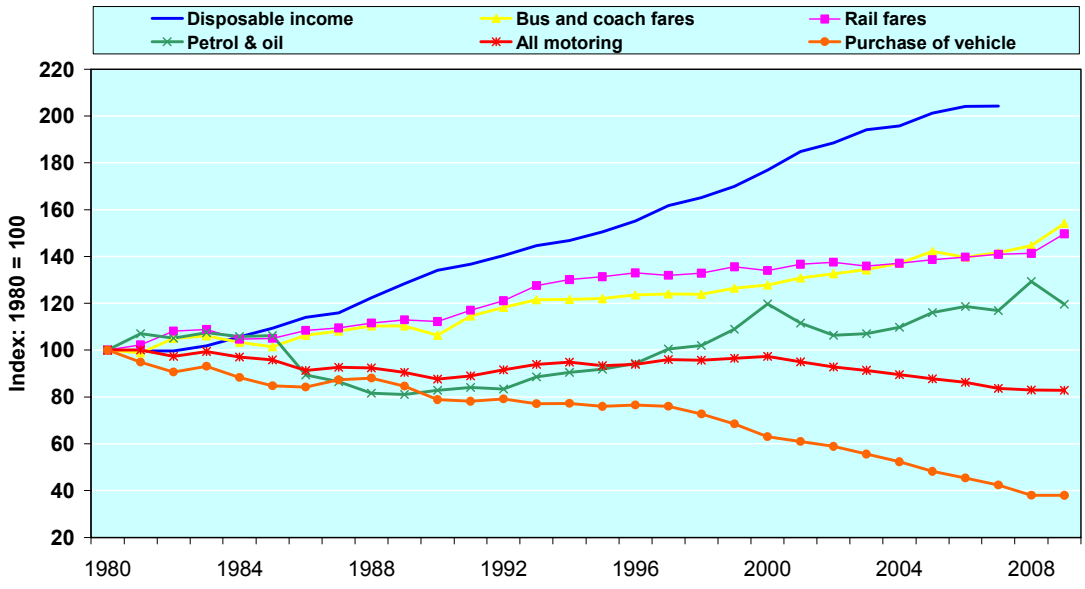


Source: Dr Metz based on NTS 2008 Table 2.1 with GDP trend added

DfT explain the inconsistency between the forecast of continued travel growth per person and recent lack of growth as being due to increasing car costs.

The graph below (from Transport Trends 2009) shows that overall motoring costs have actually been decreasing, but fuel costs have indeed increased since about 1989, albeit by much less than disposable incomes, and with little overall trend since 2000. However, the petrol and oil costs shown *do not* reflect improvements in vehicle efficiency that reduce the fuel costs of motoring. An index running cost is also published but it includes insurance, car tax and maintenance, which are largely a cost of ownership. Fuel costs approximate to the short run marginal cost, and hence are appropriate to explaining short run variations in travel demand (ie if you have a car, how much you use it). But DfT's contention seems less than convincing, as HS2AA would expect distance or journey increases in years with reductions in petrol prices – which do not occur.

Changes in the real cost of transport and income



Only rail demand has continued to increase – but there is clearly no relationship between rail and real per capital income (for decades until the early 1990s rail passenger numbers were static) – and recently rail passengers on WCML continued to increase despite the recession. To project increases of rail demand on a purported relationship to GDP (or per capital income) is insupportable. It is clear that rail has increased its modal share because of the investments of the last 15 years and the resulting improvements in services. It is also clear that current rail pricing is below the level that can support investment to accommodate growth. If service improvements reduce or stop, so will the growth in passenger numbers.

Were one inclined to accept HS2 Ltd's demand estimates, there are two possibilities:

- The next franchisee(s) for WCML (and Chiltern Railways?) will be stopped from taking the measures needed to stimulate and accommodate growth (through more services and longer trains) – so that the demand forecast by HS2 Ltd cannot develop because they involve unachievable load factors (see the discussion of crowding below); or
- The next franchisees take the steps to attract and accommodate growth in demand, making something like Rail Package 2 a sunk cost, leaving the full cost of HS2 able to deliver only the considerably smaller incremental benefits.

The problem is that HS2 is an all or nothing investment, or rather gamble. DfT in the 2007 White Paper 'Delivering a Sustainable Railway' correctly cautioned against investments based on inflexible investments on long term forecasts.

If the forecast growth in rail travel does not materialise, as it did not for HS1 (where it was about one-third the forecasted level[27]), it will be clear long before the railway opens. This will present an invidious choice: abandon the project and writing off the costs, or, complete the investment and create another commercial white elephant like HS1.

3.2 Overestimated time saving benefits

The largest single benefit, £13bn for reduced journey time, is, putting aside issues with demand, overestimated for two reasons: the basis of time savings and unit values used.

Time savings

Firstly, it takes no account of the usefulness of time during long distance rail journeys (despite Cmd 7827, 2.23 page 46 alluding to it in contrast to road), and references to supporting work:

- The Mott MacDonald IWT Consortium wrote in, 2008[28]:

  'Rail Business travellers in the UK are now using travel time highly efficiently. Marginal reductions in travel time (10, 15, 20 minutes) are not guaranteed to lead to much extra productive time at work, whether in the 'usual workplace' or elsewhere.'

- The Centre for Transport & Society, UWE, Bristol, and Centre for Mobilities Research, Lancaster University in 2007 found[29]:

  'Most rail passengers either make some use or very worthwhile use of their time travelling by train, suggesting that rail travel has positive utility for many travellers. Only 18% of passengers agreed with the statement that their travel time was wasted. Only 3% of rail passengers spent most of their time being bored or anxious.'

[27] C&AG's Reports (HC 302 of Session 2000/1, Fig. 6; HC 77 of Session 2005/6, Fig. 8)
[28] 'The Productive Use of Rail Travel Time and Value of Travel Time Saving for Travellers in the course of Work' The Mott MacDonald IWT Consortium, 2008
[29] 'Travel Time Use in the Information Age: Report', Centre for Transport & Society, UWE, Bristol, and Centre for Mobilities Research, Lancaster University, October 2007

- Lyons, Jain and Holley (January 2007) say[30]

  '….With the pace of technological change and the potential time uses afforded by mobile technologies it could prove unwise to unquestioningly persist with today's appraisal assumptions about travel time use if the possibility remains that such assumptions may increasingly become invalid over time.'

It is unlikely that time in the middle of long distance rail journeys will be anything but fully productive by 2025, when HS2 starts.

Unit values

The second source of over-estimation of benefits is the Webtag value for business time saving. There are two issues.

First, the value uses data several years out of date, which relates to a time when rail had a smaller share and high average income for business users compared to other modes of transport.

Second, the value is also not reduced with the projected increases in the number of business journeys. The increases in journey numbers imply a fall in the average income of rail using businessmen, as a small high earning group could not be responsible for all the projected journeys. (Long distance business journeys on rail are projected by HS2 Ltd to increase to 460% of their 2008 level (24% of 45,000 journeys/day) by 2033 (30% of 165,000 journeys/day), against a population increase of just 16%).

HS2 Ltd and DfT accepted that there are issues concerning these assumptions (when HS2AA met with them on 29 June 2010).

While reductions in the time on board long distance trains may have some limited value, the increase in travel forecast by HS2 Ltd to be generated by HS2 will waste time. This is because much of the time getting to and from stations, waiting and transferring is irredeemably unproductive. Encouraging alternatives to travel, as Norman Baker has[31], is better for the economy and the environment.

3.3 Competition and pricing

HS2 is assessed on the basis that fares will be the same as the conventional services that it replaces. However, competition between HS2 and conventional services, either in the form of the residual long distance services on WCML or from Chiltern, will push fares down and reduce the number of passengers on HS2. The issue will become more serious with high speed track extended north of Birmingham, as there will be more scope for direct competition rather than having complementary services (conventional and high speed trains will no longer share track north of Birmingham). This greater competition will be more damaging to the economics of building the railway.

HS2 Ltd's demand modelling does not consider the impacts of competition, indeed they assume that there will be none, as:

'…HS2's approach has effectively assumed a regulatory framework that allows joint (social) optimisation of both high speed and classic rail services.'[32]

To try to justify HS2 on the basis of competition being suppressed indicates that HS2 Ltd recognise serious problems with its economics.

[30] 'The use of travel time by rail passengers in Great Britain', Glenn Lyons, Juliet Jain and David Holley, January 2007
[31] 10 July 2010
[32] HS2 Ltd 'Outline for HSE Technical Annex' (091123-ACP technical note.pdf)

3.4 Crowding

HS2 Ltd's assumptions on crowding appear to be inconsistent and unrealistic.

They project 81% load factor on WCML long distance services prior to HS2, giving HS2 benefits from reducing crowding worth £5bn. HS2 Ltd explain[33] a greater than 80% load factor as 'standing on most trains throughout the day' (and 60-80% as 'standing on some trains throughout the day'). Oddly HS2 Ltd forecast a 61% load factor for HS2, which is higher than the current load factor which itself has triggered the purchase of more rolling stock.

An 81% load factor is totally unrealistic for a service where the great majority of trips are into London and back rather than are balanced in origins. If all seats are taken in the morning to London and the evening from London, 60% of the seats need to be taken on the trains running in the opposite direction to achieve the 81% load factor. But the flows are projected to be much more dominated by trips starting in the north. The only way it is possible to reach 81% is, if either:

- People travelling from the north return on a different day from the one on which they start the trip – and so travel back in the morning; or
- Massive crowding on the morning trips into London, and evening trips out, with light loading on the contra-flow services.

The former is implausible and has major implications for redistributing wealth from the North to London, due to the costs of staying in London.

For the latter, it is difficult to imagine people choosing to travel long distances by rail with standing on almost all trains. If trains are overcrowded, how will the demand ever build up to such a high level? If crowding never reaches the 81%, ie standing on most trains, then neither the level of demand required for HS2's business case, nor the (£5bn) benefits from reducing crowding, will be realised.

3.5 Assessment basis

The appraisal of HS2 is against a do-minimum scenario, not against the alternative means of coping with the projected demand. As some of the alternatives have better Net Benefit Ratios (see Myth 4), ie some of those that involve improving the existing infrastructure, HS2 should be assessed against adopting these 'better' alternatives.

For HS2's assessment, incremental benefits beyond these alternatives should be balanced against the full costs of HS2. On such an approach, HS2's 'business case' would be in tatters.

3.6 Excluded costs

HS2 would cause serious environmental damage, particularly in the Chilterns, where it passes through an area of outstanding natural beauty, and South Northamptonshire, where it passes through tranquil countryside. This damage is not priced, and so not taken into account in the monetary comparison of costs and benefits. For a densely populated island, this damage is to a scarce and irreplaceable resource.

The destruction of property values in the proximity of the 207km new line, due to its nuisance (noise etc) and visual impact, are also ignored. The HS2 Ltd assessment takes account of the cost of acquiring the properties it needs, and of paying compensation (under the statutory schemes and EHS rules) but *not the full cost* of loss in value of all the properties that it affects. Irrespective of whether the government or the unfortunate property owners bear this cost, the cost of property blight should be included in full in the economic appraisal.

It cannot be right to exclude the full cost of property blight in considering whether HS2 is in the national interest.

[33] 'HS2 Baseline Forecasting Report' 5.3 page 33

Myth 4: 'Only HS2, ie a new railway, can solve the rail capacity problem'

It is argued that there will be a need for additional capacity that can only be met by a new railway, as uprating the existing network would be unacceptably disruptive or yield insufficient capacity. The Secretary of State made exactly this case on BBC television on 20 August.

The West Coast Route Modernisation is undeniably an example of massive cost escalations, project over-runs and disruption. It is a case study in ill founded technical optimism and disastrous management.

4.1 More capacity on existing routes

However substantial increases in capacity on WCML and the Chiltern Trains route can be achieved without any additional infrastructure works. And infrastructure improvements are not always a problem – Chiltern's Evergreen 2 project was achieved while maintaining class topping punctuality and customer satisfaction ratings.

WCML

We can have massive increases in WCML capacity without new infrastructure works (beyond that planned for completion in 2012). This will permit 65% more capacity using longer trains.

The reference case ('do minimum') has the committed new Pendolinos (4 new sets and 31 sets extended to 11 car) equivalent to 32% more capacity. This can be increased to 65% more capacity by lengthening all trains to 12-car. Additional rolling stock is usually the least costly means of providing more capacity, causes no disruption and is often commercially justifiable.

Rail Package 2 de-bottlenecks WCML and lengthens all trains to 11-car sets. The analysis of Rail Package 2 (RP2)[34] shows that it increases capacity by 54% over the 'do minimum' case, which is 104% more than 2008 capacity. RP2 gives a 53% load factor in 2033 compared to the current (2008) 49% load factor. Both these are lower than the load factor forecast for HS2 (61%), ie HS2 would be more crowded.

RP2 together with lengthening sets to 12-car gives a total of 130% more capacity. This is sufficient to accommodate HS2 Ltd's forecast level of demand (133%) without HS2.

Chiltern

Chiltern Railways, which have a lower speed route to Birmingham, are upgrading their route for more 100mph running (for May 2011). When this is achieved they will be only 15 minutes slower than the Pendolinos on WCML, having cut 25 minutes off the journey time. There is considerable opportunity to expand current services between London and Birmingham, with 8-car running already possible on the route. Capacity limitations at Marylebone may become the major bottleneck, but HS2AA understand that it is practicable to add one more additional platform (to give seven not six) without major works.

4.2 Speed

While ERTMS is assumed to be available for HS2, it is not included in the context of upgrading WCML, eg for RP2. While this may have little effect on capacity, it would allow 140mph running on WCML in some places on the existing alignments. This is the operational top speed of the Javelin services on CTRL. It would also allow higher speed running of some of the long distance services on East Coast Main Line, where the Intercity 225s have a design capability of running at 225km/hr (ie 140mph).

[34] 'High Speed 2 Strategic Alternatives Study – Strategic Outline Business Case' section 3.5.1.5 page 38, Table 3.7

4.3 Best value for money

Eddington says[35]

(xi) Do not be seduced by grand projects with speculative returns, for example:

- *Pursue high speed rail options only where they have been demonstrated to be the highest value for money option to relieve congested corridors;*

On DfT's own analysis Rail Package 2 and Road Package 2 are better value for money solutions to creating additional capacity (RP2 at 3.63[36] and Road Package 2 at 3.66[37]) than HS2 (at 2.7, including wider economic benefits). These rail and road packages have a present value costs of £2.0bn and £1.4bn – compared to £11.9bn for HS2 (£25.5bn total cost less £15.0bn incremental fares plus lost tax of £1.5bn).

[35] 'The Eddington Transport Study: Main Report' (December 2006), recommendation 2
[36] 'High Speed 2 Strategic Alternatives Study – Strategic Outline Business Case' section 4.8.2.2 page 59, Table 4,8
[37] 'High Speed 2 Strategic Alternatives Study – Strategic Outline Business Case' section 4.8.4.3 page 63, Table 4.13

Myth 5: 'HS2 will eliminate domestic air travel'

The HS2Ltd/DfT projections of 11,000 journeys/day switching from air to rail depend on

- Increases in demand for domestic air travel (178%). This assumes that the third runway at Heathrow.
- Ignoring the trend in the domestic air market on the routes that HS2 would serve.
- Ignoring the time threshold above which passengers do not choose rail over air.

5.1 Demand

The number of domestic air passengers that may switch to HS2 depends on what the demand for air will be in 2033. HS2 Ltd project 178% increase in domestic air passenger numbers to 2033[38]. The HS2 Ltd main report[39] states however they have assumed that the third runway at Heathrow goes ahead.

HS2 Ltd estimate that 8% of journeys on HS2 will come from transfers from air, which means 11,000 journeys/day transfer from flights from NW and the lowlands of Scotland. The 11,000 journeys/day is equivalent to 57% of the 19,500 journeys per day flown in 2009 between these places and all London airports (Heathrow, Luton, Stansted, Southend, London City, and Gatwick). It is 117% (ie more than total) of the 9,400 passengers per day (in 2009) between Heathrow and the NW and Lowlands of Scotland.

Domestic air travel is expected to get cheaper, while rail more expensive. This makes it less likely that the residual domestic air passengers will swap to rail when HS2 becomes available. See Myth 1 for discussion.

Long haul flights are more profitable for airlines and airport operators and are unlikely to be sacrificed for domestic air growth.

5.2 Trend in domestic air market (see Graph at Myth 1)

Domestic air passengers for Heathrow have been reducing since 1997, as the graph using CAA data shows. Without the third runway, it is hard to see how domestic passenger volumes from Heathrow can grow sufficiently for HS2 to displace the projected 11,000 passengers.

Flights between all London Airports and the NW and Scottish Lowlands are currently 30% of the UK domestic total. This market is not growing: growth tailed off in the early 2000's and has declined from a peak in 2004. Domestic air travel generally peaked in 2005, since when passenger numbers have fallen. This is despite GDP continuing to grow until 2008.

Domestic air services may well continue to grow for other routes eg that between Aberdeen and Exeter[40]. Places that have poor surface travel routes can be expected to enjoy growth in air services and gain passengers.

5.3 Time threshold

It is generally agreed, as Myth 1 notes, that rail may replace air where journey times are less than about 3 hours, with rails percentage falling off sharply above 2.5hrs[41].

The HS2 Ltd estimate that 11,000 journeys per day transfer from flights from NW and the Lowlands of Scotland on the basis of the train journey being half an hour shorter than previously (reducing to about 4 hours according to HS2 Ltd[42], or 3hr 39 mins for the fastest

[38] HS2 Ltd Main Report. Section 2.3.37 page 48
[39] HS2 Ltd Main Report Section 4.4.12 page 189
[40] CAA UK Airport Statistics. Table 12 2 Domestic air PAX route analysis
[41] Michael Mann op cit
[42] HS2 Ltd 'Demand Model Analysis' Section 4.2.7

current service for Glasgow (ie the 4h 09m service, see UK table under Myth 6)). This is optimistic given the time threshold.

Myth 6: 'The UK lacks a fast national railway network.'

The UK actually has an extensive high speed network. With the exception of CTRL, the principle routes in the UK have a line speed of 125mph for intercity services (ie West Coast Main line, East Coast Main Line and Great Western). 125mph can qualify as high speed for a line uprated to be high speed under the European Directive on high speed rail[43].

Bearing in mind the compactness of the UK and the closeness of centres of population such a speed is entirely appropriate, as supported by Eddington's report and findings[44].

In fact the quickest travelling times by rail between the capital and major UK cities (using the most recent data and timetables[45]) are shorter than for Germany, France, Italy and Spain

Germany

City	City pop. 000s[46]	Rank by Population size	Time from capital city (fastest train)
Hamburg	1,773	2	1hr 36m
Munich	1,357	3	5hr 52m
Cologne	995	4	4hr 19m
Frankfurt	668	5	3hr 34m
Stuttgart	600	6	5hr 00m
Avge time to/from Berlin	**3,430**	**1**	**4hr 04m (244m)**

France

City	City pop. 000s[47]	Rank by Population size	Time from capital city (fastest train)
Marseille	839	2	3hr 03m
Lyon	472	3	1hr 57m
Toulouse	438	4	5hr 31m
Nice	347	5	5hr 38m
Strasbourg	273	6	2hr 17m
Avge time to/from Paris	**2,203**	**1**	**3hr 41m (221m)**

Italy

City	City pop. 000s[48]	Rank by Population size	Time from capital city (fastest train)
Milan	1,307	2	2hr 59m
Naples	964	3	1hr 07m
Turin	909	4	4hr 10m

[43] 'Directive 96/48/EC — Interoperability of the Trans-European High Speed Rail: System Technical Specification for Interoperability'
[44] Transport Study: Main Report (December 2006), Vol. 2 para 2.18, chart 2.4
[45] Information on fastest times in Europe from timetables on Rail Europe (on a typical midweek July day)
[46] 2008 census (except Cologne and Frankfurt (2007))
[47] 2006 census (except Paris (2007))
[48] 2008 census (except Rome 2009)

Italy (continued)

City	City pop. 000s [49]	Rank by Population size	Time from capital city (fastest train)
(Palermo)[50]	(660)	(5)	(11hr 32m)
Genoa	612	6	4hr 58m
Bologna	375	7	2hr 05m
Avge time to/from Rome	**2,727**	**1**	**3hr 04m (184m)**

Spain

City	City pop. 000s [51]	Rank by Population size	Time from capital city (fastest train)
Barcelona	1,622	2	2hr 43m
Valencia	815	3	3hr 43m
Seville	703	4	2hr 20m
Zaragoza	674	5	1hr 18m
Malaga	568	6	2hr 30m
Avge time to/from Madrid	**3,213**	**1**	**2hr 31m (151m)**

UK

City	City pop. 000s [52]	Rank by Population size	Time from capital city (fastest train)
Birmingham	1,017	2	1hr 22m
Leeds	771	3	2hr 04m
Glasgow	582	4	4hr 09m
Sheffield	535	5	2hr 08m
Bradford	502	6	2hr 24m
Avge time to/from London	**7,556**	**1**	**2hr 25m (145m)**

Summary of average (fastest) journey times between the capital and five largest cities

Country	Average Journey Time	Notes
Germany	4hrs 04m (244m)	Mixture of high speed, upgraded and some conventional lines
France	3hrs 41m (221m)	All high speed TGV except Marseille - Nice link
Italy	3hrs 04m (184m)	All high speed except last section to Genoa
Spain	2hrs 31m (151m)	All high speed except some short sections to Valencia
UK	2hrs 25m (145m)	Intercity network

The tables also show how dominant London is as the major city in the UK (seven times the next largest), compared to other major West European countries (where the capital is about twice as large).

[49] 2009 census (except Barcelona 2008)
[50] Palermo is on the island of Sicily, and has been excluded from the analysis of average times
[51] 2009 census (except Barcelona 2008)
[52] 2008 census (except Glasgow (2007)