Modal shift matters –and HS2 delivers it

January 2022

HIGH SPEED RAIL GROUP

About High Speed Rail Group

Representing companies with relevant experience and an interest in high speed rail, the High Speed Rail Group (HSRG) is committed to supporting the successful delivery of a world-class high speed rail network in Britain.

Our members have helped deliver major infrastructure projects in the UK and around the world, including creating entirely new high speed networks and improving the UK's existing rail network.

This gives us a unique insight into both the shortcomings of the current network and the transformative capacity, connectivity, economic and environmental benefits that high speed rail brings.

Our members support a national high speed rail network including the delivery of HS2, its extension to Scotland and integration with other rail investments, believing that this should go hand in hand with wider ambition to maximise the released capacity benefits HS2 brings and to catalyse change through supply chain. A full list of our membership can be found at www.rail-leaders.com.

This report was produced for the High Speed Rail Group by transport Think Tank Greengauge 21.

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EXECUTIVE SUMMARY

With road transport accounting for some 67% of the transport sector's greenhouse gas emissions, and rail just 1.4%, it is clear that modal shift will have an important role to play if the UK is to achieve its 2050 net zero ambitions.

Government's 2021 Transport Decarbonisation Plan places a "heavy emphasis on modal shift", but tangible policies to encourage the move from high carbon to zero carbon travel modes are currently lacking.

Beneficial modal shift will only happen if: (1) there is a more attractive alternative to road (and short-haul air) travel; and (2) the capacity to accommodate modal shift on a significant scale. Uniquely, HS2 offers just this combination.

This report shows that a relatively small proportion of all domestic travel is over long distances, but this still represents a significant percentage of vehicle miles and carbon emissions. HS2 offers a unique combination of a more attractive travel option and a big step-up in capacity—for both person travel and for freight.

Evidence from existing high-speed rail services show significant modal shifts from car and short-haul flight alternatives. In France, for example, the TGV Atlantique route achieved a 66% shift from air to rail (models had predicted just 29%). Closer to home, Eurostar services reduced air passenger volumes by 50–60% on the London–Paris/Brussels routes.

In the UK, evidence shows that the tipping point for modal shift from air to rail lies in the 2½h–4½h range. Research shows that taking an hour off rail journey times on Edinburgh/Glasgow–London and Edinburgh/Glasgow–Midlands routes .would result in rail market shares growing from today's 30% share of the Anglo-Scottish travel market to 75%.

We set out a new analysis of what modal shift is likely to be achieved by Britain's new high speed rail network, HS2. We show why the presentation of HS2 modelling to date has suggested only a small modal shift from car to rail travel, while the evidence elsewhere of high speed rail points to pressure being taken off parallel motorway networks.

We also look beyond passenger travel to consider freight and logistics. Increasingly, the nation's freight is 'inter-modal' (based on containers and pallet-loads). While electric or hydrogen goods vehicles will meet future needs for local deliveries at a regional scale, over half the total kilometres of HGV journeys are over longer distances, where an alternative to large, 44-tonne diesel HGVs is still needed.

The UK is set to become the first country in the world to commit to end the sale of non-zero emission heavy goods vehicles by 2035. There will be a consequential shift towards rail provided there is the capacity to handle the extra railfreight services that will be needed. Step forward HS2 (phases 1 and 2a), which will release capacity on the country's busiest freight corridor, the West Coast Main Line.

The ability of high speed rail to bring about modal shift is clear. This report shows that travellers will switch from car and from air, and freight will switch from longer distance HGV haulage.

HS2 is uniquely placed to bring about this highly beneficial modal shift and help the UK to reach net zero.

1

WHY MODAL SHIFT MATTERS

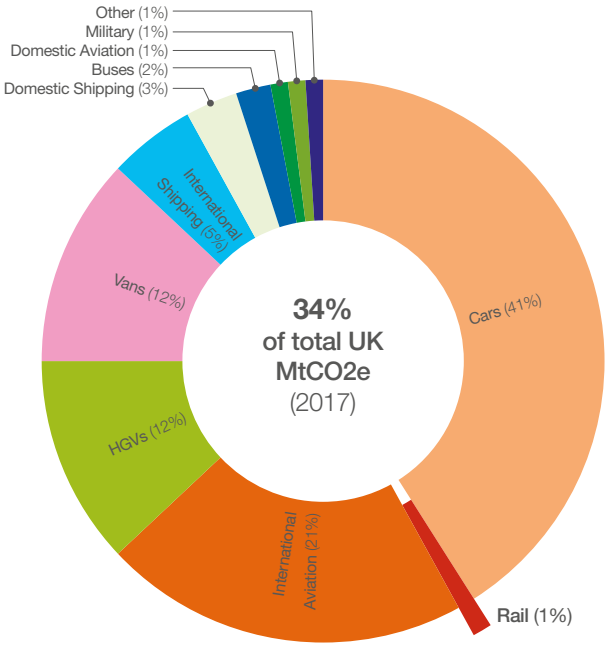


Figure 1: Carbon missions from the transport sector by mode
Source: Professor Jillian Anable, ITS Leeds

Transport accounts for a third of UK greenhouse gas emissions. This is a significant increase over 1990 (the benchmark year for Climate Change calculations) when it was only 20% of the total. It is the problem sector. There has been no net reduction in carbon from transport since 1990.

Road transport accounts for 67% of greenhouse gas emissions, and it is clear there must be dramatic changes to reach Government's net zero target by 2050. Rail, with 40% of the national network already electrified, results in only 1.4% of the transport sector's emissions. Electric passenger trains have reduced their emissions by 30% since 2005.[1] A shift from road (and air) travel modes to rail could therefore have a major role to play.

Greenhouse gas emission rates, mode by mode, couldn't be more encouraging. Rail isn't a problem: it's an opportunity, HS2 more so—see Table 1 and Figure 1.

Table 1: Carbon emissions by travel mode

Travel mode	Carbon Dioxide equivalent grams/ passenger kilometre
Air (domestic routes)	170
Car (longer distance)	67
Rail (intercity)	22
High Speed Rail	8

Source: https://www.gov.uk/government/publications/hs2-phase-one-full-business-case

1. Railway Industry Association, *Why Rail Electrification*? April 2021.

Transport sector emissions have been broadly flat over the past decade, falling only 1% between 2009 and 2019. Improvements to the efficiency of cars (41% of all transport sector emissions) have been lost to a trend towards both driving larger vehicles and driving more miles.[2]

Overall, road vehicles account of 72% of the UK's transport sector carbon emissions (41% cars + 12% HGVs + 12% vans + 7% buses). Alongside carbon, road traffic is responsible for other detrimental environmental and health effects, including poor air quality from particulates and road traffic noise (road traffic is the dominant noise source affecting humans).[3] These other adverse effects are largely unchanged by the planned switch from petrol/diesel to electric power systems for road vehicles (except that at low speeds, electric vehicles are much quieter).

2. https://www.theccc.org.uk/wp-content/uploads/2021/06/Progress-in-reducing-emissions-2021-Report-to-Parliament.pdf.

3. Based on exposure above the EU's threshold of 55 decibels (dB) for daily exposure and 50 dB for night exposure. Source: https://www.eea.europa.eu/highlights/road-traffic-remains-biggest-source (updated 2020).

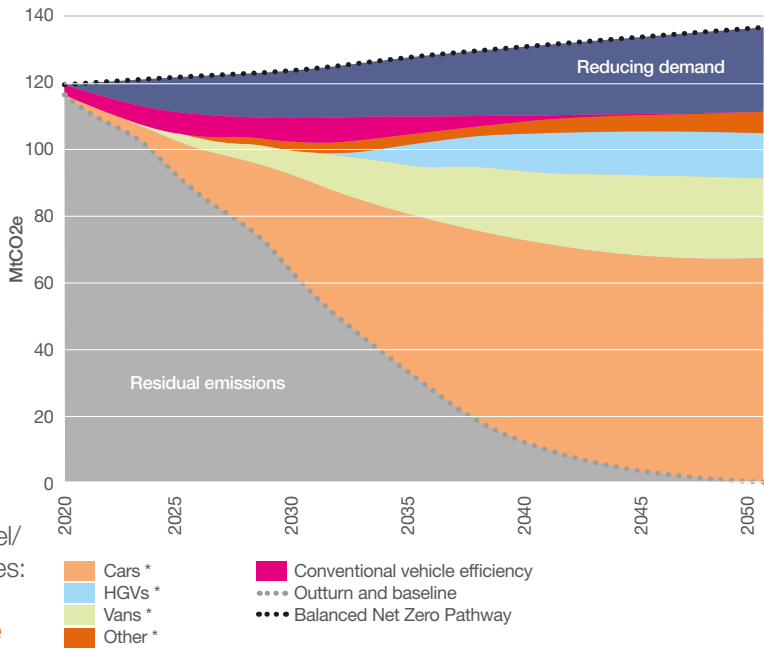


Figure 2: Climate Change Committee projections for surface transport to reach net zero

Source: Unpacking the Sixth Carbon Budget—The transition for transport (p12), The Committee on Climate Change, 2020

Government's policy to decarbonise the transport sector centres on a switch from diesel/petrol to electric for cars and other road vehicles:

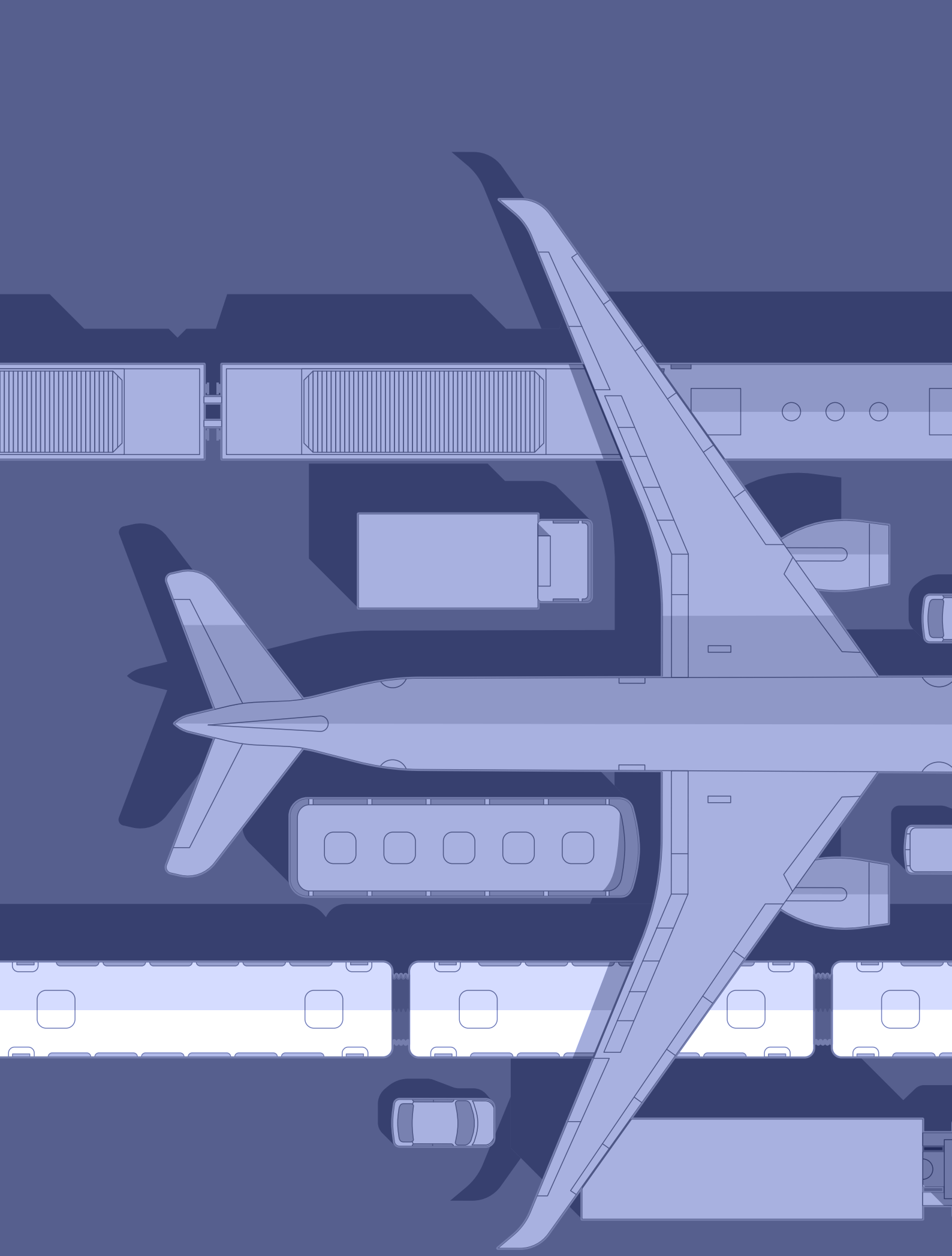
"That is why our plan to decarbonise motor transport, the most ambitious of any major country, is so vital. In November, we announced that new diesel and petrol cars and vans would no longer be sold from 2030, and that all new cars and vans must be fully zero emission at the tailpipe from 2035."[4]

DfT's Transport Decarbonisation Report of July 2021 also says it places a "heavy emphasis on modal shift", noting that is "essential to avoid a car-led recovery [from the Pandemic]." Yet with the emphasis on electrifying the national road fleet of 35m+ vehicles, it is easy to lose sight of the potential for consumers to switch their choice of travel mode. And the role that HS2—and related projects including Northern Powerhouse Rail—can play in helping to achieve modal shift passes unmentioned.

Figure 2 above, developed by the Climate Change Committee (CCC) that advises Government, shows how electrifying the road fleet is indeed expected to have a major role to play. It shows that demand reduction will also be needed to meet our national targets (coloured purple). But it ignores the policy option of encouraging (or simply embracing) a switch from high-carbon to zero-carbon travel modes.

This is a key missing element in policy. True, it requires behaviour change, encouraging and supporting consumers to make **different travel choices**—to low or zero carbon modes of travel which might seem challenging. But this can become an easy choice for people to make if the zero-carbon option is more attractive—and of course, that is what HS2 services will offer: quicker and more reliable journeys.

4. Secretary of State for Transport Grant Shapps, a foreword to DfT's 2021 plan to decarbonise the transport sector. The phrase 'at the tailpipe' is important. It allows a gloss over the question of whether all of the extra electrical power generation needed to charge road vehicle batteries or to create hydrogen for heavier vehicles will be from renewable energy sources. This too is a huge challenge.



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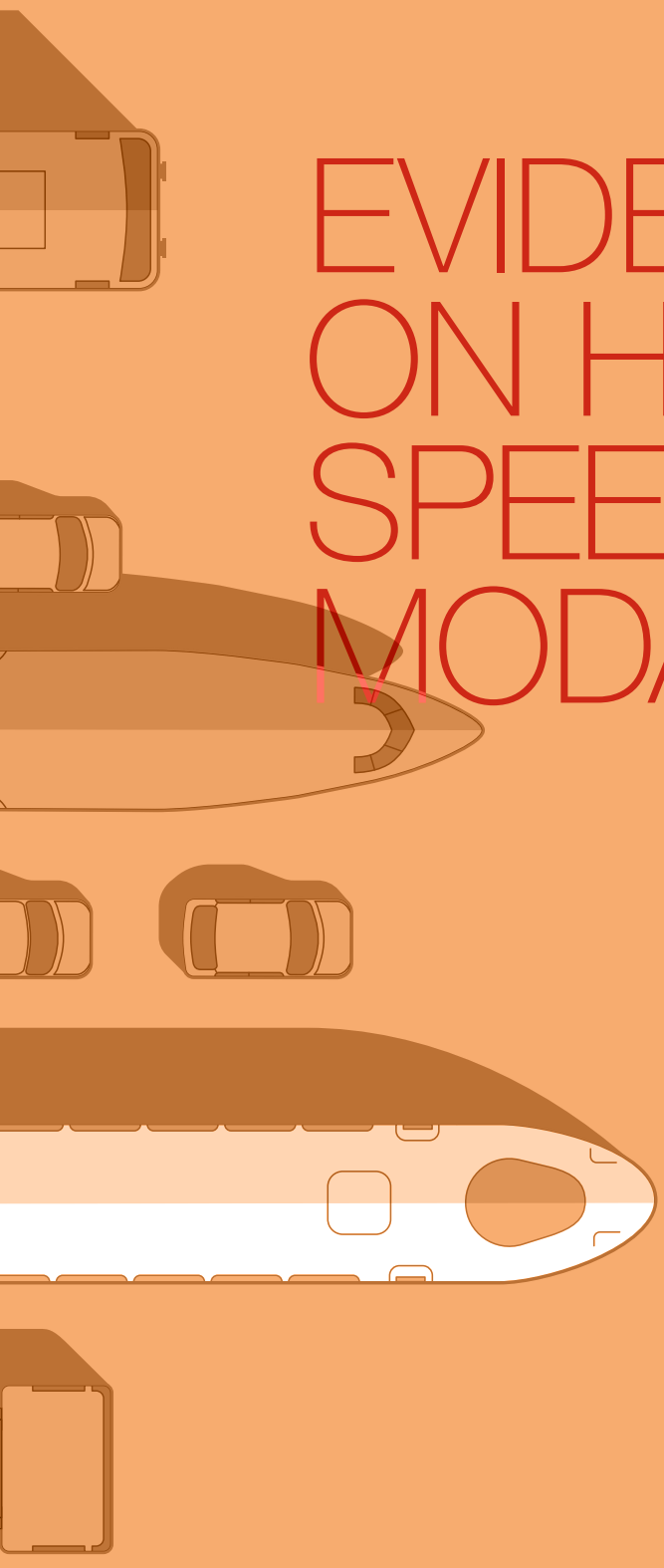


EVIDENCE ON HIGH SPEED RAIL MODAL SHIFT

There is plenty of evidence of modal switching when high speed rail services have been introduced. High speed rail has a proven track record in attracting those who would otherwise choose to travel by car or fly. For example, in France (where TGV[5] services started 40 years ago, and to which routes have been added over the succeeding decades), there is evidence on what TGV passengers travel would have done in the absence of the TGV service.

Answers are readily categorised as 'would fly', 'take the car', or 'do something else/travel elsewhere—and they are available both in terms of projected (modelled) travel changes and observed changes following the start of TGV services on various corridors, each one a high speed route radiating from Paris (see Table 2).

From Table 2, it is clear that high speed rail in France has attracted many travellers who would otherwise use private car or domestic aviation services. The Rhône-Alpes case, unlike the other three, has most new trips attracted from car rather than newly generated ('induced'[6]) or switching from air. The table also reveals the accuracy levels of forecasting models. The data on four TGV lines in France shows that forecasts were broadly matched by outturns (except in the case of TGV Atlantique, where the proportion switching from air rather than car was much higher than expected).

Air–rail modal shares

The impact on air volumes from introducing high speed rail can be seen in Figure 3, which shows cases from around the world. There are passenger volume reductions in a range of 20-80% on competing air routes. The UK's Eurostar service is revealed to have had a large impact on parallel air routes, with air passenger volumes decreasing by 50–60% on the London Paris/ Brussels routes.

Table 2: Summary of evidence from TGV studies—sources of traffic new to rail

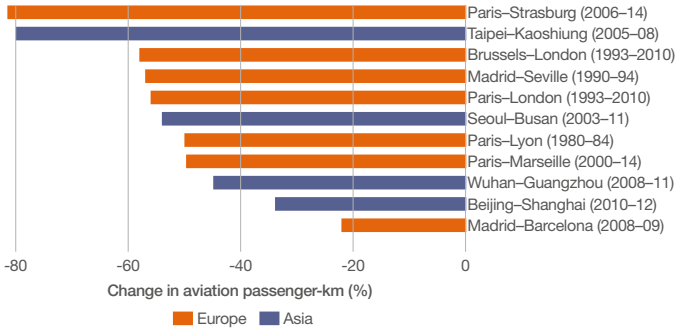
	Forecast			Observed after opening		
	From Air	From Car	Induced	From Air	From Car	Induced
LGV Rhône—Alpes	16%	21%	63%	23%	77%	
LGV Méditerranée	48%–51%	18%–16%	34%–33%	40%	27%	33%
TGV Atlantique	29%	71%		66%	34%	
LGV Est Européen	44%	22%	15%	33%	22%	45%

Source: SYSTRA

5. TGV – Train a Grande Vitesse (high-speed train).

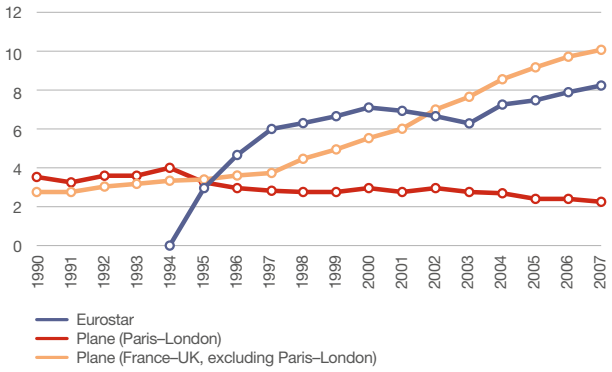
6. Induced demand is travel that would not—in the absence of high-speed rail—have been undertaken by another transport mode. It includes demand which switches from other destinations.

Figure 3: Change in passenger volumes on selected air routes following introduction of high speed rail service



Source: International Energy Agency, 2019 https://www.carbonbrief.org/eight-charts-show-how-aggressive-railway-expansion-could-cut-emissions

Figure 4: long term effect of Eurostar on London-Paris air market



Source: SYSTRA

Eurostar

The experience of Eurostar, the UK's only long-distance high speed rail service is important. As Figure 4 shows, the rail/air mode share increases against a background of increasing demand for UK-France air travel (green line) over the period 1994–2007. The introduction of Eurostar services (blue line) in 1994, caused a reduction of London–Paris air passengers (red). The effect for London–Paris is long-lasting and Eurostar passenger volumes would continue to grow from 8m passengers per annum (mppa) to reach 11mppa by 2019, sufficient to attract the interest of RENFE to plan the introduction of a competing high speed rail service.

The potential for air transfer to rail in Britain

There has long been understood to be an 'S-curve' that explains how modal share between air and high speed rail evolves as rail journey times shorten. Market shares are shown in Figure 5 below for city pairs in the UK that have competing air and rail services. To reach a 50% market share for rail appears to require a rail journey time of around 4 hours in the UK. With shorter rail journey times—typically those between Northern English cities and both London and Glasgow/Edinburgh where rail journey times are 3 hours or less—rail market share is much higher: 80% or more.

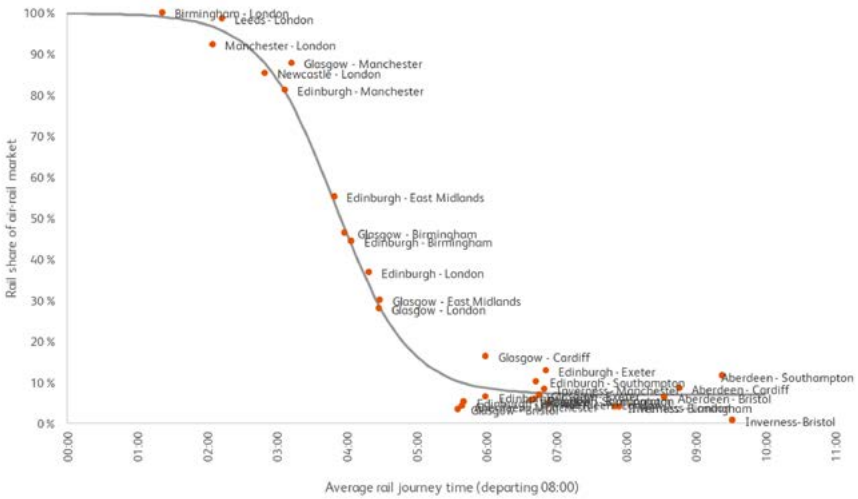


Figure 5: The relationship between rail journey time and rail mode share vs aviation

Source: Network Rail Call for Evidence response to the Union Connectivity Review, Figure 77, p201 Technical Report 26th November 2021

There are two groups of city pairs of particular interest. The first is for city pairs where the current rail journey time is 4–4½ hours. These routes include Edinburgh/Glasgow–London and Edinburgh/Glasgow–Midlands. Here current rail share of the air+rail market is in the range 30–50%, with market share closely aligned to the rail journey time on offer. Taking an hour off these rail journey times would see rail market share rise to 75% or more. This is the set of flows where HS2 can have greatest impact.

The second set is a wide set of what would be thought of in rail terms as longer Cross Country routes. They can be summarised as multiple city pairs Aberdeen/Edinburgh/Glasgow/Inverness—Bristol/Cardiff/Exeter/Southampton (and Inverness–Birmingham). These markets could be susceptible to switches to rail, especially if a way is found to extend the HS2 network of services to run across Birmingham so that Bristol/Cardiff/Exeter/Southampton can be reached by services from Scotland having made use of new high speed rail infrastructure north of Birmingham.[7]

Over the last 15–20 years, domestic air travel has continued to grow with additional services amounting to six airports serving London/South East. Rail services have been improved, especially between Northern English cities and Glasgow/Edinburgh, resulting in a growing rail market too (see Figure 6). This is a strong and growing base on which to build.

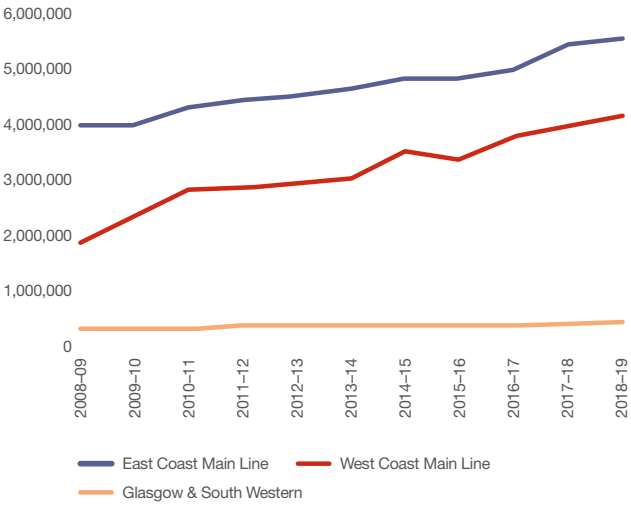


Figure 6: Annual cross-border rail journeys between England and Scotland by route

Source: Network Rail Call for Evidence response, using MOIRA1 data, for Union Connectivity Review 2021

7. See http://www.greengauge21.net/rail-investment-for-the-north-midlands-how-to-make-it-happen/ for an overview of how this can be achieved.

Transform Scotland has estimated that between 2005 and 2015, with rail offering faster journeys following the West Coast Route Modernisation programme, rail market share grew from 20% to 33%, with air travel declining from 80% to 67%. This was estimated to have led to a reduction of greenhouse gas emissions over the period of approximately 700,000 tonnes because of the modal shift people chose to make.

Impact of HSR on Car Traffic

High speed rail doesn't just reduce the need for short-haul air travel, it also has a clear impact on road traffic. This is illustrated in Figure 7 which shows traffic levels on three major French motorways over 15 years. In this diagram, two of the motorways are not in competition with a TGV route (Paris to East France [A4] and Paris to Normandy [A13] while one is in direct competition with a new TGV line (Paris to Lyon [A6]).

While all three were on the same growth trend before the launching of TGV service between Paris and Lyon, the effect of TGV was immediate on the A6, and traffic growth suddenly tailed off in 1982. The traffic on the other motorways was not affected. In 1990, the Paris Lyon High Speed Line was extended by 150 km, saving an additional 40 minutes travel time, and the growth of motorway traffic on the A6 was again curtailed.

High speed rail has an impact on traffic levels on parallel motorways. In these earlier cases, there was a flattening of motorway travel demand growth. As with air travel, there is clear evidence of modal shifting from car to high speed rail.

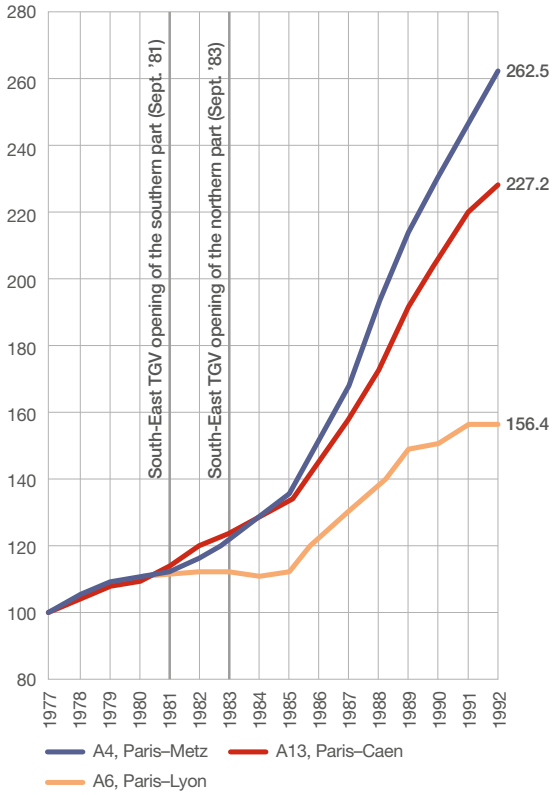
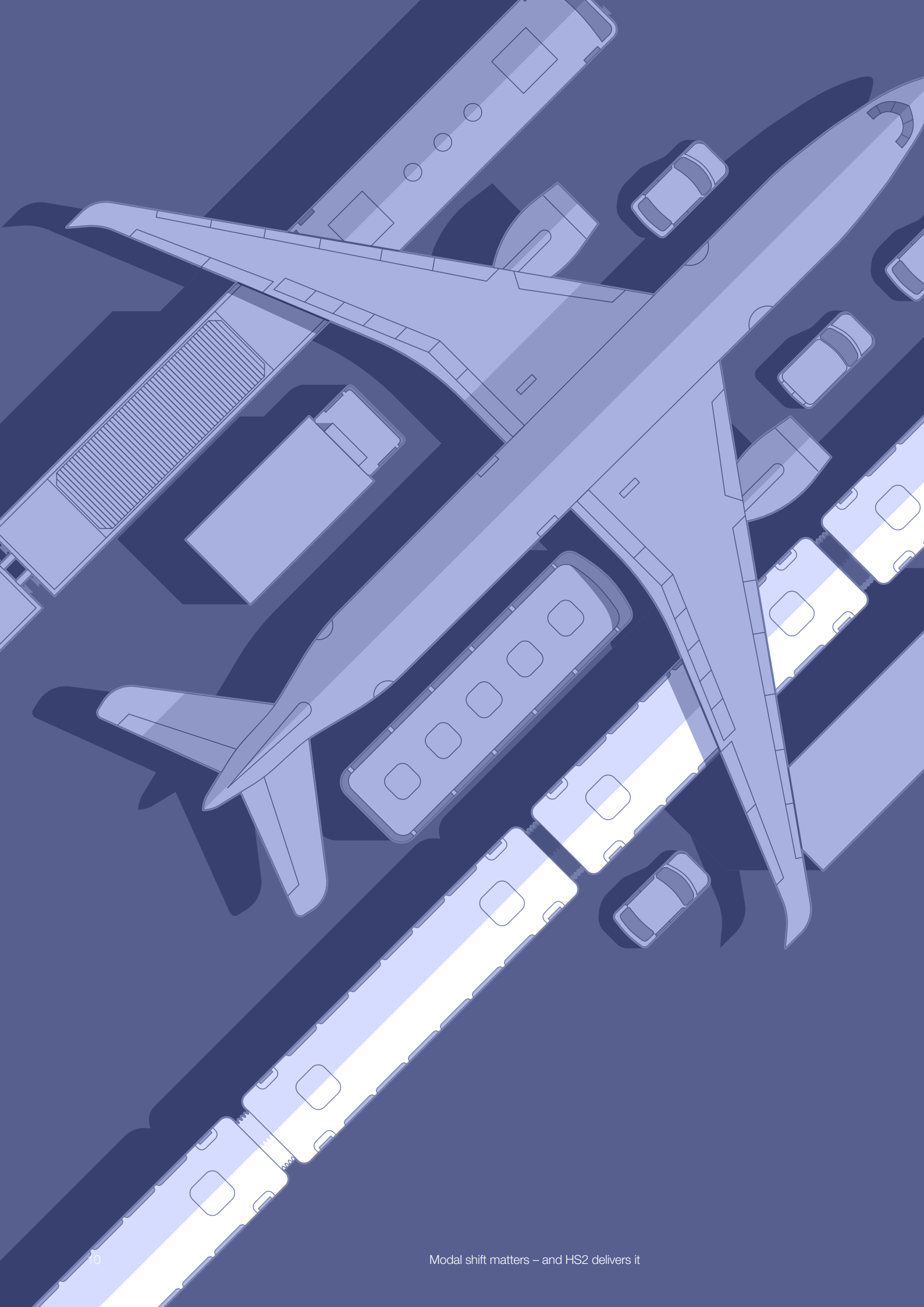


Figure 7: Motorway traffic growth (base 100 in 1977) and the effects of high speed rail



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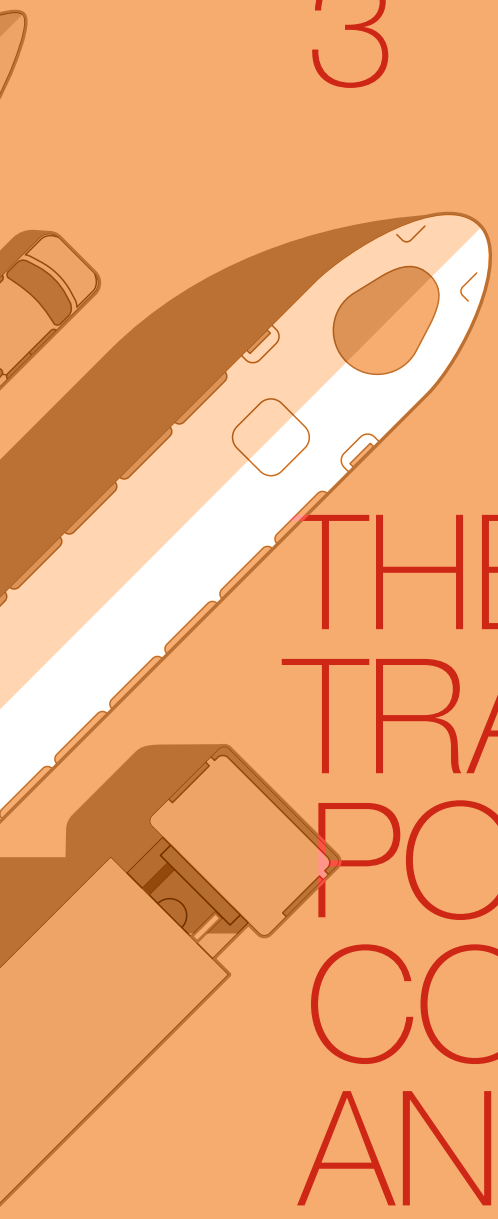


THE WIDER TRANSPORT POLICY CONTEXT AND HS2

A recent Network Rail survey has shown that while two-thirds of the public recognise rail as a 'greener' mode of transport, 73% still primarily use cars to get around.

Of the 2,000 people surveyed, 67% said they would consider using the train instead of a car for a day out with friends or family, and 55% would also consider using the train for travel to a big music or sports event. Train is seen as a good option for what can be broadly defined as leisure travel, which is a far bigger travel segment than commuting and business travel combined. The survey was carried out as part of the industry-wide 'We Mean Green' campaign.[8]

As in other areas of public behaviour, in transport there is often a need for both push and pull factors to bring about desired changes.

The switch to electric power is creating very cheap motoring for those who can afford new electric vehicles and for whom home charging is feasible—currently a strong (if selective) 'pull factor'. And in London there is now an Ultra-Low Emission Zone, applicable 24/7, applicable over a much wider area than the congestion charge and requiring drivers of older diesel/petrol vehicles to pay a £12.50 entry charge—a 'push factor'—and since June 2021, there is one for central Birmingham too.

London has the advantage of a comprehensive user-friendly public transport system with inter-modal ticketing, of course, to provide good alternatives to car use and often provide a way to avoid the ULEZ fee. There have been many calls for 'London-style' public transport in the UK's other major cities, and Government is moving to support this with investment of £360m in contactless ticketing systems.[9] Government has also allocated £6.9bn to what amounts to a catch up spend on urban transit systems. These measures have good business cases as free-standing developments. They will also help gain public acceptability if/when cities other than London and Birmingham come to introduce their own congestion or ULEZ charging zones.[10]

What helps gain public support for change in travel behaviour is a sense that there is a 'joined up' plan, rather than measures taken in isolation. It seems quite likely that these measures at an urban level could be the starting point of a system of road user charging at a national level.

8. https://www.networkrailmediacentre.co.uk/news/public-see-rail-as-green-but-many-still-use-cars-network-rail-survey-finds.

9. https://www.gov.uk/government/news/360-million-investment-to-transform-rail-ticketing-across-the-country.

10. Bath and Portsmouth also now have air quality-based charging systems in place and other city schemes are following.

Limits to changing travel behaviour

Useful evidence on the acceptability of charging and the need for attention to be given to the alternatives so that people are not 'forced to pay' comes from Manchester in 2008. Here, a plan to charge road users first and then use the proceeds partly to fund public transport alternatives was thrown out by public poll: 'give us better alternatives first" is a fair summary of the post-poll assessment. For urban areas, better facilities for walking, cycling and bus and tram networks are likely to be needed before a London-style congestion charge is likely to gain public acceptance elsewhere.

These measures across urban areas, large and small, could form a basis on which to apply national scale road user charging without, in the next 10–15 years or so, penalising those living in rural areas, where travel distances are longer, active travel options are less realistic, and public transport is in short supply.

Understanding what is currently uncharted territory—national scale road user charging—is important, because it may be the context in which HS2 is launched in the 2030s, and a key factor in travel mode choices. Without road user charging in place, HS2 services could be competing for customers against a mode with very low operating costs (untaxed electric cars). If this is the case, then the motorway/trunk road network to which HS2 provides an alternative, is likely to be congested, as (electric) car users escape vehicle and fuel taxes and elect to travel more. What won't work, as was shown 30 years ago, is a policy of expanding road capacity to cope. But travellers are likely to be attracted to HS2 and to rail in numbers well above current projections if road user costs remain minimal for electric vehicles.

In practice, road use cannot continue to be offered at zero cost to consumers, for two reasons:

1. HM Treasury would **lose around £40 billion a year** (around 5% of government revenue), equivalent to about £750 per adult in the UK. Most of this comes from (fossil) fuel duties, which in 2019–20 was expected to raise £28 billion in their own right plus an additional £5.7 billion from the VAT payable on the duties. Another £6.5 billion comes from vehicle excise duty (VED).[11] Based on unchanged fuel duty and VED policies, the Office for Budget Responsibility's July 2021 report estimated a loss of 1.5 per cent of GDP.

2. Any reduction in motoring costs—such as cheaper per milage costs with electric vehicles, **incentivises more road use**, more private car travel. Leaving aside the adverse safety and wider social and environmental impacts of more road traffic (even if 'electrified'[12]), this means more road traffic and economically damaging road congestion.

11. https://ifs.org.uk/publications/14407

12. Electric vehicle emissions include health damaging particulates from tyres and brakes; most traffic noise is tyre/surface, not from engines.

So when, as would seem likely, Government introduces wider, possibly national, road user charges,[13] the introduction of HS2 services could be a great facility to have available as an alternative to more expensive journeys by car. HS2 offers the twin benefits of faster journeys and the extra capacity needed to accommodate a significant switch of travel modes between the nation's largest cities. Indeed, the existence of HS2 (with its high speed services extended along the major motorway corridors) could help reduce public resistance to introducing wider road user charging.

To offset the financial losses from disappearing fuel duties, US-style EZ-pass tolls on motorways could be applied. Here in the UK, for longer distance trips (over 50 miles) using the national motorway network there is almost always a rail option available.[14] And, as noted, with HS2 there is scope both to offer a faster and more attractive alternative, and the extra rail capacity available at a corridor level needed to accommodate significant levels of transfer from road to rail.

As yet there is no policy or plan for introducing road user charging nationally, and HS2 could function perfectly well without it. But it would be competing against a low-cost, congested, slower and less reliable, road alternative.

A nation-wide user charging system for road use is a likely outcome but experience suggests it will meet public resistance unless it is part of a wider programme to improve transport. HS2 and the scope it offers for large-scale modal shift, could be a key part in the way forward as cars are decarbonised.

At the early stage of planning HS2 and assessing its business case, of course it is right to judge the investment, on its merits and not compounded with other policy initiatives. But just as there will be an important decision to be taken on HS2 fare levels, so too is there an important decision to be taken on road user charges.

13. Road user charging looks like it might becomeEE an inescapable accessory to transport decarbonizing the transport sector. A Social Market Foundation report of October 2021 found that when road-pricing is presented as a replacement for existing road and fuel duties, public support rises and resistance is reduced.

14. Longer distance trips using orbital motorways around cities may of course entail travelling in and out of city centres. The combination of Thameslink and Crossrail (when it is open, with a convenient central London interchange at Farringdon) will help deliver this outcome for many journeys across South East England.

4

MODAL SHIFT FORECASTS FOR HS2

Here, we examine the way in which forecasts of demand for HS2 services have been developed.

Published figures on modal shift to HS2 are small—and as we will show—misleadingly so. Unfortunately, they have led commentators to assume negative positions on the project, for example:

> **"Even HS2 Ltd suggest that only 1% of HS2 travellers would otherwise fly, and only 4% would have driven"**[15]

These are indeed the numbers that emerge from the models, so we seek here to understand why these proportions are so low—indeed much lower than those experienced on Britain's only operational set of HSR services, on HS1, where 4 million out of the 26 million domestic and international travellers carried annually had switched from cars and flights (an overall modal transfer of 15%).[16]

The demand model used in HS2 business cases (Planet Framework Model – PFM) is well-established and is owned by DfT. It is an 'all-day' model and therefore takes no account of peak period travel conditions.

The application of PFM for HS2 makes only a limited attempt to optimise the assumed timetables on existing lines when HS2 is introduced. All 'freed up' paths are assumed to be used, but, in some cases, such as over the West Coast Main Line north of Preston, it is assumed that the addition of a HS2 train would necessarily lead to the removal of a pre-existing service.[17] Indeed as the HS2 Full Business Case makes clear, the model:

> **"assesses the extent to which HS2 and the associated capacity released attracts new demand (although the potential for additional services on the existing network, which are made possible by the released capacity, is not reflected in PFM)."**[18] [emphasis added]

Whereas the strategic part of the model addresses both induced demand and diverted demand, there are also three regional models (Planet North, Midlands and South) from which results are taken and merged with the long distance results. These regional models use simplified elasticity models that do not generate separate estimates of modal shift. This is a key reason why the overall total (national) levels of modal shift arising from HS2 are too low.

15. C Wolmar, RAIL 940, September 2021.

16. Dyan Crowther, CEO HS1 Ltd, Railway Gazette International, October 2021.

17. Such a change would lead to offsetting 'disbenefits' and a reduction of rail mode share for the journeys affected, attributable to HS2.

18. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/939905/full-business-case-hs2-phase-one.pdf (p47).

For specific city pairs, the projected impact of HS2 when it opens is much greater, as is shown in Table 3.

Table 3: Modal shares (%), with and without HS2 London–Glasgow/ Edinburgh—design year

	Without HS2			With HS2		
	Rail	Car	Air	Rail	Car	Air
London–Glasgow	47	2	50	70	2	28
London–Edinburgh	67	0	33	75	0	25

Source: SYSTRA/HS2 Ltd

Here, using data taken from the model used to generate HS2 demand forecasts, it can be seen that rail mode share in the design year (mid 2030s) increases substantially with HS2, growing for example from 47% rail without HS2 for travel between London and Glasgow to 70% with HS2. There is a similar (but smaller shift) in the case of Edinburgh–London where the rail base market share is higher. These results have not previously been published, but they are in line with the air-rail demand curve presented earlier in Figure 5. As far as the air-rail shift is concerned, they show a significant transfer at this city pair level that is simply masked in a presentation of passenger numbers for the whole of the nation.

But it will be noted that car shares of the city to city journeys shown in the table above remain very low (0% and 2% respectively)—and this is inconsistent with the evidence we presented earlier on car-rail switching following the introduction of high speed rail (Table 2).

This is likely to be due, at least in part, to the small sample sizes on specific car travel origin-destination data available from the national travel survey. We understand that attention is now being given to improving understanding in this area, using ‘’big data’ sources—such as anonymised mobile phone data to provide a proper sample of long distance trips by car. It would seem likely that this will increase the level of long-distance car movements represented in the HS2 business case demand modelling, better reflecting actual travel patterns. This is of course of relevance to understanding the positive modal shift impact that HS2 would bring. If it is wrongly assumed there are very few car journeys made in Britain over longer distances (including between large cities) then the scope for modal shift when rail is much improved (HS2) will have been under-represented.

Trend-based growth assumptions

There is another underlying issue with the demand model used for assessing HS2. The projections of modal shares are for a ‘design year’ in the mid-2030s, to examine and contrast ‘with’ and without’ cases. This requires background projections of how demand for each travel mode is likely to change between now and 15 years or so hence. For these projections, DfT has standard guidance which reflects current policies.

Of particular relevance are assumptions on rail fares and on private car operating costs—and in particular fuel prices. Rail fares are assumed to grow in real terms at RPI + 1% but fuel prices are projected to fall dramatically in line with Government's expectations of a rapid take-up of electric vehicles. Unlike today's petrol and diesel which are heavily taxed, electric vehicle energy is untaxed. The net effect is that for consumers, rail costs are assumed to have increased significantly whereas car costs are assumed to fall dramatically. With no plan for road user charging system in place to recoup the lost tax income from fuel duty, this creates a strong background growth in car use and a decline in rail use over time. This is a hidden modal shift mechanism working against a transfer to rail year-on-year, baked into the demand models used to appraise HS2.

Conclusion

In summary, the published modal shift numbers used in the HS2 business case are not, we conclude, a good indicator of what is likely to happen in practice when HS2 services start up. The 1% from air and 4% from car numbers are misleading because:

- They are mode shifts expressed as percentages for travel across the whole nation, not just the corridors where HS2 services will operate
- The possibility of additional services on the existing rail network made possible by HS2, for instance at currently under-served intermediate stations, along with the changes in mode choice they would bring, are yet to be properly investigated
- Three of the four models used cover journeys of less than 50 miles where modal shifts are not separately identified
- The data available on car travel understates long distance journeys that would be attracted to switch modes if high speed rail was available.

It is also the case that:

- The published mode shifts are much smaller than has taken place upon the introduction of services on HS1 across Kent, where modal shifts of around 15% have been observed
- The assumptions made on prices for rail and car modes over the next 15–20 years assume that rail fares will increase at the level of inflation +1% per annum (which is current policy), but car users are assumed to get the benefit of a switch to electric vehicles which have no tax and for which no road fuel duties apply either, and these assumptions will distort the operation of the modal choice elements of the forecasts too.

When the focus is drawn more tightly around where HS2 services will operate, for instance between London and Glasgow, significant modal shift occurs (rail market share growing from 47% to 70%, for example).

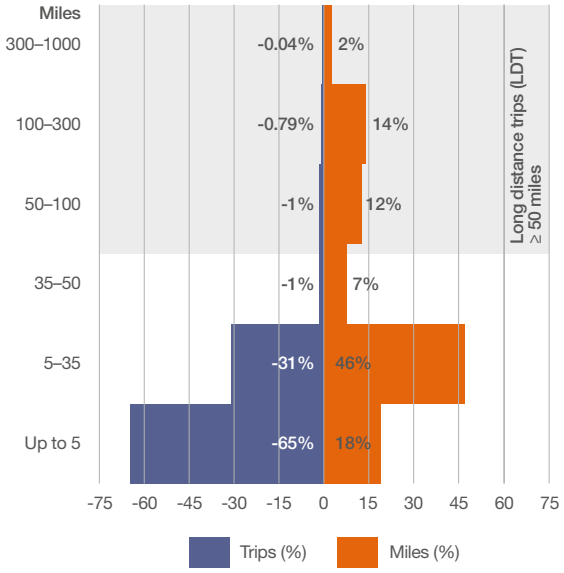
5

LONGER DISTANCE TRAVEL IS CRUCIAL FOR NET ZERO

Longer distance trips of over 50 miles account for under 2% of the trips people make, but nearly 30% of their travel mileage (see Figure 8). It is travel mileage that is relevant when it comes to assessing carbon emissions and the measures necessary to reduce them.

For longer distance car journeys, the alternatives to petrol/diesel are not quite so suitable as those for short and medium distance travel. Battery power for longer journeys requires a huge investment in rapid-charging systems for intermediate top-ups, and intermediate stops for re-charging.

For HGVs and coaches, the adopted technology might be hydrogen rather than batteries, but both technologies worsen power/weight ratios. When Highways England and Network Rail looked together at what each mode could do best along the Southampton-West Midlands Corridor in July 2021, they concluded that rail is more cost effective than road over long distances and for high loads.[19]

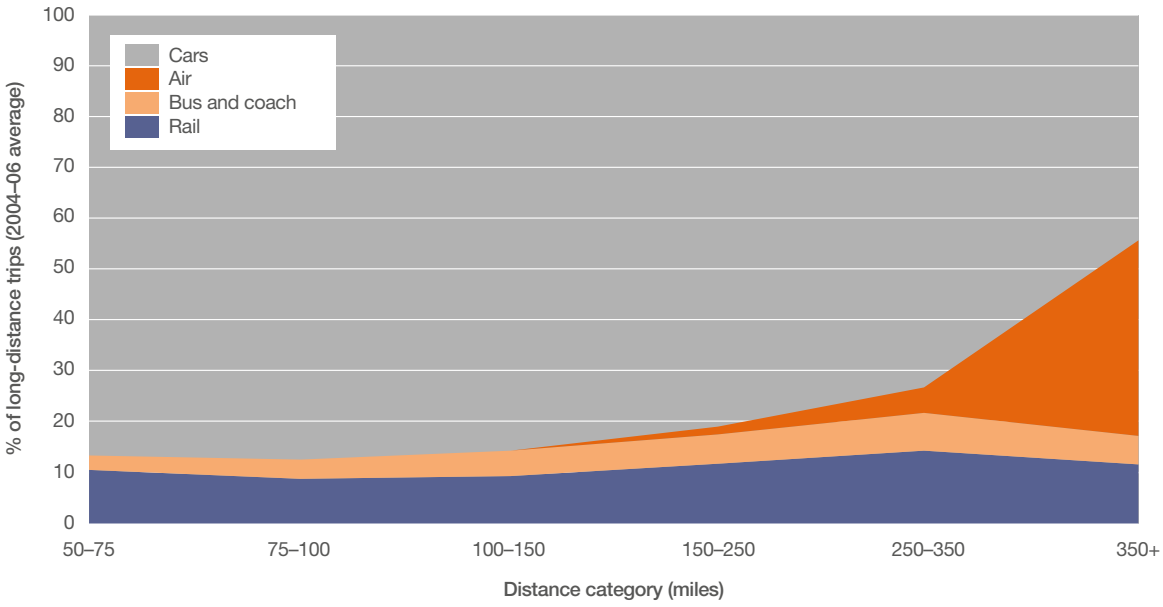


Annual per capita mobility in England			
	Overall	LDT	% LDT
Miles	6,600	1,900	~30%
Trips	780	19	~3%

Source: NTS 2015–2017, pooled weighted N=46, 603.

Figure 8: Distribution of trips and trip-miles by journey length
Source: https://tps.org.uk/public/downloads/6wbpV/Anable_TPS_DEC%202020_V1.pdf

19. See also 'The value of freight', Vivid Economics on behalf of the National Infrastructure Commission https://nic.org.uk/app/uploads/Future-of-Freight_TheValue-of-Freight_Vivid-Economics.pdf p37.



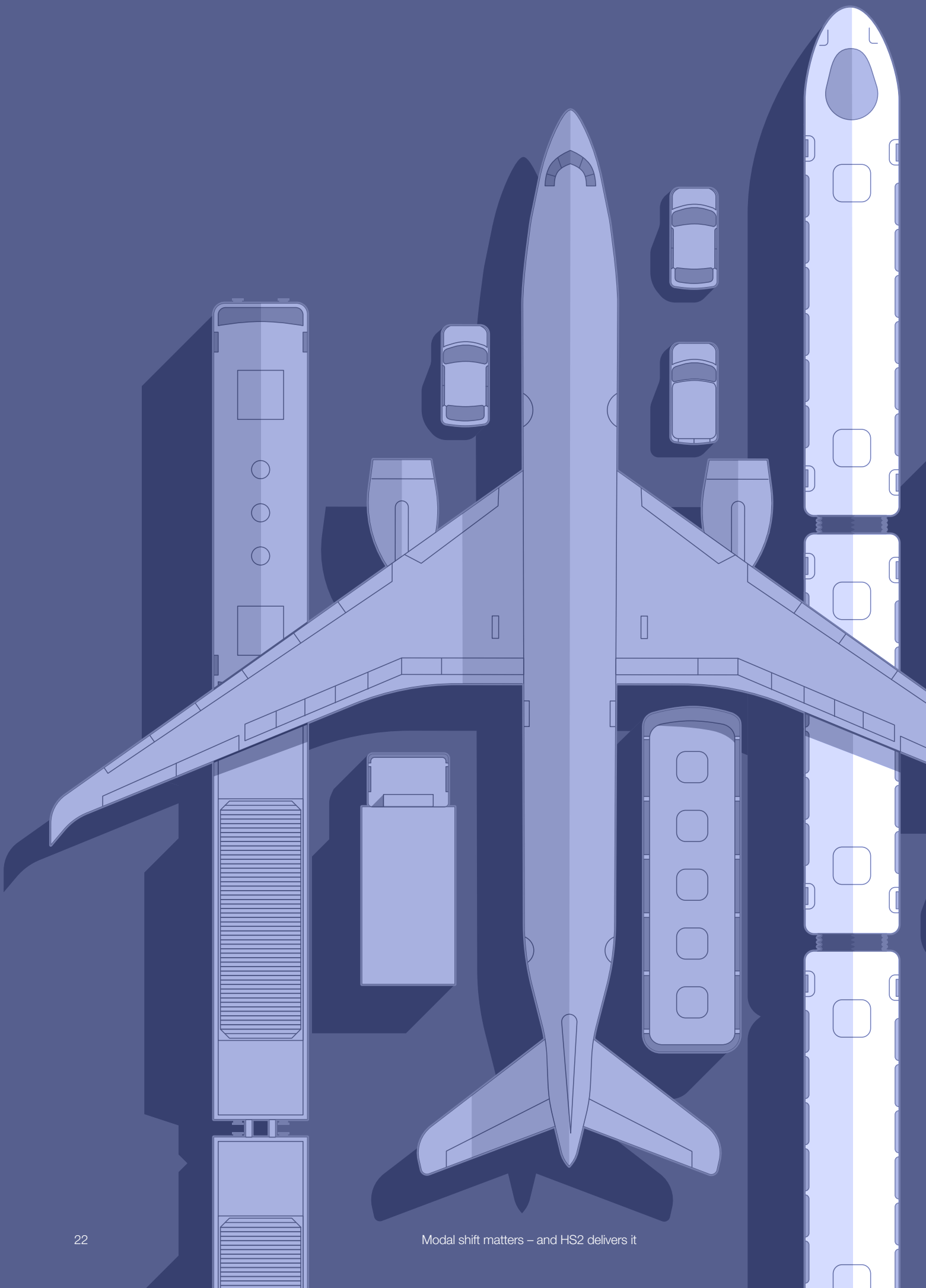
Choice of travel mode is very dependent on travel distance. Currently, private car dominates travel over all distances but across medium and longer distances, rail is the main alternative, as shown in Figure 9. Here choices of travel mode are shown as journey length varies (benchmarking typical journeys along the west coast corridor as an illustration). Over longer distances, aviation captures significant market share for within-UK travel (very largely Anglo-Scottish and Northern Irish markets). Air travel was estimated to account for approximately 40% of the demand for journeys over 350 miles 15 years ago.[20]

Figure 9: Market shares (by mode) of long-distance travel

Source: Systra analysis.

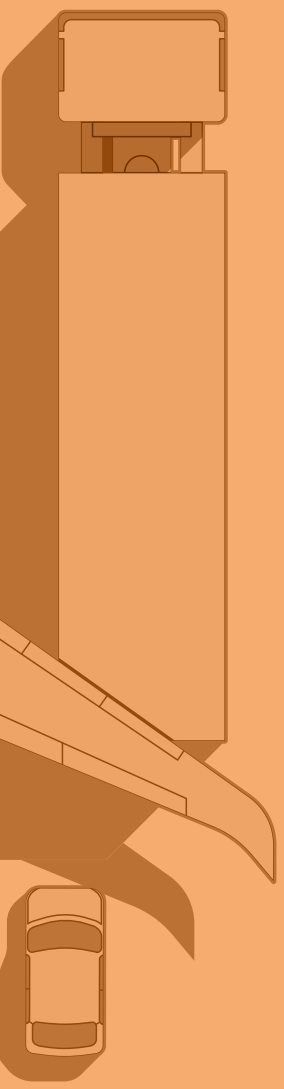
Since this analysis was carried out, domestic air travel has continued to grow, although it suffered a setback following the 2008–09 global financial crisis. Rail demand has also grown substantially, including on the West Coast Main Line Intercity services where demand in 2014 was three times the level of 1997.

20. DfT National Travel Survey, 2004-06 average. Department of Transport (2004-06). National Travel Survey. http://www.dft.gov.uk/pgr/statistics/datatablespublications/personal/methodology/ntstechreports/



6

FREIGHT



The UK will become the first country in the world to commit to the sale of zero emission heavy goods vehicles (weighing 26 tonnes and under) by 2035, with all new HGVs sold in the UK to be zero emission by 2040, as the UK government has confirmed in November 2021.

As with forward thinking on person travel, the emphasis has been on decarbonising road transport rather than looking at switching mode to alternative low/zero carbon alternatives. With congested networks, there may even be an unspoken presumption that there is no room on the national rail network for additional freight flows transferred from road. But this is not the case.

The analysis that follows draws heavily on a programme of work that has been led by Julian Worth, Chair of CILT's Rail Freight Forum.[21] As he acknowledges 'there has been little or no analysis of the overall potential for modal shift'. His own work draws extensively on DfT's freight statistics contained in the Continuing Survey of Road Goods Transport (CSRGT).

The current prognosis for battery powered heavy goods vehicles (HGVs) limits their range and payload (to around 100 miles and 15 tonnes, respectively) well shy of diesel HGV capabilities. As Worth says:

'What is not remotely in prospect is a viable alternative to diesel in a 44-tonne [long-haul] HGV'.

But there are trials of electrified motorway lanes designed for HGVs with twin pantographs. As Will Wilson , CEO Siemens Mobility explained in a recent interview, current trials use hybrid diesel/electric HGVs, but he added: "the biggest challenge … is actually how to get … modal shift". For many observers, it's not the technology that is in doubt, but the risks around rare events such as de-wirements on mixed-traffic motorway environments.

Another option for HGVs is hydrogen/fuel cell. But as with battery power solutions, transporting hydrogen for use in powering fuel cells adds to vehicle weights and limits payload/range for HGV applications. This problem is not so critical when considering equivalent applications for rail services.

Switching to railfreight in the near term

Changes in the logistics sector are already seeing traditional road freight flows switch to rail. The recent start-up of regular shorter distance freight trains—for instance, those between Liverpool Docks and West/East Midlands (trip lengths around 100 miles)—helps bury the myth that rail freight is only suitable for long distance flows. But it is true that it is over longer distances that the greatest gains in carbon reduction are to be found, and here too, where the basic economics favour rail.

21. This work is summarised in the April (p75ff) and September 2021 (p72*ff*) editions of Modern Railways.

Most of today's railfreight is diesel-hauled, but even so, a switch from road haulage still achieves a 70% reduction in carbon emissions. A number of small infill electrification schemes would permit many more freight services to be electrically hauled over long distances. Worth identifies five priority schemes with a total route length of just 50 miles which carry 2m train-miles each year. Capital costs would be modest—in the £100m–150m range.

A plan for the medium/longer term

Building on the current trends which will likely see railfreight return to routes where it is currently absent (for instance over the relatively long route from the Midlands to South West England), Worth suggests:

'in the absence of a viable zero-carbon HGV, an emerging new model of logistics is to trunk by electric rail and distribute by battery truck'.

Worth's analysis of the national database for freight movement—CSRGT—centres on existing road flows over 200km and bulk commodity flows of over 100km. These are ranges within which there are already commercially successful railfreight operations. While only 16% of HGV tonnes lifted is for flows in these categories, Worth finds that over half of HGV tonnes kilometres (tkms) (52%) are in these longer distance movement categories. (The average length of HGV hauls is around 200km). This finding, of course, mirrors the key assessment we made earlier in relation to the significance of longer distance person travel.

Not all of these longer distance freight flows are readily transferable to rail—where volumes are insufficient to make rail services viable, for example. And then there is the key question of available capacity for additional railfreight paths on today's rail network. After considering these points in the second part of his analysis, Worth concludes that:

'rather more than one third (38%) of all HGV tkms make up a realistically addressable market for rail over the next 20–30 years'.

Half of this addressable market he suggests consists of very long HGV trips (over 300km), accommodated largely on multi-customer trains, mainly using intermodal swap bodies, with refrigerated units being used as needed.[22] Several private sector funded Strategic Rail Freight Interchanges will be needed to make this a reality.

Worth calculates, that with each additional freight train replacing around 50–80 HGV movements, most main lines would see an extra 1–2 freight trains in each direction through an assumed 16-hour day. In general, this may be feasible, but Worth identifies two corridors where throughputs needed would be around 3–4 freight trains/hour in each direction and today's railway wouldn't be able to cope.

22. Tesco has just commenced a new long-haul refrigerated unit load operation by rail between London Gateway and central Scotland, twice a day, seven days a week. It is seen as a breakthrough. It will take at least 17,000 containers off the road each year, saving Tesco 7.3 million road miles and nearly 9,000 tonnes of CO2e.

The first of these two corridors links the UK's largest container port to the Midlands and North: the Felixstowe-Nuneaton route. Here remaining single track sections would need to be eliminated, key junctions would need attention and the route, he suggests, should be electrified. This will support freight flows from the country's biggest container port to the North of England, Scotland and some parts of the Midlands.

For services between Felixstowe and the major distribution centre at Daventry, the best route would be over the new (planned) east-west rail link between Cambridge and Bletchley. With an opening date perhaps around the mid-2030s, this route would support a major switch from road haulage, but the additional rail freight paths needed could not be fitted on to today's busy West Coast Main Line between Bletchley, Milton Keynes and Daventry.

While this a relatively short operation along the West Coast Main Line, it will need HS2 (due for opening on a similar timescale) to free up the train paths needed.

The West Coast Main Line and HS2

The dominance of the West Coast Main line for railfreight is reflected in the projected distribution of freight trains across the national rail network shown in Figure 10.

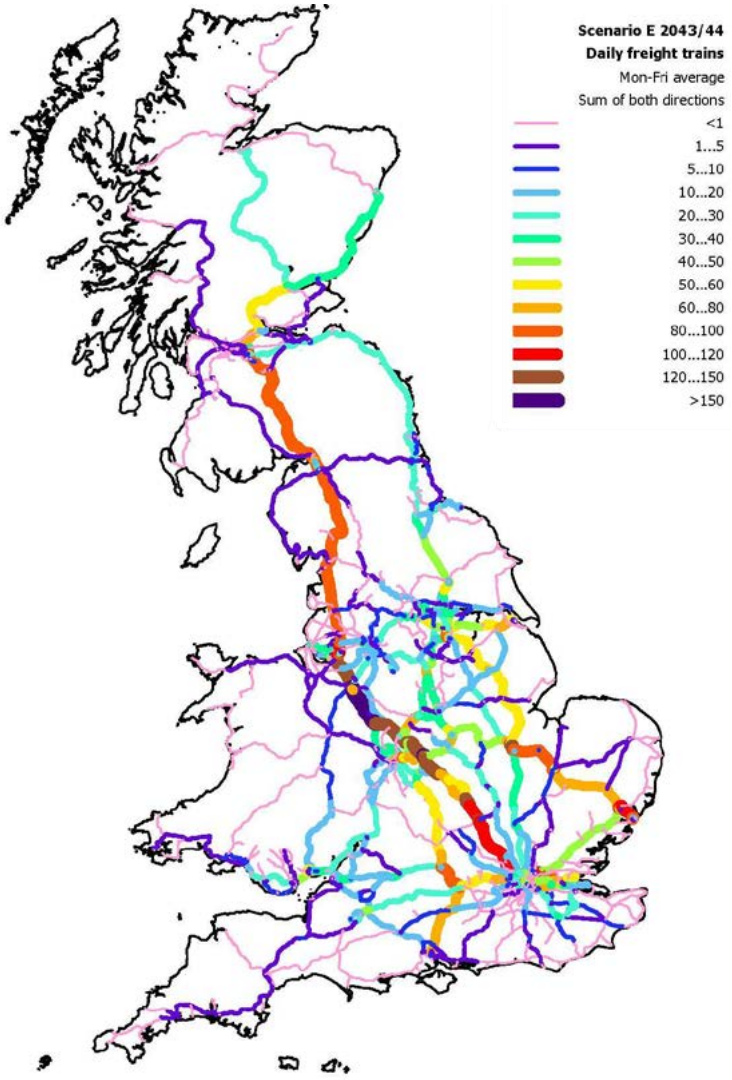


Figure 10: Rail freight flow density, 2043/4

Source: Routing of rail freight forecasts, A study for Network Rail by MDS Transmodal (2020), https://www.networkrail.co.uk/wp-content/uploads/2020/08/Routeing-of-rail-freight-forecasts.pdf

There are already 14 intermodal trains each day across the Anglo-Scottish border and these replace about 1000 long-distance HGV movements daily.

Worth's analysis suggests that the second route that would need to accommodate 3–4 freight trains/hour through a 16-hour day is the West Coast Main Line. As Worth points out:

'With HS2 Phase 1 under construction and Phase 2a to follow, WCML should have sufficient released capacity'.

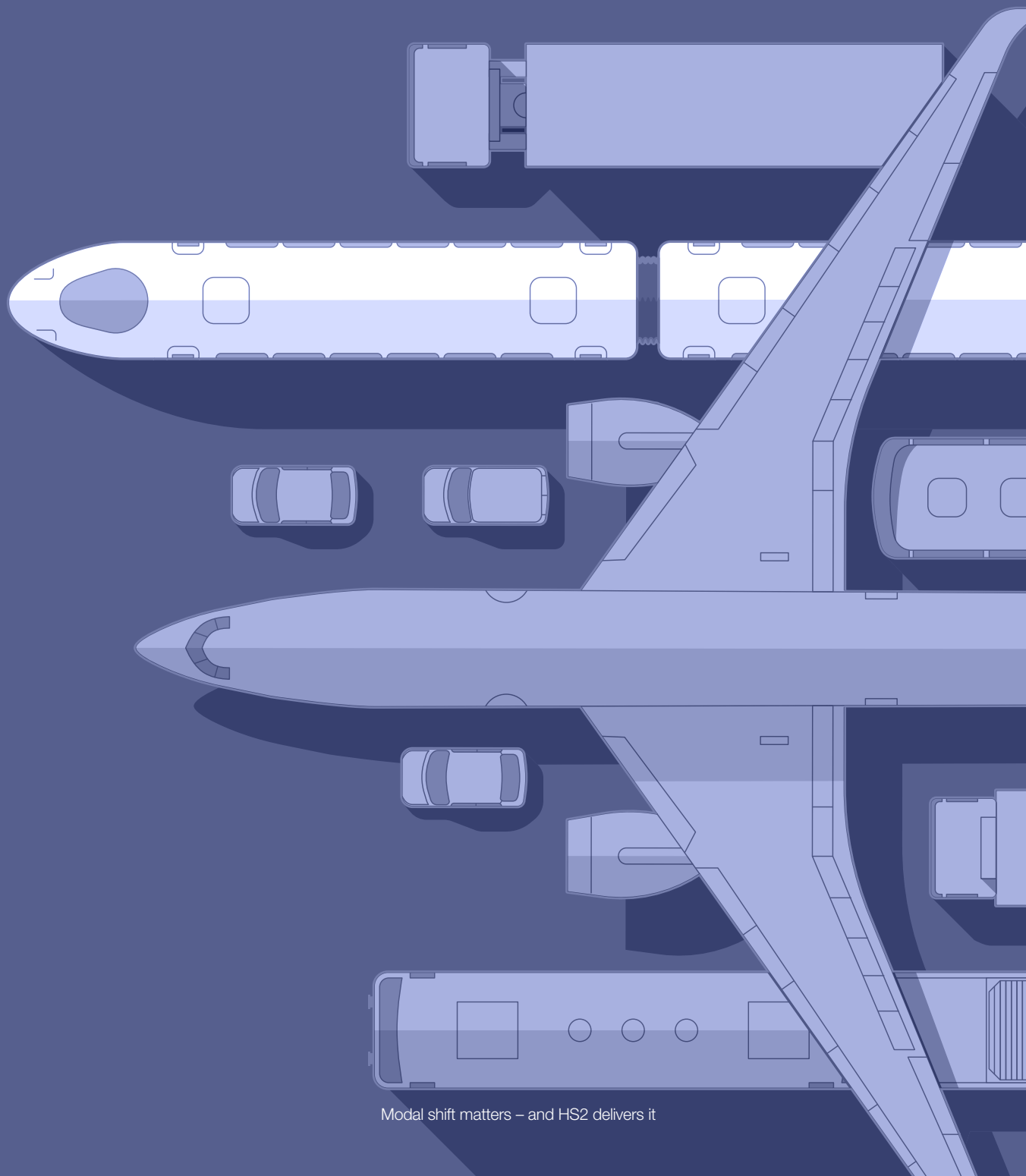
North of Crewe there are capacity constraints for which Worth identifies a flighted timetable pattern and the use of long, fast entry/exit freight loops, the re-introduction of the separate freight lines through Carlisle and the diversion of slower freight trains to parallel routes.

Summary

Around 38% of HGV freight mileage could be replaced by railfreight. Modal shift is as important (perhaps of greater importance) in the freight sector than for person travel and can make a significant contribution to national carbon reduction ambitions. Indeed, it is unclear whether as of today, any viable alternatives exist.

Inescapably, the country's busiest freight corridor (the West Coast Main Line) would be where a lot of the freight that switches to rail would need to be carried. HS2 is necessary to accommodate the scale of modal shift envisaged with freight trains running over the section paralleled (and relieved by) HS2 Phase1/2a.

North of Crewe (the currently committed northern limit of HS2), accommodating additional freight can be achieved by a set of measures including lengthy freight loops. The Union Connectivity Review has already identified this section of line as the number one priority to improve connectivity across the UK as a whole and suggest part of the investment needed might be an extension of HS2 from Crewe to Preston.



7

ANGLO-SCOTTISH CONNECTIVITY

As we have seen, the most significant air market that could be addressed by high speed rail is between Scotland's central belt and London and a significant part of the huge opportunity to switch traffic from HGVs to railfreight also depends on using the West Coast Main Line across the England–Scotland border.

At the planning stage of HS2, twelve years ago, the Scottish Government's position on this matter was set out in Scotland's National Planning Framework document, and in the National Transport Strategy. As was the case in Westminster, the key concerns for Scotland were connectivity (to support economic growth) and reducing carbon emissions—see panel right.

Work undertaken by Network Rail and HS2 Ltd on behalf of the Union Connectivity Review demonstrated the potential for increased trips by rail if journey times are reduced. For assurance purposes, two forecasting models were used in assessment of the impact of HS2 Phase 2b rail journey time savings and also of further potential savings of 20, 35 and 50 minutes on rail journey times.[23] The outcomes from both models were broadly similar. In terms of air-rail modal share across the Anglo-Scottish border, the effect of faster rail journey times can be clearly seen in Figure 11. Note that in this diagram, the modal share estimates relate to travel between London and the whole of Scotland.

23. The first model used was a bespoke forecasting model to estimate choice of air and rail trips for journeys between London and the Scottish Central Belt and the second was the multi-modal forecasting model as used for HS2 analysis.

Scottish Policy on High-Speed Rail when HS2 was developed

While the expansion of direct air links has dramatically improved Scotland's international connectivity in recent years, air travel is making a growing contribution to greenhouse gas emissions. A key issue over the next 25 years will be how to maintain and enhance this connectivity, with all the economic and other benefits that this will bring, while tackling the challenge of climate change. Faster cross-border rail links would make the train more competitive with the plane for many journeys to and from London and other UK cities, potentially helping to reduce emissions from short-haul flights. The new Eurostar terminal at St Pancras offers opportunities for easier rail journeys between Scotland and the Continent. For most overseas trips and business trips between the north of Scotland and the south of England, however, flying is likely to remain the only practical option.

Cross-border road and rail links are of prime economic importance and congestion and lack of infrastructure outwith Scotland can have an adverse impact on access to Europe and other parts of the UK. The economic benefits of tourism can be spread more widely if more of Scotland can be brought within 3 hours of major English cities. There is a need to improve journey times and the frequency of rail services to key destinations such as London, Manchester, Leeds and Birmingham. Reducing journey times on routes between Aberdeen and Newcastle would improve the connectivity of knowledge economy clusters on the East Coast. Improvements to the West Coast Main Line would allow more cross-border freight to be moved by rail. The Scottish Government will work with the UK Government and other bodies to strengthen cross-border transport links.

Source: Scottish Government (December 2008), National Planning Framework 2

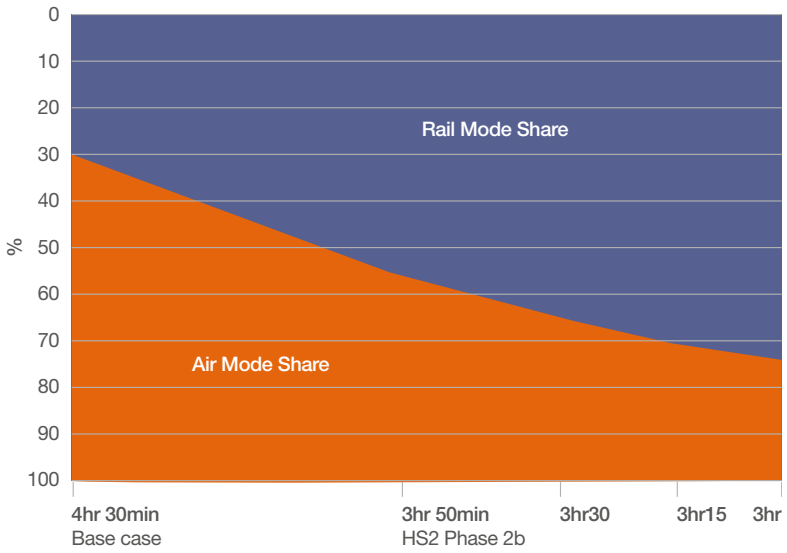


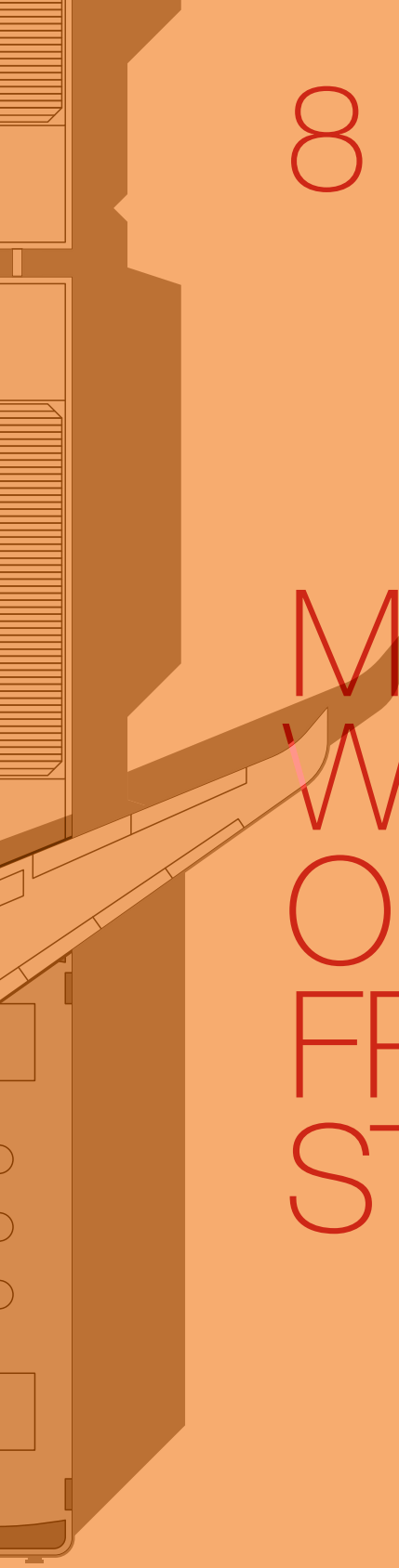
Figure 11: London–Scotland Air-Rail Mode Share as a function of rail journey times

Source: Union Connectivity Review, p40 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1036027/union-connectivity-review-final-report.pdf

"These initial estimates indicated that a three-hour journey time (London–Glasgow/Edinburgh) was forecast to increase the number of Anglo-Scottish rail passengers by around four million a year and increase rail mode share from the 2019 level of 29% to around 75%. It was also forecasted that journey times in the region of three hours would generate considerable transport user benefits and revenues over the lifetime of the scheme." [24]

As the Union Connectivity Review pointed out, the shift to rail from better London-Glasgow/Edinburgh journey times following the introduction of HS2 (as shown above) will also allow improved rail services for Midlands/North of England–Scotland journeys—and this is also true for rail journeys between England and places further north in Scotland too, such as Inverness and Aberdeen.

24. Union Connectivity Final Report p40.



8

MODAL SHIFT WAS AN OBJECTIVE FROM THE START

The drive to net zero has undoubtedly risen up the Government agenda, latterly through the UK's presidency of COP26. But sustainability has been a central aim of the HS2 project since its inception in 2009. Whilst some critics may seek to suggest they were first told that HS2 was all about speed, in fact reducing carbon emissions and modal shift have been consistent themes throughout HS2's development. Here we briefly re-examine the definition of high speed rail objectives when HS2 was initiated. We dispel any notion that sustainability was an afterthought or an attempt to attach HS2 to a new 'fashionable' agenda.

At the time that HS2 was being considered as a possible successor to the then newly opened HS1, the highly regarded and much-referenced Eddington Review was published in December 2006. It said that one of the key objectives of new transport infrastructure should be to provide capacity where it was needed to facilitate economic growth. High speed rail did not feature in the published report, but Sir Rod Eddington made clear his views on the need for high speed rail to the Transport Select Committee, soon after his report was published (see panel below).

Examination of Witnesses (Questions 60–79)

Transport Select Committee 16th April 2007: **Sir Rod Eddington**

Q60 Mr Martlew: But you have not given us anything for the future beyond that, have you?

Sir Rod Eddington: What I have not done is give you a list of projects. I tried to build a transport strategy and talk about what the priorities are because to give you a list of projects would have taken a lot more time than I had. What I tried to do was provide a set of criteria against what future projects could be based on. I made the observation, given the timescales (and you are right to talk about them), that making best use of existing infrastructure is essential to getting us where we need to go but by itself it is not enough, that we will need to make what I describe as some substantial investments to ensure that we can meet the transport needs of the country beyond 2015. I was quite clear about that.

Q61 Mr Martlew: So you accept that the things that we have both been talking about should be done by 2015?

Sir Rod Eddington: Yes.

Q62 Chairman: I think the National Audit Commission said that by that time the West Coast Main Line would be full to capacity.

Sir Rod Eddington: Yes.

Q63 Mr Martlew: If we are talking about a high speed rail of any sort, whether it is from north to south, whether it goes to Glasgow, Edinburgh or just Manchester or Newcastle, then the planning has to start now, has it not?

Sir Rod Eddington: I agree. We are looking at very long lead times. If you agree a transport strategy, and that needs to be pressure-tested, advisers advise and governments decide, so the Government should decide whether it accepts my findings or not, and if it can therefore deliver a transport strategy we then need to think about what it means in the most congested corridors and what is the best modal solution.

Q64 Mr Martlew: Really what you are saying is that high speed rail fits that particular bill. You may not be in favour of Maglev but high speed rail will fit that bill in those corridors that you have referred to?

Sir Rod Eddington: There is no doubt to me that in the most congested corridors—and you have spoken of them and, as you said, is it London/Birmingham/Manchester or is it London/Birmingham/Manchester and beyond—there should be a strong business case for trains in those corridors. That business case will live or die based on its strength in my judgment, and when I talk about investing in success I am talking about investing in places where the congestion charges are greatest, whether it is road or rail or port or airport.

The guiding principles for planning a UK high speed rail network used to help frame the work of HS2 Ltd at the outset were set out in Greengauge 21's Fast Forward report in 2009.[25] They are:

1. HSR routes need to be located such that they provide additional capacity for the national transport system where there is forecast to be unmet demand on the long-distance routes and create high-value capacity relief on the existing rail network

2. HSR needs to serve places which are capable of **stimulating economies** to achieve growth, regeneration and wider productivity benefits and to stimulate and support a sustainable pattern of development

3. HSR has to be planned to address the whole journey, to make it an **attractive, lower carbon, alternative to car use**

4. HSR needs to be able to **attract travellers away from short-haul aviation** to/from major international hub airports in order:

   - to free-up runway capacity for more valuable longer-distance services or
   - to reduce carbon emissions, or
   - to provide a suitable HSR service in cases where it has been found necessary to withdraw air services that have a significant effect on business travel and the economy.

25. http://www.greengauge21.net/fast-forward-a-high-speed-rail-strategy-for-britain/.

The first principle concerns capacity, the second the economy, and the third and fourth modal shift to reduce carbon emissions. These are not new arguments: they have been the driving purpose behind HS2 from the outset.

By this time (2009), the national rail network was busy, but not as congested as it subsequently became. The most congested longer distance route was the West Coast Main Line from London through the West Midlands to Cheshire. This is why Greengauge 21 suggested, in its earlier report of June 2007, following the re-branding of the Channel Tunnel Rail Link as HS1:

"The next step—High Speed Two—is to build a line … [to] … connect the centre of London with the centre of Birmingham and with the North West."

This was the context in which Government established HS2 Ltd to develop, as a first stage, a detailed costed plan for the London-West Midlands section of what was envisaged to be developed into a wider, Y-shaped, high speed rail network for Britain. The report describing this plan and its policy context were published in March 2010.[26]

The first sentence in a two-page summary of its assessment of why high speed railway was needed reads:

"The Government's assessment is that over the next 20–30 years the UK will require a step-change in transport capacity between its largest and most productive conurbations, both facilitation and responding to long term economic growth."[27] [emphasis added]

The report also noted the Eddington study's observation on the potential for road pricing, but concluded that it was 'not currently technologically feasible'.[28]

With HS2, Government had three stated aims from the beginning: capacity, connectivity and sustainability. Under the latter heading, it explained that the need for sustainability was in particular driven by the (then) need for a reduction in carbon emissions of 80% by 2050, which it explained would entail 'promoting lower carbon choices' and 'using market mechanisms to encourage a shift to lower carbon transport'.[29]

So, for Government, modal shift was an objective from the start of its planning for HS2. It saw this as being needed to help achieve national carbon reduction aims which have in the years since been significantly enhanced.

26. High Speed Rail, DfT, Command paper 7827, March 2010.

27. Ibid. p8.

28. Ibid, p29.

29. Ibid, p33.

9

CONCLUSIONS

The evidence is compelling

The ability of high speed rail to influence people's choice of travel modes is well-documented. The evidence presented here shows that, when it comes available, travellers will switch from car, from air and from other travel choices, and switch destinations to make use of the advantages that high speed rail travel confers.

Modal shift will happen with HS2, just as it has around the world where high speed rail services have been provided—and indeed in Britain, across Kent following the opening of HS1.

The opportunity for modal shift from **air travel** to high speed rail in Great Britain is greater than in France, Spain, Italy and Germany where national high speed rail networks have been introduced. This is because Great Britain has a more developed, competitive set of domestic air services. These services are also more concentrated than across continental Europe. So, whereas for longer distance travel, in these four major continental European countries domestic air travel accounts for only 2%–6% trips, for the UK this proportion is much higher (14%).[30]

The potential shift from road travel is also well-documented (although currently under-represented, as we have seen, in DfT/HS2 forecasts partly because national travel survey data is patchy on location-specific long-distance car travel[31]). But where high speed rail has been introduced elsewhere, growth in parallel motorway traffic has stalled.

Looking ahead, while electric vehicle use will no doubt grow strongly once charging infrastructure is expanded, this solution works best for shorter and medium distance travel. It is for longer distance travel that the availability of a better option would be most helpful.

Why Modal Shift matters

The potential contribution that HS2 services can make to reducing carbon emissions is substantial and has been under-reported. Yet, from the start, Government saw that the availability of HS2 would help 'promote 'lower carbon choices' by encouraging 'a shift to lower carbon transport'.[32]

But the significance of the opportunity for modal shift has been under-played. It is ignored, for instance, in the Committee on Climate Change's 2020 report on the carbon transition needed for transport, which relies on a combination of technology change (electric power rather petrol/diesel) and travel demand reduction. Modal shift, which is less likely to have adverse economic consequences than simply having people travel less, doesn't get a look in.

So it is reassuring that The Department for Transport's De-carbonisation Plan of July 2011 claimed it was 'placing a heavy emphasis on modal shift'. It has a key role to play in achieving Government's goals on net zero and the aims of the Department for Transport.

30. Source: SYSTRA for UIC.

31. As we set out in chapter 4, there are several factors in the early modelling of HS2 impacts that may have caused this, and work is in hand to improve the forecasts.

32. High Speed Rail, DfT, Command paper 7827, March 2010.

Only HS2 can do this

The key to understanding how HS2 is uniquely placed to bring about highly beneficial modal shift rests on three propositions:

1. It is realistically only possible to expect large-scale modal shift by **attracting** market demand to a **better travel option where there is capacity to accommodate the transferring demand**

2. The new capability that HS2 brings is in long distance travel segments which, while forming only a small proportion of journeys, **account for 30% of personal travel** (measured in passenger miles)

3. HS2 will also **release capacity for conventional rail services including for freight** where trip lengths are also very important: 70% of carbon emissions from road haulage (HGV traffic) are from longer distance trips, and a large proportion of these (close to 40%) are susceptible to a transfer from road to rail haulage.

Long-distance travel is where HS2 will have the greatest impact, and for both personal travel and freight it is hugely important in terms of carbon impacts. There is an absence of measures other than high speed rail that can make a positive contribution, because other measures can't deliver on the three propositions noted above.

The scale of HS2's impact has recently been assessed using two different methodologies for the Government's Union Connectivity Review. This showed that HS2 together with route enhancements north of Crewe that could provide 3-hour London–Glasgow/Edinburgh rail journey times (rather than today's 4h20) and this would increase rail's share of the London–Scotland travel market from 29% to 75%. This is a dramatic shift.

But better longer distance travel opportunities following HS2 are not restricted to London. Inter-regional travel such as Plymouth/Bristol/Cardiff/Southampton–Birmingham/Nottingham–York/Newcastle/Edinburgh can also benefit from HS2 plans and provide a better alternative to flying or the motorways.

Looking forward

At a local level, for **shorter distance travel**, faced with the pressing need to reduce transport carbon emissions, measures to encourage walking, cycling, take public transport and if using car/taxi, use electric vehicles, will improve health and well-being as well as help tackle climate change. They are measures that will complement what we suggest here, which is that HS2 can bring a major contribution to reducing carbon from **longer distance travel** across the nation—both for passengers and freight.

As we have shown, right from the start, achieving modal shift figured in Government's rationale for progressing HS2. Its reasoning in 2010 and 2011 applies even more in 2022.

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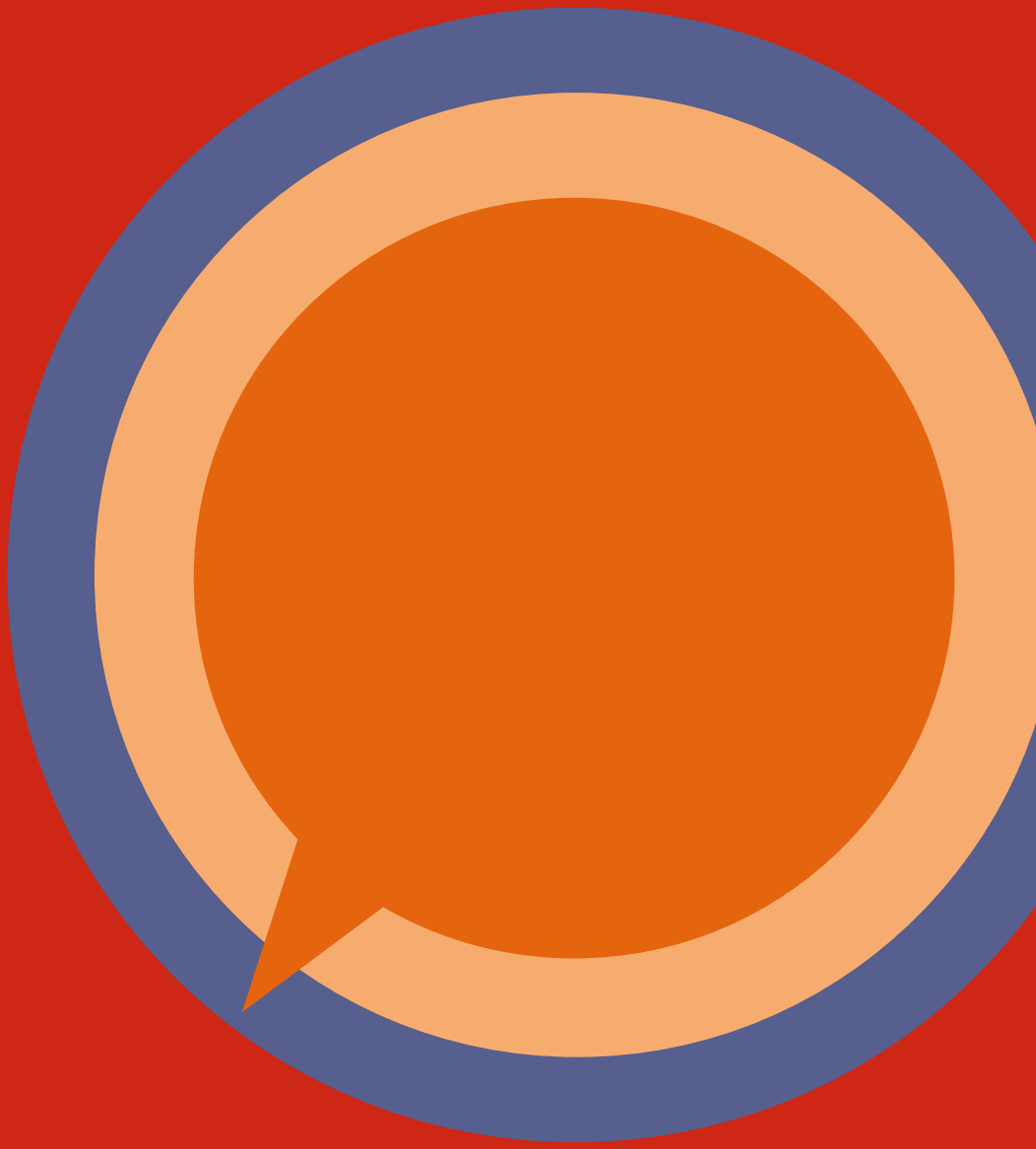

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