Final report
March 2023

Chiltern Railways Economic, Social and Environmental Value

Chiltern Railways
Steer ref: 24305201

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Introduction - Richard Allan, Managing Director

Chiltern Railways connects tens of thousands of customers to work, education, healthcare, family, friends and many other activities every day by providing rail services between London, Buckinghamshire, Oxfordshire, Warwickshire and the West Midlands.

We are determined to build on our strong track record to provide a highly reliable service that is accessible for current and future customers in our communities. We are proud to be an inclusive and flexible employer for around 900 colleagues based in more than 30 locations on our network. We use a wide range of suppliers across the UK who support the delivery of our railway services, as you can see from the geographic maps enclosed.

This report shows that Chiltern's operations generated **£1.1 billion of social value benefits in 2022**. This includes a direct contribution of £44.9 million in colleague wages and £167.3 million in procurement contracts. These interactions also helped to generate a wider indirect economic benefit of £146.5 million from supplier activity in our regions, with a further £699.5 million being generated in wider societal benefits such as improving connectivity between businesses, environmental benefits from using the railway and external benefits such as reduced congestion on UK road networks.

We are determined to modernise and decarbonise our fleet of trains by delivering our strategic 20-year fleet plan. In February 2022 we launched 'HybridFlex', the UK's first mainline diesel-hybrid train. The launch was the result of several years of hard work with Porterbrook, the train's owner, and other partners, to convert a class 168 diesel train to HybridFlex, and the results of the first 12 months of operation will be assessed shortly. A decision will be made during 2023 on whether to convert the remainder of the Porterbrook-owned class 168 fleet to HybridFlex. We continue to work hard to develop a strong business case to modernise and decarbonise the other two types of diesel trains in our 200-vehicle fleet.

Chiltern is committed to building effective partnerships with local groups through our stakeholder engagement and volunteer work. We regularly engage with political and social stakeholders, from route Members of Parliament to Business Improvement Districts and charitable organisations. This work is supported by our community groups including the Heart of England Community Rail Partnership in the West Midlands and our 10 Station Adoption Groups across our network.

We are delighted and humbled by the valuable support provided by volunteers who bring energy and character to our stations, from tending railway gardens and planters to holding local events during the 2022 Commonwealth Games and Queen's Platinum Jubilee. We have exciting plans in this area for 2023, both to develop our existing partnerships and to expand our volunteer networks to more areas of Oxfordshire and Buckinghamshire.

We are committed to generating economic growth, encouraging social interactions, and reducing our environmental footprint to achieve net zero status by 2050. We will use this inaugural report to inform our social value plan and activity. We will continue to gather regular feedback through our engagement with local and national stakeholders and industry partners.

Richard Allan, Managing Director

Executive Summary

Introduction and Methodology

Since 1996 Chiltern Railways has operated passenger railway services on the Chiltern Main Line between London Marylebone station and Birmingham Moor Street and Snow Hill stations. It also operates services from Marylebone to High Wycombe, Aylesbury and Oxford and commuter routes in the West Midlands. Since 2009 Chiltern Railways been part of Arriva UK Trains, which itself is owned by Deutsche Bahn.

Understanding Chiltern's economic, social and environmental value is important as it helps policymakers, transport and non-transport businesses, taxpayers and customers consider the case for continued support and investment in the railway.

This report presents Steer's independent assessment of Chiltern's economic, social, and environment value. For this assessment, Steer has deployed a standard methodology known as an Economic Impact Assessment. This measures the four core channels through which economic impacts may be generated:

1. Direct impact: Direct impacts measure the level of economic activity carried out directly by Chiltern, including the company's total spend on staff salaries, rolling stock lease costs and station facilities.
2. Indirect impact: The indirect impact of Chiltern comprises the jobs and Gross Value Added (GVA) supported by Chiltern's supply chain. This is analysed using the level of expenditure on non-employment goods and services.
3. Induced impact: The induced impacts of Chiltern are quantified in terms of the wider economic activity that takes place when employees of Chiltern and its supply chain spend their earnings. Induced impacts represent the final channel of economic impact, through which the wages of those employed directly by Chiltern and its supply chain support jobs in other sectors of the economy.
4. Catalytic impact: Catalytic impacts capture the wider economic and societal potential resulting from the contribution of rail network to trade and tourism (the demand-side impact) and the long-run contribution of growth in rail travel to productivity and GDP (the supply-side impact).

Key Results and Findings

Steer's analysis has shown the existing annual impact of Chiltern to stand at £1.1bn.

Direct impacts: £44.9m

- Expenditure on staff: £44.9m

Indirect impacts: £167.3m

- Supply chain spend: £167.3m

Induced impacts: £146.5m

- Multiplier impact: £137.9m
- Passenger spend at stations: £8.6m

Catalytic impacts: £699.5m

- User benefits: £630.9m
- Social and environmental non-user benefits: £19.6m
- Wider economic benefits: £49.0m

Total impact: £1,058.2m

1 Introduction and Context

Introduction to Chiltern Railways

Chiltern Railways operates both commuter and regional services along the Chiltern Main Line between London Marylebone and Birmingham via High Wycombe, Princes Risborough, Banbury, and Warwick. Chiltern's network also serves Aylesbury, Oxford, Stratford-upon-Avon, and Stourbridge. Chiltern services call at a total of 66 stations.

In 2022, 18.5 million passenger journeys were made using Chiltern services. According to the Office of Rail and Road (ORR) pre-pandemic usage of Chiltern services was at 28.4 million passenger journeys in 2019/20.[1]

Chiltern Railways' Economic, Environmental & Social Value

It is important to demonstrate the economic, environmental, and social value of Chiltern's network and services to policymakers, transport and non-transport businesses, taxpayers, and customers, in order to make the case for continued investment in and support for the key services that Chiltern operates.

As the UK moves closer to the Government's target deadlines for net zero objectives, there is an opportunity for Train Operating Companies (TOCs) to demonstrate how they can be a key driver in the reduction of transport-related carbon emissions. There is also a role to play in helping meet the Government's levelling up agenda.

This report presents Steer's independent assessment of Chiltern Railways' economic, environmental, and social value, using an established quantified and monetised evidence base.

Chiltern Railways Services and Stations

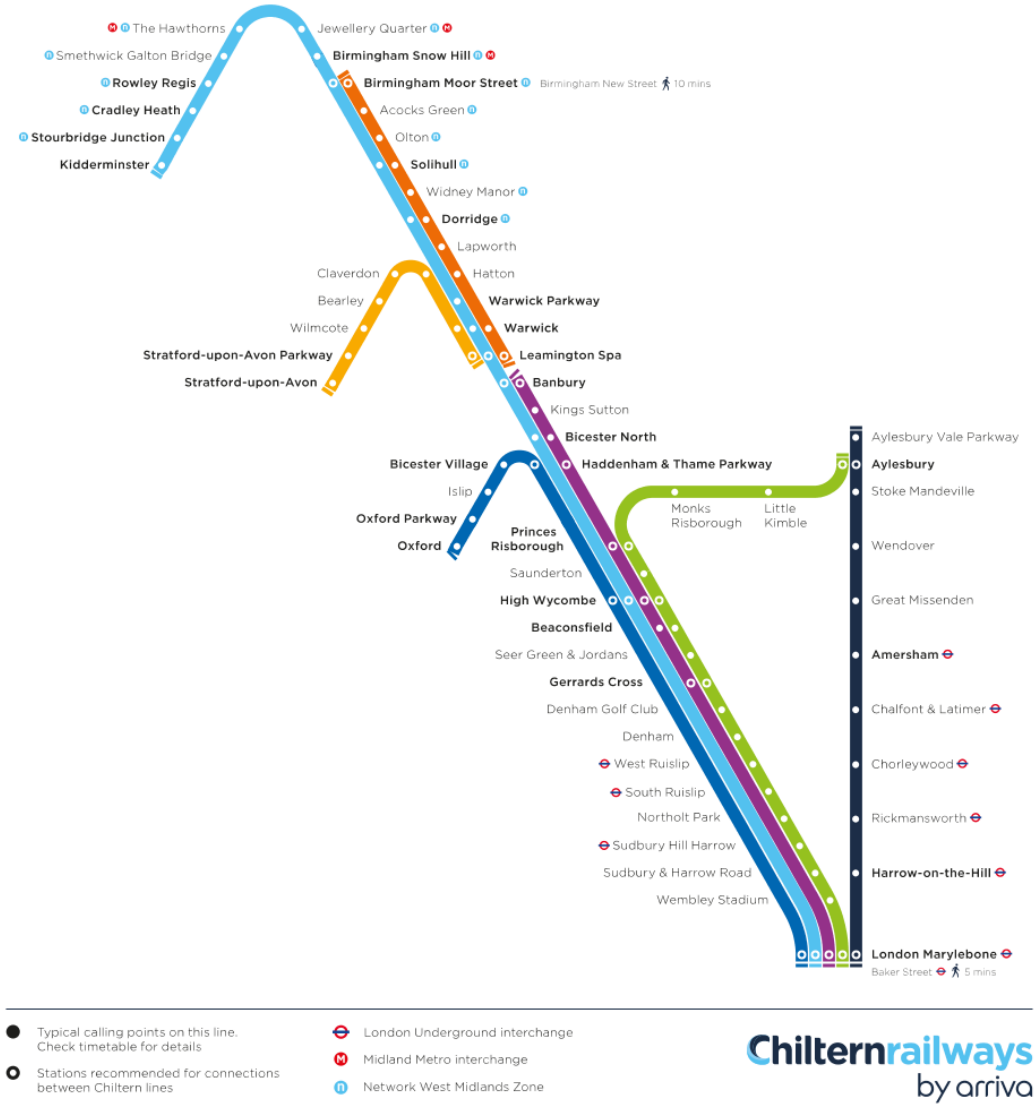
Chiltern serves a variety of passenger markets across its network. These include:

- Short distance commuter and leisure trips in north west London, between Marylebone, Wembley, and Harrow.
- Commuter routes out of London to and from major towns in Buckinghamshire, Oxfordshire, and Warwickshire.
- Intra-urban journeys in the West Midlands;
- Inter-urban flows across the Chiltern network, including between Birmingham and London; and
- Leisure and tourism journeys including to Wembley Stadium, Bicester Village and Stratford-upon-Avon.

Chiltern's route map is shown in Figure 1.1.

[1] Statistics from: https://dataportal.orr.gov.uk/media/2089/chiltern-railways-key-statistics-2021-22.pdf

Figure 1.1: Chiltern Railways route map



Source: Chiltern Railways **https://www.chilternrailways.co.uk/routes-and-destinations**

Table 1.1 shows the top ten flows on the Chiltern Railways network.

Table 1.1: Top 10 Chiltern Railways flows by patronage (year to September 2022)

Flow	Annual Chiltern Patronage (000s)
London Marylebone - High Wycombe	1,255
London Marylebone - Bicester North	840
London Marylebone - Beaconsfield	680
London Marylebone - Gerrards Cross	665
Bicester Village - Oxford	575
London Marylebone – Amersham	485
London Marylebone - Banbury	435
Solihull - Birmingham	405
London Marylebone – Leamington Spa	390
London Marylebone – Haddenham and Thame Parkway	390

Source: LENNON data extracted from MOIRA1 software

Chiltern is the station facility owner for 35 stations across its network. In 2021/22, the 35 Chiltern operated stations recorded nearly 49 million entries and exits in total. Table 1.2 below shows the breakdown of entries and exits for the top ten busiest stations.

Table 1.2: Entries and Exits by Chiltern-managed station (2021/22 data, 000s)

Station	Region	Entries and Exits (2021/22)
London Marylebone	London	7,489
Birmingham Moor Street	West Midlands	4,384
Banbury	South East	1,885
Leamington Spa	West Midlands	1,656
High Wycombe	South East	1,624
Bicester Village	South East	1,178
Solihull	West Midlands	1,038
Aylesbury	South East	743
Beaconsfield	South East	727
Gerrards Cross	South East	660

Source: ORR Estimates of Station Usage, 2022

Employees and Suppliers

In addition to the services offered, Chiltern's impact can also be seen through its employment and supply chain, including how these are spread across the country. Analysing the geographical distribution of Chiltern's full-time equivalent (FTE) and supply spending is an important tool for understanding the economic and social footprint of Chiltern Railways.

As of 31st March 2022, Chiltern had a FTE of 896, with growth from a pre-pandemic March 2019 level of 852 FTE. Chiltern's workforce is distributed widely, with a strong core along the route it operates. In total, Chiltern's employees live within 59 of the UK's 121 postcode areas.

The income of Chiltern's employees will subsequently be spent in their local economy. Knowledge of where a business's employees live can show the likely spread of its impacts, as well as the positive social impacts resulting from employment. As discussed further in this report the geographical spread of Chiltern's employees suggests that Chiltern's economic and social impacts are spread across the route.

In addition to the spend on employment, Chiltern contracts suppliers across the country. With this investment being reinvested in the suppliers' local economy, Chiltern's economic and social impact is spread even further.

Chiltern's Community Activities

Chiltern has an active and ever-expanding Community Rail Network. This forms part of the Department for Transport's Community Rail Strategy. This aims to:

- Promote a voice for local communities.
- Promote sustainable, healthy, and accessible travel.
- Bring communities together and support diversity and inclusion.
- Support social and economic development in local communities.

Station Adoption Groups

Chiltern has nine Station Adoption Groups with over 120 community volunteers in total. These groups bring a local connection to Chiltern's stations, by undertaking projects that improve community cohesion. Friends of Station Groups work towards the beautification of stations through gardening projects, artwork installation, and hosting events for prominent national celebrations. These groups help the stations to look beautiful and feel safe for Chiltern's customers, as well as showcasing the work of local gardeners, artists and schoolchildren.

Heart of England Community Rail Partnership

Chiltern's Community Rail Partnership (CRP) covers stations in Warwickshire, and helps to integrate with their local communities, alongside partners at CrossCountry, Avanti West Coast and West Midlands Railway. The CRP support Chiltern's Station Adoption Groups, work with local schools on railway education programmes and collaborate with local stakeholders on promoting active travel. In 2022, this has ranged from taking pupils and the wider community on trips on the railway to educate them on safety campaigns, to creating Rail Trail walking routes that connect Chiltern stations to local tourist attractions.

Community Rail 2022 Highlights

- Friends of Leamington Station have done a terrific job maintaining the platform gardens which beautifully compliment the newly installed colour pallets along the station entrance passage completed by a local artist.
- Friends of Dorridge and Aylesbury Stations have planted herb gardens at their stations for the community to pick on their way back from work or a leisure trip.
- To celebrate the Commonwealth Games in the West Midlands, 20 volunteers from the Friends of the Shakespeare Line added new planters and themed destination boards at Birmingham Moor Street Station. This was used as a key transport hub to get people into the region and to transport customers to the Lawn Bowls at Leamington Spa and Cycling events in Warwick.
- Friends of Bicester North held a special event to commemorate the Queens Jubilee, decorating the station with bunting and a vibrant display of red, white and blue flowers.

Environmental Initiatives

In addition to Chiltern's volunteer work, Chiltern has promoted sustainable and active travel options across their network. In 2022, Chiltern installed a new cycle storage area at Banbury Station alongside Oxfordshire County Council. Chiltern also partnered with Warwickshire County Council to upgrade the forecourt at Leamington Spa Station, creating a safe space for people to use public transport and walking routes into the town centre. At London Marylebone, Chiltern partnered with the Bike Project Charity to donate over 150 abandoned or broken bikes to the local community. The charity restores the bikes and then donates them to refugees so they can travel around the city sustainably. Over 50% of the bikes donated in 2022 went to children under 16.

Chiltern's Environmental Summary 2022

Environmental Priorities

Chiltern has a vision to decarbonise their operations over the next ten years. This is in line with the Department for Transport's plans to deliver a net zero rail industry by the year 2050. To achieve these goals, Chiltern has launched a fleet renewal strategy. This includes phasing out locomotive trains by the middle of this decade, and replacing them with a diesel/hybrid alternative. In the medium term Chiltern plans to replace 165 and 168 class trains with a zero-emission alternative. This will either be realised by the electrification of the Chiltern mainline using renewable energy sources, or alternatively by harnessing battery powered technology for our new train stock.

Figure 1.2: Chiltern fleet decarbonisation strategy

HybridFLEX Train

In February 2022 Chiltern launched the HybridFLEX, Britain's first 100mph capable battery-diesel hybrid train. The new two carriage train has initially been running between Aylesbury and London Marylebone. The 20 year old diesel train has been fitted with a powerful battery, meaning it will use 25% less fuel, significantly reducing emissions and air pollution. This includes a 70% reduction in nitrogen oxide emissions.

The project has been delivered in collaboration with Porterbrook and Rolls Royce. Findings of the trial will be reviewed during 2023, and decisions will be made on whether to roll out the hybrid technology on a wider basis.

2 Current Economic Impact

Introduction

This chapter presents the results of the Chiltern Railways Economic Impact Analysis. The chapter is split into the four core channels described in the previous chapter.

Direct Impact

Employment Costs

For 2022 calendar year Chiltern spent £44.9m on its staff's base salaries, national insurance, pensions, allowances, and overtime.

This spend has been illustrated geographically in Figure 2.1 on the following page.

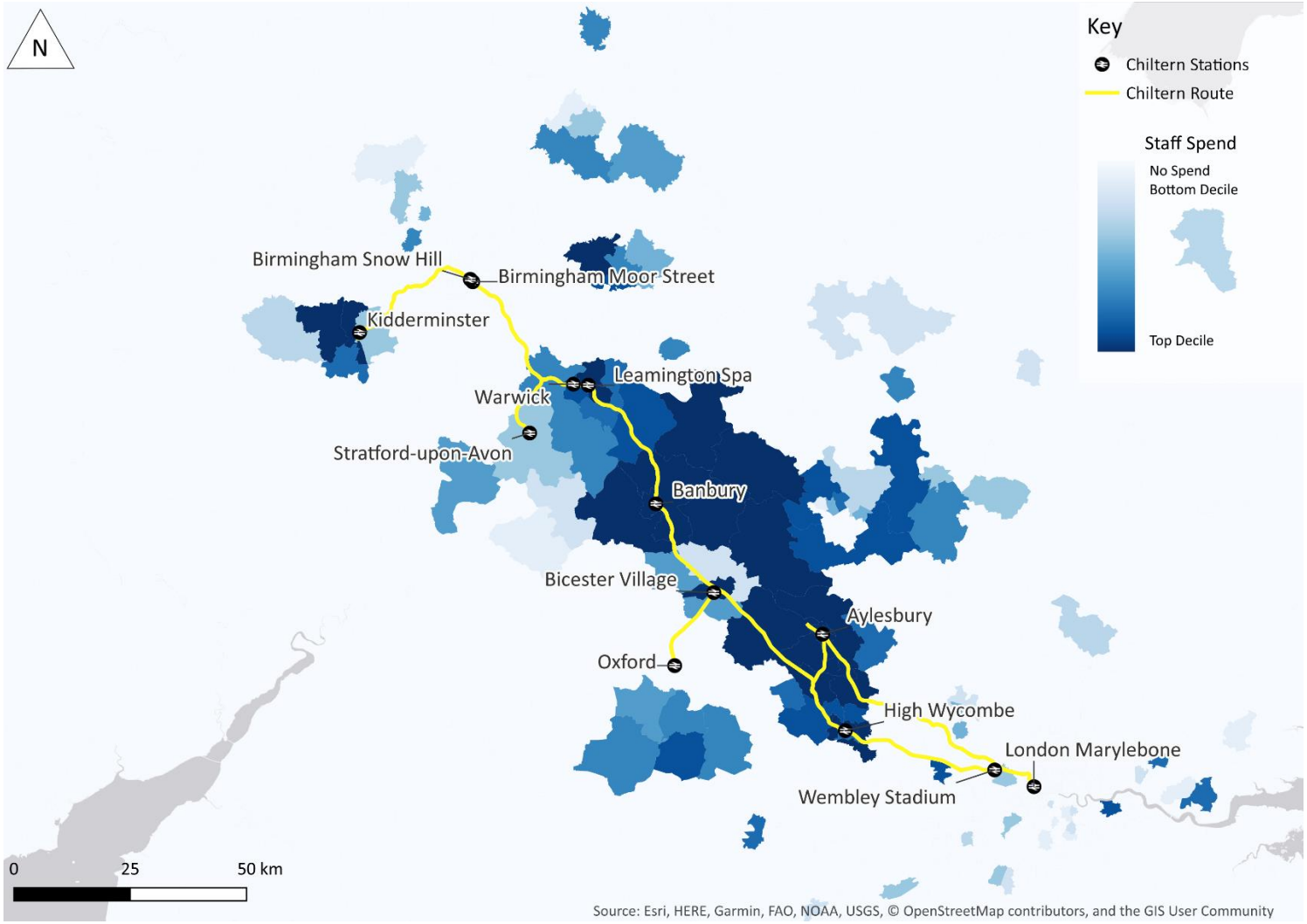
Operating Profit or Loss

Any operating profit or loss made by Chiltern could also be included a direct impact. Profit would be counted as a 'positive' impact and loss would be counted as a 'negative'. Profit/loss information was unavailable for this assessment and has not been included.

Total Direct Impact

Derived from the impacts described above, the direct annual economic impact of Chiltern is estimated to be £44.9 million. This represents the total incomes received by Chiltern staff.

Figure 2.1: Chiltern employee spend by postcode, 2022



Source: Data provided by Chiltern, mapping provided by Steer

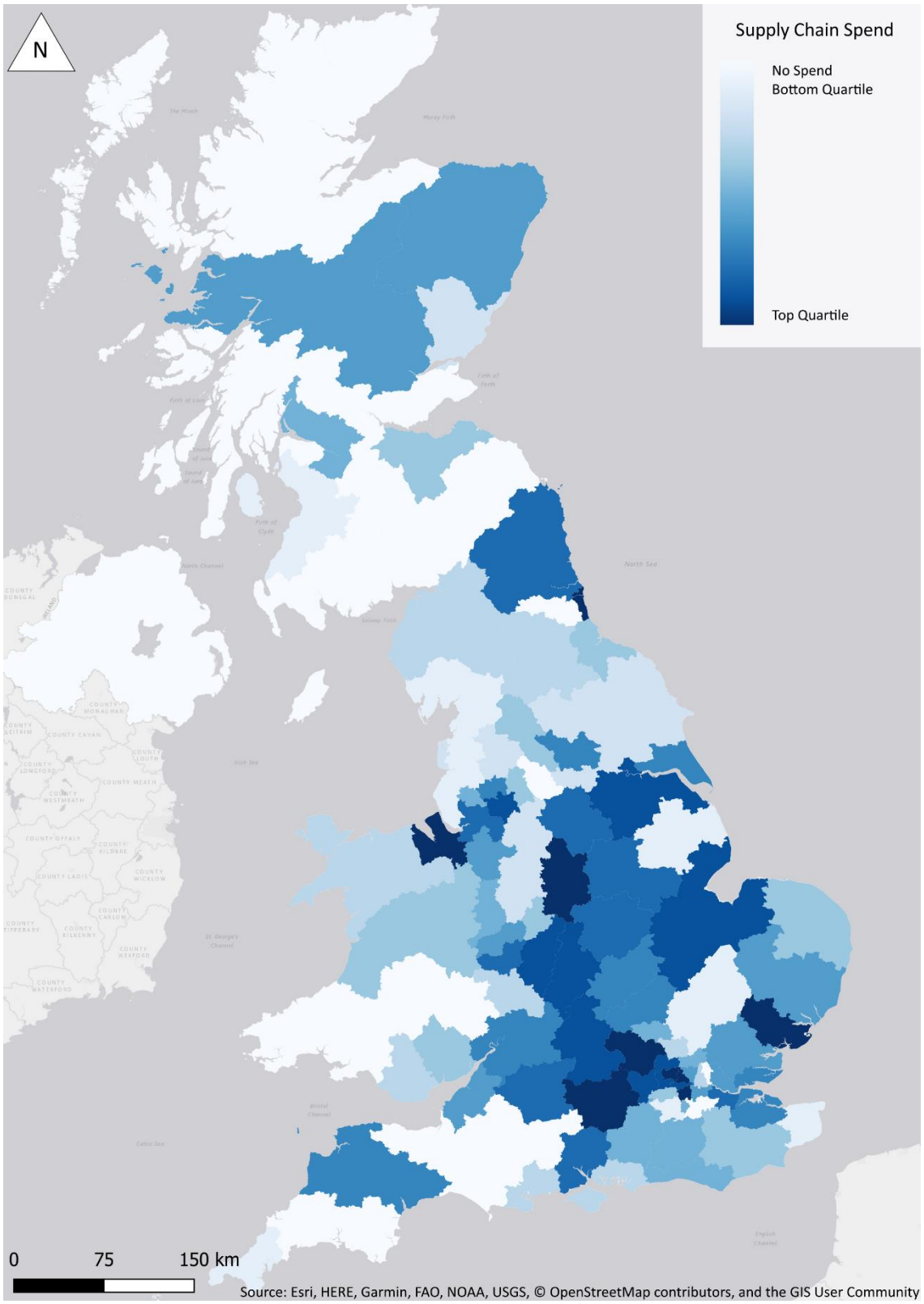
Indirect Impact

Supply Chain Expenditure

Chiltern's supply chain stretches well beyond the regions covered by its route, with significant expenditure throughout the country. In total, Chiltern spent £167.3m on non-wage expenditure in the UK in 2022.

Figure 2.2 displays Chiltern's non-wage expenditure geographically.

Figure 2.2: Geographical illustration of Chiltern's non-wage expenditure, 2022



Source: Data provided by Chiltern, mapping provided by Steer

Induced Impact

Multiplier impact

Using the total direct and indirect impact of Chiltern's activities, Chiltern's multiplier impact is estimated to be £137.9 million.

Spend at stations

Retail spend at stations across the network from Chiltern passengers in 2022 is estimated to be £8.6 million. Table 2.1 shows how this spend is distributed across the biggest flows of Chiltern passengers.

Table 2.1: Retail spend by Chiltern passengers

Flow	Average spend per passenger	Annual Chiltern passengers (000s)	Total annual spend (£000s)
London Marylebone - High Wycombe	£1.00	625	375
High Wycombe - London Marylebone	£0.60	625	375
London Marylebone - Bicester North	£1.00	420	420
Bicester North - London Marylebone	£0.20	420	85
London Marylebone - Beaconsfield	£1.00	340	340
Beaconsfield - London Marylebone	£0.20	340	70
London Marylebone - Gerrards Cross	£1.00	330	330
Gerrards Cross - London Marylebone	£0.20	330	65
Bicester Village - Oxford	£0.08	290	25
Oxford - Bicester Village	£0.60	290	175
Total	-	**16,265**	**8,635**

Total Induced impact

Using the figures quoted above, Chiltern's total induced impact is estimated to be £146.5 million.

Catalytic Impact

User benefits

The total annual user journey time benefits for Chiltern in 2022 are estimated to be £630.9 million. Table 2.2 below shows the user benefit for Chiltern's biggest flows.

Table 2.2: User benefit for biggest flows (year to September 2022)

Flow	Annual user journey time benefit (£000s)
London Marylebone - High Wycombe	22,115
High Wycombe - London Marylebone	23,591
London Marylebone - Bicester North	17,835
Bicester North - London Marylebone	17,917
London Marylebone - Beaconsfield	12,056
Beaconsfield - London Marylebone	12,155
London Marylebone - Gerrards Cross	11,919
Gerrards Cross - London Marylebone	11,911
Bicester Village - Oxford	10,337
Oxford - Bicester Village	10,341

Non-user benefits

The total annual non-user benefits, with road as the alternative to Chiltern services, are £19.6m.

Figure 2.3 shows this benefit broken down into the different categories of benefit.

Figure 2.3: Chiltern non-user benefits by MEC category (year to September 2022)

Road benefits

- Road decongestion: £30.4 million
- Reduction in road maintenance: £215.0 thousand
- Reduction in road accidents: £4.1 million (60 road casualties)

Environmental benefits

- Improved local air quality: £1.4 million
- Reduced noise pollution: £285.0 thousand
- Reduced greenhouse gas emissions: £7,455 million (103,000 tonnes of CO_2e avoided)

Fuel impacts

- Reduced tax income on fuel: -£10.5 million
- Fuel emitted by Chiltern trains: -£13.8 million (51,270 tonnes of CO_2e)

Total non-user benefits: £19.6 million

Wider economic benefit

The annual agglomeration benefits of Chiltern Railways are estimated to be £33.4 million.

The output change in imperfectly competitive markets attributed to Chiltern's services is 10% of the business user benefits, £15.6 million.

Summary

Figure 2.4 presents a summary of Chiltern's current economic, environmental, and social impact.

Figure 2.4: Summary of Chiltern's 2022 economic, environmental, and social impact

Direct impacts: £44.9m

- Expenditure on staff: £44.9m

Indirect impacts: £167.3m

- Supply chain spend: £167.3m

Induced impacts: £146.5m

- Multiplier impact: £137.9m
- Passenger spend at stations: £8.6m

Catalytic impacts: £699.5m

- User benefits: £630.9m
- Social and environmental non-user benefits: £19.6m
- Wider economic benefits: £49.0m

Total impact: £1,058.2m

Regional breakdown

Table 2.3 presents a breakdown of Chiltern's economic, environmental, and social impact by region. Note that the multiplier impact cannot be allocated to a region and is not included in the figures below. This regional breakdown is also illustrated in Figure 2.5 overleaf.

Table 2.3: Summary of regional impacts

Region	Total (£000s)	%
North West	15,503	1.7%
North East	20,514	2.2%
Yorkshire and The Humber	16	0.0%
West Midlands	163,399	17.8%
East Midlands	23,587	2.6%
East of England	49,714	5.4%
London	347,947	37.8%
South East	296,705	32.2%
South West	1,962	0.2%
England Total	**919,348**	99.9%
Wales	202	0.0%
Northern Ireland	86	0.0%
Scotland	626	0.1%
Total	**920,261**	

Figure 2.5: Map of regional impacts

A Methodology

Introduction

This appendix presents a detailed description of the methodology used to calculate the results presented in the main body of this report.

In producing this assessment, Steer has used the following data sources:

- Employment and expenditure information provided directly by Chiltern;
- DfT Transport Analysis Guidance (TAG) guidance, parameters and data;
- Information from the railway timetable planning software MOIRA, specifically the version covering Chiltern's services.

Direct Impact

The direct impacts of Chiltern Railways are quantified in terms of its contribution to UK economic output (GVA) and the employment it supports. At the core of its contribution to the economy are the activities which take place at Chiltern. Its contribution to GVA can be expressed as the sum of incomes of workers (wages).

Using anonymised salary data broken down by the area postcode of the recipient, a geographic illustration of Chiltern's employment costs has been provided.

Any operating profit or loss made by Chiltern could also be included a direct impact. Profit would be counted as a 'positive' impact and loss would be counted as a 'negative'. Profit/loss information was unavailable for this assessment and has not been included.

Indirect Impact

The indirect impact of Chiltern Railways comprises the jobs and GVA supported by the supply chain of Chiltern's operation. This is analysed using the level of expenditure on non-employment goods and services of the operator.

To calculate the total indirect impact of Chiltern, supplier expenditure data covering the calendar year 2022 has been analysed.

The supplier data has been mapped using supplier postcodes to understand the geographic spread of Chiltern's indirect impact. In the case of Chiltern's payments to Network Rail an assumption has been made to map the expenditure. The total expenditure has been split along Chiltern's route based on the frequency of services on each section. This is based on the biggest component of payments to Network Rail being track access charge which varies depending on the number of services Chiltern operate.

Induced Impact

Induced impacts represent the final channel of economic impact, through which the wages of those employed directly by Chiltern and its supply chain support jobs in other sectors of the economy. For example, a Chiltern employee may spend their income on clothing,

groceries, restaurants, household goods etc, which in turn generates employment in a range of sectors of the wider economy.

Multiplier Impact

A common-practice approach to assessing the induced effects of an activity or industry on the economy – known as economic multipliers – has been deployed to calculate the estimated impact. The use of multipliers is commonplace in economic impact studies.

There is contemporary empirical evidence to assess the scale of induced impacts from railway networks on the economy. A comprehensive study undertaken in 2014 on behalf of the Community of European Railways and Infrastructure Companies (CER) into the impact of rail on the economy found that the magnitude of induced impact multipliers used by various studies to assess induced impacts of rail activities lay within a broad range from 0.25 to 0.75.

In practice, this means that for every 100 direct and indirect jobs supported by railway companies, a further 25 to 75 induced jobs are supported in the wider economy.

The report goes on to suggest that in the UK the multiplier is at the upper end of the reported range at 0.65. For the purposes of this report, Steer has presented the multiplier impacts of Chiltern using the 0.65 multiplier.

Spend at Stations

An assessment of employment and economic activity supported by Chiltern's customers as part of the journeys that they make has also been carried out. This has been carried out by estimating the retail spend by Chiltern passengers at rail stations.

This analysis is informed by a Steer study, "Future of On-Train and Station Retail" carried out on behalf of the Rail Delivery Group and Network Rail in 2013. The full methodology is as follows:

- Use the station classifications developed as part of the RDG report to classify each station used by Chiltern passengers, e.g. London Marylebone is a "major station" and Rickmansworth is a "small commuter station". The classifications were originally defined by a number of metrics including the total passengers using each station.
- Extract the average spend per passenger at each type of station from the RDG report and inflate these values to 2023 prices using the DfT's measures of inflation.
- Use the Chiltern patronage data and the average spend per passenger to estimate the total spend for each pair of origin and destination station. For the purposes of this report, it is assumed that passengers carry out their retail spending at the station they begin their journey.

Catalytic Impact

Catalytic impacts capture the wider economic potential resulting from the contribution of rail network to trade and tourism (the demand-side impact) and the long-run contribution of growth in rail travel to productivity and GDP (the supply-side impact).

Three different categories of catalytic impact have been included as a part of this assessment:

- User benefits: The benefits realised by Chiltern passengers travelling by rail and experiencing a quicker journey time than the alternative.

- Non-user benefits/welfare impacts: Wider societal benefits due to the positive externalities of Chiltern passengers using rail instead of alternatives (for Chiltern services the alternative is assumed to be travel by road). These include congestion avoided, fewer accidents and lower CO2 emissions.
- Wider economic benefits: These agglomeration and market output benefits occur as transport networks bring firms, people and places closer together.

User benefits

People choose to use rail because they find it beneficial compared with alternative ways of travelling. In the case of Chiltern, they find using rail services more beneficial than making the same journey by road. These benefits come about because the traveller experiences a quicker journey and/or cheaper than they would do using the alternative, even when allowing for time to travel to and from stations and having to pay a rail fare.

The aggregate economic benefit of travelling by Chiltern has been calculated as follows:

- A simplifying assumption has been made that the alternative to rail travel is car travel.
- It has been assumed that all journeys made by Chiltern would continue to be made in the absence of Chiltern and these journeys would all be made by road.
- The following data has been sourced from MOIRA and Rail Usage and Drivers Dataset (RUDD) for each Chiltern flow:
  - Generalised Journey Time (GJT)
  - Average single leg rail fare
  - Road journey times
  - Chiltern passenger numbers split by business, other and commuter
- Road distances have been assumed to be the same as rail distances and an average speed by road imputed. Average vehicle operating costs for each flow and each journey purpose have been calculated by applying the formula set out in TAG Unit A1.3 and parameters from the TAG Databook.
- For rail and car and for each flow, Generalised Costs (GC) (in time units) have been calculated by summing the GJT and monetary cost divided by the appropriate value of time.
- A 'with Chiltern' composite Generalised Cost has been calculated by applying the logsum formula and dispersion parameters imported from HS2 Ltd's Planet Long Distance (PLD) model.
- The user benefits of using Chiltern are the product of the Chiltern flow and the difference between the composite GC and the car GC.

Non-user benefits/Welfare impacts

Non-user benefits, or welfare impacts, refer to the positive externalities produced by Chiltern passengers travelling by train instead of the alternative, i.e. travelling by car. These benefits are both environmental and social in nature, and are felt by the whole of society, not just Chiltern passengers.

It is important to note that, while rail travel has important benefits with respect to reduction in carbon emissions compared to private car travel, there are greenhouse gas emissions resulting from Chiltern's diesel-fuelled services. This has been taken into account in the calculation of the non-user benefit element of this report.

The methodology used to calculate the welfare impacts where travelling by road is the alternative to rail is as follows:

- Use Chiltern's patronage data to calculate the total rail miles travelled by Chiltern passengers;
- Calculate the 'alternative' road mileage. This is done so by using the DfT's diversion factors which estimate the proportion of journeys which would be carried out by car were rail not an option;
- Use the DfT's Marginal External Cost (MEC) values to calculate the monetary non-user benefits of Chiltern services. The MEC values provide a monetary value for the following lines of benefit:
- Road decongestion benefits;
- Reduction in spend on road infrastructure;
- Reduced injuries and fatalities from road collisions;
- Improved local air quality;
- Reduced noise pollution; and
- Reduced greenhouse gas emissions.
- Where possible, Steer has converted these monetary values into a 'real-world' value e.g. the reduction in carbon emissions in tonnes of carbon emissions, and number of road collisions avoided.

The methodology for calculating Chiltern's fuel disbenefit included:

- Using fuel purchase data provided by Chiltern to calculate total fuel usage for the year 2022;
- Use of TAG figures to calculate the total carbon emissions associated with Chiltern's fuel usage;
- Conversion of carbon emissions to a monetary value following TAG guidance.

Wider economic benefits

Agglomeration benefits

Trips made using Chiltern services for business generate 'agglomeration impacts'. These occur as transport networks bring firms, people and places closer together.

To value these benefits the DfT's TAG guidance and parameters have been used. A critical assumption underpinning this analysis is establishing a 'counterfactual scenario', that is what the rail journey times would be if Chiltern services were not to exist.

For the purposes of this report rail journey times equal to car journey times for the same journey have been assumed as the counterfactual.

The full methodology used to calculate the wider economic benefits of Chiltern is described below:

- The zoning system used in the modelling was established as an aggregated version of the output area regions of England that Chiltern's services cover.
- The generalised journey times between each zone by rail and road are sourced for the "with Chiltern" and "without Chiltern scenarios". These have been sourced from the DfT's RUDD dataset. The road journey times do not change between the with and without Chiltern scenarios.

- The level of demand by each mode between each zone is established. This is informed by Chiltern patronage data, and the RUDD dataset where there are gaps in the Chiltern data.
- To estimate road trips, National Travel Survey market shares have been applied to the rail patronage data.
- The 'effective density' of each zone pair is calculated for the with and without Chiltern scenarios. In transport economics effective density refers to the ease at which individuals and firms can travel between different geographies. The TAG formulae for effective density has been used in this analysis.
- The increased productivity resulting from effective density is calculated using the TAG wider economic benefit elasticities.
- This is then converted into monetised agglomeration benefits by using the total jobs and GVA per job for each zone.

Output change in imperfectly competitive markets

The presence of Chiltern services reduces the time needed to spend travelling between different parts of the UK. This reduction in travel time reduces the costs of production for businesses which use Chiltern for business purposes.

This reduction in production cost is assumed to induce investment and increase the overall level of output in the national economy. This benefit is known as the 'output change in imperfectly competitive markets.'

Further details on the economic theory behind this benefit can be found in TAG Unit A2.2. The guidance states that the value of the output change benefit can be estimated by applying a 10% uplift to the business user benefits of a given scheme. In this case 10% of the business user benefits described earlier in this chapter has been calculated and included in the wider economic benefits.

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