



High Speed Rail Group's Response to *Decarbonising Transport: Setting the Challenge*

August 2020

About High Speed Rail Group

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 and carbon benefits that high speed rail brings. We support a national high speed rail network which includes the delivery of HS2, high speed rail's integration with the existing network and investment to maximise the released capacity benefits HS2 brings on and off route, along with other rail investments such as Northern Powerhouse Rail and Midlands Engine Rail.

Find out more at [**www.rail-leaders.com**](http://www.rail-leaders.com)

© August 2020, High Speed Rail Group (HSRG), Some Rights Reserved:
We actively encourage people to use our work, and simply request that the use of any of our material is credited to High Speed Rail Group in the following way: High Speed Rail Group (HSRG),

Contents

Introduction	1
Summary of recommendations	3
Changing trajectory	5
Wider Carbon Impacts	7
Co-benefits	8
Strategic priorities	9
1) Accelerating modal shift	9
Segmenting modal shift by journey purpose	11
2) Decarbonisation of vehicles	14
3) Decarbonisation of goods	15
4) Place-based solutions	16
5) Green technology and innovation	17
Driving down carbon through better data	18
6) Reducing global carbon	20
Bringing it all together	22

Introduction

This is the response of the High Speed Rail Group (HSRG) to the Department for Transport's consultation *Decarbonising Transport: Setting the Challenge*, published in March 2020, on the development of the Transport Decarbonisation Plan (TDP).

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. HSRG supports a national high speed rail network including the delivery of High Speed 2 (HS2), high speed rail's (HSR) integration with the existing rail network and investment to maximise the released capacity benefits HS2 brings on and off route, and other rail investments such as Northern Powerhouse Rail and Midlands Engine Rail. A full list of our membership can be found at www.rail-leaders.com.

Although the consultation comes in the midst of the unprecedented COVID-19 pandemic, it also comes in a year setting new temperature and rainfall records. According to the Bank of England, "the window for an orderly transition to a carbon-neutral economy is finite and closing"¹. As the consultation notes, in terms of carbon emissions, surface transport is now the biggest single contributor of the UK economy. The challenge of decarbonising the sector is even greater if International Aviation and Shipping (IAS) emissions are factored in too.

1. <https://www.bankofengland.co.uk/-/media/boe/files/paper/2019/the-2021-biennial-exploratory-scenario-on-the-financial-risks-from-climate-change.pdf>

While demand for travel has dropped, as Lord Stern noted this June, “[t]he longer-term story is one where public transport will be extremely important”². Although much focus has been on urban public transport, this response demonstrates it is longer distance travel, often for leisure, which contributes the most to transport sector carbon and which now needs to be a priority in tackling. In its 2020 annual report to Parliament, the Committee on Climate Change (CCC) stressed the importance of each sector having a “well-designed, coherent and effective package of policies to deliver a high level of ambition”³. The TDP will only be effective if it addresses longer-distance travel through new investment and additional policies.

HS2, as a new transport spine for Britain able to operate on zero carbon electricity, will be transformative. Not just for these longer journeys but also by enabling the full potential of existing railways to cater for local travel and unlock sustainable housing. Up to now, however, HS2's decarbonisation potential has been underplayed by:

- > National forecasts assuming a decrease in rail growth, with demand for HS2 capped shortly after it opens: the former assumption does not sit with achieving net zero, the latter with the experience of uplifts in passenger growth from new railway⁴;
- > The cumulative impact of wider rail upgrades needed to meet net zero, in particular up to Scotland, which would make HS2 services even more competitive to flying;
- > HS2's benefits of freeing up capacity on the existing network for freight & local passenger services have still not been fully modelled;
- > The potential impact of expanding European HSR and sleeper services within a few hours of many UK cities.

The net zero challenge now requires that the Government commits to a world class public transport network integrated through a national HSR network, by which we mean a core network of dedicated high speed lines integrated with upgraded, electrified and digitally signalled lines, reaching all regions and major cities. Electrification is needed to enable trains to run off the core, with digital signalling to minimise risks of disruption, particularly to the highest frequency sections of the core. Higher speeds are needed to help design out domestic mainland aviation and for rail to be competitive, not just from city centre to city centre but also trips to/from suburbs involving interchange to local public transport.

This submission forms part of a wider set of activities by HSRG that make clear the fundamental role that HS2 has to play in the UK reaching net zero. This includes the publication of a report titled *HS2 - towards a zero carbon future*, which examines the carbon case for HS2 and considers its impacts from construction, operation and modal shift.

We are happy to provide any further information that may be required. Indeed, given the expertise of our members we would be very happy to play a deeper role in working with the DfT to develop the TDP, including further discussing and testing ideas and emerging conclusions.

2. <https://www.bloomberg.com/news/articles/2020-06-09/lawmakers-must-resist-urge-to-regress-toward-fossil-fuels>

3. <https://www.theccc.org.uk/publication/reducing-uk-emissions-2020-progress-report-to-parliament/>

4. Chapters 1-2, HS2 Full Business Case (DfT, 2020)
<https://www.gov.uk/government/publications/hs2-phase-one-full-business-case>

Summary of recommendations

We warmly welcome the DfT's strong desire to tackle transport emissions in order to respond effectively to the climate emergency, in particular the bold ambition that modal shift is central to doing this.

As the CCC recently set out in its 2020 report, this ambition needs to be backed by firm policies in the coming months, so that a full net-zero package is in place ahead of COP26. Summarising the recommendations set out in our full response below, we suggest the TDP should include the following:

1. Trajectory and scope

- 1.1 Ensure trajectories for surface and international transport emissions comply with the Paris Agreement, particularly over the next two decades
- 1.2 Consider "Wider Carbon Impacts" beyond the transport sector, including land use implications, to avoid unintended consequences
- 1.3 Harness the potential for transformative rail upgrades to create industry clusters in the rail sector and beyond
- 1.4 Plan for climate resilience alongside planning for net zero

2. Modal shift

- 2.1 Refocus on distance (i.e. personal mileage) not trip numbers when assessing carbon emissions, as this reveals the importance of shifting longer distance travel
- 2.2 Make rail explicitly the longer distance mode of choice, move from backward looking forecasts to ambitious targets, then fund the necessary enhancements, including a national HSR network
- 2.3 Harness the potential of cycling, in particular e-bikes, through an ambitious programme of cycleways well integrated with rail stations

3. Decarbonisation of vehicles

- 3.1 Encourage systems thinking across modes to integrate grid connections and storage with transport electrification
- 3.2 Rapidly move forward a rolling programme of rail electrification as the centrepiece of decarbonising rail by 2040 at the latest
- 3.3 Make the most efficient use of constrained energy vectors by enabling shorter distance travel by e-bikes and longer distance by rail

4. Decarbonising goods

- 4.1 Set modal shift targets for freight, starting with doubling rail freight mileage when HS2 opens in 2030
- 4.2 Plan wider upgrades to maximise freight benefits from HS2
- 4.3 Modernise the HGV road user charge quickly, borrowing off anticipated revenue to improve rail freight options in the interim

5. Place-based solutions

- 5.1 Use HS2 to build momentum for transformative wider sustainable travel upgrades, especially in regions with higher car modal share
- 5.2 Secure through reforms to the planning system and policy the fullest possible shift to public transport, walking and cycling

6. Green technology and innovation

- 6.1 Publish an interurban or national Future of Mobility strategy to orchestrate innovation for longer distance travel
- 6.2 Fund Future Mobility Networks for longer distance travel along and around HS2 and Northern Powerhouse Rail
- 6.3 Develop standards to enable sharing real time carbon data and comparison of modes across their full life cycles

7. Global

- 7.1 Incorporate IAS emissions into domestic carbon budgets and develop a cross-modal international connectivity strategy
- 7.2 Improve international rail connectivity across and capacity within London, such as by reviewing HS1-HS2 connectivity
- 7.3 Modernise Channel Tunnel regulations to attract new services
- 7.4 Provide policy and funding support to enable new international passenger and freight rail services for modal shift

The Nationally Determined Contribution the UK is required to submit under the Paris Agreement should demonstrate international leadership by:

- > Setting out a science-based trajectory for all UK transport emissions;
- > Accelerating modal shift by adopting rail as the longer distance mode of choice;
- > Committing to transformative investment to deliver a national HSR network, starting with the section to Scotland by 2032, and to decarbonise the whole rail network by 2040.

Changing trajectory

The UK ratified the UN Paris Agreement on Climate Change in 2016, the ultimate goal of which is to seek to limit the rise in global temperatures to 1.5°C. Because all emissions over time matter when seeking to meet a goal of this kind, it is total cumulative emissions that matter, not simply whether they are reduced to net zero by 2050. As the Paris Agreement includes principles of equity, developed economies such as the UK's are required to make sharper reductions in emissions. In its decision on Heathrow Airport earlier this year, the Court of Appeal confirmed that the Paris Agreement forms part of UK policy and that it goes further than the 2050 net zero amendment to the Climate Change Act that was legislated in 2019.

Earlier this summer, over 200 leading businesses wrote to the Prime Minister, calling for an economic recovery aligned with delivering net zero by 2050 at the latest⁵. Their letter asked for "a combination of targeted public investment and clear policy signals" to accelerate investment in sectors such as low carbon mobility infrastructure. It is therefore vital that the TDP quickly sets a science-led trajectory for transport, so that the private sector can be confident its investments align fully with climate goals.

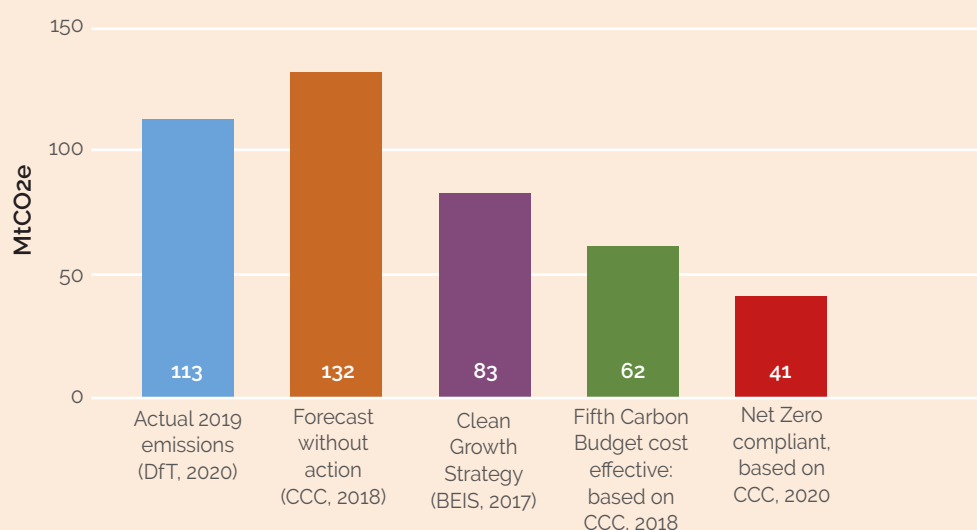
There is a significant gap, however, between the trajectory proposed in the consultation and where the UK is required by law and science to be. The consultation adopts the Clean Growth Strategy's pathway of 83MtCO₂e for surface transport emissions in 2032⁶, the end of the Fifth Carbon Budget (5CB).

⁵ <https://www.corporateleadersgroup.com/reports-evidence-and-insights/news-items/leading-businesses-urge-uk-government-to-deliver-resilient-recovery-plan>

⁶ P85 in https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf

This appears inadequate as:

- > The CCC in 2018 advised a figure of 62MtCO₂e, i.e. 25% less;
- > The CCC has since advised that the Fifth Carbon Budget that ends in 2032 is “likely to be too loose” as it was based on an 80% reduction rather than the 2050 net zero target; and
- > The Paris Agreement, given its temperature and equity goals, is likely to require a sharper drop than the domestic net zero target in the UK’s emissions over the next two decades, with some even arguing for a reduction at least two times greater⁷.



Where should UK surface transport emissions be in 2032?

If IAS emissions are included in domestic carbon budgets, as the CCC recommends, transport would account for 34% of UK's greenhouse gas emissions, rather than 28%. The climate impact is higher still if including non-carbon effects of burning fuel high in the atmosphere that synthetic fuels do not address. The UK's current aviation target, set before the net zero target or the Paris Agreement were adopted, is for aviation emissions by 2050 to have returned to 2005 levels. The difficulty in reducing IAS emissions⁸ may require a proportionately greater reduction of domestic emissions, which surface transport is now the biggest single contributor to. With rail able to offer an alternative for shorter international flights and also for freight over longer distances, clarity is urgently needed over what a Paris compliant trajectory for IAS would look like⁹, to maximise private sector investment in rail alternatives.

⁷ Kevin Anderson, John F. Broderick & Isak Stoddard (2020): A factor of two: how the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways, *Climate Policy*, DOI: [10.1080/14693062.2020.1728209](https://doi.org/10.1080/14693062.2020.1728209)

⁸ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/813343/international-aviation-paris-agreement.pdf

⁹ Although Paris did not include IAS explicitly, as it sets temperature based goals, IAS must be decarbonised: see previous two footnotes.

Wider Carbon Impacts

As the CCC noted in its most recent report, as decarbonisation deepens, there are ever more complex interactions between different sectors. The consultation proposes that in-use emissions (i.e. scope 1) from transport should be the TDP's focus. But the scale of the net zero challenge is such that it is important not to ignore what were described as "Wider Carbon Impacts" in our 2019 report *HS2 – towards a zero carbon future*. Decarbonisation requires rapid change over decades and the danger of focusing entirely on the most direct emissions is that this leads to increases in emissions outside the system not being considered. The example of developed countries 'exporting' manufacturing emissions is now well known for instance.

The pace of decarbonisation of the grid makes scope 2 emissions less of an issue for surface passenger transport beyond the 2030s. Scope 3 emissions from industry, whether manufacturing vehicles, constructing infrastructure (including energy as well as transport) and ongoing maintenance of either will remain important, so the TDP should consider them. This fits with the recent call of the DfT's Science Advisory Council that "a closer examination is required of the overall 'well to wheel' impact of potential transport energy vectors and any unintended consequences within that life cycle"¹⁰. Besides making efficient use of energy, rail, in particular HSR with ballastless track and high occupancy of carriages, makes efficient use of resources.

Just as wider economic impacts relating to changes in land use are critical to making the case for transformational infrastructure, awareness is likely to grow about the wider carbon impacts from land use changes unlocked by transport. Net zero will require very substantial changes to how we use our land, in order to provide biofuels as well as capture carbon so as to balance hard to treat emissions such as from using concrete¹¹. The DfT's Science Advisory Council recently highlighted that "indirect competition could occur earlier in the supply chain, for example land use competition between growing biofuels and food"¹².

Transport investment results in a degree of change to land use, unlike any other sector. Unless part of the value chain, such as was the case with London's Metropolitan line that was funded by housing along its route, these impacts fall beyond even scope 3, however. Nonetheless these carbon impacts should be considered, especially when unlocking housing is a major goal of transport investment. These impacts include requiring less land for higher density, compact housing and then less carbon to construct and heat them, compared to low density, detached homes¹³.

¹⁰ <https://www.gov.uk/government/publications/research-and-innovation-to-support-transport-decarbonisation-2019/position-statement-on-transport-research-and-innovation-requirements-to-support-the-decarbonisation-of-transport>

¹¹ See section 3.6 (land use) in <https://www.cat.org.uk/info-resources/zero-carbon-britain/research-reports/zero-carbon-britain-rising-to-the-climate-emergency/>

¹² <https://www.gov.uk/government/publications/research-and-innovation-to-support-transport-decarbonisation-2019/position-statement-on-transport-research-and-innovation-requirements-to-support-the-decarbonisation-of-transport>

¹³ See HSRG (2019)

Co-benefits

How the TDP assesses co-benefits of decarbonisation will be important as these may tip the balance in favour of options that appear to have relatively lower carbon savings. A narrow focus on one form of efficiency can lead to unintended consequences: cars, for instance, were seen as the future for offering door-to-door convenience. By 2030 levels of physical activity are forecast to decline such that the average British person will use only 25% more energy than if they had spent the entire day in bed¹⁴. Mobility choices such as rail that encourage the incorporation of active travel into longer journeys are vital to tackle the growing crisis of obesity.

More broadly if our cities, which enable lower rates of car use, are going to continue to thrive, they need to offer a good quality of life. The landmark report *Living with beauty; promoting health, well-being and sustainable growth* from the Building Better, Building Beautiful Commission (MHCLG, 2020)¹⁵ concluded that "every sector of the industry has told us, and our specialist working group and wider research has confirmed, that overly car-dominated places tend to be less attractive or popular places in which to spend time" (p102). A failure to tackle car dominance could lead to population outflow from cities, with more people adopting rural lifestyles with higher transport and energy needs.

There is also a link to the potential for infrastructure investment required to deliver the TDP's priorities to create and strengthen industrial clusters. In its study *Improving Competitiveness*, the National Infrastructure Commission noted that as "well as providing infrastructure services that support globally important clusters, infrastructure and its supply chains can themselves develop into industrial clusters. These can attract investment and talent, and lead to exportable innovations for the UK."¹⁶ The East Midlands is already important for rail manufacturing, while wider procurement from rail investment could create new industrial clusters, such as for zero carbon steel.

Finally although this consultation is about climate mitigation, even if the ambitions of the Paris Agreement were met, the CCC estimates a 1.8°C rise in average UK temperature by 2050. It therefore called for all investments to be resilient to a minimum of 2°C. Looking at mobility choices through an adaptation lens is crucial, both in terms of prioritising investments to deliver resilience including for existing rail infrastructure that is particularly at risk¹⁷ and also the impacts of different transport choices. Cars, whether conventional, electric or autonomous require more hard space, making it harder to manage runoff with heavier rainfall or create places that are permeable for nature.

Recommendations:

- > Ensure trajectories for surface and international transport emissions comply with the Paris Agreement, particularly over the next two decades;
- > Consider "Wider Carbon Impacts" beyond transport sector, including land use implications, to avoid unintended consequences;
- > Harness the potential for transformative rail upgrades to create industry clusters in the rail sector and beyond;
- > Plan for climate resilience alongside planning for net zero.

¹⁴ https://www.ukactive.com/wp-content/uploads/2018/09/ukactive_Turning_the_tide_of_inactivity.pdf

¹⁵ <https://www.gov.uk/government/publications/living-with-beauty-report-of-the-building-better-building-beautiful-commission>

¹⁶ <https://www.nic.org.uk/publications/improving-competitiveness-a-discussion-paper-on-the-commissions-objectives/>

¹⁷ See p.23 in HSRG (2019)

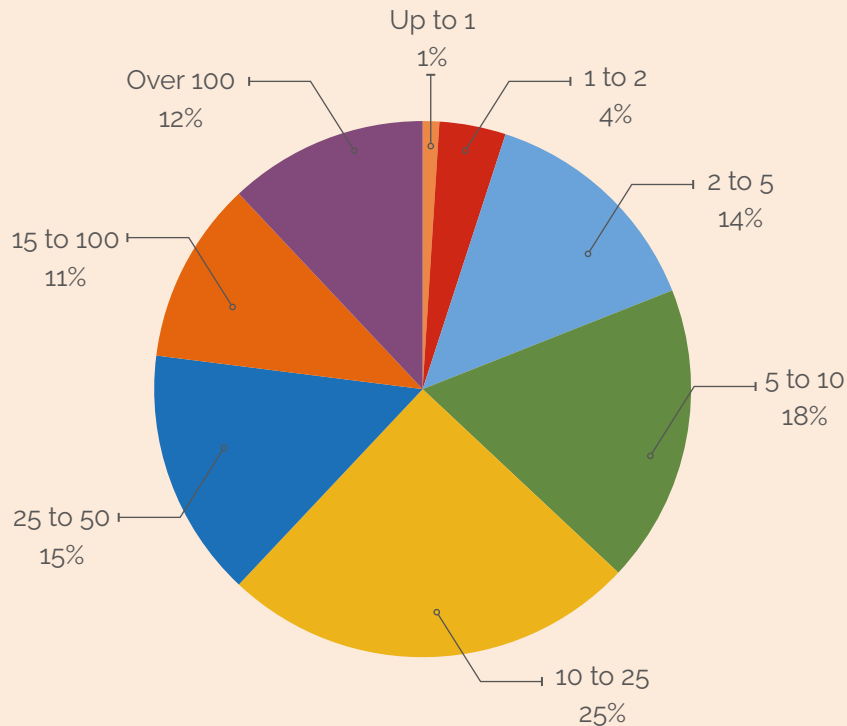
Strategic priorities

HSRG supports the consultation's suggested six strategic priorities, which we set out below with suggestions as to how they could be delivered and, where appropriate, fine-tuned.

1 Accelerating modal shift

We very much welcome the recognition we need to use our cars less to secure net zero and the importance of developing the public transport network to deliver this. This is particularly important in the next two decades when we need to make radical cuts to transport emissions and when the majority of vehicles remain fossil fuelled.

The consultation's analysis focused on trip numbers rather than carbon, overplaying daily travel and commuting over longer distance and leisure travel, which tend to be more irregular. The majority of journeys made are short, with about 83% being under 10 miles but the majority of travel measured by person-km is medium/long distance (63% over 10 miles), which is beyond the range of walking, and for most people cycling and is slow by bus. As the chart below shows, longer journeys are responsible for the majority of carbon emissions, so these need to be a greater and more explicit priority. Rail already has a high modal share for longer journeys, and its share could improve further with a national HSR network and wider upgrades such as electrification. A clear aim to shift longer journeys will be critical, so we suggest the TDP should explicitly make rail the natural first choice for longer distance travel.



Mileage share: by journey distance

Source: Carbon Pathways Analysis. Informing Development of a Carbon Reduction Strategy for the Transport Sector (Department for Transport, 2008)

The business case for rail schemes is hindered by the current approach to transport forecasting and appraisal, such as the DfT's Transport Appraisal Guidance (TAG), which assumes far lower rail growth in the future than the historical growth seen over the past 25 years that has been as high as 4.2% per annum for the market most relevant to HS2¹⁸. The refreshed business case for HS2 noted the DfT assumed an annual growth rate of 2.2% in 2013, then lowered that to 1.9% in 2018 but that long-distance growth since 2011/2 has been 2.8%¹⁹. That has been a decade when fuel duty was frozen, but rail fares have been increasing above inflation.

In addition, TAG requires capping rail growth 20 years after the start of the appraisal period²⁰. For HS2 this means ignoring the huge potential growth that would be unlocked once the whole HS2 network is completed. The "high" demand scenario for HS2 only assumed 16% higher usage, a figure that could easily be attained in a few years of a 60 year appraisal period. Even that small change would increase HS2's Benefit Cost Ratio by 40%. Given the priority to accelerate modal shift, it is clear that new assumptions—rather than forecasts that have been shown repeatedly to underplay rail's potential—are rapidly required, not least to build the case for the Integrated Rail Plan for the Midlands and the North.

¹⁸ <https://www.gov.uk/government/publications/tag-data-book>

¹⁹ Para 1.19 in <https://www.gov.uk/government/publications/hs2-phase-one-full-business-case>

²⁰ Paras 2.78 & 2.96 (ibid)

Another challenge is providing the increased rail capacity required, on a network that has seen travel double in decades. Both the Committee on Climate Change and the National Infrastructure Commission have this year started to look at the potential requirements for additional public transport capacity to meet the challenge of net zero. The Commission's 2018 National Infrastructure Assessment previously suggested that from the late 2020s (Control Period 7) funding for Network Rail should be cut to focus just on maintenance²¹, with funding focused on urban transport instead. It seems clear now that major investment is required as an absolute minimum for rail electrification, digital signalling and climate adaptation in the 2030s to deliver a national rail network that is fit for the 21st century. This includes an ongoing programme, building on HS2, to bring forward a national high speed rail network.

The largest segment of journeys, those that are 10-25 miles long, cause a quarter of transport's carbon emissions. HS2 is relevant here where it frees up existing railways, enabling them to cater better for shorter journeys, and through catalysing wider sustainable travel upgrades. For instance, the proposed East Midlands Hub at Toton includes transformative upgrades to public transport and the creation of safe and appealing walking and cycling connections, linking it to surrounding towns and villages²².

In the Netherlands, the cycling modal share at the home-end of trips to railway stations has increased from 36% in 2005 to 43% in 2016, with bike-rail travellers preferring larger stations with intercity services to suburban ones. At the activity-end, cycling modal share has risen from 10% to 14%, with shared bikes becoming more popular²³. Recent research concluded that "once a traveller can rely on the bicycle and train for longer distance trips, the bicycle arguably becomes a more suitable mode for local trips" (ibid.). E-bikes offer even greater potential for modal shift²⁴, whether wholly replacing a car trip or in conjunction with rail. Opportunities should be taken to use the transformative potential of HS2 stations to encourage further provision of high quality cycleways and cycle hire schemes into the surrounding areas. This requires new modelling techniques²⁵.

Segmenting modal shift by journey purpose

Making rail an even more attractive option, as the consultation proposes, will require segmenting user needs to address them better. As the chart below shows, travel for leisure (shown in shades of green) makes up the majority of distance travelled and this proportion may increase further if more people work regularly from home. Some have sought to argue against HS2 on the basis it is simply for business travel, ignoring that this is only a small proportion of distance travelled, and the popularity of HSR for leisure travel, whether abroad or on HS1 here in Britain.

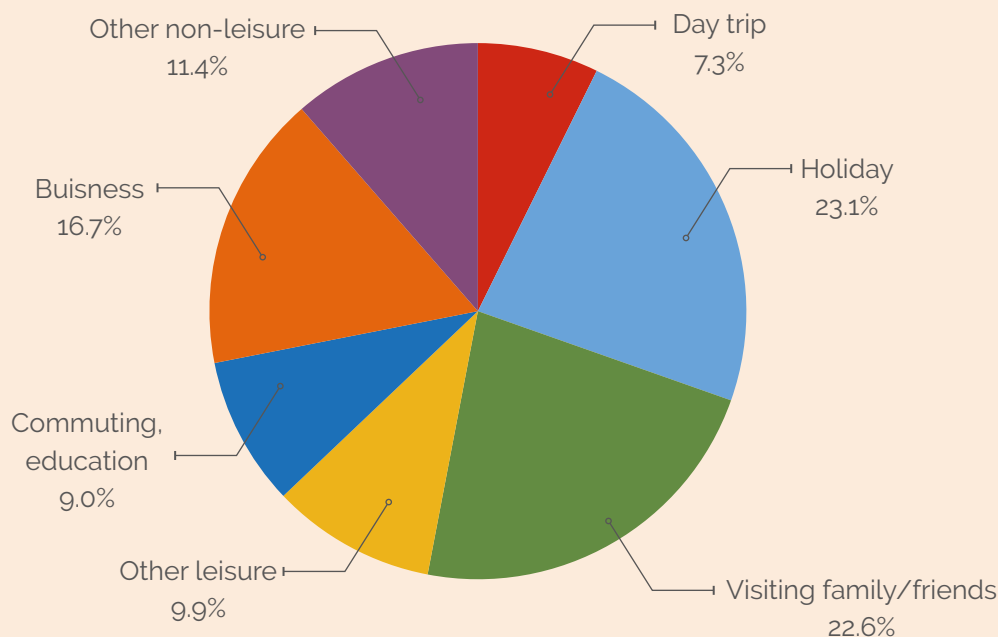
21 At page 114. Though it has analysed its headline recommendations (those in Appendix D) in terms of their compliance with the net zero target that was legislated since, it appears not to have considered these wider recommendations.

22 <https://www.midlandsconnect.uk/media/1706/final-access-to-toton-report.pdf>

23 <https://link.springer.com/article/10.1007/s11116-019-10061-3>

24 <https://www.creds.ac.uk/publications/e-bike-carbon-savings-how-much-and-where/>

25 Although the Propensity to Cycle Tool has 'Go Dutch' and 'E bike' options, these do not seem to consider cycle-rail interactions such as destination shift in stations



Mileage share: by purpose (domestic journeys over 50 miles)

Source: Analysis of National Travel Survey data (2015-2017) by ITS, University of Leeds

The success of Eurostar, which has cut the equivalent of 60,000 short-haul flights, the equivalent of 750,000 tonnes of CO₂e, is well known. HS1 has been transformative for domestic services too, however. Over 15,000 leisure trips are carried on HS1 daily compared to 4,000 business trips. Between 2010 and 2016, leisure journeys to Kent via HS1 increased almost nine-fold, with almost of third of Kent visitors citing HS1 as having influenced their decision to choose the county²⁶.

The difficulty in attracting more leisure travel to rail is that evenings and in particular weekends have traditionally been seen as the time to shut down the rail network for engineering works, because of a perception that work related travel is the most important. If people gain the impression the railways offer a poor service during weekends and public holidays then they may be more likely to drive long distance or fly, with obvious knock-on carbon implications. The alternative approach to providing some of the extra capacity that HS2 offers would have been upgrades to the existing network, causing disruption every weekend for a decade, something that played a significant part in the decision to proceed with HS2 and not a major programme of route upgrades.

The COVID-19 crisis shows how behaviour can be changed very rapidly and substantially²⁷. Some changes may stick for certain types of journey more than for others, for instance grocery shopping, although this is not a major share of mileage. Learning from this, the TDP should segment the possibilities for behaviour change over different journey purposes, timescales as well as different types of behaviour change. The most important of these from a carbon perspective are modal shift, destination shift and service shift.

²⁶ <https://highspeed1.co.uk/media/vemkxmot/delivering-for-britain-and-beyond-the-economic-impact-of-hs1-march-2020.pdf>

²⁷ See p14 in CCC (2020) for instance

It is important not to oversimplify trends, not least those from COVID-19. Rail commuting may be reduced due to more home working (service shift) at the same time as benefiting with space being reallocated in cities to active travel (modal shift). In the medium term more people may move further from their offices, commuting further (destination shift). By contrast, service shift is less relevant for leisure travel: video conferencing can be used to keep in touch with family and friends but is not the same as face-to-face contact²⁸. The combination of increasing environmental taxation and awareness alongside upgraded rail services - in the UK and abroad - is likely to lead to destination shift for holidays, including more Europeans travelling to further flung parts of the UK by rail.

The table below illustrates these tensions with examples for 2020-22 (the current carbon budget), then 2030 (a key date for the Paris Agreement as well as HS2) and then 2050. Further value would be gained by undertaking this exercise separately for different journey purposes.

Behaviour change	2020-3	2030	2050
Modal shift	Increased active travel	Initial effects from opening first phases of HS2	Rail well established as longer distance mode of choice (freight & people)
Destination shift	Greater use of local facilities, changed leisure patterns	Far larger 'part-time commuter belt' Longer leisure journeys by rail	Continued bifurcation of trends
Service shift	Upsurge in online shopping, working from home	3D printing Seamless integration of mobility into wider services	The complexity of socio-technical interactions make this hardest to predict

Recommendations:

- > Refocus on distance (i.e. personal mileage) not trip numbers when assessing carbon emissions, as this reveals the importance of shifting longer distance travel;
- > Make rail explicitly the longer distance mode of choice, move from backward looking forecasts to ambitious targets, then fund the necessary enhancements, including a national HSR network;
- > Harness the potential of cycling, in particular e-bikes, through an ambitious programme of cycleways well integrated with rail stations.

²⁸ Exploring motivations and barriers for long-distance trips of adult women Vermonters (2020)
<https://www.sciencedirect.com/science/article/pii/S2214367X2030171X>

2 Decarbonisation of vehicles

This priority should be broadened to include decarbonisation of rail and electrification of human powered modes such as pedal cycles. Breaking down modal silos to enable systems thinking to integrate the decarbonisation of different modes is crucial for a number of important reasons:

- Enabling prioritisation of low carbon energy vectors whether due to competition between modes or beyond to other sectors such as heating, food and carbon sequestration;
- Increasing integration of refuelling, recharging and storage infrastructure with the energy system;
- Convergence of drivetrain, hydrogen, and battery technologies enabling faster development of market and stronger supply chains;
- Potential to derisk the critical path for decarbonisation through modal shift.

HS2 Ltd has been considering options to integrate grid storage into its network to reduce peak demand from its trains²⁹. Providing sufficient power at major railway stations, such as those serving HS2, to enable recharging of cars and public transport may require additional grid reinforcement. There are opportunities in future HSR phases and wider rail electrification to integrate expansion of grid capacity and storage as transport and heat electrification is set to increase demand on the grid.

Electrification is not just about vehicles currently using Internal Combustion Engines (ICE), but also e-bikes and new modes such as scooters to cater for a wider range of journeys, whether on their own or in conjunction with public transport. This requires integration of policy, procurement and funding, whether for purchase incentives to infrastructure design. The procurement specification for HS2 trains already includes a requirement for on train cycle storage to allow charging of e-bikes, for instance³⁰.

Resource constraints could act as a brake on plans to phase out all ICE cars and vans³¹. By encouraging longer journeys to shift to rail, the average car would not need such a large battery, with a capacity that would be barely used for daily travel. By contrast battery trains on branch lines can make more efficient use of scarce resources as their energy needs can be optimised based on their timetable. Prioritising modal shift creates a virtuous circle, by supporting the case for more train paths for freight as well as passengers which strengthens the case for rail electrification. In turn electrification can enable better services with lower operating costs. So it is important not to assume current service patterns will continue on the rail network, which could preclude the case for upgrades.

Recommendations

- Encourage systems thinking across modes to integrate grid connections and storage with transport electrification;
- Rapidly move forward a rolling programme of rail electrification as the centrepiece of decarbonising rail by 2040 at the latest;
- Make the most efficient use of constrained energy vectors by encouraging shorter distance travel by e-bikes and longer distance by rail.

²⁹ *HS2 electricity strategy – final report* (KPMG, 2018). Available from <https://www.whatdotheyknow.com/request/487395/response/1177578/attach/4/FOI18%202020%20Annex%20A.pdf>

³⁰ <https://www.gov.uk/government/publications/hs2-rolling-stock-procurement>

³¹ See for instance pp. 5-6 HSRG (2019)

3 Decarbonisation of goods

With freight miles (in vehicles over 3.5t) making up just 5% of mileage on the road network but 17% of carbon emissions³², tackling these emissions will be crucial. Decarbonising freight is one of the biggest challenges because of the difficulty of storing sufficient power for heavier vehicles and the technology pathway remains unclear.

Although we have not found data to show the distribution of freight distance travelled and hence emissions across different journey lengths, the lack of short freight trips means (depending on how one counts online delivery services stopping between homes), longer distance freight journeys are likely to make up an even larger share of emissions. The focus in the consultation on decarbonising the last mile is certainly important, and rail could help by bringing freight into city stations, particularly outside peaks. Much more emphasis is needed, however, on using proven technology to rapidly decarbonise freight on longer distance journeys and this requires the TDP adopting a goal of modal shift of freight in addition to people.

As the consultation notes, in 2018 only 9% of UK freight tonnage by distance was moved by rail. While this is the same as France, it is low compared to many other European countries, for instance in Italy it is 14%, for Germany 18% and 35% in Switzerland. Inspired by this opportunity, 4F, a new alliance in France, is seeking to double rail freight to 18% by 2030³³. Zero Carbon Britain estimated that 30% by weight of road freight would need to shift to rail by 2050³⁴, which would require a similar trajectory for 2030 in the UK as now proposed in France. With many companies now seeking to rapidly reduce their carbon emissions and the ability for customs inspections away from congested ports, there is a major opportunity.

Because the UK rail network is so intensively used already, such an ambitious target could be seen as unrealistic. A major piece of the jigsaw is now ready to be put in place however. By removing non-stopping trains from the busiest railways between our biggest cities, HS2 will free up space for more rail freight and it is set to open as far as Crewe around 2030. Midlands Connect has estimated that HS2 frees up capacity for more than 140 extra freight trains per day, enough to transport over 2.5 million more lorries' worth of cargo on railways each year.

More broadly the right price signals need to be in place to encourage the private sector, whether carriers or users, to invest in rail freight. Charging road freight vehicles to take account of their impacts on the network and wider environment is critical and would provide a revenue stream for urban consolidation centres as well as rail freight enhancements. Modernisation of the HGV Road User Charge was announced in the 2017 Budget, but nothing has been said since this was consulted upon that year with a promise to reform the levy "as soon as possible"³⁵. Quickly moving forwards by setting out how the HGV charge will be updated to tackle carbon is the first step to doubling rail freight's modal share.

³² DfT figures from 2014

³³ https://www.sncf.com/sites/default/files/press_release/CP_NR_4F_Coalition_Fret_ferroviaire_08062020.pdf

³⁴ P51 in <https://www.cat.org.uk/info-resources/zero-carbon-britain/research-reports/zero-carbon-britain-rising-to-the-climate-emergency/>

³⁵ <https://www.gov.uk/government/consultations/reforming-the-heavy-goods-vehicle-road-user-levy>

Recommendations here are:

- Set modal shift targets for freight, starting with doubling rail freight mileage when HS2 opens in 2030;
- Plan wider rail upgrades to maximise freight benefits from HS2;
- Modernise HGV road user charge quickly, borrowing off anticipated revenue to improve rail freight options in the interim.

4 Place-based solutions

Transformative investment is needed to level up regions with the lowest rates of sustainable travel. Figure 4 in the consultation highlights how the modal share of commuting by car highlights the West and East Midlands is the highest in England. Moving swiftly with the eastern arm of HS2 Phase 2b and unlocking the wider Midlands Engine Rail proposals is needed to address this. Providing certainty for such investments is necessary to align land use plans with transport, and through this unlock wider changes to deliver more sustainable transport and development. Already at Toton, the site of HS2's East Midlands hub, master planning by a range of local authorities is unlocking denser development and transformative public transport and active travel routes.

Changes to planning policy are needed to align it to the TDP. A core planning principle of the original 2012 version of the National Planning Policy Framework (NPPF) required authorities to "actively manage patterns of growth to make the fullest possible use of public transport, walking and cycling, and focus significant development in locations which are or can be made sustainable" (paragraph 17). By contrast, the current version is far weaker, simply suggesting that "opportunities to promote walking, cycling and public transport use are identified and pursued" (paragraph 102) and that "appropriate opportunities to promote sustainable transport modes can be – or have been – taken up" (paragraph 108). It has no mention in the transport section of climate or carbon, nor any explicit linkage between that section and part 14 on climate change. By missing opportunities to design in fullest possible levels of sustainable travel, including for freight, the current NPPF risks undermining the strategic principle of modal shift.

The radical reforms to the planning system heralded by the Prime Minister this June could, if development is tied to existing or planned public transport accessibility and capacity, help readdress the balance. It is critical that the reforms make public transport oriented development a key principle.

Recommendations

- Use HS2 to build momentum for transformative wider sustainable travel upgrades, especially in regions with higher car modal share;
- Secure through reforms to the planning system and policy the fullest possible shift to public transport, walking and cycling.

5 Green technology and innovation

Some of the most transformative changes have been simple technology, such as the humble shipping container. A focus on new technologies, such as autonomous vehicles, should not come at the cost of missed opportunities for greater use of existing technologies or service innovation, which is more likely to lead to faster change. Rail may be nearly 200 years old but there is still no alternative on the horizon for very reliable, high capacity travel into and within our cities.

Mobility as a Service (MaaS) is the most talked about innovation in transport but so far has had a city focus, effectively ignoring the longer journeys that produce the most carbon. The potential benefits of MaaS for customers are greatest for infrequent rather than daily journeys that they are less familiar with. When HS2 is completed, it will be quicker to travel on it from London to Leeds than on the Central Line across London. A lack of integration - for ticketing between regions or enabling integration of options such as car sharing for travel further afield - would hold back HS2's potential.

More broadly, while place-based solutions, whether spatial planning or local integrated ticketing will play a role, the analysis above shows the importance of greater focus on longer-distance travel which by its very nature connects different places. Without some minimal level of alignment and standards of service, such as the public transport offer and integration of new modes, there is a real likelihood that opportunities to tackle carbon from longer journeys will be missed. This may have further knock-on impacts. Failing to enable seamless journeys from our biggest cities into the countryside could make it harder to encourage city dwellers to give up private car ownership and thereby release more urban space needed for walking and cycling.

The DfT is proposing a Future of Mobility: Rural Strategy to complement its Urban Strategy. This still risks leaving a gap for longer distance journeys, whether interurban or between urban and rural. A commitment is now required for a longer distance or national Future of Mobility strategy to address travel between places.

The DfT's proposal for Future Mobility Zones is to create "a globally significant demonstrator of new mobility services, modes and models...creat[ing] a functioning marketplace for mobility, combining new and traditional modes of transport"³⁶. Although they are centred on cities, like the Sustainable Travel Towns before them in the early 2000s³⁷, these focus on shorter distance travel. By leaving out the potential for innovation in longer distance travel, this programme likewise risks missing large economic as well environmental opportunities.



HS2 Woodland Fund corridor

³⁶ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/886686/future-of-transport-regulatory-review-call-for-evidence.pdf

³⁷ <https://www.gov.uk/government/publications/sustainable-travel-towns-evaluation-of-the-longer-term-impacts>

If HS2 was just about travel to and from its stations in London and Birmingham, a dumbbell shaped zone could be suitable. That would however underplay HS2's transformative impact of freeing up existing railways, such as the West Coast Mainline, in turn potentially affecting cities like Oxford and Bedford linked to it via East West Rail. The HS2 Woodland Fund covers a 25 mile corridor either side of HS2 and a similar focus could be considered for HS2, extended to Crewe given the pace of Phase 2a. This could focus on the 10-25 mile journeys that are the largest segment (as shown in the figure above). A different approach to a conventional zone might be required for 25+ mile journeys - perhaps more of a Future Mobility Network focused on integrating digitalisation, unlocking barriers at pain points and targeted promotion. This is best tested by requesting proposals from the public and private sector.

As the Integrated Rail Plan for the Midlands and the North develops, a second longer distance Future Mobility Zone could be considered across the Pennines. These zones would aim to shift longer-distance and irregular non-daily travel by focusing on a minimum level of integration between city transport systems, app coverage does not simply stop at city boundaries and integration of modes at station hubs.

Driving down carbon through better data

Enabling transport users to understand the full carbon impacts of their choices will encourage some, but realistically not all to change behaviour. Although new cars have energy labels, the concept of labelling dates from the pre-internet era: now consumers increasingly expect bespoke data at the time of making a travel decision such as when using apps. Although the DfT is promoting open data through its Future of Mobility workstream, this is focused on transport data (routes, speed limits etc.) rather than environmental impacts of transport data, such as carbon. Comparing transport modes is much more difficult than comparing cars for three main reasons:

- > Electricity is increasingly the power source but can have very different carbon intensity depending when and where it is taken from the grid, while larger users can now contract for genuinely additional renewable power;
- > As decarbonisation increases, emissions from vehicle manufacture and maintenance make up a growing proportion of life cycle emissions compared to from use;
- > The carbon footprint of infrastructure also needs to be included, as increasing vehicle weight increases maintenance requirements, for instance.

Figure 6 of the consultation, which sets out emissions for a journey from London to Edinburgh, illustrates the increasing complexity of comparing in-use emissions. It suggests by train a journey contributes 29Kg of CO₂e of emissions, but by electric car just 0Kg. This is wrong since the switch to bi-mode trains in 2019 on this route means all services have operated as electric since then. As a large electricity user, Network Rail has contracted directly for its own dedicated low carbon electricity through a Power Purchase Agreement, as HS2 Ltd is now considering. By contrast an individual consumer may even on a green domestic tariff simply increase UK consumption of higher carbon electricity overall.

Comparative information about different lifetime emissions of different modes requires assumptions about lifespan - a train may last 30 years, a new hybrid car only ten - and the degree of occupancy or sharing over that period. For an average European petrol car typical emissions are about 258 lifecycle CO₂e g/km, 104 for a Nissan Leaf electric car and just 22 for an e-bike, giving that mode significantly greater potential to reduce lifecycle carbon emissions³⁸. By contrast HS2 Ltd is aiming for under 10 CO₂e g/passenger km (1.86 CO₂e g/pkm in relation to the train and 8 CO₂e g/pkm for electricity used when it opens in 2030). Uncertainty is greatest for new modes, for instance Bird estimates its latest scooter has emissions of 60.75 CO₂e g/pkm³⁹, though this will depend on assumptions about longevity of shared modes that may vary significantly by country or even city, for instance due to crime rates. A major advantage of HS2 is its scaling of proven technology, enabling greater certainty about its emissions.

With 16% of UK emissions associated with construction, operation and maintenance of economic infrastructure⁴⁰, reducing them is critical. Network Rail is seeking to reduce infrastructure and property carbon by 25% in Control Period 6 (2019-2024)⁴¹ and HS2 has stretch targets to reduce its carbon footprint of main works for Phase 1 by 50%⁴², while Highways England is committed to setting out a timetable to investigate some carbon metrics during Road Period 2 (2020-2025)⁴³. Data for local roads is by contrast lacking. A process for developing and then evolving standards for sharing lifecycle carbon data to consumers and businesses should be agreed as quickly as possible. This needs to include user research so that information is communicated in ways that are easy to understand.

Standards are required for freight too. With freight being the hardest to decarbonise, providing consumers with information about the carbon cost of products would help spur more efficient logistics and a shift towards rail freight. This should not be about labelling on products, but enabling customers to obtain data from delivery as well as transport providers on emissions they are personally responsible for.

Recommendations

- > Publish an interurban or national Future of Mobility strategy to orchestrate innovation for longer distance travel;
- > Fund Future Mobility Networks targeting longer distance travel along and around HS2 and Northern Powerhouse Rail;
- > Develop standards to enable sharing real time carbon data and comparison of modes across their full life cycles.

³⁸ <https://www.creds.ac.uk/wp-content/pdfs/CREDS-e-bikes-briefing-May2020.pdf>

³⁹ <https://www.bird.co/blog/life-cycle-analysis-co2-emissions-gap-between-cars-scooters/> NB the figure used here has been converted here from miles to km

⁴⁰ <https://www.ukgbc.org/wp-content/uploads/2017/09/Delivering-Low-Carbon-Infrastructure.pdf>

⁴¹ <https://safety.networkrail.co.uk/home-2/environment-and-sustainable-development/energy-and-carbon-management/>. See also the recommendations on targets (though these do not appear to include train lifecycle emissions) on p13 of <https://www.rssb.co.uk/en/Research-and-Technology/Sustainability/Decarbonisation/Decarbonisation-our-final-report-to-the-Rail-Minister>

⁴² See pp9-11 in HSRG (2019)

⁴³ P63 in <https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025>

6 Reducing global carbon

According to figures from IATA, UK nationals make the most international flights in the world, making up 8.6% of all international passengers⁴⁴. With domestic and international aviation contributing to 8% of the UK's carbon emissions in 2018, and having an even greater impact once non-CO₂ emissions are considered, modal shift will be important for those international journeys where it is practical.

As the Zero Carbon Britain report noted: "Eurostar connections provide an example of how European journeys currently made by plane could be made by high-speed rail instead" (p51). In 2018, there were approximately 15 million air trips between London and destinations within a five-hour rail journey time of London⁴⁵. Cheap aviation damaged the dream of achieving the full potential from the Channel Tunnel, but disruption to aviation markets and the need to cut emissions could bring it back. The CCC has noted that "aviation and shipping, may have to pass a greater degree of decarbonisation costs onto their end customers"⁴⁶. Given the lack of international progress reducing emissions from IAS so far, the consultation's proposal to incorporate these emissions into UK carbon budgets only if there is a continued lack of progress is a high risk strategy. It also stymies investment in modal shift for longer distance travel.

A particular risk in the UK is capacity at St Pancras International, which is already very busy despite only half of HS1's potential train paths being used and not by trains, such as double deckers, that have higher density seating. In a carbon constrained future, making the best use of HS1 and HS2 is required through improving connections between them and to make a wider range of longer distance rail journeys more attractive. This could be achieved through a travellator (or similar) between Euston and St Pancras: it needs a focus on what longer distance travellers really need to overcome this unwanted half-mile gap in their journey.

International operators have considered offering new services to London but been put off by the Channel Tunnel's safety regulations⁴⁷. The 30th anniversary of the Tunnel's opening in 2024 should be taken as an opportunity to modernise the regulations to ensure they are no longer based on an era of smoking on trains and electrical fires. Multiple European countries are considering subsidies to kickstart new international services such as sleepers, the UK should do so too.

The carbon impact of air freight is rarely considered explicitly, despite amounting to about a fifth of aviation emissions. Some studies suggest to achieve net zero, we will need to eliminate air freight for all but the most essential items⁴⁸. Other countries such as China now are introducing dedicated high speed freight trains. Though HS2, unlike HS1, is not designed for conventional rail freight, it could carry high value freight on dedicated high speed trains or in flexible compartments. Clearer long-term policy and medium-term incentives would encourage development of this market and there is a major opportunity in the short-term following the disruption faced by the aviation sector as a result of COVID.

44 <https://www.iata.org/en/pressroom/pr/2019-07-31-01/>

45 Steer (2020)

46 Pg8, CCC(2020)

47 <https://www.nzz.ch/amp/schweiz/mehr-nachtzuege-rollen-mit-subventionen-ld.1543799>

48 P51 in <https://www.cat.org.uk/info-resources/zero-carbon-britain/research-reports/zero-carbon-britain-rising-to-the-climate-emergency/>

In light of the need to incorporate IAS emissions into domestic carbon budgets and the opportunity provided by rail, a cross-modal approach would enable opportunities for modal shift.

Recommendations

- > Incorporate IAS emissions into domestic carbon budgets and develop a cross-modal international connectivity strategy;
- > Improve international rail connectivity and capacity across London, such as by reviewing HS1-HS2 connectivity;
- > Modernise Channel Tunnel regulations to attract new services;
- > Provide policy and funding support to enable new international passenger and freight rail services for modal shift.

Bringing it all together

Beyond the six strategic priorities set out above, there are some specific levers that need to be used for delivery.

Given the importance of decarbonising longer distance travel, it is no surprise that a longer term rail vision and strategy is urgently required, for which the landmark report *Beyond HS2*⁴⁹ provides an excellent foundation. As part of this, rail needs to be recognised as the longer distance mode of choice, in particular by updating the National Networks National Policy Statement to ensure it accelerates modal shift and achieving net zero. TAG should be updated so that loss of fuel duty as a result of modal shift no longer counts against sustainable travel investment.

The Williams Review is expected to lead to the biggest rail shake-up since privatisation and offers a chance to update rail legislation to ensure the sector is fully aligned to play its role in helping meet carbon budgets⁵⁰. The DfT is about to set the way forward for the second Cycling and Walking Investment Strategy, an important opportunity to enable more zero carbon door to door journeys through world class walking and cycling connections to stations.

49 http://www.greengauge21.net/wp-content/uploads/Beyond_HS2WEB.pdf

50 Such by strengthening Section 4 (General Duties of the Secretary of State and Office of Rail and Road) in the Railways Act 1993.

The CCC has called for this autumn's National Infrastructure Strategy to “prioritise early funding for areas needing public finance that will support the recovery and prepare for net-zero and the impacts of climate change”⁵¹. Providing a high capacity, higher speed and resilient rail connection between England and Scotland to open in the early 2030s should be a flagship measure to shift the busiest domestic aviation routes and long distance freight to rail⁵².

The UK is required to set out its Nationally Determined Contribution under the Paris Agreement this year, potentially before the TDP is finalised. This deadline provides an opportunity to show global leadership in cutting transport emissions, in particular by:

- > Setting out a science-based trajectory for all UK transport emissions;
- > Accelerating modal shift by adopting rail as the longer distance mode of choice;
- > Committing to transformative investment to deliver a national HSR network, starting with the section to Scotland by 2032, and to decarbonise the whole rail network by 2040.

⁵¹ P165, CCC (2020)

⁵² See pp32-34 in <https://www.rail-leaders.com/wp-content/uploads/High-Speed-Rail-and-Scotland.pdf>

High Speed Rail Group's Response to
Decarbonising Transport:
Setting the Challenge