The value of rail to the green economic recovery from Covid

A WPI Economics Report for Rail Delivery Group

James Edgar – Chief Economist – james.edgar@wpieconomics.com

Catrin Owen – Junior Consultant – catrin.owen@wpieconomics.com

Matthew Oakley – Director – matthew@wpieconomics.com

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EXECUTIVE SUMMARY

This report was commissioned by the Rail Delivery Group (RDG). It provides a more in-depth picture of the findings and methodology presented in a separate report published by RDG.

As the country begins to emerge from the economic and social restrictions of the last 18 months, there is a clear desire to tackle the challenges, and leverage the opportunities that have been identified and deepened by the pandemic. For example, trends in flexible and part-time working that existed before the pandemic have now been catalysed, and inequalities, the need to rebalance the UK economy and move to cleaner and more sustainable growth, have entered the public discourse like never before.

The future of rail is at the centre of that debate. From historic highs, following two decades of rapid growth, the pandemic saw rail usage drop to unprecedented levels – the lowest level of passenger usage since the mid-nineteenth century at 5% of pre-pandemic levels, before beginning to rebound. This report shows that ensuring rail plays its full role in the economic and social recovery will be vital for delivering the sort of new economy that people want as we emerge from the pandemic.

Of course, this is also a time of significant change in the rail industry, with the Williams-Shapps Plan for Rail representing the biggest shake up since privatisation. The challenge now is to use this as the catalyst to grasp the significant opportunities to propel the industry into a time of stronger, smarter and more sustainable travel, which can support growth, livelihoods and living standards right across the country as well as ensuring that the UK moves towards its environmental goals.

To understand the size of the prize involved with placing rail at the centre of the recovery, this report presents findings on the economic footprint of rail, alongside original research into the value people place on the wider economic, social and environmental benefits that rail brings over other transport modes.

The value of rail to passengers and freight users and to broader society

Updating previous work, we have found that passengers benefitted by around £16bn per year pre-pandemic from use of the rail network, and recent research published by the RDG has also estimated that there are a further £1.65bn in benefits enjoyed by the customers of rail freight.

As well as fare payers, broader society benefits from the rail network. Through nationally representative surveys we have found **rail travel brings social, environmental and wider economic benefits that are worth**:

- **Around £2.9bn per year to households in Great Britain** (around £8.90 per month to the average household ± £0.60).
- **Around £1.2bn per year to small and medium sized enterprises in Great Britain.**

These benefits are felt right across the country, with significant value being reported from households from the North-West (£290m) to the South-West (£250m) of England and to Scotland (£260m) and Wales (£120m).

The economic footprint of rail

But of course, it's not just the journey itself that matters. It's the role that rail plays in supporting every business along the way, with passengers being the difference they need to recover. To understand the size of the spending associated with rail, we asked respondents to our survey to

estimate how much they spent on other travel, hospitality, shopping, entertainment and culture alongside their rail fare. On average people say they spent £94 per rail journey on associated items. This includes food and drink (£29), shopping (£27) and accommodation (£18 – reflecting a mix of overnight stays and day trips with zero spending on accommodation). Each person makes an average of 22 rail trips per year, meaning around 1.4bn trips made annually across the 65m people in Great Britain.[1]

This implies total spending associated with rail travel in Great Britain to be around £133bn per year. This includes £16bn per year of spending associated with rail trips in the mayoral city regions, such as Greater Manchester and the West Midlands, £8.5bn in Scotland and £4.8bn in Wales.

More broadly, the rail industry makes a significant contribution to overall domestic production, directly contributing £7.1bn in Gross Value Added in 2019. The direct economic activity in the rail sector also leads to further indirect activity through the supply chain to the rail industry, which we estimate to have been around £4.3bn in 2019.

The costs of a car-led recovery

With such significant economic and societal benefits, spread right across Britain, it should come as no surprise that people are concerned about a wide range of implications of a drop in rail usage long-term. To understand these fears, this report presents findings from original quantitative research into the British public and businesses' attitudes to scenarios where the number of people travelling by rail in Great Britain dropped permanently from pre-Covid-19 levels by 5% and 20%, with many of the same journeys now being taken by car instead.

Overall, when asking the GB population, this report shows that:

- More than 1 in 2 (56%) are concerned about environmental impacts, including increased carbon emissions, reduced air quality and harm to biodiversity;
- Around 4 in 10 (42%) are concerned about increased traffic on Britain's roads; and
- More than 1 in 2 (54%) are concerned about economic impacts, including falling jobs in the retail sector, negative impacts on city centres and high streets and reduced access to jobs.[1]

Using scenario-modelling, this report estimates the potential impacts of a large change in rail usage. The estimates show that a switch of 20% of rail usage to car across Great Britain could result in:

- Increased greenhouse gas emissions of over 1 million tonnes CO2 equivalent per year;
- Lost time worth £2.75bn per year due to increased congestion;
- Increased air pollution with health impacts valued at £79m per year;
- Increased accidents with a valuation of £181m per year; and
- Increased noise with a valuation of £12m per year.

Businesses are also concerned about a car-led recovery; even a scenario of a relatively small fall in rail usage of 20% prompted significant concern. For example, 34% of participants in the North of England picked a drop in customer numbers as one of their three biggest concerns. More broadly, the report

[1] Participants who listed these in their top three concerns when considering a permanent drop in rail usage by 20%.

finds that 4 in 10 businesses are concerned about a rise in carbon emissions from a fall in rail usage and 4 in 10 are concerned about an increase in traffic on Britain's roads.

The value of rail to our cities, towns, rural areas and seaside towns

The economic and social benefits of passenger rail, and associated concerns of the public and businesses about a permanent reduction in rail use, are spread right across the country.

Although the largest valuations of the societal benefits of the rail network are found in cities, there is substantial value across the towns and villages of Great Britain – in total **people in all towns outside conurbations value the broader social benefits of rail at over £1bn per year**, and **people in villages or more rural areas at another £489m per year.**

The average valuation per household does not vary much by type of area. Although there are high valuations in London's cosmopolitan areas as would be expected (£13 per household per month), the report finds that, for example, **people living in rural areas value the benefits at around £8 per household per month.**

Earlier work from WPI Economics also demonstrated the scale of some of the positive benefits that rail brings to seaside towns and leisure locations. For example, it showed that people going to seaside locations spent on average £116, with food and drink, shopping and accommodation attracting the most spend per journey. Moreover, respondents told us that a substantial portion of this spending was with small businesses. **For 19% of people, over half of their spending was with small or independent businesses, and for a further 20% it was around half.**

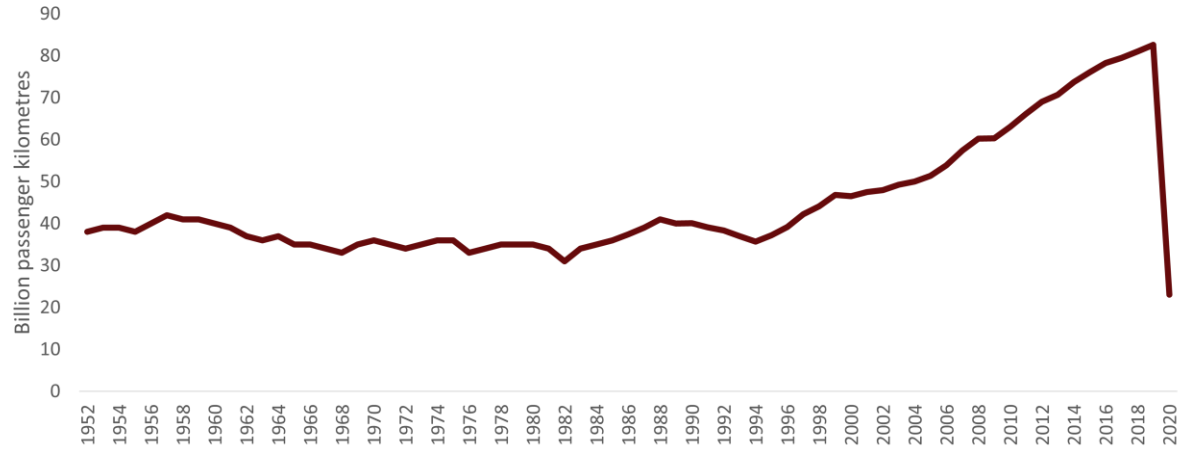
A stronger, fairer and cleaner recovery

Taken together, the results in this report provide a sense of the scale of the risks associated with a fall in rail usage. Of course, with the right approach, this also provides an opportunity to ensure that the rail industry can continue to modernise and meet changing user demands. In doing so, it can support a recovery from the pandemic that spreads right across Britain, delivers on levelling up and ensures that growth is greener and more sustainable than ever before.

1. SEISMIC CHANGE AND OPPORTUNITIES

The rail industry has long been a part of British heritage, supporting industry, business and leisure as well providing friends and families with vital links. Prior to the pandemic, rail had never been so important to the UK, with use rising rapidly for the previous two decades and services adapting to changing working patterns and preferences.[2] The pandemic fundamentally changed that picture, as rail usage dropped to unprecedented levels – the lowest level of passenger usage since the mid-nineteenth century at 5% of pre-pandemic levels, before rebounding more recently.[3,4]

Figure 1: Historic fall in passenger railway usage



Source – Department for Transport (DfT), Office of Rail and Road (ORR)
Note 2020 billion passenger kilometres figure estimated by aggregating quarterly ORR passenger kilometres records, rounded to nearest whole number

Looking forward, there are a wide range of factors that could impact on how and when passengers return to rail as the economy recovers. For example, trends in flexible and part-time working and shifts to remote working that existed before the pandemic have now been catalysed, potentially changing both demand and patterns of rail use. A key example is any shift to hybrid working, which could impact the distribution and timing of demand and travel, which may shift from peak to off-peak periods. As employers experiment with new working schedules, trains may expect to be busier at different times of the day as employers are more accepting of a degree of flexibility. Flexible working may increase the demand for working spaces in suburbs, secondary cities and rural areas, which could shift the demand for rail out of city centres.[5] Online conferencing will also have knock on effects for the rail industry as the rate of business trips will reduce.

More generally, mode choice is going to be impacted by a range of policy decisions and public attitudes, which we have seen shifting during the pandemic. For example, the pandemic has highlighted existing inequalities across the UK and the need to rebalance the economy and move to cleaner and more sustainable growth have entered public discourse like never before.

Factors potentially increasing passenger rail use	Factors potentially reducing passenger rail use
Leisure market: The rail leisure market could increase in the short term. The World Economic Forum predicts that leisure travel is likely to rebound sooner than business travel with people visiting friends and family to catch up on visits not made during the pandemic. Demand for domestic holidays is also likely to increase as international travel remains uncertain.[6]	**Economic conditions:** Lockdowns, limited mobility, business closures and unemployment saw GDP decline by 9.8% in 2020.[7] As the economy cautiously returns and the labour market recovers, recovery in terms of passenger numbers will depend on a resurgence of the virus and how strong consumer sentiment is.[8]
Modal shift: The move towards net zero emissions will potentially increase the demand for rail in the long term as more modal shift takes place in the lead-up to 2050. The Local Sustainable Transport Fund set up by the Department for Transport in 2011 provides funding for Local Authorities to encourage this modal shift and the 10-point plan aims to spend £500 million reopening lines and stations closed under the Beeching cuts.[9] Over time, initiatives like these are likely to nudge consumers to change their behaviour and opt for the lower carbon option of rail.	**Remote working:** Almost half of all UK employees worked from home in April 2020. In March 2021, one year after the introduction of social distancing measures, 30% of employees were working from home exclusively and 12% occasionally.[10] There is still a great deal of uncertainty surrounding what policies employers might adopt, to what extent working from home will continue and the extent to which new demand may enter the market to compensate for some of the losses.
Migration patterns: If travel to the office becomes less frequent, the catchment area for a job increases and the barriers to workers' geographical mobility are reduced. In addition to this, evidence exists that suggests people are considering moving farther away from cities to less densely populated areas. A survey by the London Assembly Housing Committee found that one in seven Londoners want to leave the city as a result of the pandemic.[11] If employers have access to a wider pool of workers and people commute for longer but less often, the rail industry could benefit from a more even distribution of passengers.	**Choice of transport modes:** As we emerge from movement restrictions, choices will be made about people's transport mode of choice. In some cities, traffic congestion has already crept back and one in 10 households that did not own a car before June 2020 had bought one by November 2020.[12] This poses a significant risk of a car-led recovery. As populations have reduced their exposure to crowded public transport to reduce the spread of the virus, the car becomes the more attractive option in terms of limiting the risk of contact. An increase in remote working could also decrease road congestion and traffic speeds, thereby making the car even more attractive.

The rail industry itself is also set to change significantly, with Williams-Shapps Plan for Rail announced earlier this year. This is the biggest shake-up since the privatisation of the network since the early 1990s. Great British Railways will bring the network into single national leadership, absorbing Network Rail and many functions of the Rail Delivery Group, Department for Transport and Office of Rail and Road. However, the new organisation will be structured to attempt to create a balance between the need to take a whole-system view nationally, and to meet the needs of local communities and regions. Although key strategic decisions will be taken centrally, operational matters will be led by five regional divisions. These powerful regional divisions will be able to enter into partnerships with public authorities at the regional, city and town level in order to strengthen the link between how the railway is run and local leaders who can represent local priorities.[13]

Modernisation through digitalisation and electrification will continue and the current pricing system of the rail network will transform to include new products, such as flexible season tickets (aimed at new patterns of commuting), simplifying fares and making rail more convenient for customers – although the detail of how much of this will be achieved is to follow.[14,15] For some routes, predominantly long-distance routes, operators will have greater freedom to act more commercially including by setting more of their own fares and taking on more of the commercial risk, alongside the potential for new open access services to compete with the larger operators. In these markets, where leisure travel is often a key component, competition is most suited to driving continued value for money fares and high-quality service.[16] Given the potential for a robust leisure market in the future, the strengths of the private sector, if given the right levers on fares, marketing and other areas, can ensure rail remains flexible and innovative and in turn continues to attract people back to rail travel.

There is no doubt that there is a challenging backdrop to these reforms; with the industry and the needs of passengers going through significant change and, as the economy recovers from the pandemic, there remains a significant risk of a car-led recovery in which the economic, personal and wider societal benefits of rail are eroded. This report highlights the need to not let this happen.

In particular, this report highlights that rail will be critical to the 'build back better' agenda: in encouraging city life to return, moving critical freight and reducing carbon emissions. It seeks to demonstrate that the value of rail is not just in the utility of the trip itself but also the value to local economies, a green recovery and in encouraging the return in leisure and hospitality markets.

That means that collectively, we must grasp the opportunity to propel the rail industry into a time of stronger, smarter and more sustainable travel, which can support growth, livelihoods and living standards right across the country as well as ensuring that the UK moves towards its environmental goals.

2. HOW RAIL BENEFITS FAREPAYERS AND BROADER SOCIETY

Passenger rail use comes with a wide range of benefits to people, businesses, communities and society. Table 1 breaks down the type of benefits that the rail network brings between the private benefits that accrue to the farepayer directly and the social, economic and environmental "externalities" that accrue to broader society.

Table 1: Rail delivers both benefits to the individual passenger and to society more broadly

Category of benefit	Type of benefits
Private benefits net of costs (fares and generalised journey time)	Benefits of access to work, leisure and other opportunities
	Benefits of business travel and freight
	Ability to work on train
The social, wider economic and environmental net benefits of rail (externalities)	Wider economic benefits (including agglomeration)
	Reduced congestion
	Improved environment
	Other (option value, heritage value etc.)
	Accessibility / connectivity to non-profitable routes

Private benefits of rail use

People across the country benefit from using rail to access work, leisure and other opportunities and businesses benefit directly through their employees using the rail network to meet with clients, visit work sites or explore new business opportunities. These benefits accrue to the individual or organisation paying for the journey who incur both the monetary cost of the fare and other costs such as the value of the time the journey takes. Hence the net benefit to society is the private benefit net of costs.

In transport appraisal this is measured as consumer surplus. The Rail Delivery Group have previously published estimates of the value of this consumer surplus, made by Oxera, for the year 2013.[17] We have uprated these estimates to the final year pre-pandemic, 2019, by inflation, passenger growth and the increase in values of time – a key determinant of consumer surplus.

These calculations suggest that **passenger benefits increased to £16bn in 2019** (from around £12bn in 2013). Recent research by Deloitte for RDG has also estimated that there are a further **£1.65bn in benefits enjoyed by the customers of rail freight.**[18]

The social, economic and environmental net benefits of rail

The rail network also provides a wide range of benefits that accrue to broader society, and not the person paying for the journey. These externalities include:

- Wider economic benefits: Rail brings benefits through reduced congestion, and enabling individuals and firms to be more productive as they benefit from co-locating in well-connected hubs.
- Environmental benefits: Rail has considerably lower environmental impacts than car and aeroplane use through factors such as lower emissions of both greenhouse gases and nitrogen oxides / particulate matter which cause local air pollution. For every mile a person travels, passenger trains produce a third of the emissions of the average petrol car.[19]
- Social benefits: Rail provides mobility, which can help improve access to services such as education, employment and leisure, particularly for those who do not have a car.

There are a range of ways to estimate the value of these non-private benefits, or externalities, of rail. This report uses a survey-based method using people's and businesses' stated preferences. In this method, survey respondents are asked how much they would be willing to pay (or accept) for something; in this case the external social, economic and environmental benefits of rail.

We carried out two surveys:

- A nationally representative sample of the public online between 16th and 22nd June 2021, with responses from 2,241 residents of Great Britain. We also boosted the sample by 313 additional respondents in areas of particular interest including residents of combined authority areas.
- A survey of 103 decision-makers in small and medium businesses across the country online between 23rd June and 5th July 2021.

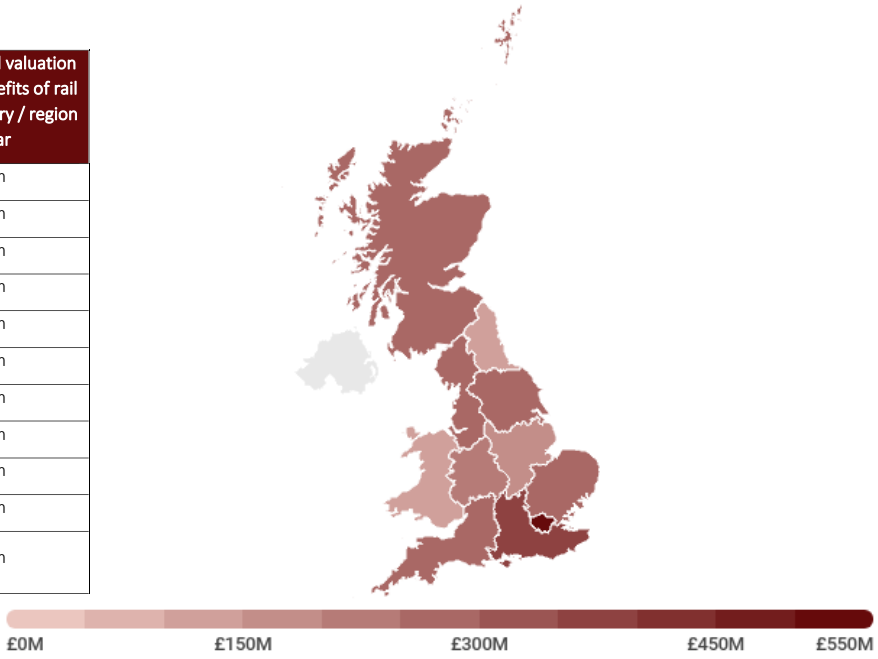
See the annex for further information on the methodology and detailed analysis of the results.

Our key findings from the surveys are that:

- Rail travel brings social, environmental and wider economic benefits that our surveys suggest are worth:
    - Around £2.9bn per year to households in Great Britain (around £8.90 per month to the average household).
    - Around £1.2bn per year to small and medium sized enterprises in Great Britain.
- Areas across the country value the rail network. Although London has a higher value than other areas, there is substantial value for households from the North-West (£290m) to the South-West (£250m) of England and to Scotland (£260m) and Wales (£120m). See figure 2.

Figure 2: Estimated valuation of external benefits of rail to households by country / region of Great Britain

Country / Region	Total estimated valuation of external benefits of rail travel for country / region per year
East Midlands	£170m
East of England	£270m
London	£550m
North-East	£130m
North-West	£290m
Scotland	£260m
South East	£350m
South West	£250m
Wales	£120m
West Midlands	£210m
Yorkshire and The Humber	£270m



Source: WPI Economics calculations

These valuations also vary by demographic and travel behaviour factors. As would be expected, those with higher incomes, residents of London and more frequent users of rail have higher valuations. A full description of the analysis is included in the annex. However, what is notable is that the value of rail amongst the rest of the country is still substantial and does not vary much across other demographic factors. For example, we estimate that the average valuation per household (controlling for other factors) in the North-East of the country is £8.40 per month and that for those on incomes less then £12,000 per year it is still £6.80 per month. Residents of seaside towns are estimated to have a valuation of £10.20 per month. This illustrates that the rail network provides value across the length and breadth of the country, and its importance for agendas like levelling up.

3. RAIL USERS' SPENDING AND THE ECONOMIC FOOTPRINT OF RAIL

Other ways of looking at the economic benefits of rail are to look at the spending associated with passengers as they make their journeys, and to estimate the overall contribution of rail to the economy.

To understand the size of the spending associated with rail, we asked respondents to our survey to estimate how much they spent on other travel, hospitality, shopping, entertainment and culture alongside their rail fare.

We found that on average people say that prior to the pandemic they spent £94 per rail journey on associated items.[20] This includes food and drink (£29), shopping (£27) and accommodation (£18 – reflecting a mix of overnight stays and day trips with zero spending on accommodation). Table 2 also highlights the differences in spending patterns between rail journeys for commuting and leisure.

Table 2: Reported spending associated with average journey by rail

	Associated spending (average per journey including spending on outward and, if any, return legs as well as at the destination)		
Spending category	All journeys	Leisure journeys	Commuter journeys
Other travel	£10	£10	£9
Food and drink	£29	£33	£12
Shopping	£27	£31	£15
Accommodation	£18	£21	£8
Entertainment and culture	£11	£12	£5
Total	**£94**	**£107**	**£49**

Source: WPI Economics/Savanta

Each person makes an average of 22 rail trips per year, meaning around 1.4bn trips made annually across the 65m people in Great Britain. **This implies total spending associated with rail travel in Great Britain to be around £133bn per year**.

Using the corresponding calculations for regions and city regions, we have estimated the implied spending for these areas, taking into account how the frequency of rail travel varies across the country (see table 3). **The results suggest that there is £16bn per year of spending associated with rail trips in the mayoral Combined Authorities, such as Greater Manchester and the West Midlands, £8.5bn in Scotland and £4.8bn in Wales.**

Table 3: Total spending associated with all rail journeys, by region and city region

Regions	Other travel	Food and drink	Shopping	Accommodation	Entertainment and culture	Total
East Midlands	£460m	£1,370m	£1,960m	£1,250m	£700m	**£5,740m**
East of England	£1,360m	£4,070m	£2,430m	£2,290m	£2,140m	**£12,290m**
London	£6,870m	£18,030m	£11,810m	£11,890m	£5,590m	**£54,190m**
North-East	£150m	£560m	£320m	£340m	£70m	**£1,400m**
North-West	£630m	£2,460m	£2,930m	£1,890m	£1,080m	**£9,000m**
Scotland	£1,060m	£2,810m	£2,090m	£1,680m	£850m	**£8,490m**
South-East	£2,180m	£6,260m	£6,170m	£2,920m	£2,160m	**£19,690m**
South-West	£600m	£1,600m	£1,670m	£1,050m	£610m	**£5,530m**
Wales	£380m	£1,450m	£1,140m	£1,280m	£590m	**£4,840m**
West Midlands	£600m	£1,920m	£2,150m	£930m	£800m	**£6,400m**
Yorkshire and The Humber	£560m	£1,470m	£1,580m	£1,120m	£590m	**£5,300m**
Great Britain	**£15,000m**	**£42,000m**	**£34,000m**	**£27,000m**	**£15,000m**	**£132,900m**
Mayoral Combined Authority	**Other travel**	**Food and drink**	**Shopping**	**Accommodation**	**Entertainment and culture**	**Total**
Greater Manchester	£270m	£1,010m	£740m	£520m	£420m	**£2,960m**
Liverpool City Region	£100m	£740m	£410m	£390m	£200m	**£1,840m**
Tees Valley	£40m	£110m	£100m	£80m	£10m	**£340m**
West Midlands	£250m	£840m	£650m	£290m	£240m	**£2,270m**
West Yorkshire	£340m	£980m	£940m	£600m	£310m	**£3,170m**
West of England	£90m	£190m	£80m	£80m	£30m	**£470m**
Cambridgeshire and Peterborough	£230m	£670m	£470m	£370m	£330m	**£2,070m**
South Yorkshire	£190m	£780m	£650m	£500m	£180m	**£2,300m**
North of Tyne	£60m	£150m	£140m	£140m	£60m	**£550m**

Source: WPI Economics/Savanta

Gross Value Added

The rail industry makes a significant contribution to overall domestic production, **directly contributing £7.1bn in gross value added**, a measure of overall economic activity.[21] The direct economic activity in the rail sector also leads to further indirect activity through the supply chain to the rail industry. This has previously been estimated by Oxera for the Rail Delivery Group as amounting to £3.5bn per year in 2013. If we assume this will have increased in proportion to the increase in direct GVA between 2019 and 2013 (22%) then indirect Gross Value Added would have been **£4.3bn in 2019.**[22]

4. THE VALUE OF A RETURN TO RAIL FOR PEOPLE, BUSINESSES, COMMUNITIES & THE ENVIRONMENT

The previous chapter of this report demonstrated the significant economic, personal and societal benefits that lead from passenger rail use. As outlined in the introduction, these benefits could be at risk if the economic recovery from the pandemic saw a significant mode shift towards car.

To understand the scale and nature of these risks, this section presents original analysis of the concerns that the public and businesses have about a permanent fall in passenger rail usage and the potential associated environmental impacts.

People and businesses across the country share a range of concerns about a drop in rail usage

To understand people's understanding of these risks, we conducted an online survey of a nationally representative sample of 2,241 residents of Great Britain between 16th and 22nd June 2021[23], which amongst other questions asked people about their concerns if we were to see a car-led recovery and a permanent drop in rail usage. We also surveyed 103 decision-makers in small and medium businesses across the country online, between 23rd June and 5th July 2021.

Public concerns about a fall in rail use

We asked our participants to imagine that the number of people travelling by rail in Great Britain dropped permanently from pre-covid-19 levels by 5% and 20% with many of the same journeys now being taken by car instead. This would mean a reduction in rail journeys made each year by 100 and 350 million respectively. We presented our respondents with a long list of potential consequences from environmental concerns such as increased traffic, to economic concerns such decreased activity in city centres, to social concerns such as a reduced ability to access leisure opportunities. We also provided them the opportunity to say that they would not be concerned.

Table 4 shows that the public has significant concern about a permanent 20% reduction in rail travel across a range of economic, social and environmental issues. For example, nearly six in ten (56%) of people are concerned about at least one environmental issue. More than half (54%) have economic concerns about a fall in rail use. Looking more specifically, we see that 42% are worried that it would cause an increase in traffic on Britain's roads and 33% about an increase in carbon emissions. Two in ten (18%) are worried about harm to city centres and high streets and the same proportion are worried about the potential reduction in ability to access jobs, leisure and other opportunities.

Perhaps surprisingly, the results show similarly strong fears even for a relatively small (5%) permanent reduction in rail travel.

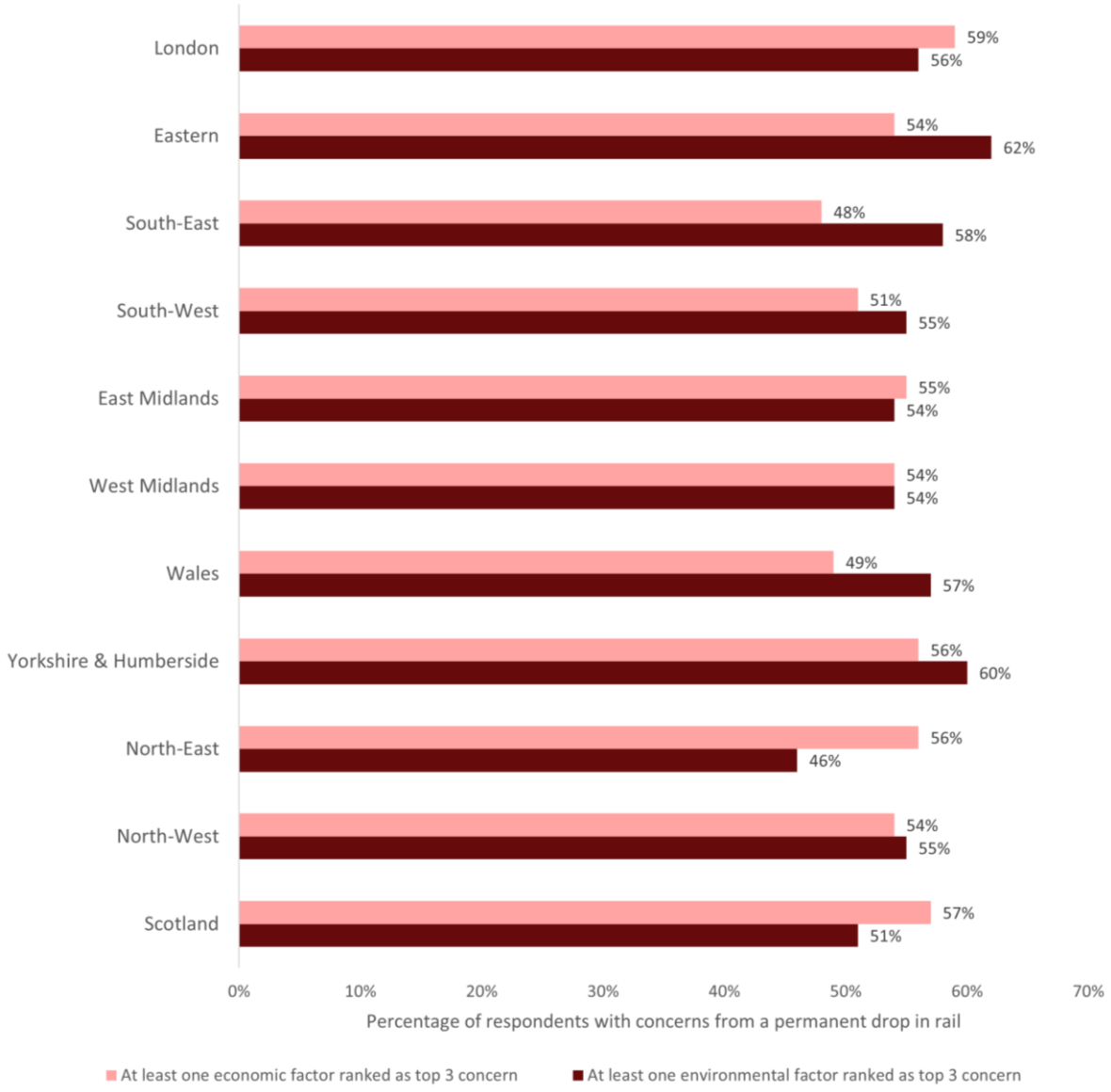
Table 4: Main concerns from a permanent drop in rail usage

	Percent of respondents ranking concern in top 3 when considering a 5% fall	Percent of respondents ranking concern in top 3 when considering a 20% fall
A least one environmental concern	55%	56%
At least one economic concern	47%	54%
Increased traffic on Britain's roads	42%	42%
Increase in Britain's carbon emissions	30%	33%
Reduction in air quality in Britain	27%	29%
Reduction in the number of jobs in the rail sector	24%	22%
Harm to the natural environment / biodiversity in Britain	22%	22%
Harm to city centres / high streets in areas with rail stations	18%	18%
Reduction in people's ability to access jobs, leisure and other opportunities	18%	18%
Harm to businesses near railway stations	17%	17%
Reduction in people's work / life balance due to increased working from home	14%	15%
Drop in house prices in areas with rail stations	11%	11%
I do not think any of these would be consequences / not concerned	10%	9%
Don't know	7%	7%

Source: WPI Economics and Savanta ComRes

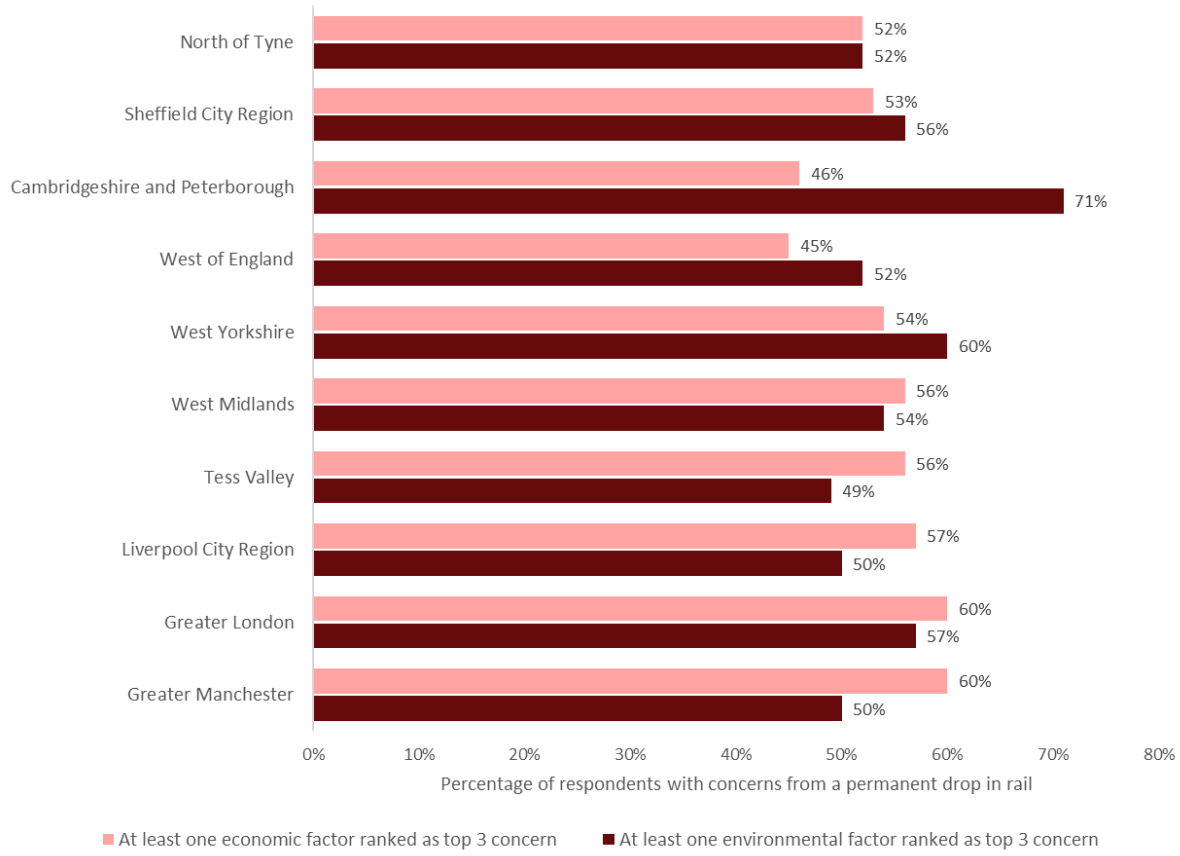
The figure below shows the percentages of people that listed at least one environmental or economic factor in their top 3 overall concerns regarding a car-led recovery. We found that environmental concerns (increased carbon emissions, reduced air quality, harm to biodiversity) were shared across the length and breadth of the country, with similar proportions in all the constituent parts of Great Britain.

Figure 3: Proportion of the public with economic and environmental concerns from a permanent 20% drop in rail usage by GB nation and region



Source: WPI Economics and Savanta ComRes

Figure 4: Proportion of the public with economic and environmental concerns from a permanent 20% drop in rail usage by combined authority



Source: WPI Economics and Savanta ComRes

Businesses' concerns about a fall in rail use

When conducting the business survey, we asked about concerns directly affecting businesses. For example, reduced punctuality of staff or a drop in customer numbers and squeezed profits. When thinking about their own business even a small fall in rail usage of 5% prompted concerns. These concerns grew as they thought about a potential fall of 20%. For example:

- 34% of participants in the North of the country picked a drop in customer numbers as one of their biggest concerns; and
- 33% of participants in the Midlands picked more traffic congestion around their business as one of their biggest concerns.

Table 5: Main concerns for small and medium-sized businesses from a permanent 20% drop in rail usage

Region	Percentage of respondents ranking concern in top 3 when considering a 20% fall in rail usage						
	Reduced profitability	Drop in customer numbers	Harder for staff to get to work	More traffic congestion around business	Worse available parking near business	Harder for business to function	Harder to receive deliveries
North	27%	34%	34%	36%	23%	39%	47%
Midlands	10%	18%	31%	33%	23%	26%	31%
South	25%	23%	25%	28%	35%	25%	28%
Scotland / Wales	Sample size too small to report results						
Great Britain	23%	26%	28%	33%	30%	28%	31%

Source: WPI Economics and Savanta ComRes

Respondents also highlighted a number of broader social concerns amongst their top three concerns about a fall in rail usage. These included:

- Over 4 in 10 (44%) being concerned about an increase in Britain's carbon emissions;
- 3 in 10 (30%) being concerned about harm to the natural environment and biodiversity;
- More than 4 in 10 (43%) being concerned about increased traffic on Britain's roads; and
- 1 in 4 (25%) being concerned about harm to businesses near rail stations.

The environmental costs of a permanent shift from rail to car

The results above show that the public and GB businesses are concerned about the environmental and congestion impacts of a permanent shift away from rail. Given the facts, this should come as no surprise. Rail can carry large volumes of passengers and freight which can efficiently reduce road traffic and increase access into city centres. As rail offers access to airports and other major transportation hubs it can help to minimise localised congestion. Trains are particularly good at keeping a city's transportation system as a whole working smoothly. It does this by creating a 'transport spine' with links to buses, overground, underground and other forms of transit.[24] Crossrail, for example, will offer significant interconnectivity benefits as well as more efficient travel – increasing London's rail capacity by 10%.[25]

Compared to car and lorry transportation, rail is also one of the cleanest modes of transport and produces less pollution per passenger.[26] Meanwhile, the costs of congestion are already expected to rise by 63% by 2030 to £21 billion (the equivalent of £2,057 per household).[27] Furthermore, high speed rail might reduce the domestic aviation market.[28] Travel from Scotland to London is most popular by flight but there will be huge environmental benefits by replacing these with proper connections into the HS2 network.[29]

Rail is the only mode of transport capable of moving both people and heavy goods in and out of cities using a low-carbon solution. For every mile a person travels, passenger trains produce a third of the emissions of the average petrol car.[30] Even with partial decarbonisation, high speed rail has emissions per passenger-km that are only 12% of those incurred by private car use and 5% of air.[31] The Department for Transport has challenged the rail industry to have removed all diesel only trains from the network by 2040 in England and in Wales. Presently, 38% of the rail network is electrified,[32] although as these are commonly the most heavily used lines over 80% of distance travelled by rail is on electrified lines.[33] There is an opportunity of even greater benefit if a rolling programme of electrification were to be introduced across the network, supplemented by hydrogen and battery technology.

In terms of air and noise pollution, emissions of nitrogen dioxide and particulate matter (PM) are lower for rail than for road and air transport.[34] NO_2 has a clear local pattern and is mostly concentrated in urban areas and busy roads where vehicles are the major causes of air pollution. Air pollution causes an estimated 40,000 deaths a year in the UK.[35] Well-designed compact cities with reduced car transportation needs can increase sustainability and lead the way to net zero emissions.

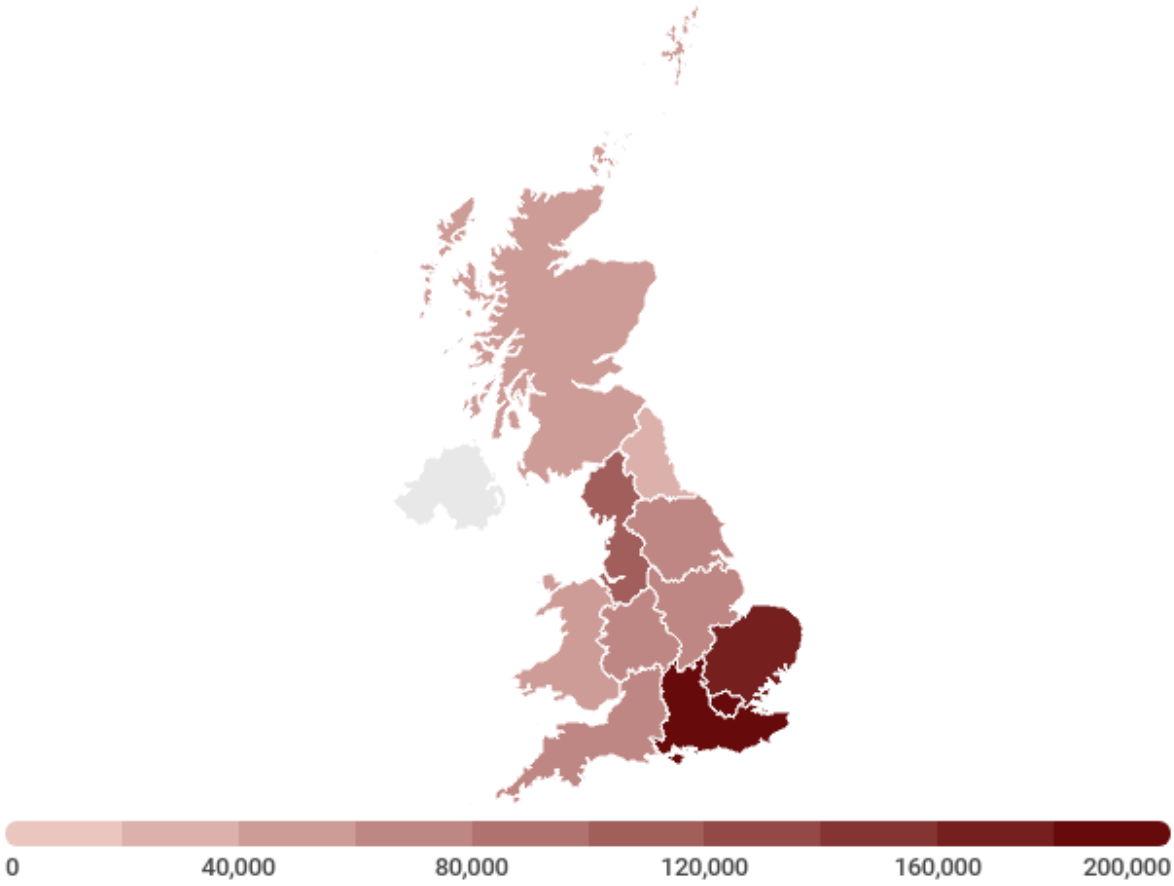
Given these significant benefits of reducing environmental damage and the costs of congestion, there is a significant risk of a recovery that moves significantly away from rail. To assess the potential impact of a permanent drop in rail usage, this report analyses the impact on congestion and greenhouse gas emissions for the constituent parts of Great Britain from 20% of rail usage switching to car. Whilst it is difficult to forecast the likely switch to car, overall rail usage in July and August 2021 was between 47-68% of pre-pandemic usage with car use up to 11% higher.[36] A detailed methodology is included in the annex.

Our estimates show that a switch of 20% of rail usage to car could result in:

- Increased greenhouse gas emissions of over 1 million tonnes CO2 equivalent per year - the same amount produced by all activity in Swansea in 2019[37];
- Costs of congestion that are £2.75bn higher per year.

The importance of rail to London is clear (accounting for £1.6bn of the congestion cost estimate), but there are impacts across the country. The North-West is estimated to suffer from an increase of £170m in the cost of congestion, and the East of England accounting for 160,000 tonnes increased emissions.

Figure 5: Estimated increase in carbon emissions (tonnes CO2e) by country / region were 20% of rail usage were to switch to car



Source: WPI Economics

Table 6: Estimated impacts if 20% of rail usage switched to car, by GB nation and region

Region / country	Impact if 20% of rail usage switches to car			
	Increase in car miles per year	Increase in greenhouse gas emissions per year (tonnes CO2e)	Increase in hours of congestion*	Cost of increased congestion per year
North East	150m	30,000	6m	£60m
North West	440m	100,000	18m	£170m
Yorkshire and The Humber	270m	60,000	11m	£110m
East Midlands	300m	60,000	8m	£80m
West Midlands	310m	70,000	13m	£130m
East of England	750m	160,000	29m	£270m
London	970m	210,000	169m	£1,590m
South East	990m	210,000	22m	£200m
South West	330m	70,000	7m	£60m
England	**4,500m**	**970,000**	**283m**	**£2,670m**
Wales	250m	50,000	4m	£40m
Scotland	230m	50,000	4m	£40m
Great Britain	**4,990m**	1,070,000	**300m**	**2,750m**

Source: WPI Economics

Notes: Increase in hours of congestion is a simple transformation of the increased costs of congestion, using the average value of time for rail travellers, so does not account for the mix of rail users that would be impacted by the increased congestion.

Table 7: Estimated impacts if 20% of rail usage switched to car, by English Combined Authority

Region / country	Impact if 20% of rail usage switches to car			
	Increase in car miles per year	Increase in greenhouse gas emissions per year (tonnes CO2e)	Increase in hours of congestion*	Cost of increased congestion per year
Greater Manchester	154m	33,000	4m	£37m
Liverpool City Region	99m	21,000	3m	£24m
Tees Valley	41m	9,000	1m	£13m
West Midlands	131m	28,000	5m	£47m
West Yorkshire	172m	37,000	4m	£37m
West of England	77m	17,000	2m	£16m
Cambridgeshire and Peterborough	96m	21,000	2m	£23m
South Yorkshire	69m	15,000	2m	£15m
North of Tyne	57m	12,000	2m	£18m

Source: WPI Economics calculations

We can also assess the potential cost of a permanent drop in rail usage on local air pollution, noise and accidents for the constituent parts of Great Britain.[38]

We find that (Table 8) a 20% switch from rail to car would cause:

- Increased air pollution with health costs valued at £79m per year across Great Britain;
- Increased accidents with costs valued at £181m per year; and
- Increased noise with costs valued at £12m per year.

Table 8: Estimated impacts if 20% of rail usage switched to car

Region / country	Impact if 20% of rail usage switches to car		
	Cost of increased air pollution per year	Cost of increased accidents per year	Cost of increased noise per year
North East	£2m	£7m	£0.5m
North West	£5m	£15m	£1.3m
Yorkshire and The Humber	£3m	£10m	£0.9m
East Midlands	£2m	£9m	£0.5m
West Midlands	£3m	£10m	£0.7m
East of England	£5m	£22m	£1.4m
London	£45m	£58m	£4.2m
South East	£7m	£28m	£1.8m
South West	£2m	£9m	£0.6m
England	**£75m**	**£168m**	**£11m**
Wales	£2m	£7m	£0.4m
Scotland	£2m	£7m	£0.5m
Great Britain	**£79m**	**£181m**	**£12m**

Source: WPI Economics calculations

5. RAIL'S VALUE IN SUPPORTING OUR CITIES, TOWNS AND RURAL AREAS

The economic, personal and societal benefits highlighted above are seen right across the country's cities, towns and rural areas. Based on our survey, table 9 shows that although the largest value of the rail network is found in cities, there is substantial value across the towns and villages of Great Britain – **in total people in all towns outside conurbations value the broader social benefits of rail at over £1bn per year, and people in villages or more rural areas at another £490m per year.** [39,40]

Table 9: Valuation of external benefits of rail travel for households by city and town classification

City and Town classification	Estimated valuation of external benefits of rail per household per month	Total estimated valuation of external benefits of rail travel per year
Core City (London)	£13	£570m
Core City (outside London)	£10	£290m
Other City	£10	£310m
Large Town in Conurbation	£7	£80m
Medium Town in Conurbation	£7	£90m
Small Town in Conurbation	£6	£40m
Large Town	£9	£480m
Medium Town	£8	£400m
Small Town	£6	£170m
Village or smaller (i.e. rural areas)	£8	£4,890m

Source: WPI Economics calculations based on Savanta ComRes survey findings

We also find that the average valuation per household does not vary much by the type of area that we are considering. Although there are high valuations in London as would be expected (£13 per household per month), we also find that, for example **people living in rural areas value the benefits at around £8 per household per month.**

The following sections show how rail contributes to different parts of the country in different ways. For cities rail is a crucial way of boosting the economy through enabling a large pool of employees to access highly productive urban centres, benefitting from being close to potential clients, suppliers and competitors (who they can learn from). Within cities the importance of the rail network to environmental goals is also clear, with heavily used public transport networks reducing greenhouse gas emissions and local air pollution.

Rail also benefits areas of the country outside cities. The importance of rail to our towns varies by the type of town; for seaside towns rail provides an efficient means of access for tourists who contribute to local economies, for suburban towns it provides fast and efficient links to many jobs in nearby cities and for towns and rural areas across the country it allows access to jobs, leisure and other opportunities for those without a car.

More generally, rail freight also offers significant benefits to rural areas, reducing the likelihood of local roads becoming overburdened with higher volumes of traffic.[41] This is driven by the bulky nature of the commodities that rail freight typically transport. A study by Deloitte for the Rail Delivery Group used National Rail, Office of Rail and Road and Department for Transport data to estimate the benefits that rail freight generates for the UK economy.[42] They estimated that congestion impacts were by far the most prominent component at over £600m per year and that the benefits of rail freight were highest outside London and the South-East. This demonstrates the constraints on road networks in Great Britain and the significant potential of rail freight to address congestion issues, and in supporting the levelling up agenda.

Cities

Across the UK, cities make up the majority of the national economy. They cover just 9% of land but account for 59% of jobs and 61% of output.[43] Cities enable close links between businesses, individuals and institutions, with distinct advantages for economic growth and productivity. Cities bring together innovators, entrepreneurs, researchers, knowledge workers and investors that collaborate and create the conditions for productivity growth.[44] This proximity is also central to the significant social and cultural opportunities in cities, and the fact that more densely populated areas have lower resource use per person that urban areas.[45]

Rail plays a major part in supporting and delivering these benefits. For example, transportation links in and around cities enable individuals and firms to be more productive as they benefit from co-locating in well-connected hubs. Because of the number of jobs transport can connect to businesses and the time and cost it takes to travel between home and work, rail offers significant economic contributions to the economy. For those that do not have a car, rail also provides mobility which can help improve access to services such as education, employment and leisure, thereby supporting social mobility and inclusion. This makes rail centrally important to the Government's levelling up agenda.

Table 10: Estimated valuation of external benefits of rail travel for households in cities

Estimated valuation of external benefits of rail per household per month	Total estimated valuation of external benefits of rail travel per year
£11	£1,000m

Source: WPI Economics calculations based on Savanta ComRes survey findings

Table 11: Main concerns from a permanent 20% drop in rail usage, for households in cities

	Proportion of population
A least one environmental concern	55%
At least one economic concern	57%

Source: WPI Economics and Savanta ComRes

Table 12: Average spending associated with all rail journeys with a city destination

Journey type	Other travel	Food and drink	Shopping	Accommodation	Entertainment and culture	Total
Commuting	£10	£12	£8	£8[2]	£6	£44
Leisure	£10	£35	£36	£20	£13	£114

Source: WPI Economics and Savanta ComRes

[2] Most commuters said they spent nothing on accommodation (88% of those who answered the question), but the average spend is slightly above zero due to a small number of commuters who report positive expenditure. We hypothesize that this is likely to be, for example, people who commute infrequently to their place of work and stay overnight nearby.

Seaside towns and leisure locations

The rail network stretches across Britain and facilitates travel to seaside towns and leisure locations. With inbound tourism still severely restricted by Covid regulations, domestic tourism by train could provide vital support to Britain's seaside towns and leisure locations.

There are a wide range of benefits associated with this travel. For example, people travelling by rail to seaside locations spend on average £116, with food and drink, shopping and accommodation attracting the most spend per journey. Moreover, respondents told us that a substantial portion of this spending was with small businesses. **For 19% of people, over half of their spending was with small or independent businesses, and for a further 20% it was around half.**

The rail network also provides substantial social value to those living in seaside towns – whether that is through the economic benefits that increased tourism brings or the reduction in congestion and environmental impacts that travel by rail has compared to car. Our survey found that those living in a seaside town with a rail station value the social, environmental and wider economic benefits that the rail network brings to their household at around £120 per year.[46] In total this implies **the social value of the rail network to seaside locations is worth up to £330 million per year.**[47] These benefits come on top of the private benefits that accrue to farepayers.

Table 13: Estimated valuation of external benefits of rail travel for households in seaside and leisure locations

Estimated valuation of external benefits of rail per household per month	Total estimated valuation of external benefits of rail travel per year
£10	£330m

Source: WPI Economics calculations based on Savanta ComRes survey findings

Table 14: Main concerns from a permanent 20% drop in rail usage, for households in seaside and leisure locations

	Proportion of population
A least one environmental concern	58%
At least one economic concern	56%

Source: WPI Economics and Savanta ComRes

Table 15: Average spending associated with all rail journeys with a seaside town / leisure destination

Journey type	Other travel	Food and drink	Shopping	Accommodation	Entertainment and culture	Total
Leisure	£13	£40	£23	£31	£10	£117

Source: WPI Economics and Savanta ComRes

Towns

Not only does rail support the growth of the UK's core cities, but it also benefits the surrounding towns and conurbations. Rail facilitates the networks and interactions between cities and commuting towns, allowing activity to continue efficiently. For busy workers in particular, rail offers an efficient mode of transport with business lounges and on-train connectivity which enables people to stay connected and work whilst in transit. In 2018 over half of all rail journeys in England were for commuting, over a quarter for leisure and the rest for business.[48]

A common misconception is that high levels of commuting hollow out places leaving them with weak local economies and limited commercial activity. However, good transportation links facilitates a mutually beneficial relationship between cities and towns, attracting investment and housing developments.[49]

Daily commuters from towns provide cities around the country with 2.6 million workers, and cities provide town residents with 2.6 million jobs illustrating that high levels of job provision and high levels of commuting are not mutually exclusive (example towns include – Castleford, Hatfield and Windsor).[50] In total, a quarter of all residents working in high-skilled occupations commuted to a city and towns with strong links to productive cities have the lowest unemployment rates.[51]

Table 16: Estimated valuation of external benefits of rail travel for households in towns

Estimated valuation of external benefits of rail per household per month	Total estimated valuation of external benefits of rail travel per year
£8	£1,000m

Source: WPI Economics calculations based on Savanta ComRes survey findings

Table 17: Main concerns from a permanent 20% drop in rail usage

	Proportion of population
A least one environmental concern	57%
At least one economic concern	53%

Source: WPI Economics and Savanta ComRes

Table 18: Average spending associated with all journeys with a town[3] destination

Journey type	Other travel	Food and drink	Shopping	Accommodation	Entertainment and culture	Total
Leisure	£8	£21	£21	£17	£9	£76

Source: WPI Economics and Savanta ComRes

[3] Towns that are classified as being within broader conurbations (such as Oldham) have not been include in this count.

Rural areas

Rail connects large numbers of people from rural towns and villages with employment and opportunities. Regional services carry more than three times the numbers of passengers than the much higher profile long distance network. For example, many of the major cities of Manchester, Birmingham, Liverpool, Bristol, Newcastle, Glasgow, Edinburgh and Cardiff, rely on regional networks to provide the bulk of the rail services for employees to work in their centres.[52]

Rail is also important in connecting residents to services in neighbouring towns and cities and in generating tourism spending in local areas. In many areas, tourism is central to the rural economy and rural lines provide the means of keeping this economy going.[53] In many cases, rail is a tourist attraction in its own right, given its heritage and historic value.[54] Rural transportation links can also reduce social exclusion through providing access to jobs and education, lowering costs and widening the search for employment and providing access to a range of other social and leisure opportunities.[55]

In towns and rural areas, community rail schemes are also innovative and important. Data from the Association of Community Rail Partnerships reveals that around 8,500 volunteers give more than 390,000 hours every year to delivering community rail activity on initiatives including community gardening, station maintenance, events, schools' engagement, walking and cycling and accessibility programmes. The activity is calculated to be worth £5.6m annually in terms of labour market contribution.[56]

Table 19: Estimated valuation of external benefits of rail travel for households in villages and smaller settlements

Estimated valuation of external benefits of rail per household per month	Total estimated valuation of external benefits of rail travel per year
£8	£490m

Source: WPI Economics calculations based on Savanta ComRes survey findings

Table 20: Main concerns from a permanent 20% drop in rail usage for households in villages and smaller settlements

	Proportion of population
A least one environmental concern	55%
At least one economic concern	54%

Source: WPI Economics and Savanta ComRes

Table 21: Average spending associated with all rail journeys with a rural destination

Journey type	Other travel	Food and drink	Shopping	Accommodation	Entertainment and culture	Total
Leisure	£10	£23	£21	£16	£13	£83

Source: WPI Economics and Savanta ComRes

6. A STRONGER, FAIRER AND GREENER RECOVERY

This report has shown the significant economic, societal and environmental benefits that rail travel can bring both to the country overall and to specific cities, towns and rural communities right across Britain. Looking forward, there are clear challenges to these. The pandemic has led to an unprecedented fall in rail use. There are also significant changes in the rail industry, and pre-existing shifts in user preferences have been accelerated by the pandemic. Navigating these challenges successfully will bring real opportunities as the economy and society recover from the pandemic. Grasping these opportunities and ensuring that rail plays a central part in the recovery could help to build growth that that spreads right across Britain, deliver on levelling up and ensure that the economy is greener and more sustainable than ever before.

ANNEX – DETAILED METHODOLOGY

Defining the benefits of rail use and methodology for the valuation of the social benefits of rail

The rail network delivers a wide range of benefits to the economy and society, both to passengers themselves through access to work, leisure and other opportunities and to broader society through enabling high concentrations of economic activity, reducing environmental damage and providing connectivity across the nation. For this work we distinguish between private benefits – those benefits accruing to the passenger themselves – and "external" benefits – those benefits accruing to broader society.

Private benefits of rail use

People and businesses across the country benefit from using rail to access work, leisure and other opportunities; this may be through wages received for work, enjoyment derived through leisure or other benefits to wellbeing derived from accessing services, shops and educational establishments etc. Businesses also benefit directly through their employees using the rail network to, for example, meet with clients, visit work sites or explore new business opportunities. Businesses also benefit from the ability of people to work on train journeys, where that is possible. These benefits accrue to the individual or organisation paying for the journey.

Passengers incur the cost of this travel including both fares and other costs such as the value of the time the journey takes. Hence the net benefit to society is the private benefit net of costs, often measured as generalised journey time. In transport appraisal this is measured as consumer surplus. The Rail Delivery Group have previously published estimates of the value of this consumer surplus, made by Oxera, for the year 2013.[57] We have uprated these estimates to the final year pre-pandemic, 2019, by inflation, passenger growth and the increase in values of time – a key determinant of consumer surplus. These calculations suggest that passenger benefits increased to £16bn in 2019 (from around £12bn in 2013). Recent research by Deloitte for RDG has also estimated that there are a further £1.65bn in benefits enjoyed by the customers of rail freight.[58]

"External" benefits of rail use:

The rail network also provides a wide range of benefits that accrue to broader society, and not the person paying for the journey. These externalities include:

- Economic benefits: Use of the rail network reduces congestion on the rest of the transport network, particularly on the roads. This saves people time, and in the case of business travel translates to economic benefit from faster, more efficient travel. The rail network also provides wider economic benefits through enabling individuals and firms to be more productive as they benefit from co-locating in well-connected hubs. This benefit comes through a number of advantages that firms get from clustering together such as learning from each other, sharing infrastructure / suppliers etc. or improving the labour market through broadening firms access to a wider pool of potential employees. These are often known as agglomeration effects.
- Environmental benefits: Rail is one of the most environmentally friendly modes of transport. For each 1,000 passenger miles rail emits 59kg of CO^2 equivalent, compared to an average of

273kg for the same journeys taken by car.[59] Emissions of nitrogen oxides and particulate matter which cause local air pollution are lower for rail than for road and air transport.[60]

- Social benefits: Rail provides mobility, which can help improve access to services such as education, employment and leisure, particularly for those who do not have a car. Across the country it promotes social capital and relationship building, which is an important pillar of the safety net of poor people in many societies, limiting the potential disadvantages of a local and restricted lifestyle.[61] Rail also provides connectivity to a wide range of rural locations. This can reduce social exclusion through providing access to jobs and education, lowering costs and widening the search for employment and providing access to a range of other social and leisure opportunities.[62]

There are a range of ways to estimate the value of these non-private benefits, or externalities, of rail including through the use of transport appraisal valuations of greenhouse gas emission reduction and wider economic impacts. We were commissioned to carry out an alternative approach through a survey-based method using people's stated preferences. In this method survey respondents are asked how much they would be willing to pay (or to accept) for something; in this case the external social, economic and environmental benefits of rail.

Methodology: approach

To design the valuation study we have followed an approach developed to estimate the social value of the post office developed by NERA (2009)[63] for PostComm and updated by YouGov and London Economics (2016) [64] for the Department of Business, Energy and Industrial Strategy. We have sought to follow best-practice throughout through a range of approaches including:

- Use of the Willingness to Pay (WTP) approach: Many studies suggest that Willingness to Accept (WTA) approaches lead to higher estimates of value than WTP approaches,[65] and have been found to yield inconsistent results.[66] We therefore used the Willingness to Pay approach throughout.
- Realistic context: For SP surveys to generate reliable information, it is important that the context for the valuation is realistic.[67] Respondents to the survey were therefore initially asked about how much they estimate they paid in rail fares pre-pandemic and then told that "*separate to rail fares, the government supports the rail industry financially to deliver benefits including reduced congestion, environmental benefits (e.g. reduced carbon emissions and local air pollution), supporting less-frequently used train services and enabling economic growth in towns and cities."* They were then asked stated preference questions about how much their household would be willing to pay in order to maintain the current rail network at its current scope.

  We followed NERA (2009)[68] and YouGov / London Economics (2016) [69] by using the framing of taxation, asking respondents how much their household would be willing to pay out of their existing tax bill. This increases the realism of the question for respondents.
- Guarding against starting point bias: Stated preference studies can exhibit "starting point" bias where respondents tend to give values close to an initial figure they have been given. We sought to follow best practice by giving a range of starting points, and by using an estimate of the average tax paid per household towards the rail network in 2014-2019 around which to group the starting points (which again gave realistic context).

- Piloting and cognitive testing: We were concerned that the questions may be difficult to answer for respondents due to their hypothetical nature, or that they may generate a large number of "protest" responses where a respondent gives an unrealistically high or low value. We therefore carried out a pilot study of 100 people and carried out detailed cognitive testing of a number of the more complex questions with 6 people.

    i. The pilot study showed no evidence of a significant number of protest responses, although we did adjust the starting values for the dichotomous choice question as the results showed a small amount of variation between the first and second question. We also noted that there was around a 20% non-response rate, but decided that we would still have sufficient sample size.

    ii. The cognitive testing showed that a number of test interviewees found the original wording of the questions confusing, so the wording was simplified. We also found that a number of test interviewees though that they were being asked whether they would be willing to pay additional tax, when our wording was supposed to convey that they were being asked how much of their existing tax bill they would be happy to pay towards the rail network. We altered the wording to make this clearer.

Methodology: specific questions asked

We carried out the nationally representative sample online between 16th and 22nd June 2021, with responses from 2,241 residents of Great Britain. We also boosted the sample by 313 additional respondents in areas of particular interest including residents of combined authority areas. We used the main sample for our core analysis, adding the boosted respondents when looking at those areas where sample sizes would be too small otherwise.

The survey asked people about their rail travel behaviour, the value the rail network has to their household, their spending associated with rail trips and their concerns if we were to see a car-led recovery and a permanent drop in rail usage. Here we report the analysis of the results on the value of the rail network.

Following NERA (2009)[70] we used two methods for asking the stated preference questions to elicit people's valuation of the external social, environmental and economic benefits of the rail network:

- Double-bounded dichotomous choice contingent valuation: This method gives respondents two subsequent either / or choices between paying part of their existing tax to maintain the current scope of the rail network, or paying none of their tax to the rail network and there being a substantially reduced rail network. In our survey respondents were first asked: *Suppose that to maintain the entire rail network as it currently is, your household would contribute [£x] per month out of your current tax bill. Or, the rail network would be substantially reduced and none of your household's taxes would be used to support the rail network. Would your household be willing, or not willing, to pay this level of tax in order to maintain the current rail network?*

  The value given was varied randomly between £7.50, £10, £12.50 and £15. Respondents are then asked the question again, but this time increasing the monetary value by £5 if they answered that they would be willing, and decreasing the amount by £5 if they answered they would not be willing.

- Payment card valuation approach: This method presents respondents a "payment card" with values from £0 to £100 per month and asks them to identify the maximum amount they

would be willing to pay to maintain the current scope of the rail network. Specifically we asked: *Out of your household's existing tax bill, what, if anything, is the maximum amount your household would be willing to pay per month to maintain the current rail network?*

These two methods are often used in the literature because the dichotomous choice method tends to produce higher values, possibly because the "take it or leave it" nature of the question may lead respondents to overstate their willingness to pay. The payment card approach tends to produce lower estimates. This may be because of a focus on money and greater opportunity for "strategic responses", where, for example, a respondent may choose a zero figure if they think the cost of maintaining the rail network exceeds their actual positive willingness to pay.[71]

Average willingness to pay can be estimated from responses to the payment card valuation question simply by estimating the average (mean) response – **our survey found an average value of £8.92 per month per household.**

Estimation of WTP from the double-bounded dichotomous choice questions is more complex. We followed the method recommended by Lopez-Feldman (2012)[72] to estimate willingness to pay through the use of the "doubleb" command within the statistical package stata which uses a probit regression as the underlying model.[73] The average valuation found depends on the control variables included:

- Running the regression with no control variables provides an **estimated average valuation of £7.93 (with 95% confidence that the true value lies within the range £7.21 - £8.60)**
- Running the regression with a number of our continuous explanatory variables (age, number of rail journeys taken in 2019, amount of fares paid in 2019) **finds a very similar average willingness to pay of £7.81 (95% confidence within range of £7.02 - £8.60)**

Our survey has therefore found relatively consistent valuations through both approaches, increasing our confidence in our findings. We have in fact found a higher value through the payment card valuation approach versus the double-bounded dichotomous approach, in contrast to what is often found. We therefore focus on the payment card valuation approach in the main text, and from here on, as it is usually found to be a lower bound on valuations.

Methodology: results

Using the data from our payment card valuation method, we can run regression analysis to explore how valuations differ due to demographic factors, travel behaviour and other factors. We use Ordinary Least Squares regression with a functional form of:

Average value = Constant + ß(Matrix of control variables)

We ran a number of regressions with a small number of control variables to determine which of our control variables were likely to increase the explanatory power of the model. We found the following:

- Age – statistically significant variable across all regressions
- Region respondent lives in – some regions were statistically significant, particularly London
- Number of journeys respondent took in 2019 - statistically significant variable across all regressions
- Gender - statistically significant variable across all regressions

- Income band of household – some income bands were statistically significant
- Seaside town indicator – whether the respondent lived in a seaside town was statistically significant
- Fares – not statistically significant
- Type of area (London, other city / urban / rural) – only London was found to be significant, but as this is also included in the region variable, this variable should be excluded.

Following this analysis, we settled on the following regression as our main model:

Average value = Constant + β_1(Age) + β_2(Region) + β_3(Rail Journeys in 2019) + β_4(Gender) + β_5(Income band) + β_6(Seaside town indicator)

Results of the regression are shown in table 1 below. 1,719 respondents provided an answer to the question, with the others responding "don't know". The table shows:

- Variables marked with a star are shown to be statistically significant. In the case of the discrete variables that have categories (e.g. region of the country), these need to be compared to a base value that is shown in the table – we have typically chosen these to be the factor that has the lowest average valuation except in the case of incomes where we have chosen the lowest income band.
- Variables found to be statistically significant with 95% confidence were:
    - Age
    - Number of rail journeys taken in 2019
    - Men compared to women
    - Income of more than £150,000, between £75,001 and £100,000 or between £33,001 and £40,000 compared to incomes of up to £12,000
    - Residents of seaside towns versus those who live in other coastal areas
    - Residents of London compared to the base region of West Midlands
- The key column of the table is the column titled "Estimated value for group, controlling for other explanatory variables". This is the marginal effect of that value, and identifies the average value that would have been found if all members had been of that group (e.g. if we had interviewed only respondents from the East Midlands, we estimated we would have found an average valuation of £7.66). We also show the lower bound and upper bound of our range of estimates, based on the 95% confidence interval, in the two columns to the right.

Table 1: Results from Payment Card Valuation main model regression

	Coefficient value	P value	95% confidence interval		Estimated value for group, controlling for other explanatory variables (£ per month)	Range (95% confidence) Lower bound	Upper bound
Age*	-0.07	0.00	-0.11	-0.04	N/A		
Rail journeys*	0.02	0.00	0.01	0.02	N/A		
Gender							
Female	Base				**£6.93**	£6.06	£7.80
Male*	1.91	0.00	0.64	3.17	**£8.84**	£7.97	£9.70
Identify in another way	-	-	-	-	-	-	-
Income							
Up to £12,000	Base				**£6.81**	£5.05	£8.57
£12,001 to £18,000	-0.70	0.57	-3.11	1.71	**£6.11**	£4.46	£7.76
£18,001 to £25,000	0.39	0.74	-1.93	2.72	**£7.20**	£5.68	£8.73
£25,001 to £33,000	1.25	0.28	-1.02	3.52	**£8.06**	£6.64	£9.48
£33,001 to £40,000*	2.92	0.02	0.43	5.41	**£9.73**	£7.97	£11.48
£40,001 to £50,000	1.97	0.13	-0.61	4.54	**£8.78**	£6.92	£10.64
£50,001 to £75,000	1.24	0.33	-1.27	3.76	**£8.05**	£6.27	£9.84
£75,001 to £100,000*	5.78	0.00	2.25	9.31	**£12.59**	£9.55	£15.63
£100,001 to £150,000	3.09	0.26	-2.25	8.42	**£9.89**	£4.86	£14.93
More than £150,000*	24.45	0.00	15.57	33.33	**£31.26**	£22.56	£39.96
Prefer not to answer	-2.07	0.20	-5.23	1.08	**£4.74**	£2.11	£7.36
Seaside towns							
Coastal but not seaside	Base				**£6.42**	£3.68	£9.17
Inland	1.04	0.47	-1.80	3.89	**£7.47**	£6.78	£8.16
Seaside*	3.74	0.02	0.68	6.80	**£10.16**	£8.75	£11.58
Regions							
West Midlands	Base				**£6.38**	£4.44	£8.32
East Midlands	1.28	0.39	-1.63	4.19	**£7.66**	£5.46	£9.85
Eastern	1.58	0.28	-1.28	4.43	**£7.95**	£5.85	£10.05

London*	4.96	0.00	2.28	7.64	**£11.34**	£9.45	£13.23
North-East	2.03	0.24	-1.37	5.43	**£8.41**	£5.63	£11.18
North-West	1.01	0.44	-1.54	3.55	**£7.39**	£5.74	£9.03
Scotland	2.62	0.07	-0.21	5.46	**£9.00**	£6.96	£11.05
South-East	-0.32	0.80	-2.81	2.17	**£6.06**	£4.53	£7.59
South-West	1.71	0.24	-1.15	4.57	**£8.09**	£6.03	£10.14
Wales	0.84	0.61	-2.38	4.06	**£7.22**	£4.67	£9.77
Yorkshire & The Humber	2.39	0.09	-0.35	5.13	**£8.77**	£6.84	£10.70
Constant	6.02	0.00	2.09	9.95	N/A		
Number of observations	1,719						
R-squared	0.10						

Example of interpretation:

- Age: older people report higher valuations than younger people, even once income has been controlled for. For each 10 years of age, the estimated valuation increased by £0.70 per month per household.
- Number of rail journeys: The more rail journeys an individual took in 2019, the greater their value. For each additional 10 rail journeys, the estimated valuation increases by £0.20 per month per household.
- Gender: Men have an average value almost £2 higher than women.
- Income: As would be expected, high income is associated with higher values. Those with very high incomes of more than £150,000 are estimated to have a value of £31 per month, and those with incomes of between £75,001 and £100,000 a value of £12.50 per month. However, we also find that those with incomes of between £33,001 and £40,000 have a statistically significant higher valuation than average of £9.70 per month.
- Seaside towns: Residents of seaside towns are estimated to have a valuation of £10.20 per month, compared to the average valuation of £8.90.
- Residents of London: London residents have a higher valuation than average of £11.30, even when differences in income have been controlled for.

Estimating the congestion and greenhouse gas emissions impact of a shift to car

To analyse the impact on congestion and greenhouse gas emissions for the constituent parts of Great Britain from 20% of rail usage switching to car, we have:

- Estimated the miles travelled by surface rail for each constituent country and region of Great Britain by using data from the National Travel Survey;
- Modelled a 20% fall in rail usage and calculating the attendant increase in car miles if this travel were to all transfer to car (accounting for average car occupancy of 1.6 people);
- Calculated the net increase in greenhouse gas emissions based on the relative greenhouse gas emissions factors for cars and rail; and[74]
- Calculated the cost of increased congestion using the Department for Transport's published estimates of Marginal External Costs of congestion by region.[75]

Endnotes

[1] This information is calculated from the National Travel Survey, a survey that asks people about their travel behaviour. It is lower than some other estimates, such as those made through use of ticket sales data.
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[3] Creds & DecarboN8, 2021. *Report: At a crossroads – Travel adaptations during Covid-19 restrictions and where next?* Available from: https://www.creds.ac.uk/wp-content/uploads/covid-transport-report.pdf Accessed 16/07/2021.

[4] Public health regulations meant that trains were only able to accommodate up to 45% of their previous capacity. Long distance operators had the largest proportional decrease in passenger journeys compared to pre-pandemic levels (21%), followed by regional operators (18%) and London and South-East Operators (13%).4 Compared to other modes of transport, the decrease in rates of use for the London Underground and National Rail has been significantly greater than for buses. At the highest point of transport use in the pandemic (September 2020), National Rail reached 42% of its normal use compared to around 58% for buses. City center office workers use the tube and National Rail proportionally more than bus services which implies that changing working habits could impact different modes of transport in different ways. As workers return to commuting once or twice a week, the rail industry is likely to see a gradual return to travel as passengers test out new working patterns and times of travel.

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[13] UK Government, 2021. *Great British Railways: The Williams-Shapps Plan for Rail.* Available from: https://www.gov.uk/government/publications/great-british-railways-williams-shapps-plan-for-rail Accessed 16/07/2021.
[14] UK Government, 2021. *Great British Railways: The Williams-Shapps Plan for Rail.* Available from: https://www.gov.uk/government/publications/great-british-railways-williams-shapps-plan-for-rail Accessed 16/07/2021.
[15] Under the new system, franchises have been abolished and new contracts will take their place for private firms competing to run trains. These companies will be paid a fixed fee for running rail services with bonuses for performance in areas such as quality, punctuality and customer experience.

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[20] Usual practice is to ask respondents about their last journey to aid recall and to get a representative sample of journeys. However, we wanted to understand the pre-pandemic spending patterns rather than spending patterns in the current unusual circumstances. Hence, we asked people to recall their last normal journey before the start of the pandemic. This is likely to introduce upward bias to the results as people will recall more memorable journeys, that are likely to have involved greater spending. To present conservative estimates, we have removed all outliers that were further than two standard deviations away from the average (mean).

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If this lower estimate is used then the the social value of the rail network to seaside locations would be worth £175 million per year.
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