Transport for London and Department for Transport

Elizabeth line post-opening evaluation

Transport outcomes: Interim Findings Report

20 June 2024

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1. Executive summary

Scope of the report

The scope of the evaluation is to provide early evidence of the transport impacts of the Elizabeth line and gather baseline information on its wider socio-economic impacts. The aim of the evaluation is to assess the extent to which the opening of the Elizabeth line is delivering its intended benefits, and to identify – if possible – the key drivers of any observed change.

The primary research question is how travel demand patterns have changed as a result of the Elizabeth line opening and what subsequent changes have taken place in connectivity and transport performance. Demand responses may include mode shift and potentially a change in the total number of trips. Alongside the two key transport outcomes of trip generation and mode shift, a series of other transport-related outcomes have been analysed such as service quality and reliability, public transport experience, inclusion, safety and security, and active travel. The aim of our analysis is to isolate the effect of the Elizabeth line on such outcomes and comment on whether a significant change can be detected.

This Interim Findings Report provides a comprehensive analysis of the early impacts of the Elizabeth line on transport connectivity, socio-economic factors, and various transport-related outcomes. As the Elizabeth line marked its first full year of operation, the data collected until October 2023 offers valuable insights into the transformative effects on London's transportation landscape. This report also connects the Post-opening evaluation with the results of the Crossrail baseline study and pre-opening evaluation summary report which was published in 2022.

The central tunnelled section of the Elizabeth line opened in May 2022, and it reached full planned capacity in November 2022 with 24 trains-per-hour (tph) each direction through-running (direct services from the outer branches to/through the central section) trains across London and the wider South East (note: future frequency could reach 30 trains-per-hour).

This Interim Findings Report uses data until October 2023 to report on key early impacts induced by the Elizabeth line after its first full year of operation. For this reason, the analysis presented in this report is based on emerging findings, and hypotheses will need to be tested further through robust counterfactual analysis in the Final evaluation report from this evaluation study.

Key findings

The report addresses five key research questions derived from the Theory of Change, and delves into the impacts on connectivity, trip numbers, mode shift, passenger experience and the broader socio-economic impacts. Key findings relating to these research questions are summarised below:

1. To what extent has the opening of the Elizabeth line led to **better connections between places** in London and the wider South East? This is the focus of section 3.

   - The Elizabeth line has increased transport connectivity across the whole of London, particularly for areas previously with poor accessibility. Improved cross-river connections are particularly emphasised around the Abbey Wood branch with an 11 per cent increase in job accessibility

2. How has the **overall number of trips taken on public transport networks** changed since the opening? This is the focus of section 4.

   - The connectivity improvement that the Elizabeth line provided has been followed by increased trip numbers across London's public transport network. Shorter journey times and fewer interchanges were identified by those surveyed as the top two reasons for using the line – both closely associated with connectivity. In 2023/24, roughly one in every eight journeys on the Transport for London (TfL) network (London Underground, DLR, London Overground and London Trams) was made on the Elizabeth line, based on TfL demand data, and the current trend suggests that further growth may be realised

   - Moreover, passenger numbers on the Elizabeth line are above TfL's post-pandemic 'Optimistic' demand forecast scenario and nearing pre-pandemic Business as Usual (BaU) forecasts. This suggests that travel demand in London is nearing the BaU forecast two years after the pandemic

3. To what extent has the line prompted a **shift away from other lines and road transport**? This is the focus of section 5.

   - The introduction of the Elizabeth line has led to mode shift from other London Underground lines, the DLR and National Rail services. According to TfL analysis, around 62 per cent of demand on the Elizabeth line is estimated to be abstraction from these lines. The proportion of trips to be either displaced from active modes, car, bus or newly generated trips is estimated to be around 38 per cent of Elizabeth line demand. As demand for the Elizabeth line has increased, trips on parallel routes have declined and dropped below those on comparator routes

4. To what extent has the Elizabeth line improved: a) the **quality and reliability** of the transport system; b) the **experience of passengers**; and c) any other **indirect outcomes**? This is the focus of section 6.

   - The Elizabeth line has the highest customer satisfaction score across all TfL lines, despite some punctuality challenges in 2023. Such high scores are likely driven by faster and more direct journeys, and reduced crowding, but also by journey comfort and improved conditions on the Elizabeth line trains compared to other modes of transport

5. What early evidence is there of **regeneration and other economic, social and environmental effects** around stations? This is the focus of section 7.

   - Secondary data analysis points to some early socio-economic impacts such as increased employment opportunities, business growth, and housing development. However, any full realisation of expected benefits in this area is expected to require more time

Additional questions to be addressed in the Final Evaluation Report

The Final Evaluation Report will make use of additional data sources on road and public transport usage across the wider study area to provide a more detailed picture of mode shift.

The Final Evaluation Report will also incorporate more detailed information about performance and customer satisfaction on the TfL network using data provided by TfL. Where relevant, information and views emerging from stakeholder interviews will also be used in the Final Evaluation Report. In the Final Evaluation Report, more detailed data will

be incorporated relating to reliability and performance, to better demonstrate the relationship between customer satisfaction and reliability of the network.

A non-experimental analysis will be conducted to investigate how the opening of the line impacted London's transport network and the wider South East. If the results are determined to be robust, this analysis will assess how much of the observed impacts on journey times and trip numbers in this report can be directly attributed to the Elizabeth line.

Key sources of data for the analysis are expected to include origin-destination journey times and trip data from two data providers: TfL for high-quality public transport data about from its own network, and mobile network data covering a wider area across the South East of England.

The Final Evaluation Report will also include findings from stakeholder interviews (approximately 60 interviews conducted around the 12 case study stations). These will explore impacts grouped into the following themes: transport, short-term economic effects, social, property markets, quality of place and wider health and environment impacts.

Interviews will explore different views of key stakeholders and test key hypotheses and causal assumptions identified in the Elizabeth line Benefits framework for early evidence on how the line has impacted local communities around stations. They will also provide an opportunity to challenge, validate and seek further detail into trends shown in the quantitative data analysed in the baselining report.

Interviews will enable a greater understanding of trends and data gaps in findings and their significance. By investigating economic and property market impacts around the same stations and with similar stakeholders as the Crossrail Baseline Evaluation Case Study Report, the interviews will also provide a good comparison between expectations of pre-opening impacts and what changed as a result of the line opening. They will also help bring the story of benefits brought by the Elizabeth line to life, with real life examples and localised case studies.

2. Introduction

Description of the Elizabeth line

The Elizabeth line is one of the most significant infrastructure projects ever undertaken in the United Kingdom, with an estimated final cost of £18.9bn. The line connects Reading and Heathrow in west London, with Shenfield and Abbey Wood in the east, running through a new 13-mile (21km) twin-bore tunnel under central and east London (see Figure 1).

Designed to go beyond enabling commuter and suburban services, the Elizabeth line establishes a high-frequency, high-capacity and accessible link between key locations such as Heathrow Airport, the West End, the City of London and Canary Wharf. The addition of ten new stations further enhances the line's reach, with stops including Paddington, Bond Street, Tottenham Court Road, Farringdon and Liverpool Street in central London. Additionally, stations at Whitechapel, Canary Wharf, Custom House, Woolwich, and Abbey Wood serve the broader London area. The completion of the project has added an extra 10 per cent to the capacity of the city's public transport.

The project is jointly sponsored by the Department for Transport (DfT) and TfL. Project delivery was managed by Crossrail Ltd, a special-purpose subsidiary of TfL. Initial construction started in May 2009 with the start of work at Canary Wharf station, followed by enabling works at sites within central London. Crossrail tunnelling began in the summer of 2012 and ended at Farringdon in 2015 with the breakthrough of the final tunnel boring machine.

The operational services have been introduced in stages:

1. **May 2015**: TfL Rail between Liverpool Street mainline and Shenfield

2. **June 2017**: The introduction of new trains (Class 345) in the east between Liverpool Street mainline and Shenfield

3. **May 2018**: TfL Rail between Heathrow Airport and Paddington mainline using new trains (Class 345) to Hayes & Harlington

4. **December 2019**: TfL Rail between Reading and Paddington mainline using new trains (Class 345)

5. **July 2020**: The introduction of new trains (Class 345) to Heathrow

6. **May 2022**: Launch of the Elizabeth line with the introduction of a 12-trains-per-hour service between Abbey Wood and Paddington via the central section and rebranding of the east and west sections from TfL Rail to Elizabeth line

7. **November 2022**: Increase in service levels and integration of services in the east and west, with the central operating section between Reading/Heathrow and Abbey Wood/Shenfield

8. **May 2023**: Full end-to-end railway and peak service levels

Figure 1: A map of the complete Elizabeth line route after opening in 2023
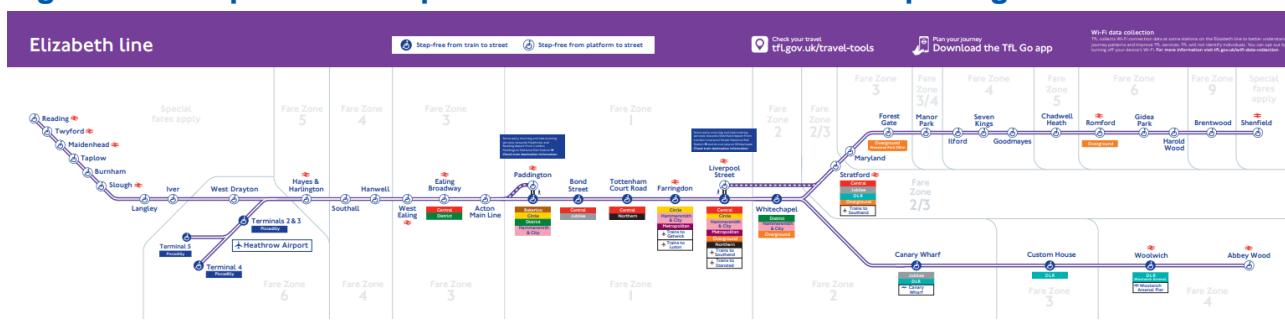
Context and scope of the evaluation

This first post-opening evaluation of the Elizabeth line builds on the Crossrail Baseline Study and Pre-opening Evaluation (running from 2016 to 2022) which provided analysis of baseline transport and wider socio-economic conditions. A future, second post-opening study will analyse wider socio-economic impacts and is due to be commissioned by 2025.

The scope of the evaluation is to provide early evidence of the transport impacts of the line and gather baseline information on wider socio-economic impacts. The aim of the evaluation is to analyse the extent to which the opening of the Elizabeth line is delivering its intended benefits, and to identify – if possible – the key drivers of any observed change.

This Interim Findings Report concentrates on the first full year of operations of the line. It uses data until October 2023 to report on results, following the May 2022 opening of the central section and the November 2022 full-scale opening when the line reached its planned capacity (24 trains-per-hour) with through-running trains across all of its four branches. The analysis presented here is therefore based on one year of data. Emerging findings and hypotheses will need to be assessed further through robust counterfactual analysis in subsequent reports.

This report uses three key sources: transport indicators on journey times and trip numbers; the results of the passenger survey conducted between September and November 2023; and socio-economic indicators which are used to monitor the wider impacts of the line. Drawing on the Elizabeth line Benefits Framework and the five key evaluation questions, the report summarises key early, interim findings and sets the scene for the Final Evaluation Report due in early 2025.

The Theory of Change and the five key evaluation questions

This section sets out the Theory of Change of the evaluation, which is used to identify key research questions and indicators. The model is based on the Elizabeth line Benefits Framework and was adjusted based on feedback from TfL, DfT and Greater London Authority (GLA) representatives. Figure 2 presents the Theory of Change in its original diagrammatic form, with the diagram then reproduced in tabular form in Table 1, where each row represents a different section of the logic model, showing the inputs, outputs, direct outcomes and indirect outcomes that were identified.

There are three key indirect outcomes: new trips, mode shift and impact on local communities. These are shown in a row of the table, with three further rows showing further indirect outcomes that are associated with each of them respectively.

Figure 2: Theory of Change of the evaluation – diagram version

Inputs	Outputs	Direct Outcomes	Indirect outcomes		
Business Case and Sponsor Requirements	New railway connecting Reading/Heathrow with Shenfield/Abbey Wood	Reduced journey times	**New trips**	Increased trips between better connected ODs	Increased trips due to improved service quality
Planning	New trains, with up to 24 trains per hour	Relieved congestion	**Mode shift**	Change in crowding/congestion on parallel lines (bus, rail)	Improved service reliability
Construction	Stations staffed from first to last train	Improved connections		Change in crowding/congestion on feeder links (bus, rail, road)	Improved air quality
	New & upgraded stations	Improved public transport experience		Decongestion on roads	Improved health
	Step free access	Improved inclusion			Increased active travel
		Improved safety and security	**Impact on local communities**	Regeneration	
		Improved accessibility		New homes	
				Improved employment opportunities	

Table 1: Theory of Change of the evaluation – table version

Inputs	Business case and sponsor requirements
	Planning
	Construction
Outputs	New railway connecting Reading/Heathrow with Shenfield/Abbey Wood
	New trains, with up to 24 trains per hour
	Stations staffed from first to last train
	New and upgraded stations
	Step-free access
Direct outcomes	Reduced journey times
	Relieved congestion
	Improved connections
	Improved public transport experience
	Improved inclusion
	Improved safety and security
	Improved accessibility
Key indirect outcomes	New trips
	Mode shift
	Impact on local communities
Further indirect outcomes associated with new trips	Increased trips between better connected ODs
	Increased trips due to improved service quality
Further indirect outcomes associated with mode shift	Change in crowding/ congestion on parallel lines (bus, rail)
	Change in crowding/ congestion feeder links (bus, rail, road)
	Decongestion on roads
	Improved service reliability
	Improved air quality
	Improved health
	Increased active travel
Further indirect outcomes associated with impacts on local communities	Regeneration
	New homes
	Improved employment opportunities

The primary research area for this study relates to how demand patterns have changed as a result of the Elizabeth line opening and what subsequent changes have taken place in connectivity and transport performance. Demand responses may include mode shift and potentially a change in the total number of trips. Alongside the two key transport outcomes of trip generation and mode shift, a series of other transport-related outcomes such as service quality and reliability, public transport experience, inclusion, safety and security and active travel have been analysed. Our analysis seeks to isolate the effect of the line on such outcomes and comment on whether a significant change can be detected.

In addition to evaluating the early impacts of the opening, the project monitors wider impacts around stations which may materialise in the longer run. The key research area is whether there is any early evidence for regeneration and property market impacts for deprived areas, new homes, improved employment opportunities or any other economic, social and environmental effects around stations which may be caused by the line.

The report follows the order of these research areas, divided into five key research questions:

1) To what extent has the opening of the Elizabeth line **lead to better connections between places** in London and the wider South East? This is the focus of section 3.

2) How has the overall number of **trips taken on public transport** networks changed since the opening? This is the focus of section 4.

3) To what extent has the line prompted a **shift away from other lines and road** transport? This is the focus of section 5.

4) To what extent has the Elizabeth line improved: a) the **quality and reliability** of the transport system; b) the **experience** of passengers; and c) any other **indirect outcomes**? This is the focus of section 6.

5) What early evidence is there of **regeneration and other economic, social and environmental** effects around stations? This is the focus of section 7.

The report concludes with a discussion on early findings and sets out the scope of the Final Evaluation Report due in early 2025.

Data and method summary

This report uses three types of indicators:

1. Transport indicators

2. Socio-economic indicators

3. Passenger survey findings

A summary of these methods is presented below.

Transport and trip data

The main transport indicators are trip numbers and journey times by mode. These are analysed using TfL datasets, including:

- NUMBAT: TfL annual demand data representing a typical autumn weekday, based on contactless and Oyster 'taps' comprising the rail, light rail and London Underground components of the transport network;

- DUNNART: TfL weekly demand data based on contactless and Oyster 'taps' comprising the rail, light rail and London Underground components of the network, covering every 15-minute period throughout the day;

- ODX: TfL origin-destination interchange database which covers rail and bus journey times, and

- Day 1: TfL dataset which covers Elizabeth line passenger usage

Most of the analysis of trips uses DUNNART as it provides more granular data than NUMBAT. The analysis of journey times uses ODX which provides the most granular information available on journey times across the TfL network.

Other indicators such as customer satisfaction and reliability are also used within the report to assess the passenger experience, based on data from TfL and the Office of Rail and Road.

The study area for the analysis is Greater London, the South East, Essex and Hertfordshire, which for brevity is described as London and the wider South East in this report. This report focuses on the London area and where possible, provides additional detail on the surrounding counties in the South East region, Essex and Hertfordshire. In each section of this report, future work until the end of the evaluation in early 2025 and any new data available are described, much of which focuses on the South East, Essex and Hertfordshire impacts.

Impact categories have been developed using a TfL methodology based on comparing 'with Elizabeth line' and 'without Elizabeth line' scenarios of the DUNNART distribution estimating model. Links between two stations with unchanged demand between the two scenarios are categorised as comparator. A manual exercise was then undertaken to identify parallel and feeder links to and from the Elizabeth line. Any links that were considered neither parallel nor feeder were categorised as mixed.

Socio-economic data

The indicators analysed to build the evidence base for economic, social and environment benefits around stations are those related to employment, population, development activity, residential planning and commercial supply. Data was gathered in a one-kilometre boundary around Elizabeth line stations for all socio-economic data analysed. For publicly available datasets published by government agencies, these boundaries are built up using Lower Super Output Areas (LSOAs) around stations. For real estate data using datasets from real estate company JLL, bespoke boundaries around stations were used.

The indicators include:

- Employment (Business Employment Register)

- Gross Value Added (Office for National Statistics)

- Population (Office for National Statistics) and residential properties stock (Valuation Office Agency)

- House prices (HM Land Registry)

- Business floorspace (Valuation Office Agency)

- Claimant counts (Office for National Statistics)

- Local commercial and residential property market characteristics (JLL)

The study categories for the analysis are: Elizabeth line stations average, Elizabeth line stations located in inner London boroughs ('inner London EL stations' in all charts in this report), Elizabeth line stations in outer London boroughs and the wider South East ('outer London Elizabeth line stations') and London average.

Passenger survey

A passenger survey was undertaken to understand people's perceptions of the line's opening. The passenger survey was undertaken from 26 September to 14 November 2023, with an objective to sample completed passenger journeys to, from and through a selection of stations on the existing rail and London Underground network that the Elizabeth line interfaces with, ensuring that data is captured from both Elizabeth line users and non-Elizabeth line users.

Surveys were predominantly carried out online, with flyers handed out by Tracsis staff at pre-agreed locations in stations. The flyers had QR codes which passengers could scan to access the survey webpage. Paper versions of the survey were also made available.

In total, more than 136,530 flyers were handed out across 18 stations. This generated 6,279 completed survey responses, representing a response rate of 4.9 per cent.

To ensure that the survey results accurately reflect passenger numbers across all stations and times surveyed on the Elizabeth line, survey results were weighted by travel demand. This method adjusted the proportions of survey responses based on observed data, aligning them with observed passenger flows at different times for each station and between stations.

The survey captured the following details of passenger journeys:

- Journey purpose
- Origin and destination
- Route taken and reason for route choice
- Journey frequency
- Ticket type and payment
- Access and egress mode (first and last mile information)
- Use of mobility aids or other equipment
- Demographic profile (age, gender, disability and employment status)

The survey was similar to the survey undertaken in 2017 as part of the Crossrail Baseline Evaluation. While the majority of questions were the same, the data collection method, fieldwork dates and sample size varied. Direct comparisons should therefore be treated with caution.

Additional questions were added to understand the impact of the Elizabeth line on travel behaviours and wider impacts. The survey also included a 'free text' response box for people to provide further commentary about the impact of the Elizabeth line. Some of these comments are provided in this report to help illustrate findings.

3.   Early connectivity impacts

How improved connectivity was expected to drive socio-economic and environmental benefits

This section details the Theory of Change for connectivity and how other expected benefits pivot from the fundamental change in connectivity, building on the logic map detailed in section 2.

The Elizabeth line provides a range of new connectivity benefits for London and the wider South East. The central tunnelled section improves cross-London connectivity and adds extra capacity to the overcrowded central London section of the London Underground. The tunnel connects the four branches of the line, providing easier access to central London for suburban areas and Heathrow airport. In addition, the line improves cross-river connectivity, providing a step-change in transport options for certain east London communities.

Improved connectivity drives much of the key benefits of the line. Reduced journey times across London and the wider South East improve access to employment, education and leisure opportunities, which in turn may lead to economic growth and improved wellbeing. Improved public transport options drive environmental and health benefits through a shift away from private car use and increased walking and cycling.

The Theory of Change associated with the Elizabeth line comprises a broad range of outputs and outcomes. The transport outputs of a new high-frequency railway and the increase in capacity relate to outcomes of reduced journey times and relieved congestion. These elements combine to create an overall effect of improved connectivity. Connectivity can be assessed considering access to employment, journey times and accessibility.

The Elizabeth line provides a unique direct through-route from one end of the line to the other end, from Reading and Heathrow airport in the west to Shenfield and Abbey Wood in the East. Providing a direct route negates the need to change at locations including Paddington, Stratford, Liverpool Street and Farringdon, meaning there is an immediate improvement to east-to-west connectivity. It also eliminates additional waiting time.

Connectivity improvements across the Elizabeth line have subsequent knock-on effects across the London network and the wider South East. The line was intended to alleviate congestion on east-to-west travel links thanks to the significant addition in capacity, so parallel links can operate more efficiently and accommodate more passengers, including National Rail services. As the Elizabeth line provides a new through-route to and from locations outside London, the catchment area for the TfL network and central London also grows.

In summary, improved connectivity, characterised by reduced journey times, increased catchment area, fewer interchanges, higher frequency, and higher capacity can be considered the direct outcomes of the Elizabeth line's opening. This enhanced connectivity may also reduce crowding on alternative public transport modes and contribute to road decongestion. Additionally, the improved connectivity can bring better access to employment and other opportunities, enhance cross-river connectivity and promote regeneration.

This section aims to illustrate the extent to which the Elizabeth line has delivered improvements in connectivity, detailing the specific changes, locations affected, and the underlying reasons for these transformations.

Early connectivity impacts show job accessibility increasing

Connectivity is measured by an employment-weighted journey time metric called 'static job-weighted accessibility' (economic literature calls this measure 'effective density'). This measure was calculated in the Economic Appraisal of Crossrail (published in 2005) to estimate the potential agglomeration benefits of the line. In this analysis, static 2019 employment has been used to isolate the effect of changing journey time on the metric.

Agglomeration refers to the effect of a cluster of companies, services and industries that coexist in spatial proximity and derive mutual benefits from this in terms of productivity and cost efficiency. Job accessibility is a simple measure to quantify how changes in journey times impact people's access to jobs and thereby contribute to agglomeration and productivity benefits.

'Static job accessibility' is calculated using ODX journey time data (Middle layer Super Output Area (MSOA) to MSOA) and Office of National Statistics Business Register and Employment Survey data (published in 2019) employment numbers at MSOA level. ODX data captures journey times from and to stations and bus stops based on contactless and Oyster taps, which includes TfL rail lines, bus and mainline rail routes within the Pay-As-You-Go (PAYG) area in London.

The results of this analysis have been shown at branch level and mapped at MSOA level below. Figure 3 illustrates the percentage change in effective density in (MSOAs) within 300 metres from the Elizabeth line, by branch. Note that the comparator month is October 2019, by which time TfL Rail (between Paddington and Heathrow Terminals, and between Shenfield and Liverpool Street) was running. The Reading to Hayes & Harlington branch and the Shenfield to Stratford branch journey time changes are excluded from this analysis due to rail data limitations. Results show that the Canary Wharf to Abbey Wood branch experienced the largest uplift, 11 per cent, and the Heathrow terminals branch the second largest uplift with six per cent, while the rest saw only marginal changes.

Figure 3: Change (%) in 'static job accessibility' in MSOAs within 300m of Elizabeth line stations, by branch (2019 = 100) (Source: ODX, TfL and Business Register and Employment Survey, ONS)
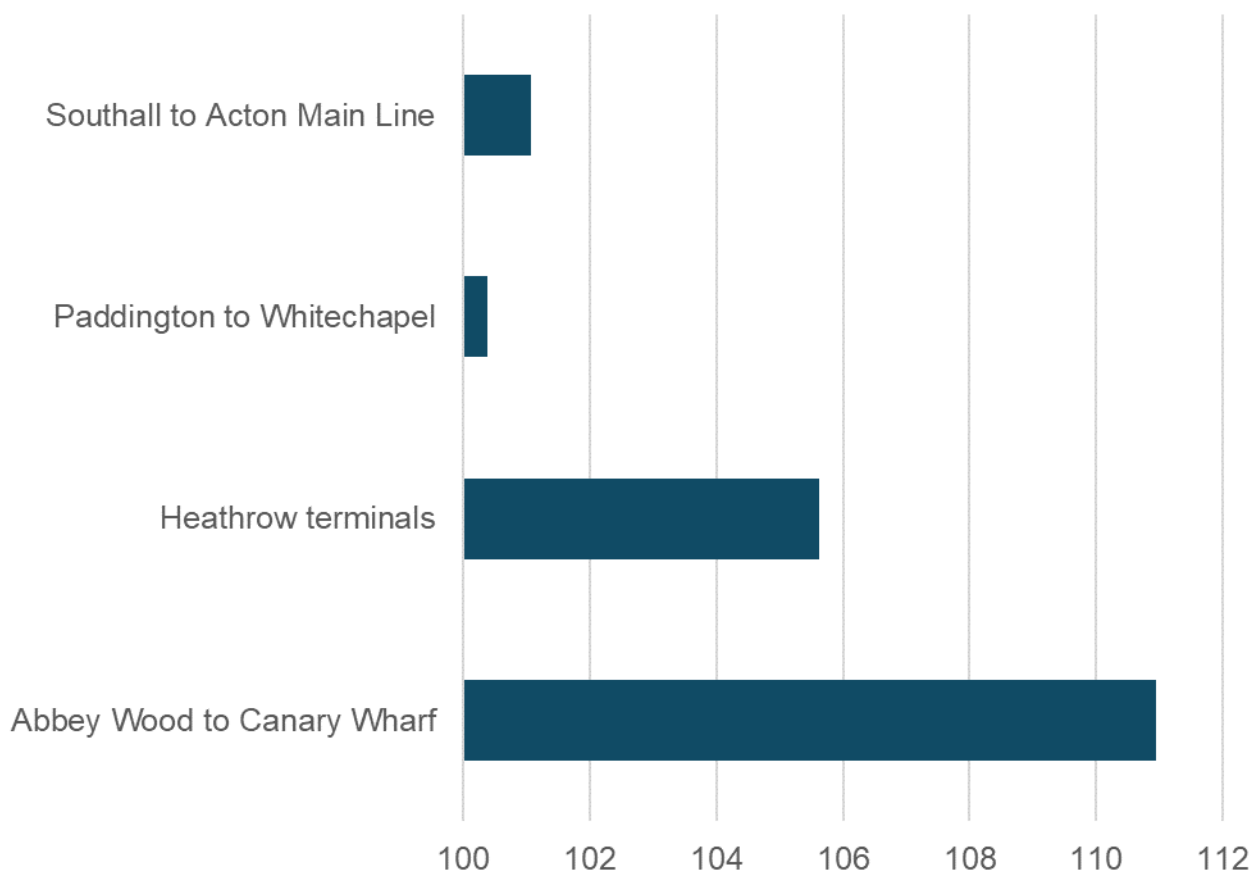
Branch	Change 'in 'static job accessibility'
Southall to Acton Main Line	+ 1%
Paddington to Whitechapel	+ 0.4%
Heathrow terminals	+ 6%
Abbey Wood to Canary Wharf	+ 11%

Figure 4 shows the change in 'static job-weighted accessibility' at MSOA level between October 2019 and October 2023. The map (Figure 4) uses observed average weekday peak journey times of passengers captured through TfL's tap-in tap-out system and 2019 employment figures. The metric 'static job-weighted accessibility' describes an MSOAs connectivity (measured in journey time) to areas with high employment density.

The map (Figure 4) distinctly shows which areas of London have benefitted the most from the opening of the line. The Canary Wharf to Abbey Wood branch with Custom House, Woolwich and Abbey Wood stations have provided a step change in connectivity not just for the immediate station area, but for the whole of South East London. Cross-river connections between the south and north of the river seem particularly prominent.

Figure 4: Difference in 'static job accessibility' in May and June 2022, immediately before and after opening of the central section of the Elizabeth line (Source: ODX, TfL and Business Register and Employment Survey, ONS)
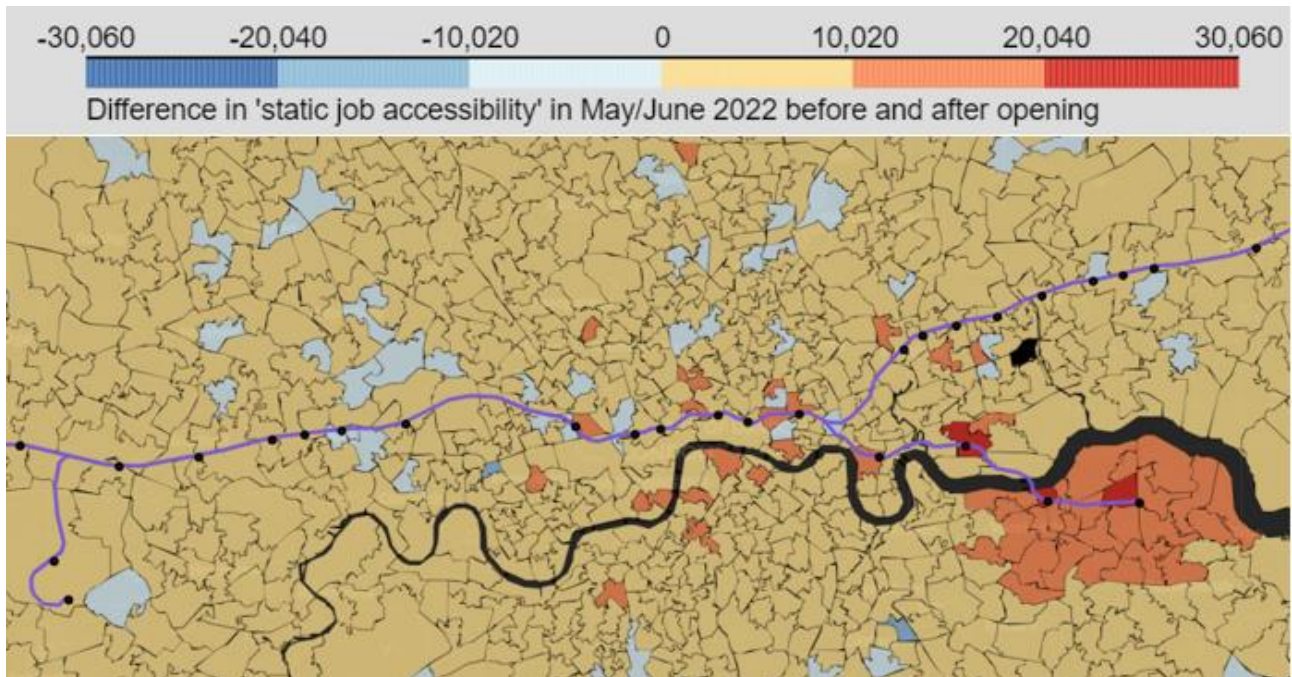
The results of the passenger survey further show the Elizabeth line's effect on connectivity and access to employment. A clear majority (62 per cent) of surveyed passengers feel that the Elizabeth line had a positive impact on their access to employment opportunities (Figure 5).The percentage of positive impact was highest for the Southall to Acton Main Line branch, the Stratford to Shenfield branch and the Abbey Wood to Canary Wharf branch (70 per cent, 71 per cent and 73 per cent respectively). The Paddington to Whitechapel branch showed somewhat lower perceived impacts, at 59 per cent.

Figure 5: 'What impact, if any, has the opening of the Elizabeth line had on your access to employment opportunities?', all passengers, by branch (Source: Passenger survey)
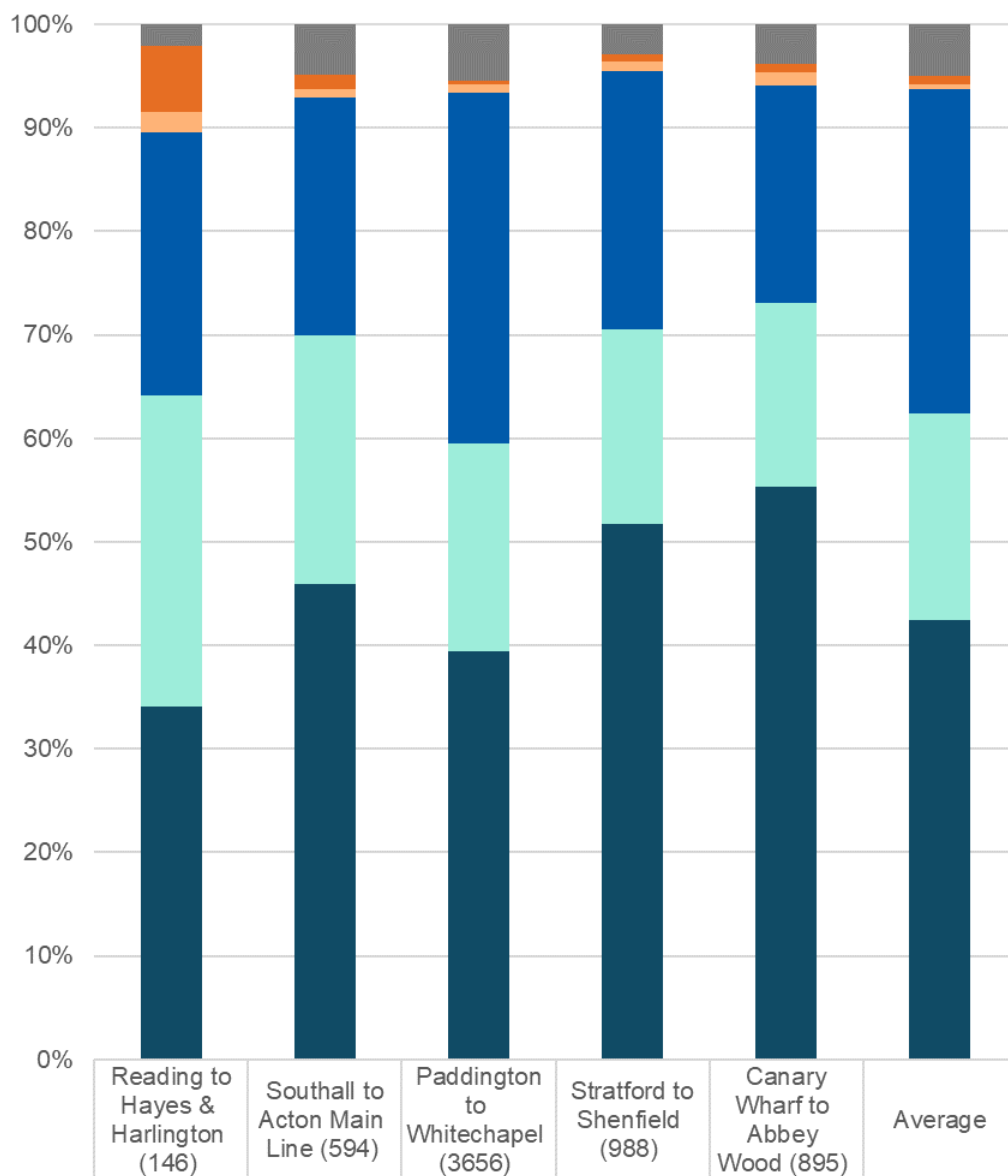
'Impact on access to employment opportunities'	Reading to Hayes & Harlington (146)	Southall to Acton Main Line (594)	Paddington to Whitechapel (3656)	Stratford to Shenfield (988)	Canary Wharf to Abbey Wood (895)	Average
Don't know	2%	5%	5%	3%	4%	5%
Very negative	6%	1%	0%	1%	1%	1%
Somewhat negative	2%	1%	1%	1%	1%	1%
No change	25%	23%	34%	25%	21%	31%
Somewhat positive	30%	24%	20%	19%	18%	20%
Very positive	34%	46%	39%	52%	55%	42%

Total base: 6,279 (Note: figures may not sum to 100% due to rounding)

Comments from the passenger survey further illustrate that the Elizabeth line has increased transport connectivity to east London suburbs, connected previously separated communities and improved access to Heathrow airport:

- "The area of east London I live in seems more connected and I have seen a change in the number of people using this route to commute."

- "The suburbs of London are much better connected with the city centre."

- "Some parts of London that were less well connected are now quicker and easier to reach."

- "It has become very easy to get to Heathrow airport, which is hugely useful."

Detailed analysis shows that the Abbey Wood branch has experienced the most significant improvements

Building on the evidence of increased 'static job-weighted accessibility' in the Abbey Wood and Woolwich area, further analysis of journey times has been carried out. Journey times in October 2019 and October 2023 between specific origin-destination (OD) pairs have been examined to further explore the changes in observed journey time between affected OD pairs. The following graphs (Figure 6 and Figure 7) present a selection of two OD pairs in which a significant and distinct improvement occurred. Additional ODs have been analysed to understand change in journey times as a sample across Elizabeth line stations. As TfL Rail was operational in October 2019, many Elizabeth line OD pairs do not show significant reduction in journey time between 2019 and 2023.

The histogram graphs in Figure 6 show the count of trips within journey time bands for all journeys taken during peak periods between Canary Wharf and Abbey Wood and between Paddington and Abbey Wood, respectively. The demand-weighted median journey time has effectively halved since the opening of the line, as shown in the data tables beneath Figure 6 and Figure 7. Median journey times nearly halved for Canary Wharf to Abbey Wood and decreased by 30 minutes (40 per cent) for Paddington to Abbey Wood. Furthermore, the number of observed journeys between this OD pair, which was 2,083 in October 2019, had climbed to 9,622 in October 2023, showing how improved connectivity can drive increased trip numbers. A journey time saving of 30 minutes for about 2,000 passengers is a combined total of 60,000 minutes (43 days) saved.

Figure 6: Histogram of median peak period journey time change between October 2019 and October 2023, between Canary Wharf MSOA and Abbey Wood MSOA (Source: ODX, TfL)
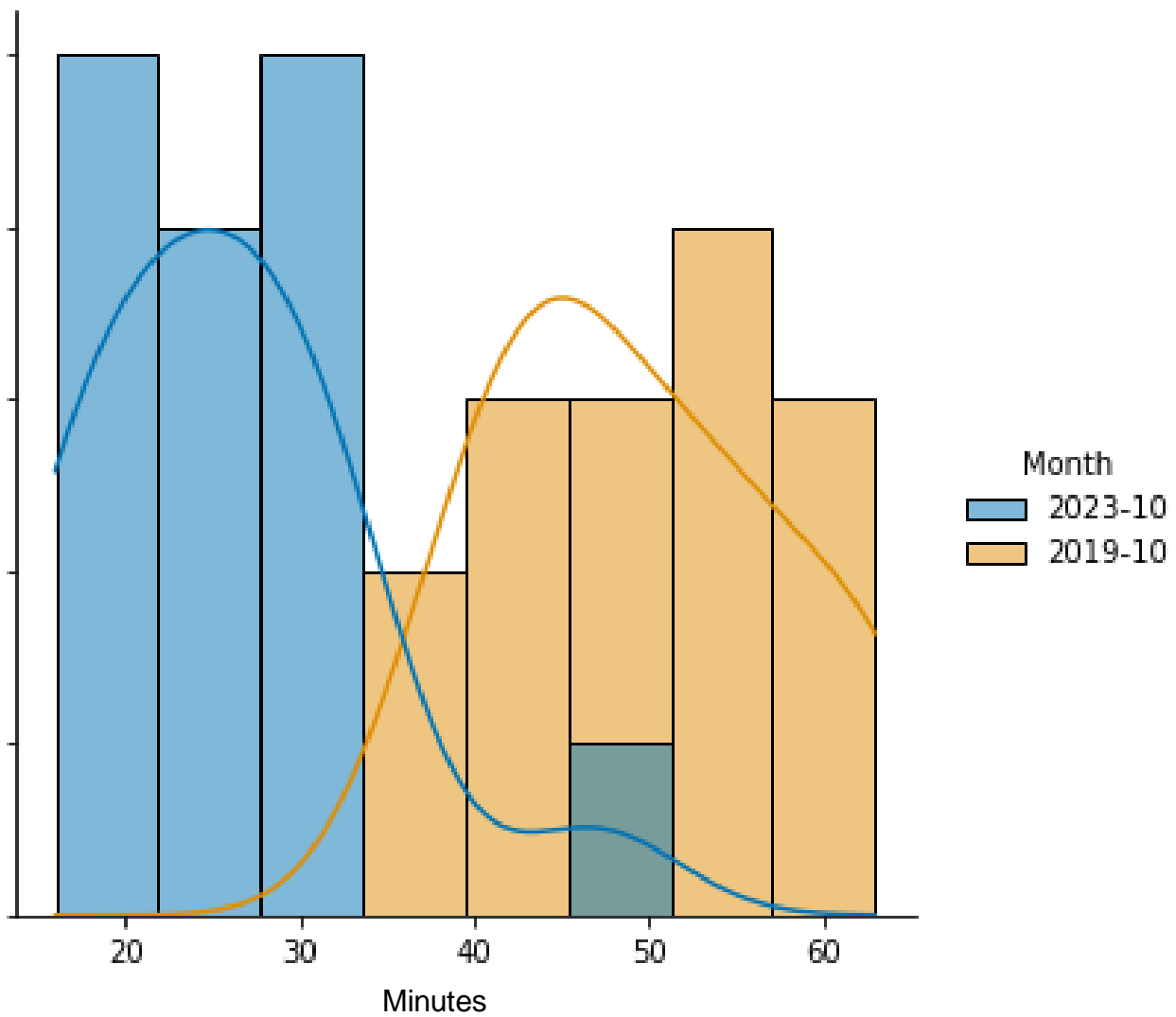
Journey time observation	Canary Wharf MSOA and Abbey Wood MSOA (2019)	Canary Wharf MSOA and Abbey Wood MSOA (2023)
Mean (minutes)	49.3	26
Median (minutes)	46.1	24.7
Minimum (minutes)	37.9	16
Maximum (minutes)	63	47
Standard deviation (minutes)	8.2	8.2
Total journey count (peak periods) (passengers)	2,083	9,622

Figure 7: Histogram of median peak period journey time change between October 2019 and October 2023, between Paddington MSOA and Abbey Wood MSOA (Source: ODX, TfL)
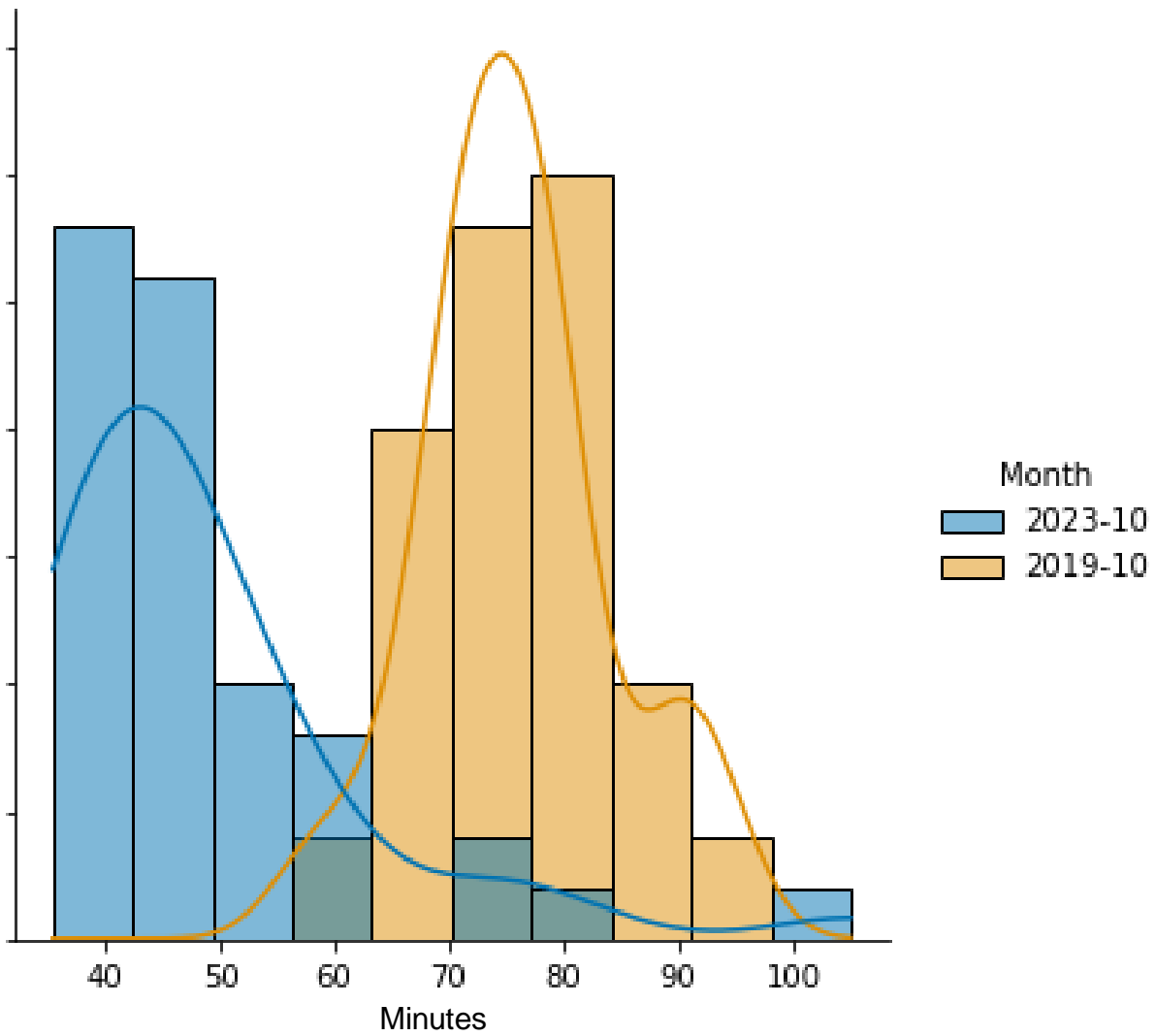
Journey time observation	Paddington MSOA and Abbey Wood MSOA (2019)	Paddington MSOA and Abbey Wood MSOA (2023)
Mean (minutes)	76	48.5
Median (minutes)	74.5	45
Minimum (minutes)	58	35.4
Maximum (minutes)	94	105
Standard deviation (minutes)	8.3	14
Total journey count (peak periods) (passenger)	1,298	6,005

Additionally, the home postcodes for passenger survey respondents are mapped in Figure 8 and Figure 9. The map illustrates the catchment area of the Elizabeth line (respondents having used the Elizabeth line are represented by blue dots), with clusters appearing along transport corridors from Bristol to Colchester and Crawley to Cambridge. This further illustrates the contribution the Elizabeth line makes to connectivity across the wider South East.

Figure 8: Origin postcodes of all Elizabeth line users and non-Elizabeth line users – all responses (Source: Passenger survey)
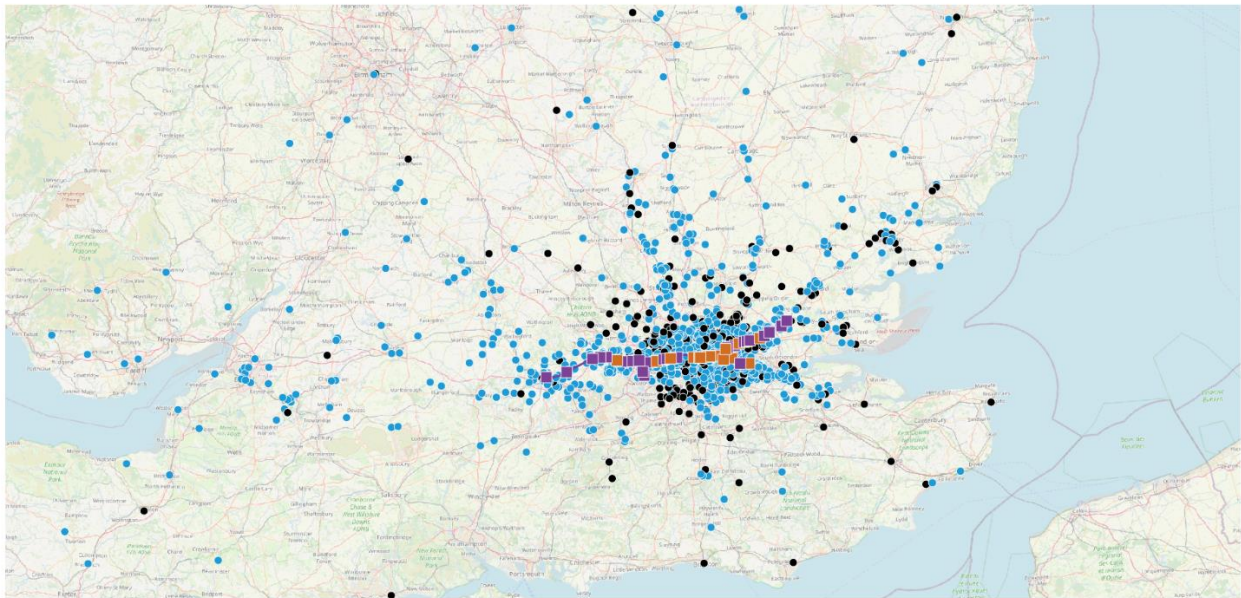
2023 Survey responses - All respondents by origin postcode
— Elizabeth line network

Elizabeth line stations
- ■ Survey stations
- ■ Other EL stations

2023 Survey: All respondents by origin postcode. EL users:
- • Yes
- • No

Figure 9: Origin postcodes of all Elizabeth line users and non-Elizabeth line users – view of responses along the line (Source: Passenger survey)
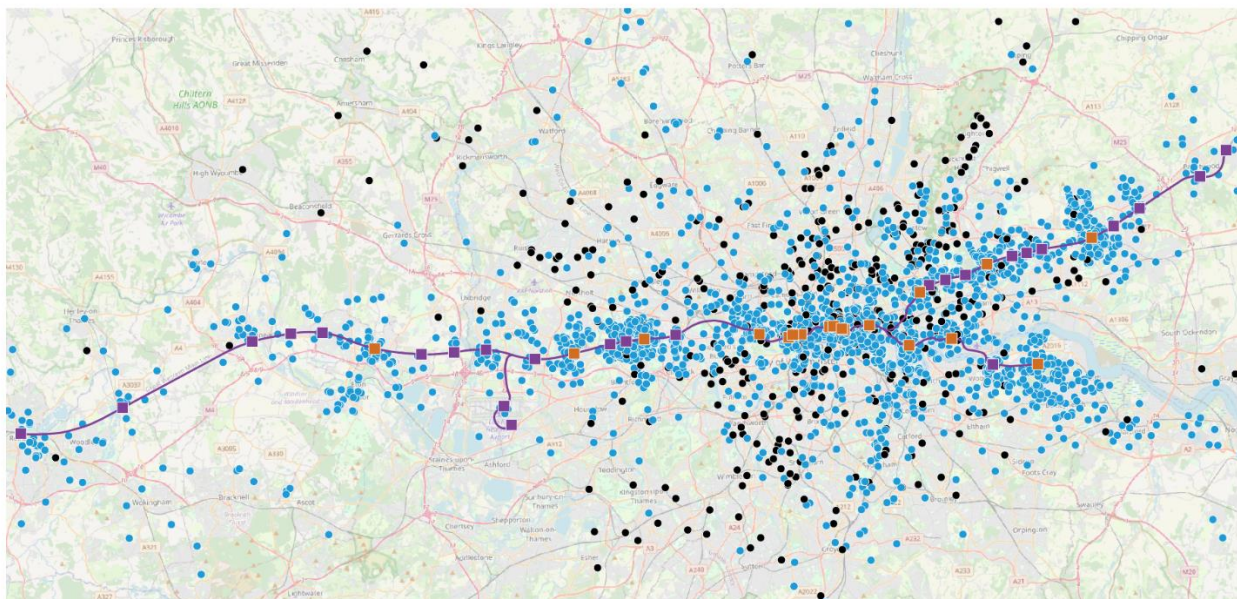
2023 Survey responses - All respondents by origin postcode

— Elizabeth line network

Elizabeth line stations
- Survey stations
- Other EL stations

2023 Survey: All respondents by origin postcode. EL users:
- Yes
- No

Discussion

Early findings suggest that the expected outcomes on connectivity are being realised. The line has increased transport connectivity across the whole of London, particularly for areas which previously had poor transport links. Improved cross-river connections are particularly emphasised around the Abbey Wood branch, providing a step-change in accessibility for local communities.

The findings presented here concentrate only on overall changes in journey times across Greater London, since much of the data currently available is from TfL and TfL data is predominantly focused on travel within the Oyster and contactless fare zones. Equivalent data was not available for the wider South East at the time of writing. In addition, road connectivity was not included in the analysis.

Static job-weighted accessibility analysis has shown significant improvements in Abbey Wood and Woolwich areas.

The breadth of the Elizabeth line catchment area is illustrated by the home postcodes of the survey respondents, demonstrating the impact of the line across the wider South East. Observed journey times for the key impacted OD pair Canary Wharf to Abbey Wood show strong evidence of significant reductions of up to about 70 per cent.

The results of the survey further suggest that passengers recognise the improved connectivity and its potential impact on their employment opportunities.

The Final Evaluation Report will show more information on how the wider South East transport network has been impacted and will aim to quantify the Elizabeth line's contribution to that.

4. Impact on trip numbers

How improved connectivity is expected to lead to increases in travel demand

This section sets out how trip numbers were expected to change since the opening of the line. Improvements in connectivity are expected to encourage people to travel more as it becomes easier to travel between places. The previous section showed that the opening of the line impacted connectivity across the whole of London, and particularly for areas close to Elizabeth line stations. The largest improvements happened along the Canary Wharf to Abbey Wood branch, which resulted in a step change in connectivity.

Improved connectivity is expected to drive increases in trip numbers on the Elizabeth line and on the whole of the transport network. Faster journey times and more comfortable travel may encourage people to commute to their offices more often or travel further for work or leisure – an expectation particularly relevant for the post-pandemic context. Step-free travel options may open up new opportunities for passengers with mobility impairments, such as wheelchair users, or passengers travelling with pushchairs, leading to more trips on the public transport network. Reduced crowding may also encourage more trips in the beginning, but as the line reaches its peak demand it is likely to become more crowded, potentially diluting this incentive.

The factors discussed above (improved connectivity through less crowding, fewer interchanges and faster journeys) all create an improved journey experience. These factors may lead to new trip generation if people switch from other modes, or may incentivise existing users to use the network more often.

Increasing trips where connectivity improved

Trips on the TfL rail network in London were significantly impacted by the pandemic (Figure 10). Across the entire TfL rail network, passenger demand from 2015 to early 2020 was around 134 million on average per 4-week period. In March 2020, passenger demand dropped to nine million passengers due to the pandemic and remained below 100 million until early 2022. Since then, it has shown a gradual upward trend and trip numbers were already recovering when the central section of the Elizabeth line opened in May 2023. From October 2022 to October 2023, passenger growth across on the Elizabeth line grew by 6.7 million, compared to 16.2 million on average per 4-week period, across the entire TfL network during the same time. Much of this growth can be attributed to trips on the Elizabeth line, but the chart shows that the rest of the network has also benefitted. In 2023/24, roughly one in every eight TfL journeys (London Underground, DLR, London Overground and London Trams) in London was made on the Elizabeth line, and the current trend suggests that further growth may happen.
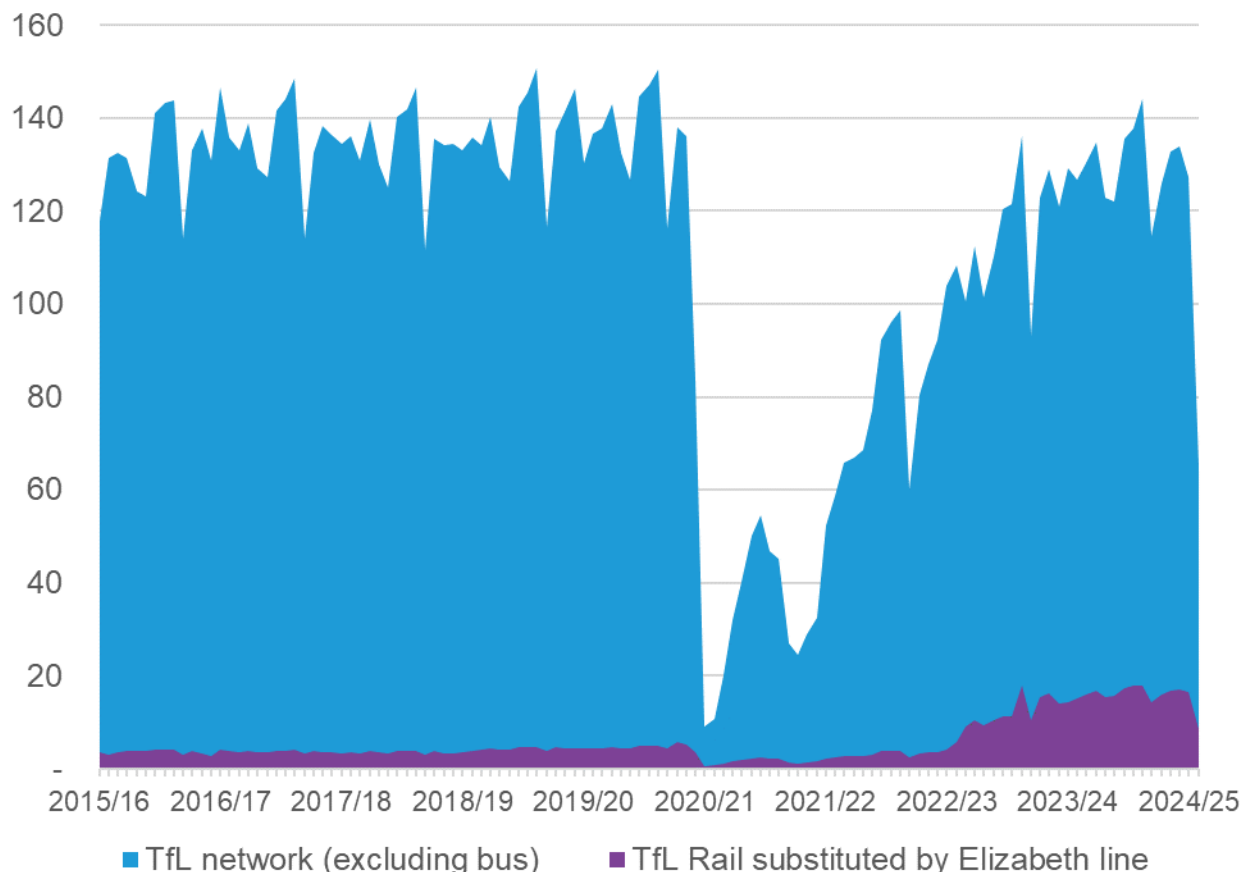
Since the May 2022 opening, average daily trip numbers on the Elizabeth line have gradually increased, from about 400,000 in May 2022 to about 600,000 in October 2023. The introduction of the through-running service in November 2022 increased trips ahead of the dip during the festive season. In October 2023, the Elizabeth line was the fifth busiest TfL line in London, after the Northern, Victoria, Central and District lines.

Improvements in connectivity were particularly high along the Canary Wharf to Abbey Wood branch and the two Western branches. However, branch-level trip numbers do not reflect this, since the largest increases in trips (between June 2022 and October 2023) happened on the Heathrow terminals branch (which had an increase of 174 per cent), with a clear increase after the integration of the branches in November 2022. The growth in Heathrow reflects post-pandemic trends, as the number of people travelling abroad, employed at Heathrow and travelling to and from Heathrow Airport was slow to recover post pandemic. Besides this, the increase in service rates from four trains per hour to six trains per hour may have also driven growth on this branch. Post-covid, there has also been a change in passenger demographics with more tourists and less business travel, which has impacted growth on the Heathrow branch ([CAA Business Travel trends 2022](#)). The number of daily boarders on the Reading to Hayes & Harlington branch also grew substantially, with lower increases seen on the rest of the branches (Figure 11). This can be explained by the fact that some of these branches were already served by TfL Rail and for the most part this could have been enough to meet demand. This also means that there was higher base demand on branches served by TfL Rail, so percentage growth is lower (base effect). It is worth noting that the increase in connectivity provided by the EL is relatively lower for the Shenfield to Stratford branch, and relatively higher for the central London to Heathrow branch.

Figure 11: Elizabeth line boarders during peak times (Indexed to June 2022 = 100) (Source: DUNNART, TfL)
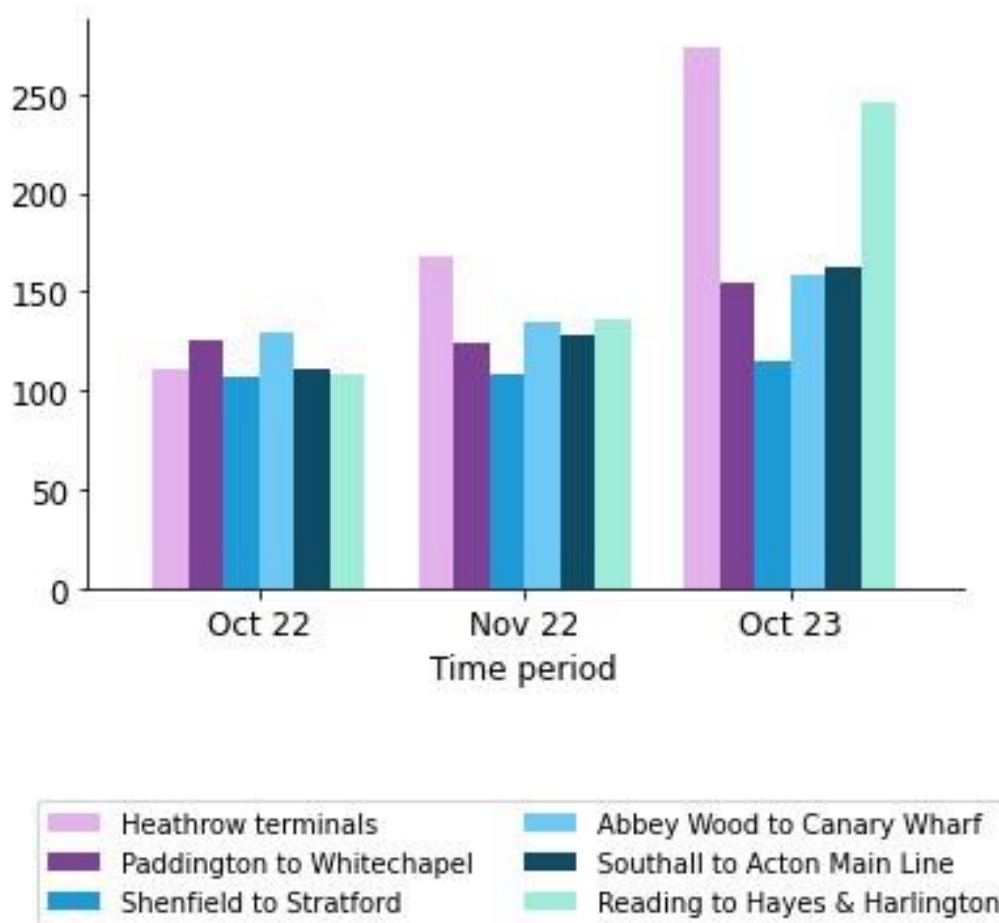
Branch	Oct-22 boarders	Nov-22 boarders	Oct-23 boarders
Heathrow terminals	111	167	274
Paddington to Whitechapel	126	124	155
Shenfield to Stratford	107	108	115
Abbey Wood to Canary Wharf	129	134	159
Southall to Acton Main Line	111	128	162
Reading to Hayes & Harlington	108	137	246

The results of the passenger survey provide insights into why passengers chose the line. Elizabeth line users participating in the survey were asked why they chose to travel on the Elizabeth line (more than one option could be chosen). Reasons related to connectivity were most frequently mentioned: around two thirds of respondents felt that the Elizabeth line provided the most direct route with the fewest changes (65 per cent) and that it was the fastest route (64 per cent) (Figure 12).

Reasons related to crowding are also cited: 24 per cent chose the Elizabeth line because the trains were less crowded or nicer, and 12 per cent because the stations were less crowded or nicer (Figure 12).

Responses were broadly consistent for respondents with and without long-term physical or mental impairments.

Figure 12: 'Why did you choose this route?', Elizabeth line passengers reporting or not reporting a long-term physical or mental impairment (Source: Passenger survey)
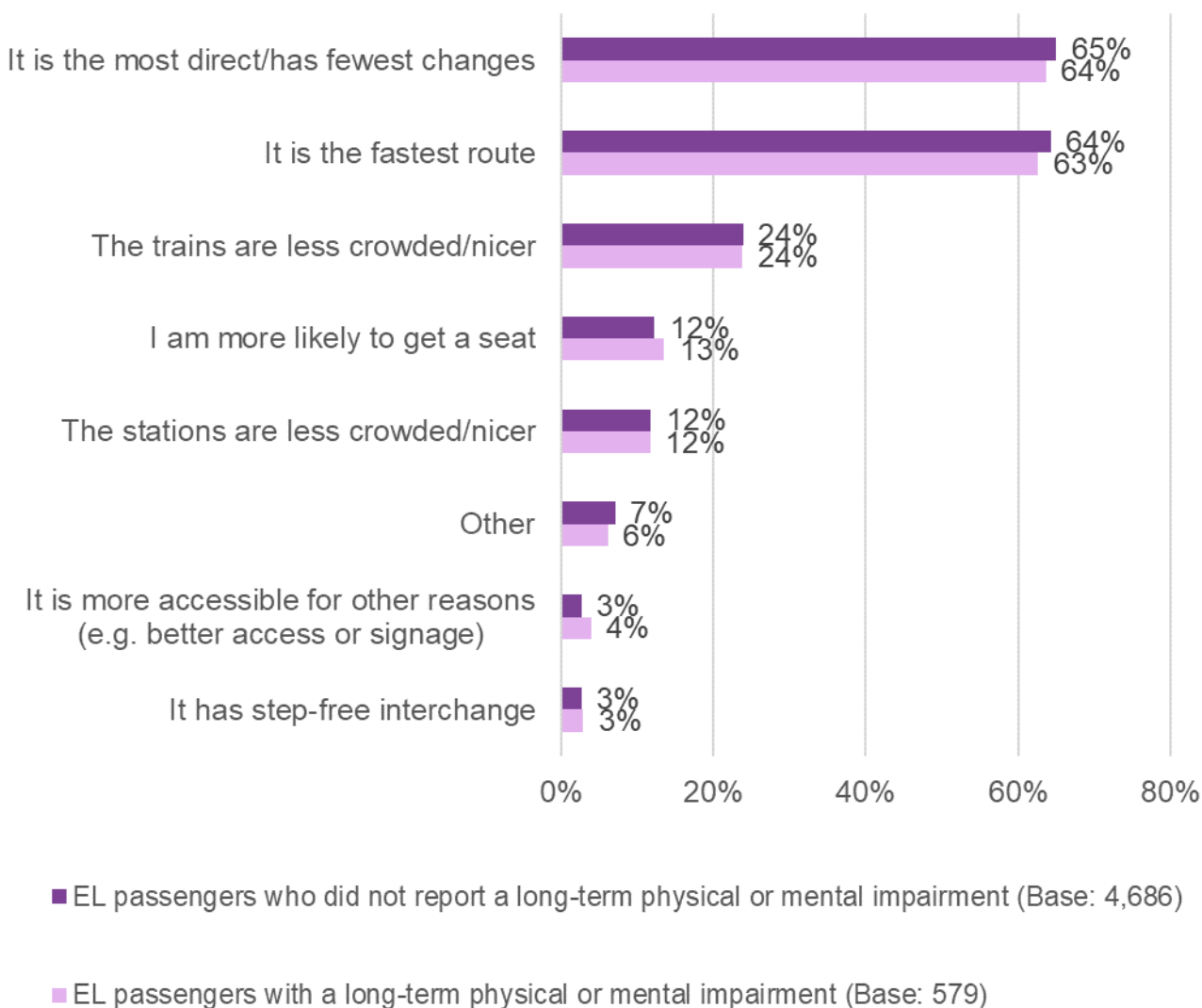
Total base: 4,686 respondents using Elizabeth line and reporting no long-term physical or mental impairment which limits their daily activity, and 579 respondents using Elizabeth line and reporting a long-term physical or mental impairment which limits their daily activity (including 'Prefer not to say' and 'Don't know') (Note: due to multiple selection possible, responses sum to greater than 100%)

A selection of comments by Elizabeth line users are provided below, illustrating the self-reported behavioural change associated with the new line.

- "I go shopping in Westfield more often."

- "My wife uses a wheelchair, and we travel together much more often now. It's been fantastic."

- "Willingness to travel more often, as the travel times [are now] reduced."

- "Shorter journey times and quicker access to more places. I also see some friends and family more often."

- "I meet friends (who live in west London) for socialising more often. We go out to Farringdon and Liverpool Street which we never used to do."

Elizabeth line passenger numbers outperform post-pandemic forecasts

The pandemic impacted trip numbers across the London and wider South East network, with numbers eventually stabilising at around 10 to 20 per cent below pre-pandemic levels in October 2023.

Elizabeth line daily journeys have continued their upward trajectory, surpassing 700,000 journeys on 1 November 2023, with the 7-day rolling average at 621,000 by 5 November 2023 as shown in Figure 13.

Figure 13: Elizabeth line daily journeys (thousands) (Source: Day 1 data)
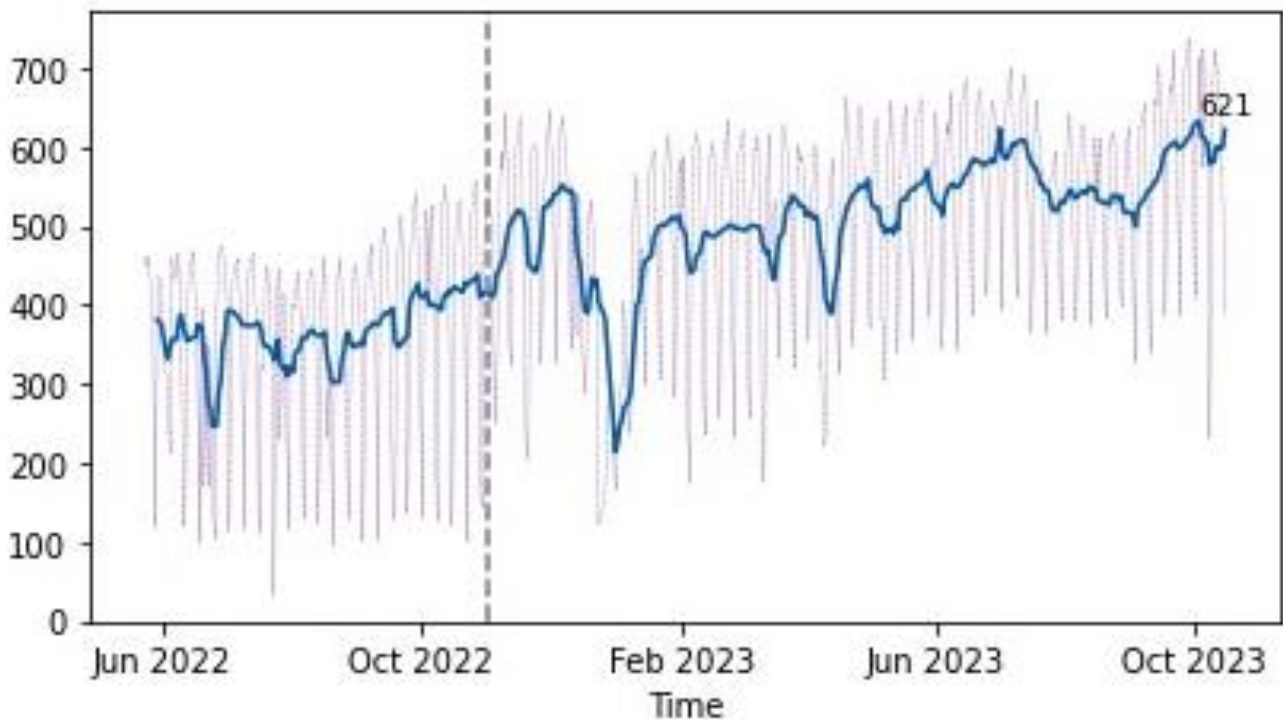
TfL's Railplan model provides data about the number of Elizabeth line passengers under different scenarios. Initial forecasts on demand for the Elizabeth line were undertaken before the coronavirus pandemic using this model.

The BaU scenario was the pre-pandemic forecast made in 2021. The use of post pandemic scenarios was introduced during the pandemic to help estimate the potential impacts of the pandemic itself and what might be achieved, and optimistic/pessimistic recovery scenarios were created to model the potential recovery in 2021.

This analysis has added observed passenger numbers on the Elizabeth line based on the first full year of operation (November 2022 to November 2023). Overall, there were 150.7 million Elizabeth line journeys recorded in the first full year of operation and 137 million journeys in 2022/23. Observed passenger numbers (Day 1 data) are above the post-pandemic 'Optimistic' scenario and nearing pre-pandemic 'Business as Usual' forecasts (Figure 14). This suggests that travel demand is nearing BaU forecasts two years after the pandemic.

Figure 14: Expected and observed numbers of Elizabeth line passengers under different scenarios (Source: TfL Railplan and analysis from Oyster/contactless)

Legend:
- Pre-Pandemic ("Business as Usual")
- Post-Pandemic Optimistic Scenario
- Post-Pandemic Pessimistic Scenario
- Actual 2022/23 and forecast 2023/24
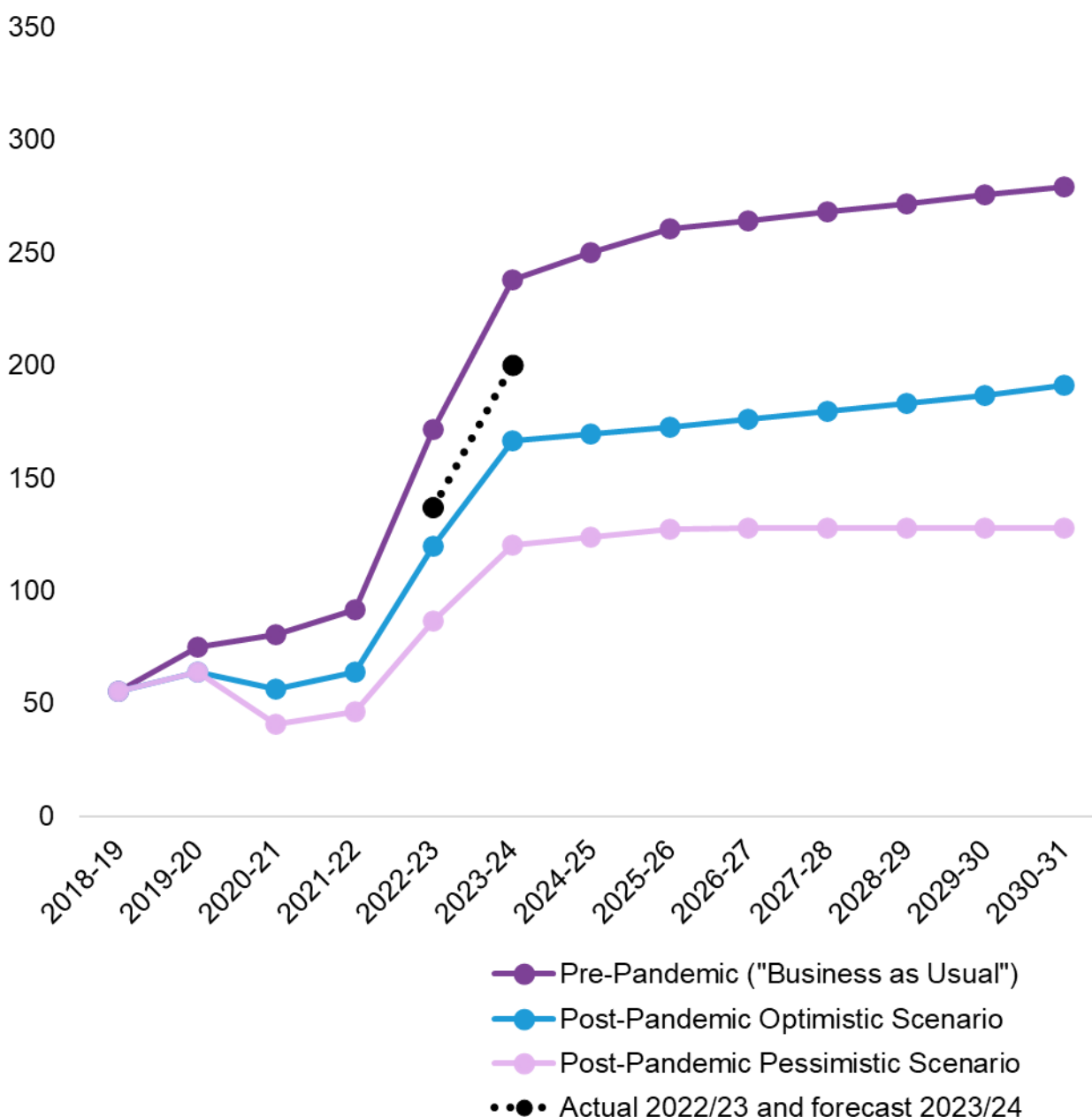
Elizabeth line weekday morning crowding is most prominent in the east-to-west direction

Elizabeth line Class 345 trains have a notional capacity of 1,500 passengers: this assumes all seats are taken, and usable standing space is occupied to a standing density of four passengers per square metre.

Weekday morning crowding on the Elizabeth line has been most prominent in the east-to-west direction, with the highest level on the Whitechapel to Liverpool Street link (Figure 15). Between October 2022 and October 2023, standing density on the Whitechapel to Liverpool Street link increased by 63 per cent, implying that usage increased there. A reason for the increase at Liverpool Street could be the service frequency increase that happened here during the same time frame. Occupancy throughout the Paddington to

Farringdon section remains below two passengers per square metre at the height of morning peak, suggesting sufficient capacity for both comfortable travel and future growth.

Comparing to other lines on the TfL network, average standing density levels on the Elizabeth line in October 2023 were similar to the DLR and District lines. Whereas, the Jubilee, Waterloo and City, and Victoria lines had higher levels of crowding in the same time period.

Figure 15: Number of passengers standing per metre square at the height of weekday morning peak (Source: DUNNART, TfL)
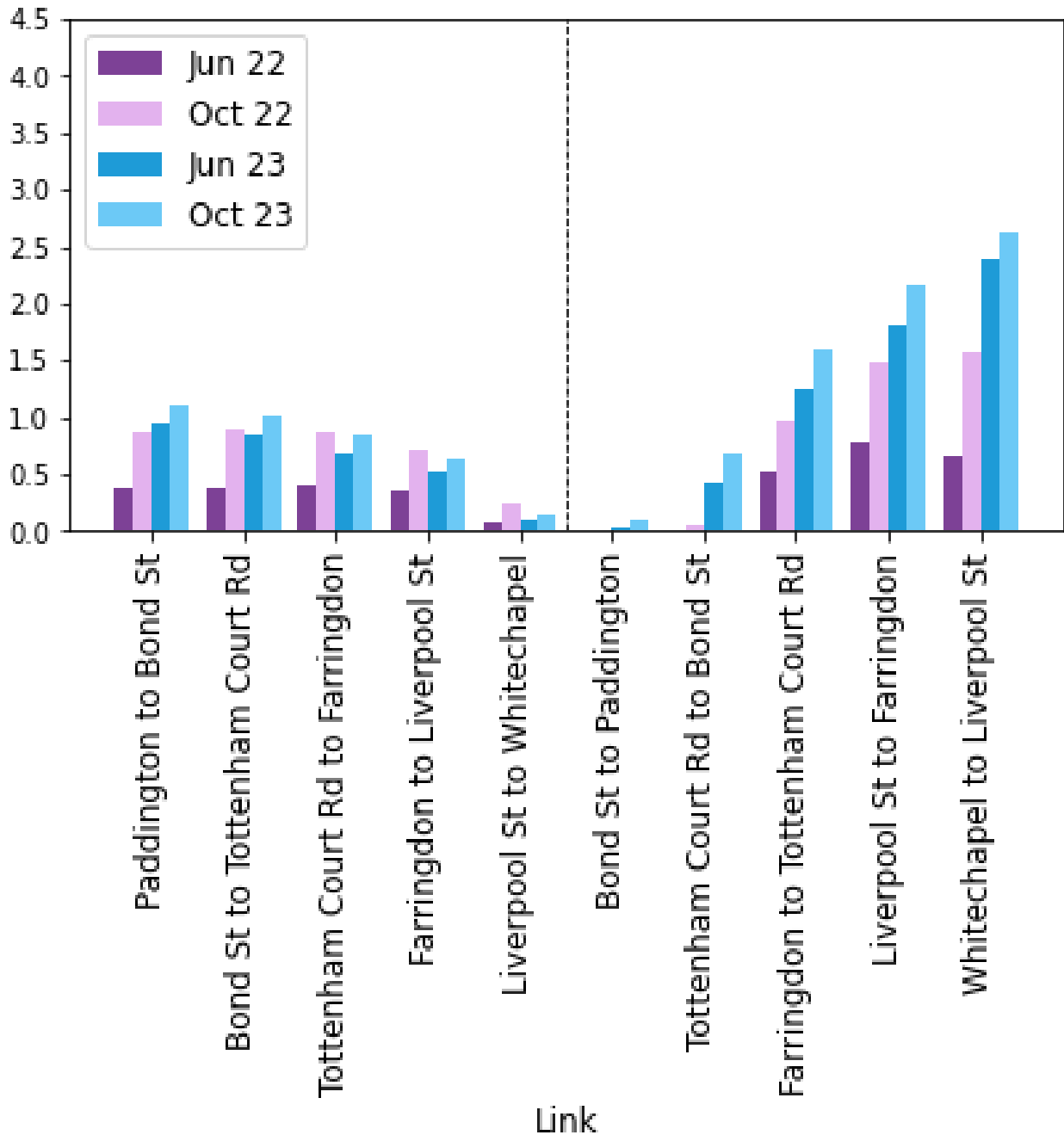
Direction	Link name	Jun-22	Oct-22	Jun-23	Oct-23
Eastbound	Paddington to Bond Street	0.4	0.9	1.0	1.1
Eastbound	Bond Street to Tot Court Road	0.4	0.9	0.9	1.0
Eastbound	Tot Court Road to Farringdon	0.4	0.9	0.7	0.8
Eastbound	Farringdon to Liverpool Street	0.4	0.7	0.5	0.7
Eastbound	Liverpool Street to Whitechapel	0.1	0.2	0.1	0.2
Westbound	Bond Street to Paddington	0.0	0.0	0.0	0.1
Westbound	Tot Court Road to Bond Street	0.0	0.1	0.4	0.7
Westbound	Farringdon to Tot Court Road	0.5	1.0	1.3	1.6
Westbound	Liverpool Street to Farringdon	0.8	1.5	1.8	2.2
Westbound	Whitechapel to Liverpool Street	0.7	1.6	2.4	2.6

Elizabeth line passenger demand growth outstrips TfL rail network growth between June 2022 and October 2023

This section compares Elizabeth line demand to other lines used for this analysis which are classed as parallel (DLR, Central, Jubilee, Piccadilly) if they act as substitute to the Elizabeth line, or comparator (Victoria) if they are not parallel for the Elizabeth line.

The demand story supports the positive TfL Railplan forecasts; between June 2022 and October 2023, passenger demand on the Elizabeth line grew faster than total TfL rail network passenger demand in London (increasing by 53 per cent against 19 per cent). Through the 2023/24 financial year, Elizabeth line daily boarders formed roughly 12 per cent (1 in 8) of total TfL daily boarders (excluding bus) (Figure 16).

Figure 16: Average weekday boarders during peak times (June 2022 = 100) (Source: DUNNART, TfL)
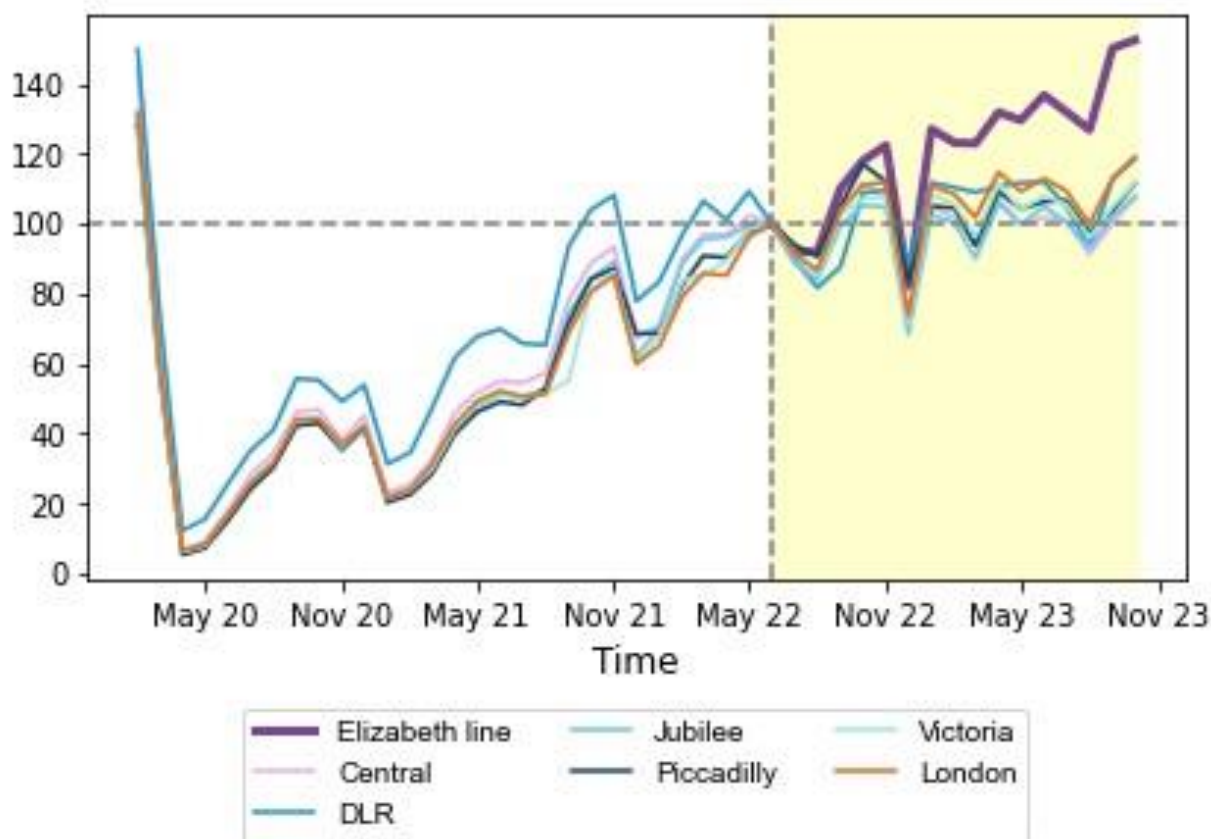
Line	Nov-21	Jun-22	Nov-22	Jun-23	Oct-23
London (All TfL lines)	85	100	112	113	119
Central	93	100	107	102	108
DLR	108	100	110	112	119
Elizabeth Line	0	100	122	137	153
Jubilee	89	100	105	105	108
Piccadilly	87	100	112	106	111
Victoria	86	100	108	108	112

As shown above in Figure 16, average daily boarder growth on the Elizabeth line surpassed all other comparator and parallel lines (Central, DLR, Jubilee, Piccadilly, Victoria), growing by 53 per cent between June 2022 and October 2023. However, London as a whole and the Victoria line (comparator line) increased more than parallel lines in relative terms, which suggests that in the absence of the Elizabeth line, parallel lines might have grown more, and that the Elizabeth line overall acted at least partially as a substitute to the Central, Jubilee and Piccadilly lines, although not for the DLR.

In October 2023, the part of the Elizabeth line with the largest share of boarders was the Paddington to Whitechapel branch (44 per cent of total) and the smallest share was the

Heathrow airport branch (3 per cent of total). However, the Heathrow airport branch experienced the largest increase in boarders with an increase of 174 per cent between October 2022 and October 2023. This is thought to reflect the continued recovery of air travel demand, return of workers at Heathrow airport, improved service frequency, and more competitive fares (smaller percentage increase on EL line fares relative to parallel lines) after the pandemic. The results of the passenger survey reveal that connectivity was a top reason behind increasing trip numbers on the Elizabeth line, which suggests that the Heathrow airport branch has experienced rapid growth by providing a direct and well-connected route to Heathrow airport.

The largest increases in average daily station entries appear to have occurred in areas where regeneration activities have been undertaken or are ongoing. However, it is important to note the base effect: as the Elizabeth line opened in May 2022, the low base in June 2022 may lead to accentuated increases. Stations along the Reading to Hayes & Harlington branch saw the largest increase in usage. Station entries at Maidenhead increased by 660 per cent between June 2022 and October 2023. This could reflect an increase in population and new housing developments in the area. For example, a new town centre is being developed in Maidenhead under the new Nicholson's Quarter. Slough is also undergoing regeneration but on a smaller scale to Maidenhead, hence station entries have increased by less. Furthermore, Maidenhead and Slough are towns and therefore act as regional centres in a way that individual London stations do not (unless they are a key rail terminus), meaning that large growth in station entries there may reflect an increase in the number of residents who are using the main town centre station for commuting or leisure purposes. Part of the increase in Maidenhead could also be because PAYG usage increased there as PAYG was rolled out at this station in March 2022.

Table 2: Elizabeth line stations with the largest % increase in average weekday station entry counts in peak periods (Source: DUNNART, TfL)

Station	Jun-22 station entries	Oct-23 station entries	% change
Maidenhead	1,098	8,448	669%
Slough	1,463	8,832	504%
Acton Main Line	689	2,508	264%
Twyford	1,765	5,450	209%
Taplow	353	715	103%
Elizabeth line average	**9,038**	**12,400**	**37%**
Elizabeth line median	**3,450**	**5,095**	**48%**

Note: average and median are for all Elizabeth line stations, not just top five

On the other hand, Hanwell saw the biggest decrease in entries at less than 12 per cent between June 2022 and October 2023. This could be because people are choosing to use the National Rail services from stations near Hanwell (such as Southall) rather than the Elizabeth line. Given that there are substitutes for the Elizabeth line near Hanwell, residents may be drawn to the familiar National Rail service to start their journey. There has been negative feedback by passengers around the reliability of the Elizabeth line in

west London, and this reflects in the decline in station entries at Hanwell. In addition, Hanwell station is in a suburban area, hence may not get much passenger traffic.

Table 3: Elizabeth line stations with the largest % decrease in average weekday station entry counts in peak periods (Source: DUNNART, TfL)

Station	Jun-22 station entries	Oct-23 station entries	% change
Hanwell	2,168	1,903	-12%
Gidea Park	3,520	3,133	-11%
Chadwell Heath	4,406	4,013	-9%
Iver	574	566	-1%
Harold Wood	3,274	3,265	0%
Elizabeth line average	**9,038**	**12,400**	**37%**
Elizabeth line median	**3,450**	**5,095**	**48%**

Note: average and median are for all Elizabeth line stations, not just top five stations.

Findings from the passenger survey indicate that surveyed passengers have changed their travel behaviour due to the Elizabeth line (Figure 17). On average, 14 per cent of passengers said they would travel less if the Elizabeth line had not opened, and 37 per cent said they would travel by other means of transport (Figure 17).

A high proportion of passengers who travel via outer and inner suburbs said they would travel less if the Elizabeth line had not opened (17 per cent and 18 per cent respectively), suggesting that the line's opening has made a difference to their travel habits (Figure 17). People living in suburbs also indicated a greater inclination towards using other means of transport in the absence of the Elizabeth line. Contrastingly, respondents travelling from 'City' stations exhibited a different pattern, with 46 per cent stating that the absence of the Elizabeth line would have little or no effect on their travel behaviour. Only 14 per cent of this group suggested a potential decrease in travel in the absence of the Elizabeth line.

These findings underscore the significance of the Elizabeth line in shaping the travel behaviour of individuals residing farther from central London, as it enhances accessibility to London. Without the Elizabeth line, these residents would need to explore alternative transport options or potentially reconsider travel altogether.

Figure 17: 'Thinking about your travel more generally, if the Elizabeth line had not opened, which of the following best describes how you would travel?', all passengers, by station type (Source: Passenger survey)
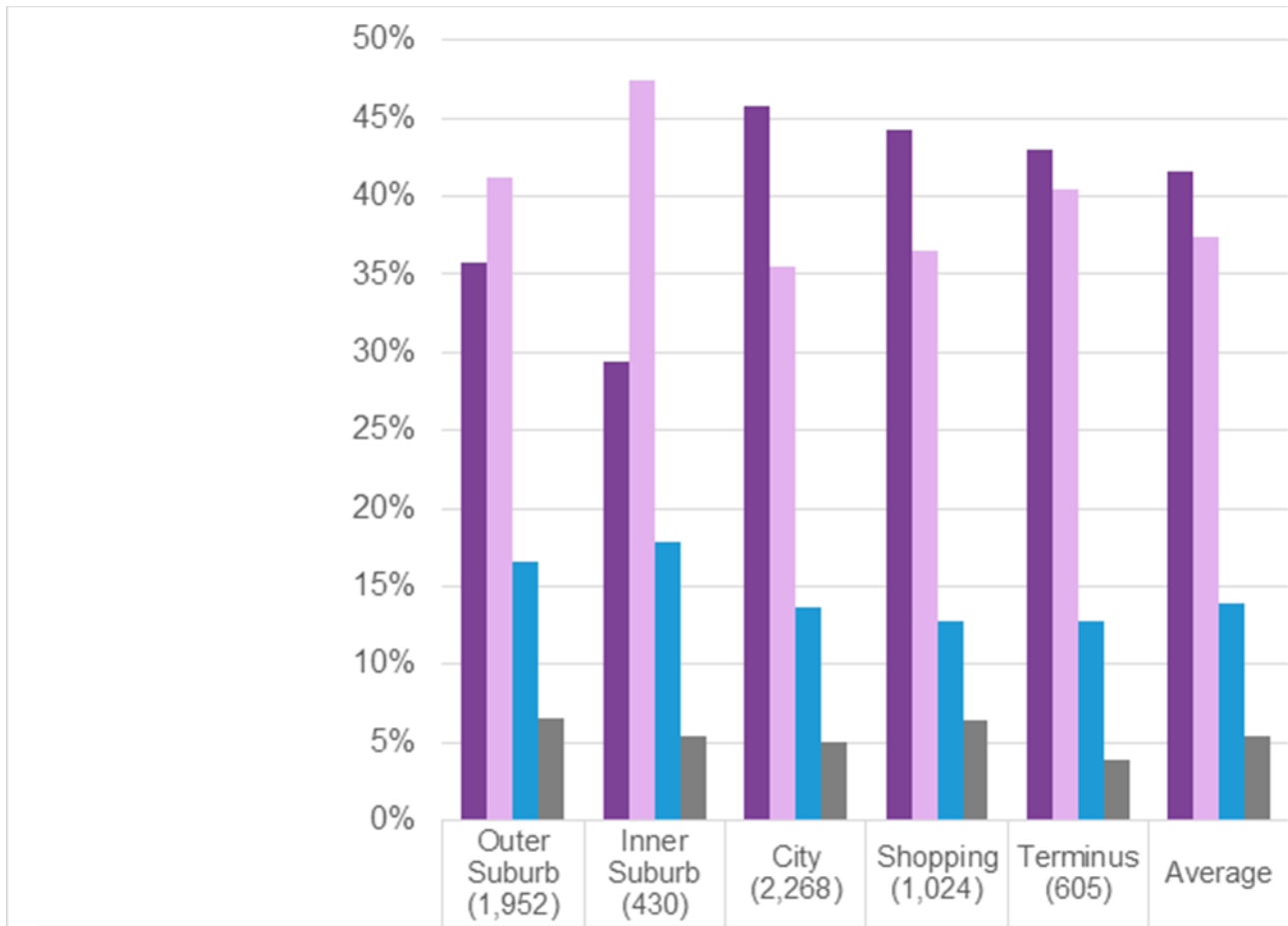
'How you would travel?'	Outer Suburb (1,952)	Inner Suburb (430)	City (2,268)	Shopping (1,024)	Terminus (605)	Average
■ It would make little or no difference	36%	29%	46%	44%	43%	42%
■ I would travel more by other methods of transport instead	41%	47%	36%	37%	40%	37%
■ I would travel less overall	17%	18%	14%	13%	13%	14%
■ Don't know	7%	5%	5%	6%	4%	5%

Total base: 6,279 (Note: figures may not sum to 100% due to rounding)

Current limitations

Most of the charts in this section use the DUNNART dataset, which provides information on trips within the Pay-as-you-go area in London and the wider South East. DUNNART data provides information on trips that were made using oyster, or contactless card, however pay-as-you-go contactless technology is not available at stations further into the South East. The Final Evaluation Report will incorporate more data on travel outside of London to provide a more holistic picture about the Elizabeth line's impact.

Discussion

Trips on the TfL rail network of London were hit hard by the pandemic, with average daily boarder numbers in London declining by 54 per cent between February and March 2020. The pandemic impacted trip numbers across the London and wider South East network, but numbers eventually stabilised at around 10 to 20 per cent below pre-pandemic levels in October 2023.

Early findings suggest that the connectivity improvements provided by the Elizabeth line may have been followed by increased trip numbers across the public transport network of London. Overall rail trips on the TfL network grew 19 per cent between June 2022 and October 2023. The immediate jump in trip numbers following the Elizabeth line opening was followed by a gradual increase which may grow further, based on the trends observed until October 2023. In October 2023, the Elizabeth line was the fifth busiest TfL line in London with approximately 600,000 number of daily trips. The Elizabeth line appears to have transformed travel in areas previously not served by high-capacity public transport options, which might be encouraging people and companies to change their home, work, or other daily travel destinations.

The results of the passenger survey suggest that the most important reasons for choosing the Elizabeth line were journey time and fewer interchanges – both closely associated with improved connectivity. Reduced crowding was also important for users; but it is also worth noting that any reductions in crowding on the line may be temporary and may not remain if the line reaches its full capacity. However, the broader London transport network is expected to be less crowded following the addition of the Elizabeth line, as people will substitute away from parallel lines to the Elizabeth line.

The Final Evaluation Report will paint a more holistic picture and show how trips outside London were impacted by the opening.

5. Impact on mode shift

Theory of Change on mode shift

The Elizabeth line was expected to reduce journey times, improve connectivity and deliver other service enhancements. All of these represent improvements to the public transport offer, which means that the Elizabeth line is expected to increase the number of trips on the public transport network.

Some trips on the Elizabeth line represent newly generated journeys (see Section 4), but others represent mode shift, either from other public transport options or other modes, such as road. This occurs because the new option provided by the Elizabeth line is more attractive than the alternative for some journeys.

The impact on mode shift would be expected to increase after the initial opening of the Elizabeth line in May 2022 to reflect subsequent improvements to the service, including the opening of the Elizabeth line Bond Street station (October 2022), the connection of the east and west sections to the central tunnels (November 2022), and the introduction of full end-to-end running of the line (May 2023).

The focus of this section is on abstraction from other public transport options – that is, trips on the Elizabeth line that would still have been made on public transport if the Elizabeth line had not opened. As set out in section 5, mode shift from other modes will be explored later in the study when additional data is available.

A total of 38 per cent of Elizabeth line demand comes from trip generation and mode shift from active modes, road travel or bus

Demand for the Elizabeth line can be divided into four main categories:

- TfL Rail: trips that were already using the mainline rail lines that now form part of the east and west sections of the Elizabeth line, before the Elizabeth line opened

- Abstraction: trips that were already using a different form of rail (London Underground, DLR or National Rail)

- Mode shift: trips that were already being made through other modes not covered by the above, such as road, bus and active travel

- Trip generation: entirely new trips that were not being made prior to the opening of the Elizabeth line

TfL has carried out analysis of where demand on the Elizabeth line has come from (such as abstraction) and how much of the demand is trip generation or mode shift from modes for which there is currently no data available (such as road, bus and active travel). The analysis method utilises available demand data for public transport modes to estimate how much of the Elizabeth line demand has been shifted from them. The remaining demand is therefore assumed to be new trips (trip generation) and mode shift from uncaptured modes. The analysis therefore splits Elizabeth line demand into the categories outlined above, with abstraction further split between London Underground, DLR and Rail, and trip generation and mode shift combined together.

Figure 18 below (see page 41) shows that as of September 2023, abstraction from London Underground, DLR and National Rail was estimated to account for 35 per cent of Elizabeth

line demand. The remaining 65 per cent was made of mode shift, newly generated trips and those that had already been travelling on TfL Rail prior to the Elizabeth line opening.

This analysis has been carried out by TfL analysts utilising a broad range of data and tools to estimate where the demand (in passenger kilometres) on the Elizabeth line has come from. It represents an estimate based on high-level analysis and should not be interpreted as a robust counterfactual analysis due to inherent assumptions which may not reflect the full complexity of changes in demand patterns seen on the network.

Current analysis is unable to separate 'trip generation and mode shift' from road, bus and active travel, due to data limitations. The final evaluation report will seek to explore this further.

Figure 18: Estimated composition of Elizabeth line passenger kilometres in September 2023 as a proportion of total (Source: TfL analysis)
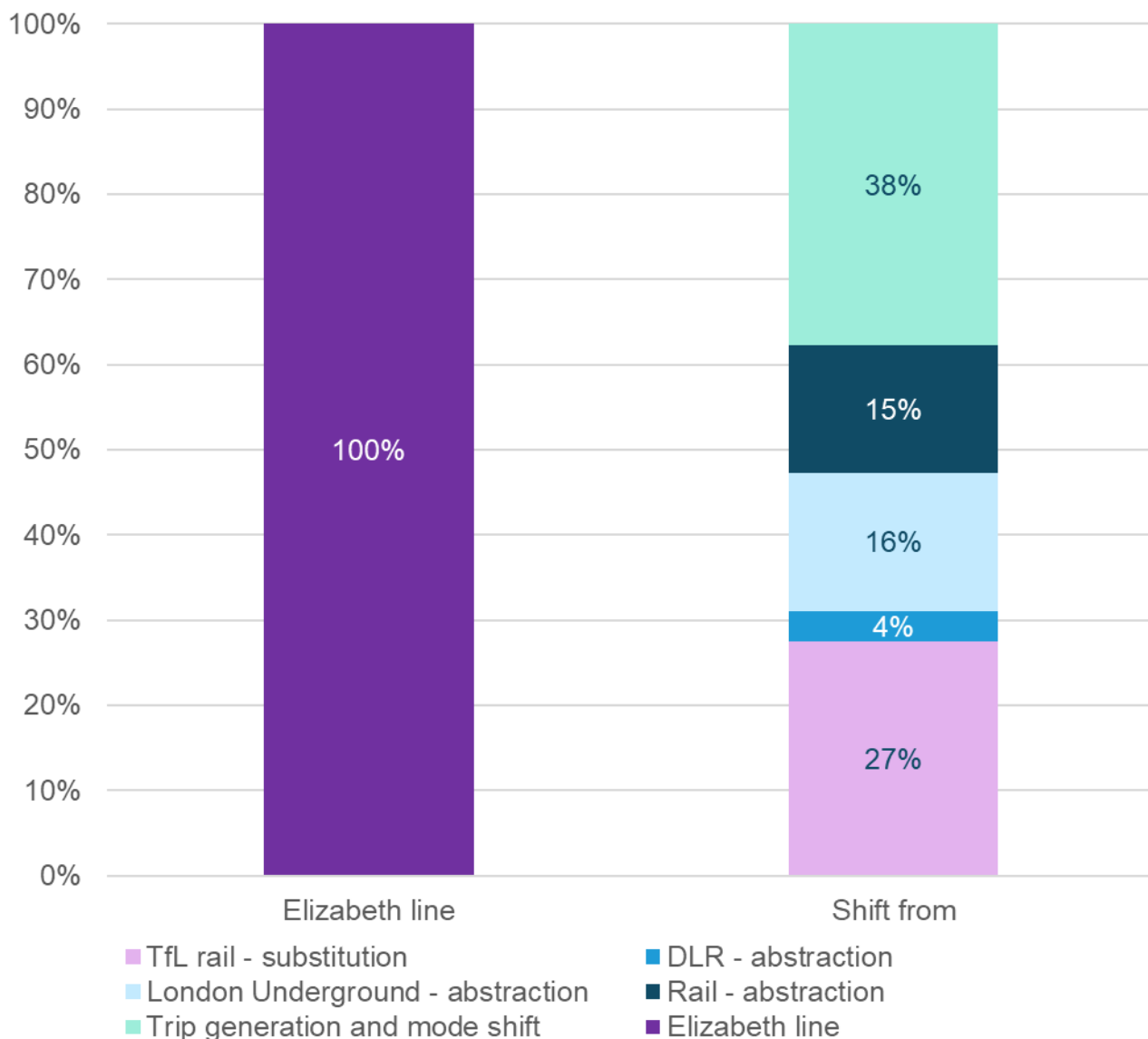
Elizabeth line demand shift from	Percentage
TfL Rail – substitution	27%
DLR – abstraction	4%
London Underground – abstraction	16%
Rail – abstraction	15%
Trip generation and mode shift	38%
Total (Elizabeth line demand)	100%

Demand on links parallel to the Elizabeth line saw a decrease since the opening

Figure 19 below shows link level demand (number of trips on a station-to-station link) indexed to June 2022. This illustrates the decline in demand for parallel routes after the opening of the Elizabeth line, while Elizabeth line (previously TfL Rail) demand grew significantly. Trip numbers on comparator and feeder links – as well as those deemed to be 'mixed' because they represent a combination of feeder and parallel – increased over the same time period.

Figure 19: Rail and London Underground link level demand by impact category (June 2022 = 100) (Source: DUNNART, TfL)
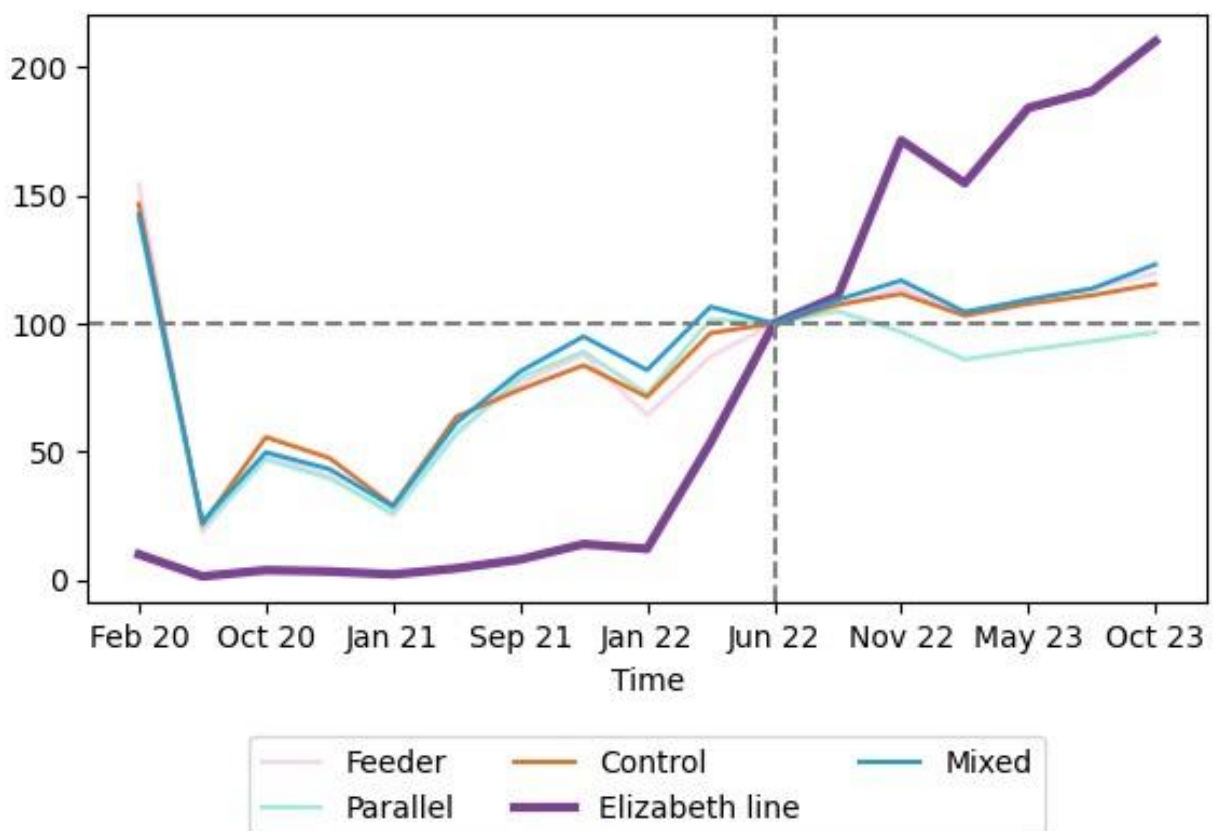
Note: TfL Rail, which became the Elizabeth line, demand is captured within the Elizabeth line category.

Month	Elizabeth line (previously TfL Rail)	Control	Feeder	Parallel	Mixed
Feb-20	10	147	154	141	143
Jun-20	1	22	18	20	23
Oct-20	4	56	49	47	50
Nov-20	3	48	41	40	43
Jan-21	2	29	25	26	29
Jun-21	4	64	58	57	61
Sep-21	8	74	77	79	81
Nov-21	14	84	88	89	95
Jan-22	12	71	64	73	82
May-22	54	96	87	102	107
Jun-22	100	100	100	100	100
Sep-22	111	107	107	105	109
Nov-22	171	112	114	97	117
Jan-23	155	103	103	86	105
May-23	184	108	110	90	109
Jun-23	191	111	114	93	114

Demand on the Elizabeth line significantly increased more than comparator links after November 2022

Figure 20 shows how link-level demand has changed over time on the Elizabeth line, and how this compares with links that have been identified as either comparator or parallel links. This uses an index, with June 2022 set equal to 100 for each link type.

This shows that prior to the opening of the Elizabeth line in May 2022, demand on parallel links has grown more than the comparator links. Between June 2022 and October 2023 there was strong growth in Elizabeth line trips, with modest growth in demand for comparator links and a decline in the number of trips on parallel routes. This supports the finding that the Elizabeth line has led to some abstraction from parallel routes.

Figure 20: Link loads over time for the Elizabeth line, comparator and parallel routes (June 2022 = 100) (Source: DUNNART, TfL)
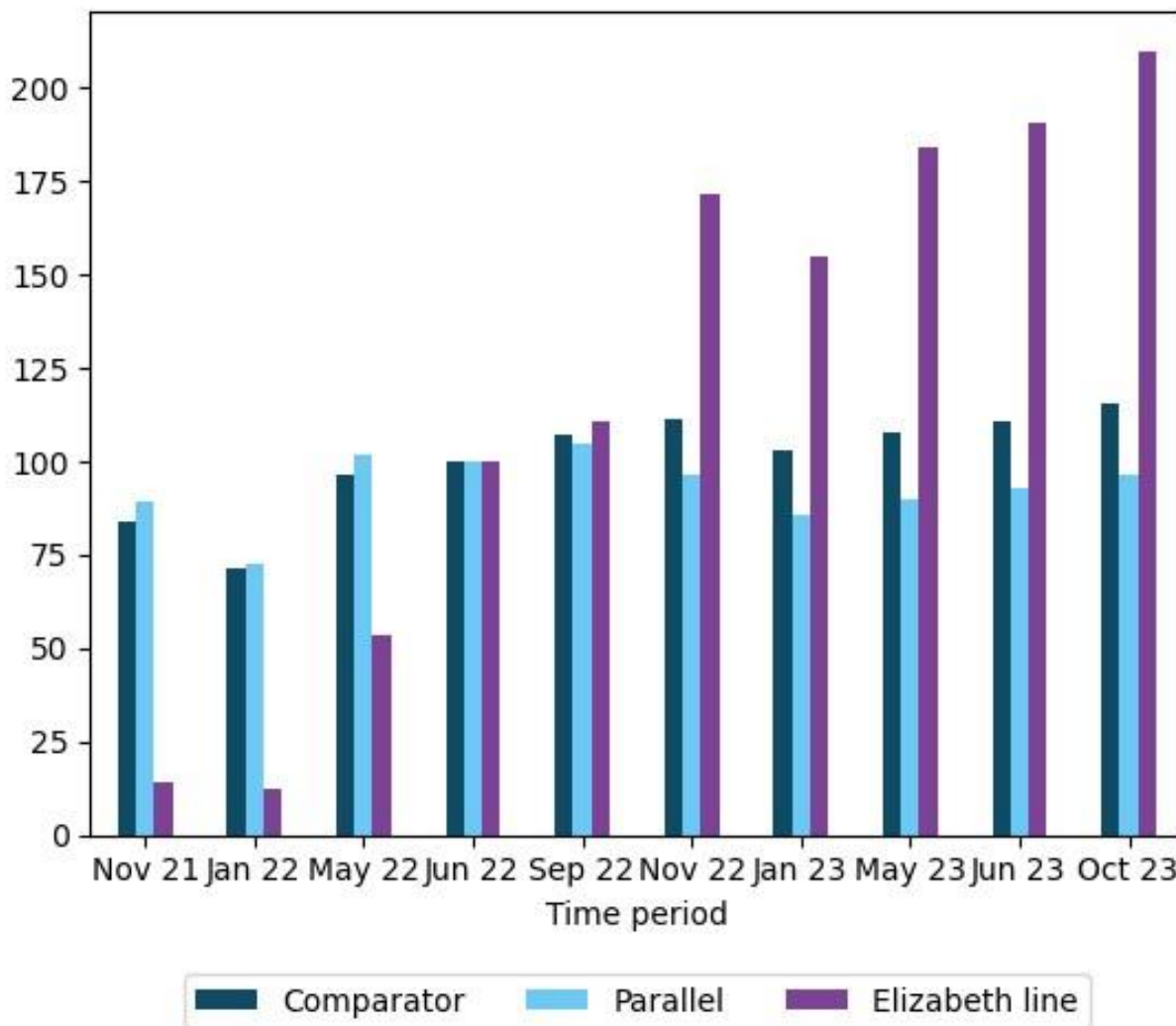
Date	Comparator	Parallel	Elizabeth line
Nov-21	84	89	14
Jan-22	71	73	12
May-22	96	102	54
Jun-22	100	100	100
Sep-22	107	105	111
Nov-22	112	97	171
Jan-23	103	86	155
May-23	108	90	184
Jun-23	111	93	191
Oct-23	115	97	210

Passenger survey results suggest more journeys were made as a result of the Elizabeth line opening

Figure 21 provides the results from the passenger survey for the question 'If the Elizabeth line had not opened, how would you have made this journey?'. The results suggest that 72 per cent of passengers using the Elizabeth line would have travelled to the same destination in the absence of the Elizabeth line. Notably, 18 per cent would have travelled to a different destination, suggesting that the Elizabeth line may have contributed to a

redistribution of travel destinations. A smaller segment (4 per cent) of passengers stated they would not have travelled at all without the Elizabeth line. This indicates that the line has generated some new trips that would not have occurred otherwise.

Figure 21: 'If the Elizabeth line had not opened, how would you have made this journey?', Elizabeth line passengers (Source: Passenger survey)
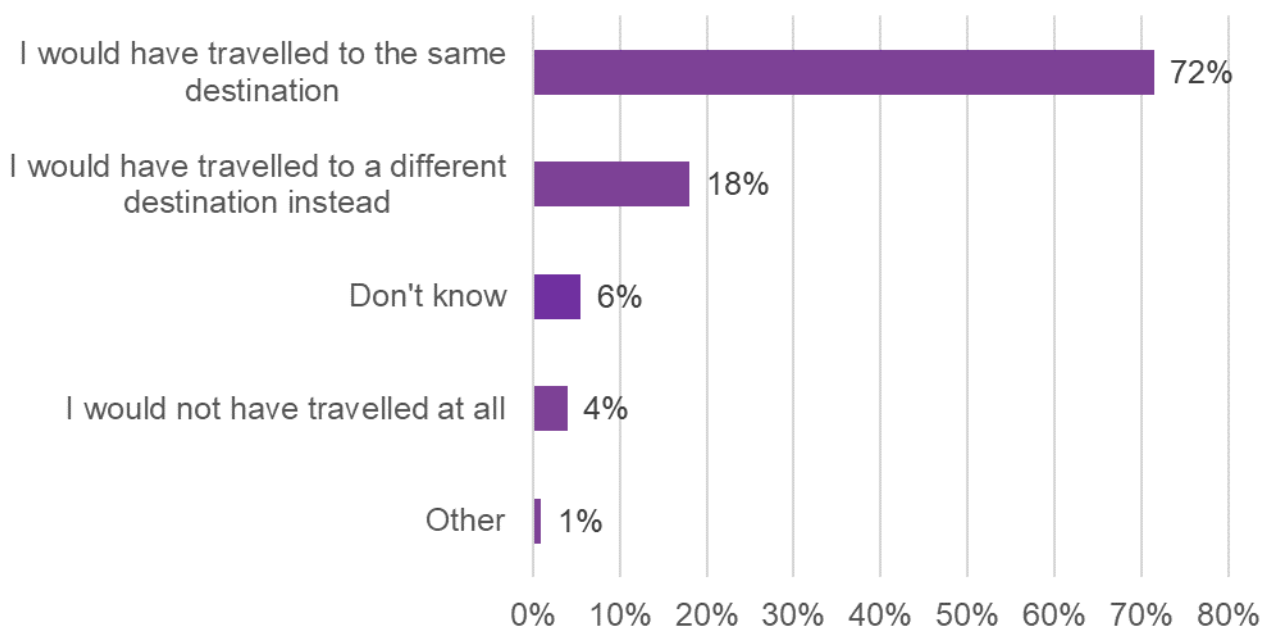
Total base: 5,265 (Note: figures may not sum to 100% due to rounding)

Figure 22 shows more detail about which other methods of transport would have been used, for those passengers who report that they would have travelled to the same or different destination in the absence of the Elizabeth line (see Figure 21).

This analysis indicates that the majority (80 per cent) of Elizabeth line users who said they would have travelled to the same or a different destination would have used another TfL Underground or Overground line, and 14 per cent would have used another rail line. A total of four per cent of passengers would have taken the bus or coach, and only one per cent of surveyed passengers said they would have used a car (either as a driver, passenger, or a taxi/minicab) instead of the Elizabeth line.

These results suggest that the Elizabeth line passengers mostly switched from London Underground, London Overground or other rail lines, with limited switch from other transport modes such as buses, cars or active travel.

Figure 22: If the Elizabeth line had not opened, which type of transport would you have used?', specific passengers* (Source: Passenger survey)

Transport type	Percentage
Other TfL underground or overground line	80%
Other rail line	14%
Bus or Coach	4%
Car (driver, passenger, taxi)	1%
Active travel (walked all the way, bicycle)	1%
Other	0%
No response	0%
Don't know	0%
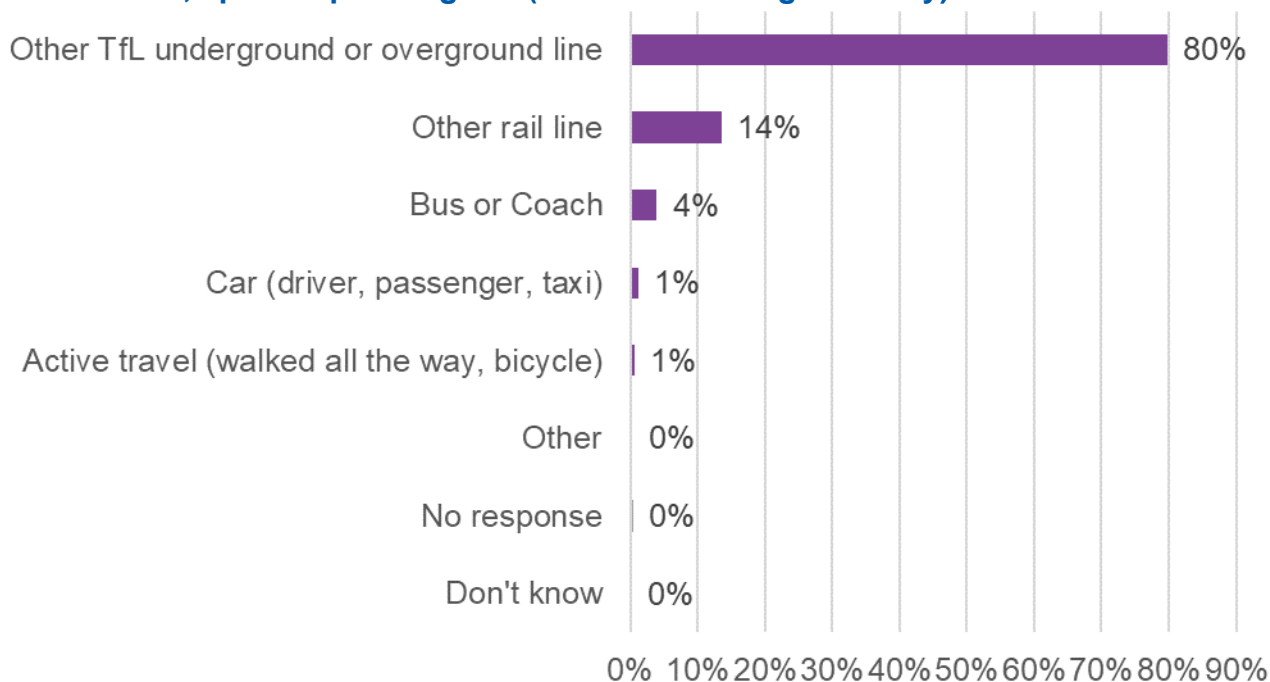
Total base: 4,656 (Elizabeth line passengers who selected 'I would have travelled to the same destination' or 'I would have travelled to a different destination instead' for the question 'If the Elizabeth line had not opened, how would you have made this journey?')

Figure 23 shows how people said they would travel in general if the Elizabeth line had not opened. The results show variation between the different branches of the Elizabeth line. For example, 28 per cent of passengers on the Canary Wharf to Abbey Wood said that it would make little or no difference to how they travelled if the Elizabeth line had not opened, whereas 44 per cent of passengers on the Paddington to Whitechapel branch gave that answer.

The Reading to Hayes & Harlington branch had the highest proportion of passengers saying that they would travel less overall (19 per cent, compared with an average of 14 per cent across all branches). Nearly half (47 per cent) of passengers on the Canary Wharf to Abbey Wood branch said that they would travel more by other methods of transport instead, compared with an average of 37 per cent across all branches.

Figure 23: 'Thinking about your travel more generally, if the Elizabeth line had not opened, which of the following best describes how you would travel?', all passengers, by branch (Source: Passenger survey)
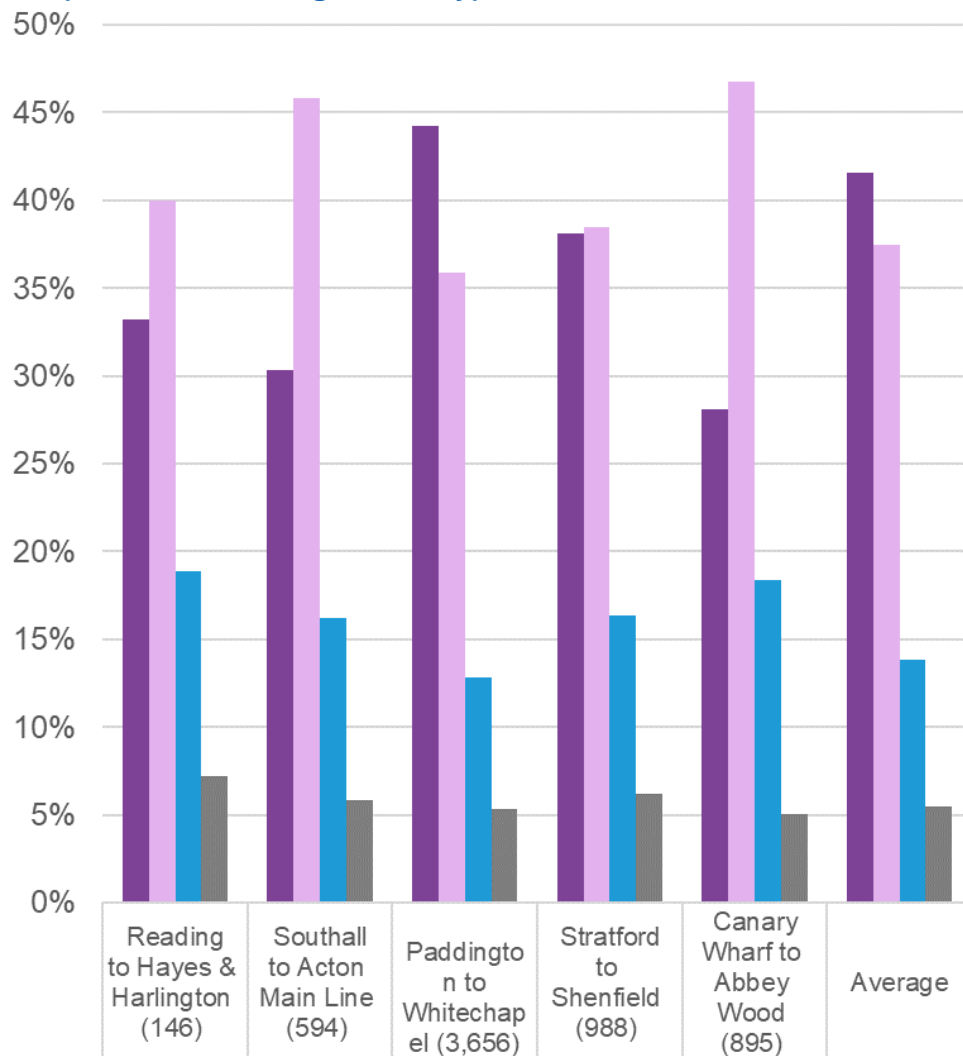
'How would you travel?'	Reading to Hayes & Harlington (146)	Southall to Acton Main Line (594)	Paddington to Whitechapel (3,656)	Stratford to Shenfield (988)	Canary Wharf to Abbey Wood (895)	Average
■ It would make little or no difference	33%	30%	44%	38%	28%	42%
■ I would travel more by other methods of transport instead	40%	46%	36%	38%	47%	37%
■ I would travel less overall	19%	16%	13%	16%	18%	14%
■ Don't know	7%	6%	5%	6%	5%	5%

Total base: 6,279 (Note: figures may not sum to 100% due to rounding)

Surveyed passengers were asked about any changes (positive or negative) which they believe have occurred as a consequence of the Elizabeth line opening. A number of comments provided focused on the importance of modal integration, the new travel opportunities provided by the Elizabeth line, and potential reasons for not using the new line.

- "Overcrowding at station car park for commuters limiting ability to park and travel."

- "The connections make it an option to not take the car but doesn't necessarily mean I will take it."

- "There have also been a number of reliability issues which are making it more likely I will need to buy a car or motorbike to commute to work."

Figure 24 presents the journey purpose of Elizabeth line passengers, highlighting that work-related travel ('Travel to/from your place of work' and 'Other travel as part of my work' was the most common reason for Elizabeth line passengers' journey purpose at 71 per cent. Further analysis revealed from answers to the survey question 'If the Elizabeth line had not opened, how would you have made this journey?' reveals that of these passengers, 20 per cent would have travelled to an alternate destination if the Elizabeth line were not available, while three per cent would have not travelled at all in the absence of the Elizabeth line. This suggests that the Elizabeth line may have incentivised a proportion of individuals to commute more frequently and potentially facilitated individuals in pursuing new job opportunities by enhancing travel accessibility, therefore influencing their choice of destination. A selection of free-text quotes from the passenger survey supports this idea:

- "I wouldn't have taken the job if Elizabeth line didn't exist. It's the only way and fastest way to get to south London."

- "Started new job, commute to work was better so this job more appealing than other locations."

- "I would probably not be making the journey to work in Paddington. I would have chosen remote work or a job in an alternative location."

Leisure-related travel ('Travel to leisure destinations (such as the cinema)', 'Go shopping' and 'Visit friends or relatives') accounted for less journeys than work-related travel, at 17 per cent. Further analysis reveals that a slightly smaller proportion of passengers travelling for leisure-related travel would have travelled to a different destination in the absence of the Elizabeth line (15 per cent), with 7 per cent opting not to travel at all. This suggests that since leisure travel is discretionary, accessibility of the Elizabeth line likely influenced passengers' decision to travel, with some possibly not travelling at all, in the Elizabeth line's absence.

Only 5 per cent of Elizabeth line journeys were for travelling to/from passengers' place of education. Within this group, further analysis shows that nine per cent of journeys would not have taken place without the Elizabeth line, and 17 per cent would have been directed to different destinations. This trend might be due to improved accessibility and opportunities facilitated by the Elizabeth line, encouraging students to commute to educational facilities located across the city and potentially providing access to a broader selection of schools, colleges, universities etc. of their choice. Furthermore, while only making up one per cent of total Elizabeth line journeys, 28 per cent of these passengers commuting for school drop-off or pick-up would have travelled to a different destination if the Elizabeth line had not opened. This shows the role of the Elizabeth line in potentially

facilitating school-related travel, providing families with transport options and easing congestion on alternate routes.

Figure 24: What is the main purpose for your journey today?', Elizabeth line passengers (Source: Passenger survey)
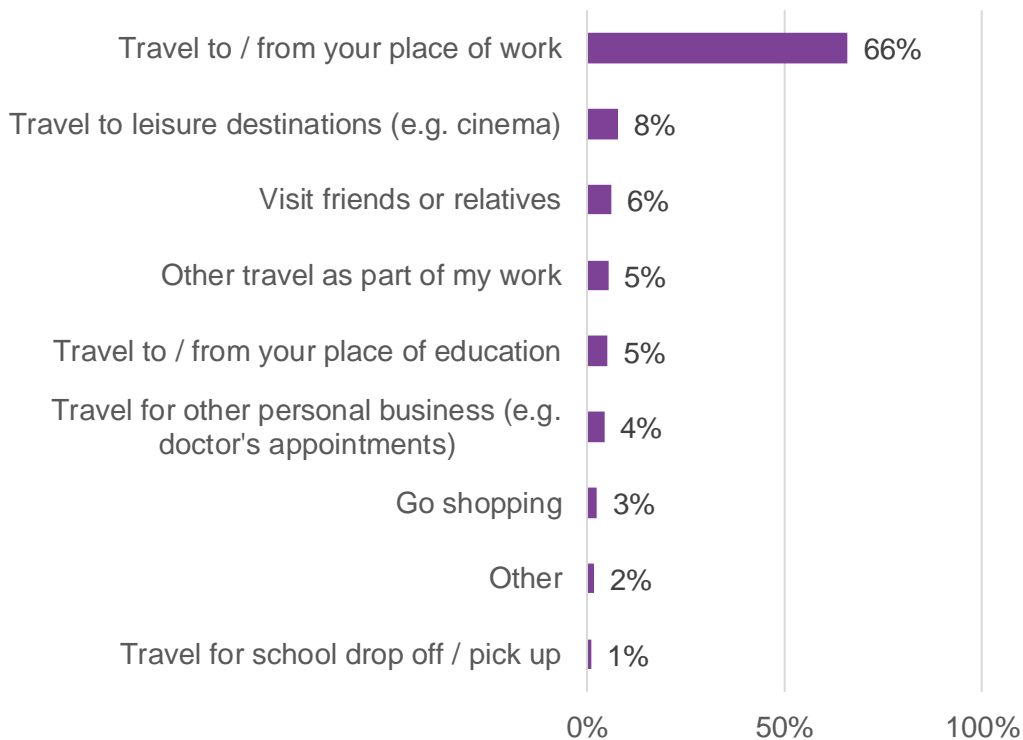
Total base: 5,150

Figure 25 shows results from the passenger survey with regards to the mode used to access the station at the start of the journey, for Elizabeth line passengers. While walking was the most common way of getting to the station of origin, there is variation between different branches.

For instance, Elizabeth line passengers along the Reading to Hayes and Harlington branch were least likely to have walked (54 per cent against 66 per cent on average along the line) and most likely to have travelled by car or van to get to their origin station (29 per cent against 12 per cent on average).

For the Stratford to Shenfield branch, although walking was below average (63 per cent), public transport was high, with 28 per cent of Elizabeth line passengers using this mode to get to their origin station in comparison with 17 per cent on average.

Figure 25: 'How did you get to your first station from where you started your journey?', Elizabeth line passengers, 07:00-10:00, by branch (Source: Passenger survey)
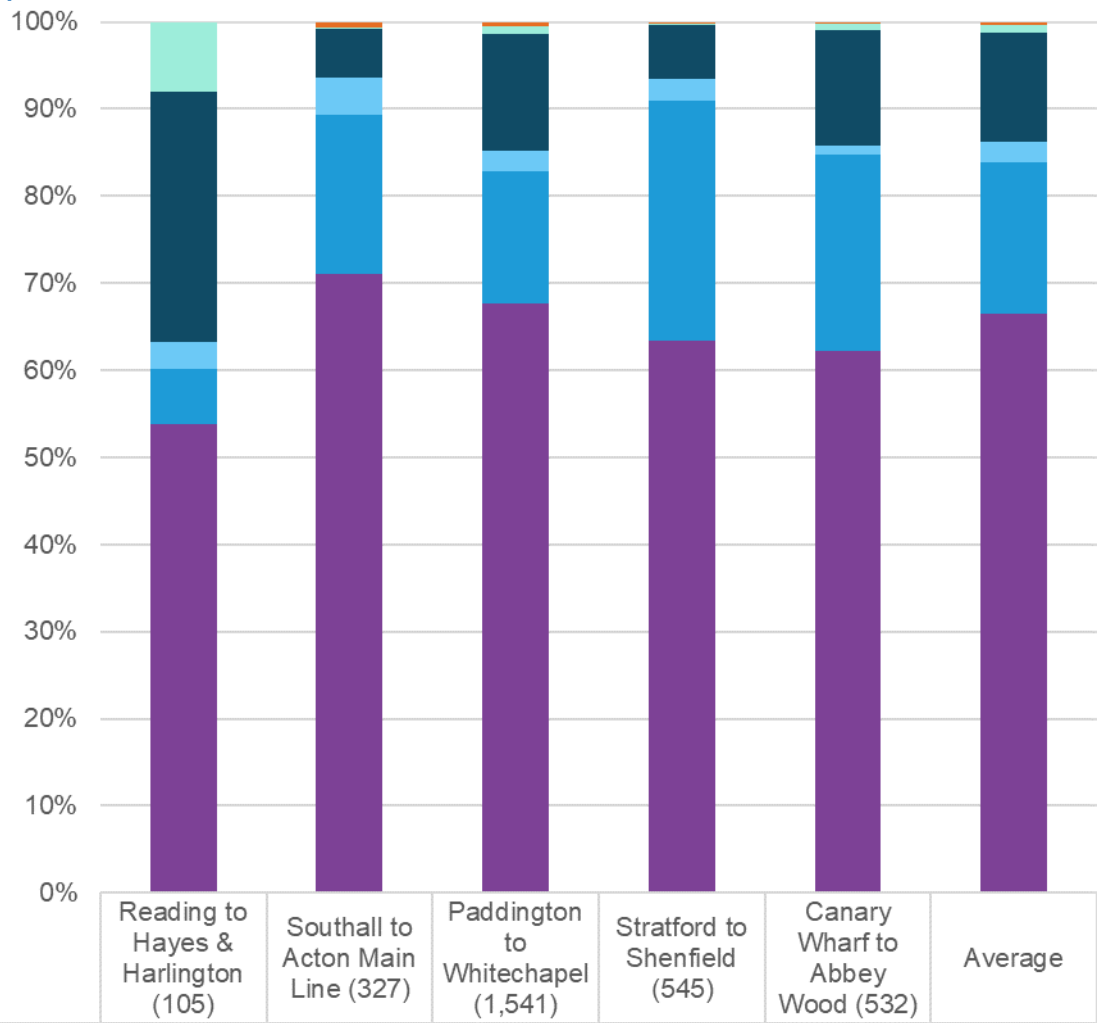
'How did you get to your first station from where you started your journey?'	Reading to Hayes & Harlington (105)	South-all to Acton Main Line (327)	Paddington to Whitechapel (1,541)	Stratford to Shenfield (545)	Canary Wharf to Abbey Wood (532)	Average
■ Other	0%	1%	0%	0%	0%	0%
■ Taxi/ Minicab	8%	0%	1%	0%	1%	1%
■ Car/Van	29%	6%	13%	6%	13%	12%
■ Bicycle	3%	4%	2%	2%	1%	2%
■ Public transport	6%	18%	15%	28%	23%	17%
■ Motorcycle	0%	0%	0%	0%	0%	0%
■ Walked all the way	54%	71%	68%	63%	62%	66%

Total base: 3,050 (Note: figures may not sum to 100% due to rounding)

Discussion

Overall, the findings presented in this section tend to support the Theory of Change on mode shift, which stated that the Elizabeth line was expected to increase the number of public transport trips through a combination of mode shift and trip generation.

The analysis in this report uses TfL's DUNNART data (available for the rail, light rail and London Underground parts of TfL's network) to explore the extent to which Elizabeth line demand may represent abstraction from the rail network that existed before the Elizabeth line opened. The analysis undertaken to date suggests that the introduction of the Elizabeth line has led to mode shift from London Underground, the DLR and National Rail. Abstraction from these modes is estimated to account for around 35 per cent of Elizabeth line demand. As demand for the Elizabeth line has increased, trips on parallel routes have declined and dropped below those on comparator routes.

This means that around 65 per cent of Elizabeth line demand is estimated to come from other sources, of which 38 per cent is estimated to be trip generation and mode shift from bus, road and active travel, and 27 per cent is estimated to be journeys by people who were already using TfL Rail prior to the Elizabeth line opening.

At this stage, the scale of mode shift from bus, road and active travel has not been assessed. However, the passenger survey results suggest that Elizabeth line passengers mostly switched from London Underground, London Overground or other rail lines, with limited switch from other transport modes such as buses, cars or active travel. Mode shift will be explored further in the Final Evaluation Report.

6.   Impact on the passenger experience

Theory of Change on the passenger experience

Positive passenger experience on public transport is driven by factors such as good quality of service, journey reliability and convenience. The Elizabeth line is likely to have prompted a shift in these factors through the provision of a series of key outputs: the Theory of Change in Section 2 mentions new rail connections, new trains and stations, step-free access and other factors. The new and upgraded Elizabeth line stations are designed to enhance accessibility, comfort and convenience for passengers, and are equipped with features such as improved signage, better facilities and streamlined interchanges. The service provides new travel options for individuals with accessibility needs, expanding the London network to a range of new passengers.

These changes are expected to improve customer satisfaction; a direct outcome measured as part of this evaluation. The Elizabeth line opening is also expected to have had a significant impact on journey reliability in London and the wider South East through mode shift away from other modes and increases in public transport capacity. This could generate positive changes in customer satisfaction and reliability both on the whole London public transport network and on the Elizabeth line throughout each opening stage, starting with the opening of the central tunnelled section, followed by the integration of the east and west services and the start of the final timetable.

Previous sections showed that most Elizabeth line passengers switched from other rail lines or from the London Underground, and that a sizeable minority would travel less overall in the absence of the line. This could also impact how passengers perceive travelling on the Elizabeth line in comparison. The passenger survey suggests that their main incentive to use the line was fewer interchanges and fastest way of travel, with less crowding also playing a role.

This section aims to understand passenger experience on the Elizabeth line, what drives it, and how it compares with other train lines.

The Elizabeth line has the highest customer satisfaction score across all TfL modes

TfL Rail's satisfaction score (spanning from zero per cent to 100 per cent) fluctuated within the range of the other modes before it became the Elizabeth line (Figure 26). However, after the opening, the score increased by six percentage points, from 77 per cent to 83 per cent, between April and July 2022, with the Elizabeth line becoming the TfL line with the highest score.

Since its opening, the Elizabeth line has consistently maintained the highest satisfaction score, exceeding the London Underground's average satisfaction score by seven percentage points between June 2022 and June 2023.

Figure 26: Percentage score for Customer Satisfaction by Line (Source: TfL customer satisfaction data, 2023)
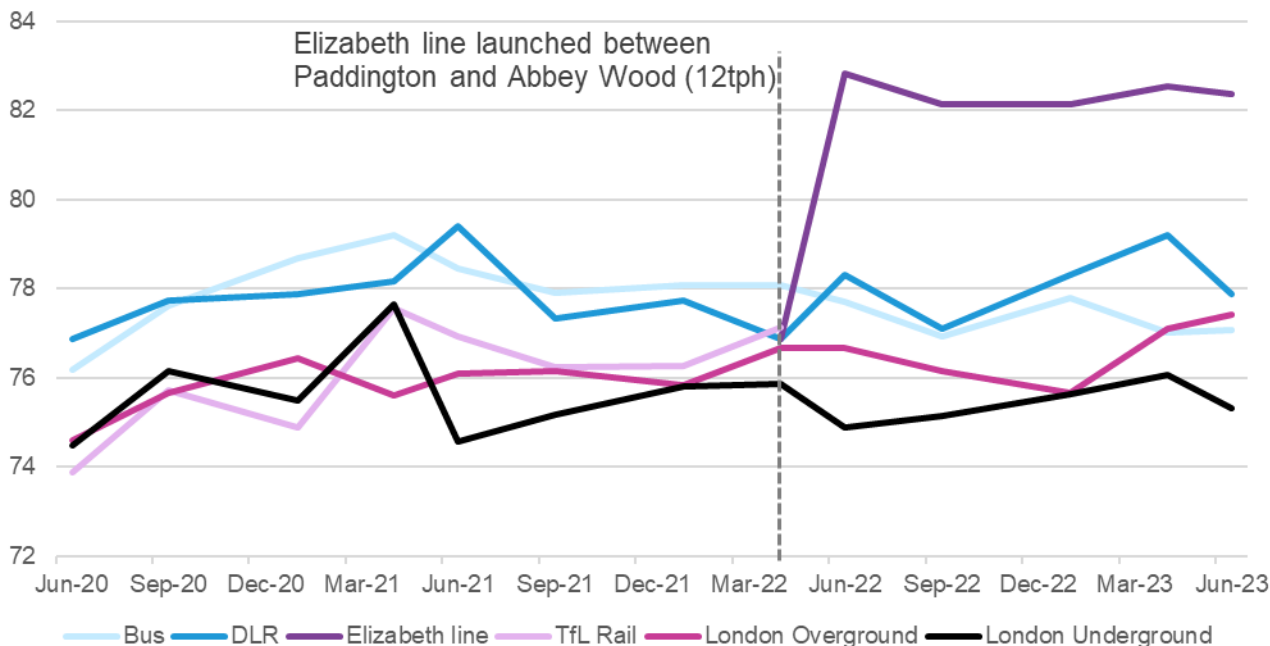
Customer satisfaction on the Eastern branch increased significantly in April 2023, possibly reflecting the increase in service levels and integration of the east and west services with the central section of the line (Figure 27).

High customer satisfaction scores since the opening may reflect the introduction of the central branch, given that it provided a new, modern line for customers to use. Such offer would be attractive to customers, leading to a greater satisfaction with the Elizabeth line service. The customer satisfaction score for the central section of the line peaked at 87 per cent in June 2022, when Elizabeth line services began operating between Paddington and Abbey Wood, offering a frequency of 12 trains per hour (Figure 27). Prior to the opening, average satisfaction for the outer east and outer west sections of the TfL Rail line mirrored the average satisfaction for the London Underground, demonstrating the substantial value which the Elizabeth line provided for passengers.

**Figure 27: Elizabeth line customer satisfaction by branch (0-100%)
(Source: TfL customer satisfaction data, 2023)**
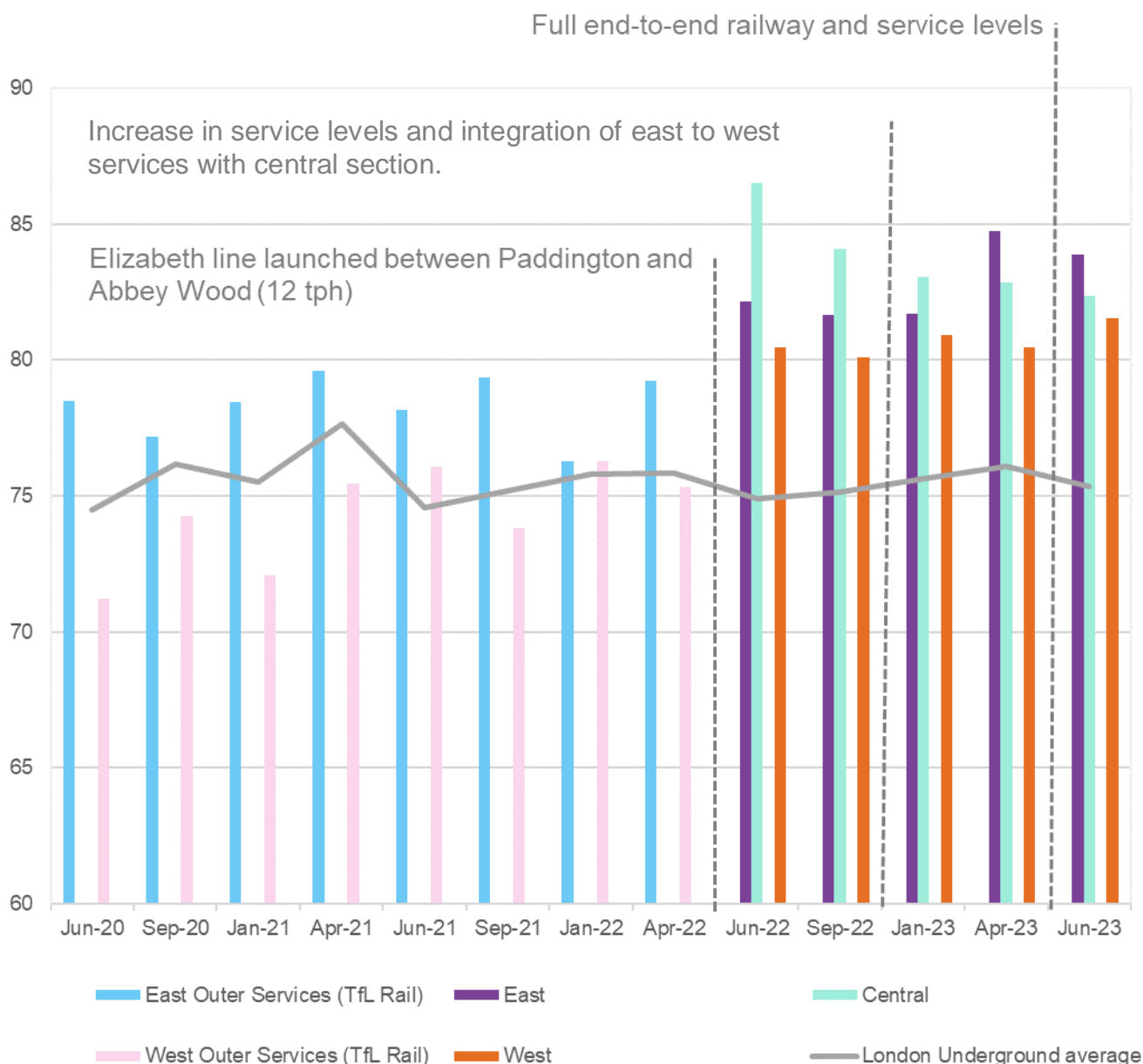
Feedback provided in the passenger survey also sheds light on passenger experiences on the new line. The final question in the passenger survey asked, 'Are there any other changes (positive or negative) that have arisen as a consequence of the Elizabeth line opening?'. In answer to the final, free-text question in the survey, 3,633 responses were provided, and a Natural Language Processing (NLP) model[1] was used to support the interpretation of the responses, combined with a manual review.

The clusters created by the NLP model were then categorised and labelled by the evaluation team, and the top seven categories described are presented in Figure 28.

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[1] Natural Language Processing is a branch of artificial intelligence (AI) that enables computers to understand, interpret and process natural human language in a meaningful way. In this case, the model was asked to map the topics discussed in the free-text responses, clustering the most raised issues.

Most of the top categories identified in this process were clearly either negative or positive. However, it should be noted that within the category 'It has caused an increase in house prices', the comments were a mixture of both negative sentiment – referencing being priced-out and gentrification – and positive sentiment, with passengers referencing that the value of their home has increased.

Figure 28: 'Are there any other changes (positive or negative) that have arisen as a consequence of the Elizabeth line opening?', all passengers (Source: Passenger survey)
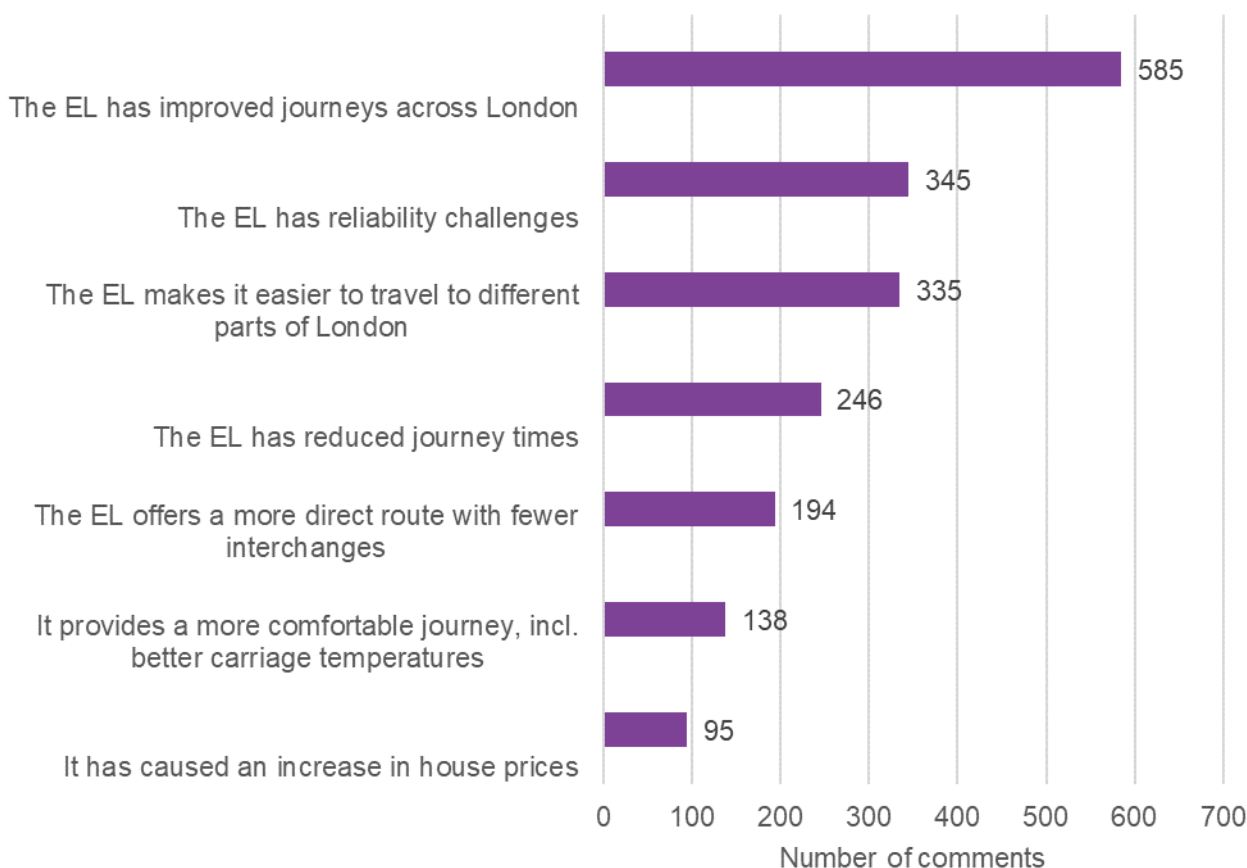
Total base: 3,633, Natural Language Processing (NLP) analysis of free text responses, by main theme of comment.

Following the manual review of the responses, passengers highlight journey comfort, accessibility issues, and suggested improvements to car and parking provision, as well as provision of accessibility ramps and bus services to connect the rest of the network.

Many comments – at least 138 as identified by the NLP analysis (see Figure 28) – were very positive about their experience on the line, citing the line's cleanliness, temperature and how spacious the carriages feel.

- "I have found the Elizabeth line to be fast, comfortable, clean and efficient. It has been well worth waiting for!"

- "The overall experience of travelling to work is infinitely nicer! I arrive less stressed, sweaty and troubled and to me that is worth a lot."

- "My journey home (from Bond St to Canary Wharf) is quicker, quieter, less sweaty. I'm more likely to stay with my current employer for longer."

- "Makes me feel better on the arrival at destination because travel is a more comfortable experience with air conditioning, space, relative quiet and faster travel. Less likely to feel frazzled and hot and sweaty at destination."

- "Overground and Elizabeth line are nicer trains to travel on. They might be crowded at times, but they are less noisy, more spacious and cleaner."

- "The Elizabeth line has been great. I don't like taking the Tube now as the Elizabeth line trains are so clean and spacious. I always try to plan my journey with Elizabeth line stations in mind."

However, a smaller proportion of passengers were more critical about certain aspects of their travel experience; this tended to be more station specific, and related, in a lot of cases, to first/last mile journeys.

- "It has made my journeys a lot easier. But there needs to be a better / more frequent bus service from Abbey Wood to places like Welling, Crayford, Sidcup and Bexleyheath, the buses that do pass there are overcrowded."

- "Appalling lack of bicycle storage in Southall – don't know how it got through planning."

- "Mostly it is excellent for Stratford residents; but for me the need for access ramps at 75 per cent of stations on the Elizabeth line is a huge issue and should have been considered right from the beginning of the planning. Staff training for the use of ramps, and especially communication from central London stations to stations which need a ramp is very haphazard."

When considering the free-text responses provided by those passengers who identified themselves as having either a mental or physical impairment of some kind, there was limited variation in the general theme of feedback provided when compared to those who did not identify as such. Having said that, a few comments were given that related particularly to the accessibility of the line overall, the stations and the trains. Broadly, the consensus in these comments was positive, though some issues remain for those with accessibility needs.

- "Central London is more accessible from the suburbs to those with disabilities."

- "Being mobility impaired it opens up parts of London that has been difficult or impossible to access. It's made a major difference to my experience of travelling."

- "I now notice how helpful staff are to wheelchair users. The train is more open, so visibility is better. A very pleasant trip."

- "The seating is better for more people to board the train; plus enables people to notice my "Please offer me a seat" badge more. The platforms are much more pleasant, open, and safer. It is easy to get on and off the trains. There are lifts/escalators. It is a completely different experience from most tube lines, long may it continue and be the model for new lines / line refurbishments."

Some of that same group who identified themselves as having a mental or physical impairment identified both positive and negative impacts that the line had on their mental health in particular.

- "Much easier to use with anxiety disorder as [the line has] better air conditioning, more space and increased safety achieved by means of the glass doors separating the platform and the train."

- "It means other lines are less crowded. Also, it has helped my mental health! I used to have panic attacks on the tube regularly when I had to get the Central line, to the extent I would do anything to avoid it. But even when Elizabeth Line is busy, it feels spacious, clean and calm."

- "A decent proportion of my journeys are disrupted due to cancelled or delayed trains on the line, and this typically leads to very busy trains and platforms. As someone living with a neurological disability, the increased stress this causes and the more uncomfortable and overcrowded journeys make travelling more stressful and unappealing, which leads me to choose not to travel at all sometimes."

Reliability for the Elizabeth line

Since 2019, TfL Rail (which became the Elizabeth line after it opened) had the highest punctuality rate across all main line rail lines, consistently performing above 95 per cent. In London and the South East, a train is defined as on time if it arrives at the destination less than five minutes (four minutes and 59 seconds or less) of the planned arrival time. This means that 95 per cent of passenger trains were punctual at the destination between 2019 and May 2022. In line with the rest of the rail network in London and the South East, punctuality decreased to 93 per cent after the Elizabeth line's November 2022 opening 2022 (Figure 29). The punctuality of the Elizabeth line has continued to fall since it opened to 89 per cent in September 2023 (Figure 29). It is important to note, National Rail strikes in recent years are likely to have contributed to declining punctuality metrics.

Figure 29: Rail punctuality by line, measured as the percentage of passenger trains punctual at the destination, 12-month moving average (Source: PPM data, ORR, 2023)
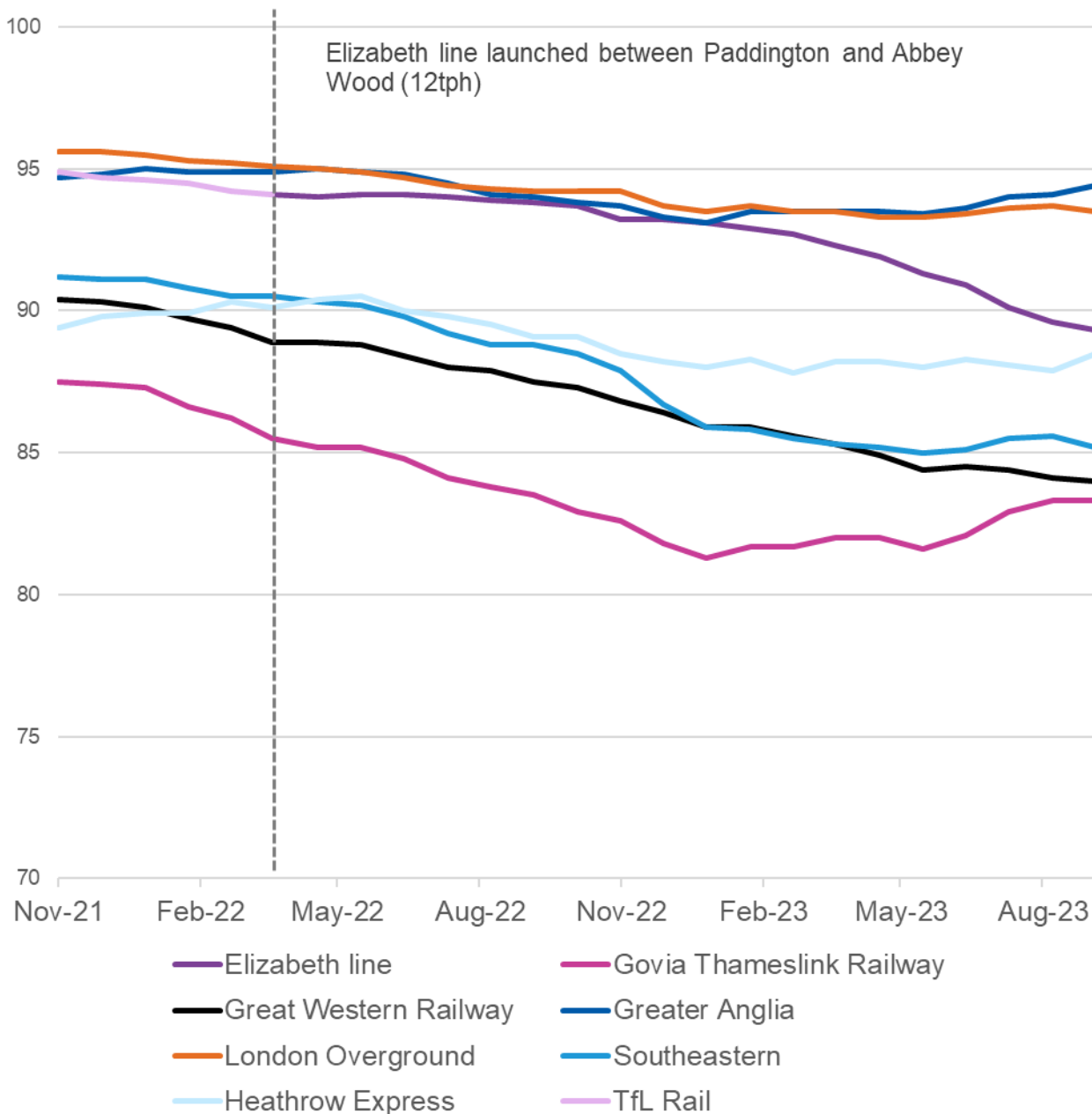
Transport for London's Elizabeth line punctuality data suggests that 93 per cent of trains arriving at Elizabeth line stations in 2022 were on time, and this fell by nine percentage points in 2023, reflecting a larger proportion of trains arriving at Elizabeth line stations being late or cancelled entirely (Figure 30).

Figure 30: Average Elizabeth line train punctuality, by percentage of trains arriving at stations cancelled, late or on time. (Source: TfL Reliability data)
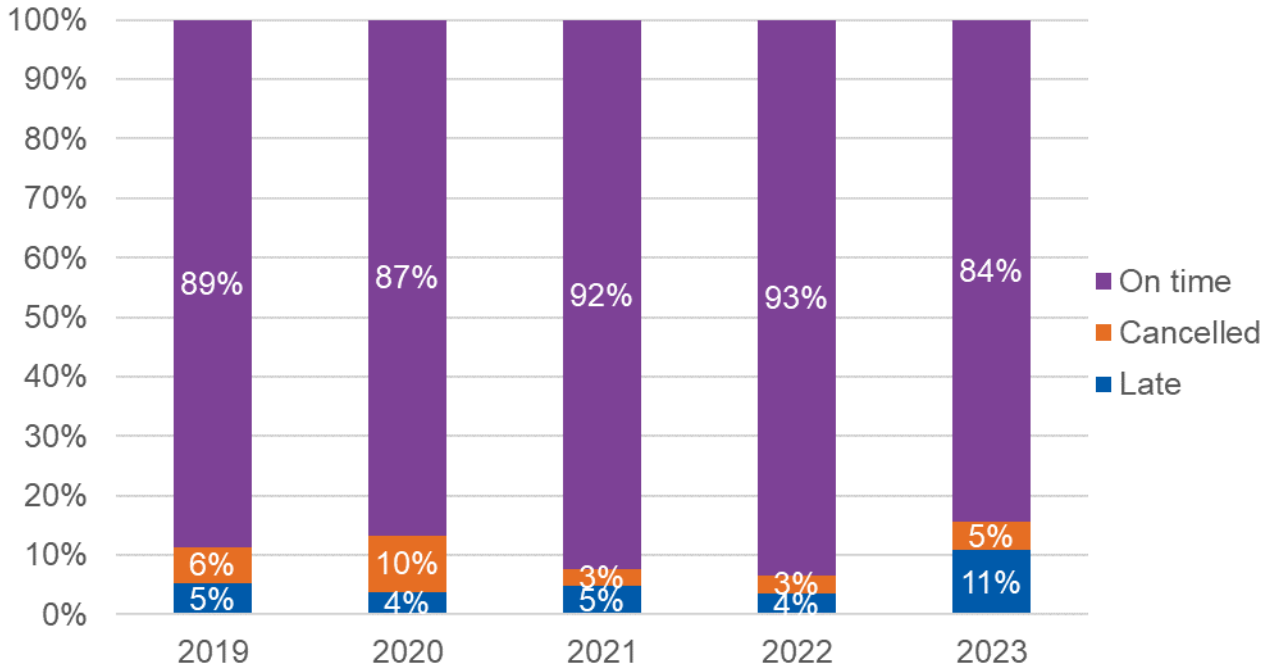
Figure 31 shows that of the late trains arriving in Elizabeth line stations in 2023, the majority (5 per cent) were late by an average of 6 to 10 mins. Additionally, the proportion of trains arriving in Elizabeth line stations with significant delays (16 or more minutes) tripled between 2022 and 2023, from one per cent to three per cent.

Figure 31: Average Elizabeth line lateness, by percentage of trains by minutes late arriving at Elizabeth line stations (Source: TfL Reliability data, 2023)
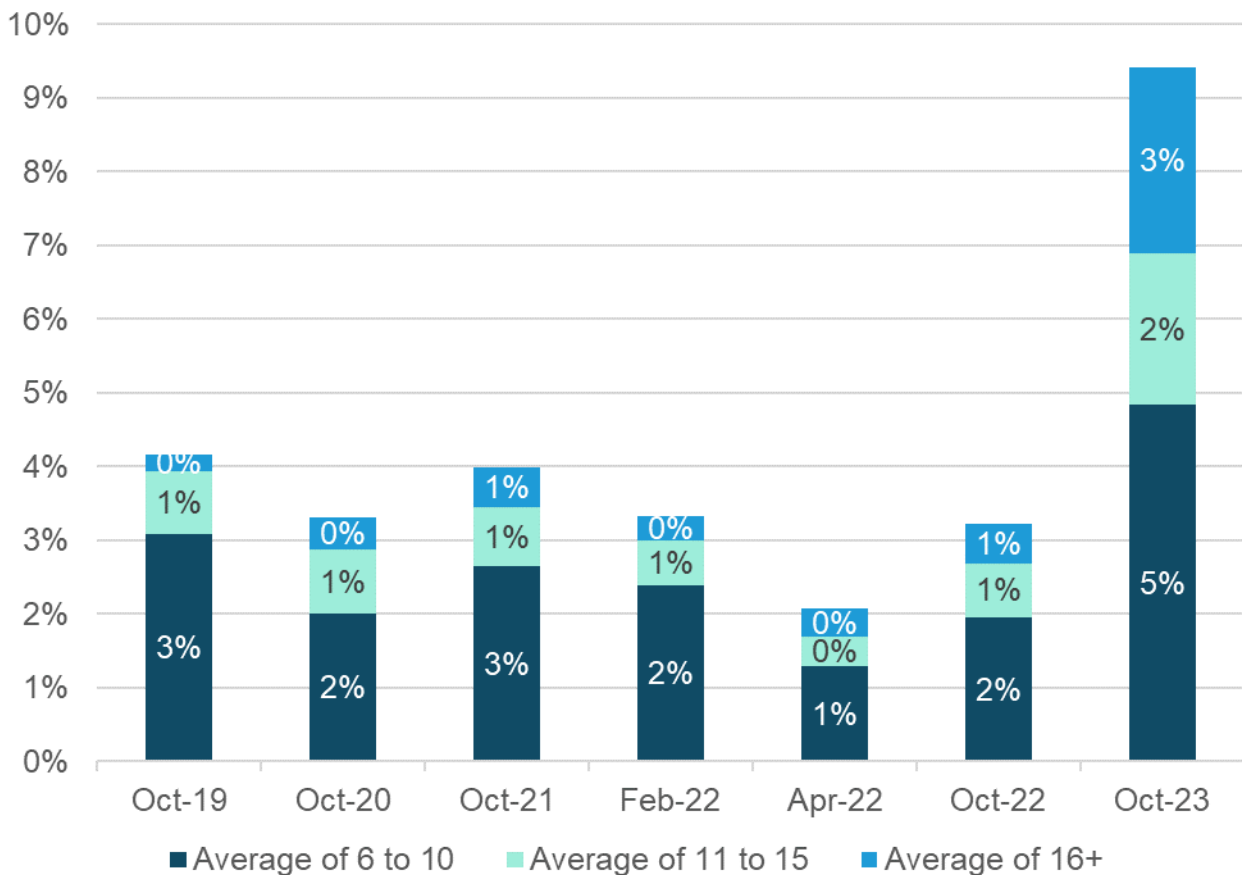
Reliability has been variable across the Elizabeth line, with some branches becoming less reliable than others from 2022 to 2023. Reliability appeared to be similar across all branches of the entire Elizabeth line in 2022, with 93 per cent to 95 per cent of trains arriving on time at stations (Figure 32). However, in 2023 reliability fell for all branches, with Heathrow and Western Outer branches falling the most to 81 per cent of trains arriving on time at stations (Figure 32). The smallest reductions in reliability were seen on the North Eastern branch, with 89 per cent of trains arriving on time (Figure 32).

There could be several reasons for this reduction in reliability. After the opening, the Elizabeth line became integrated with the wider National Rail system, which means that it could have been impacted by delays on mainline rail lines.

Figure 32: Percentage of trains arriving on time at Elizabeth line stations (%) by branch, October 2022 compared to October 2023 (Source: TfL Reliability data, 2023)
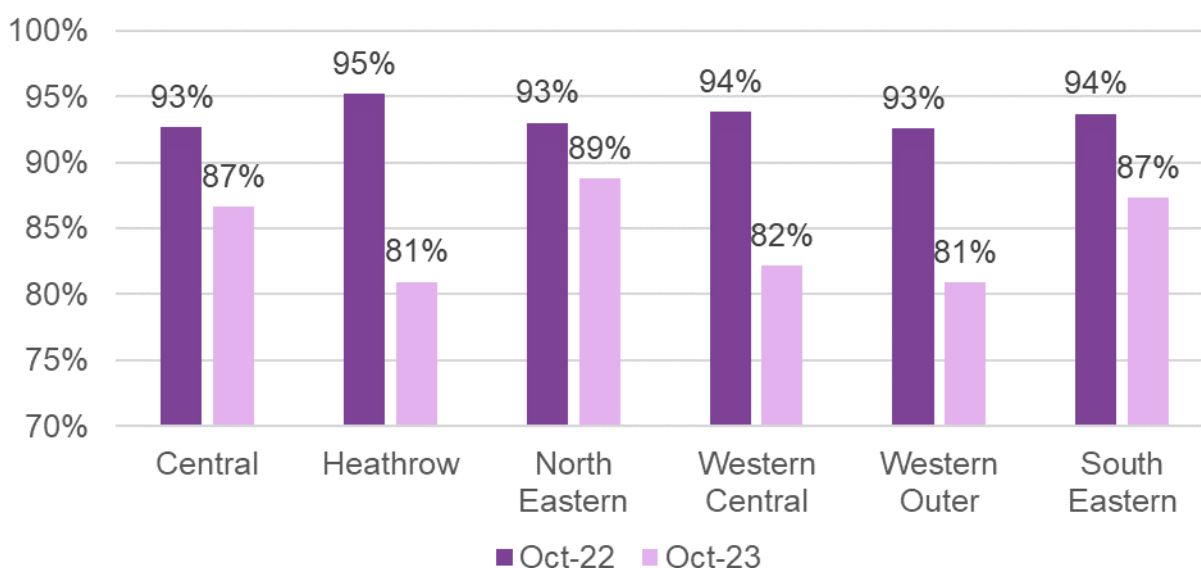
Discussion

Evidence from TfL customer satisfaction surveys and the passenger survey suggests that the Elizabeth line is generally perceived as providing a positive customer experience and compares well to other TfL lines. Customer satisfaction metrics have seen marked improvements after the opening, with the Elizabeth line consistently outperforming other modes of transport such as National Rail or London Underground. The high satisfaction levels likely reflect the level of service provided by the Elizabeth line, including more direct and faster routes.

TfL customer satisfaction survey results show that satisfaction scores vary across different branches of the line. The central branch experienced a peak in satisfaction upon opening, and this increase is driving the average up for overall customer satisfaction for the Elizabeth line. This is likely due to the official opening of the line in May 2022. By contrast, the Eastern branch saw the highest satisfaction levels in the TfL survey, probably due to the introduction of new transport routes in historically underserved areas. The Eastern branch experienced a significant customer satisfaction increase following service level enhancements and integration with the central branch, while the Western branch, while positive, displayed comparatively lower satisfaction levels.

The Elizabeth line has seen reductions in reliability since opening. Notably, reliability reductions seem to have changed inconsistently across the Elizabeth line, with some branches becoming less reliable than others from 2022 to 2023. It is likely that these

reductions in reliability and subsequent punctuality/cancellations issues are related to the integration of the line with the wider National Rail system. The reliability performance will continue to be monitored and will be reported in the final report.

7. Wider impacts monitoring

How improved connectivity is expected to bring economic, social and environmental changes and support regeneration around Elizabeth line stations

The Elizabeth line is expected to deliver short-term impacts and longer-term benefits around economic, social, and environmental outcomes through better connections and increased transport capacity. Most of the wider benefits related to the outputs generated by the line opening are expected to emerge over the long term, given the nature of and pace associated with these impacts. Concurrently, certain shifts may already have begun due to the announcement of the Elizabeth line, particularly affecting investment, and business location choices, with some effects manifesting in the years leading up to the line's opening. Consequently, the aim of this section is to gather evidence on socio-economic indicators, monitor key metrics and provide early evidence on local impacts. This will also help inform future evaluation activity exploring wider impacts of the line.

The case for building the Elizabeth line was partly developed around the assumption that better connections would broaden employment, leisure, and education opportunities for residents through reduced travel times and easier access (see Section 2), while making areas around the line's stations more attractive to developers and employers, resulting in increased population, new homes and jobs. Increased activity and attractiveness, as well as footfall from new passengers, are expected to support economic regeneration, increase the employment pool for businesses and reduce poverty and social exclusion. It was anticipated that a shift to public transport would bring down carbon emissions and improve air quality across London and the wider Elizabeth line area. Additional trips by public transport would also impact first and last mile trips, encouraging more active travel walking or cycling to the stations.

Early socio-economic impacts

In this section, a trend analysis based on the pre-pandemic baselines established in the Crossrail Baseline Evaluation has been undertaken, starting reporting in 2015 and comparing evolution up until most recent data available (2022 data for most publicly available datasets). Elizabeth line averages and line section analyses are defined using LSOAs within one-kilometre buffers from Elizabeth line stations.

Data monitored suggests improved access to jobs

The line opening increased connectivity of areas around its stations, with reduced journey times and increased access to jobs throughout the city.

Figure 33 and Figure 34 show places of residence of surveyed passengers who indicated that the Elizabeth line influenced where they work (dark blue dots, 1,553 surveyed passengers) by their home postcodes. The geographical spread suggests that the line opening increased access to jobs and supported a broader talent pool for businesses in outer London and outside of London. There is a marked spatial trend of respondents who report that the Elizabeth line opening influenced where they work living towards the South East section of the line (where most significant time savings are observed due to the Elizabeth line opening). The home postcodes of these respondents are spread across Bexley and Dartford, indicating knock-on effects of the line opening well outside of the immediate areas around stations.

Figure 33: Home postcode of passengers saying the opening of the Elizabeth line has influenced where they work, London and the South East (Source: Passenger survey)
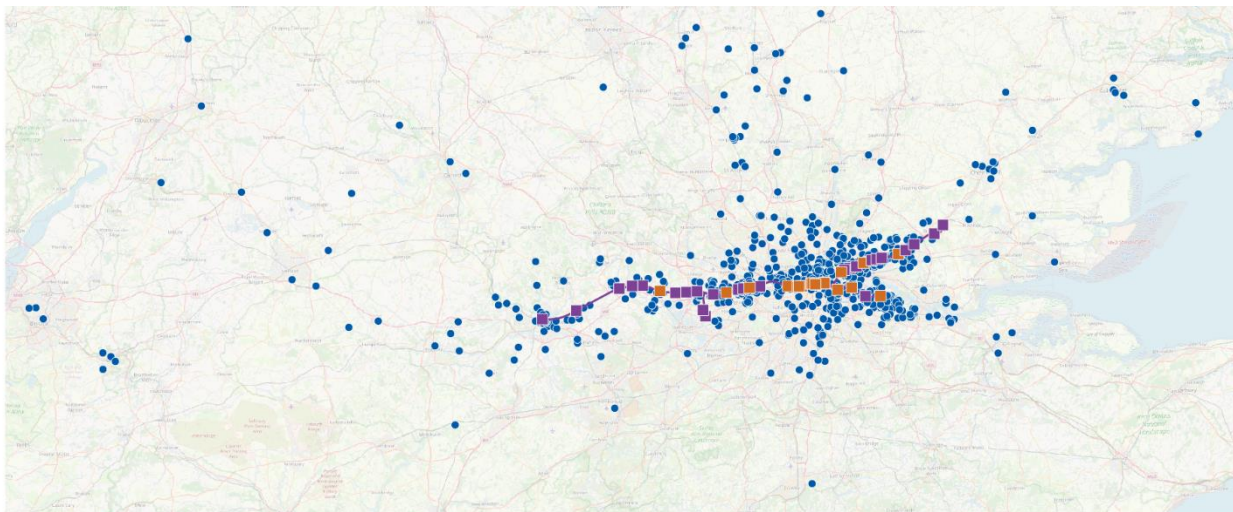
Q30: Has the opening of the Elizabeth line influenced any of the following?

— Elizabeth line network

• Q30: The EL influenced where I work (home postcode)

Stations
- ■ Survey stations
- ■ Other EL stations

Total base: 4,987

Figure 34: Home postcode of passengers saying the opening of the Elizabeth line has influenced where they work, Elizabeth line route (Source: Passenger survey)
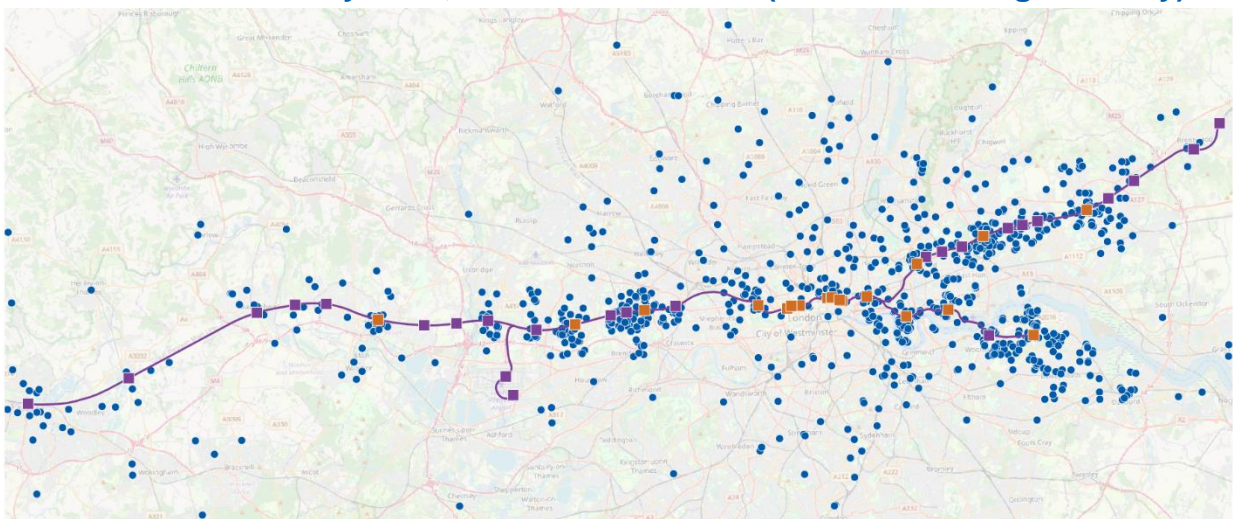
Q30: Has the opening of the Elizabeth line influenced any of the following?

— Elizabeth line network

• Q30: The EL influenced where I work (home postcode)

Stations
- ■ Survey stations
- ■ Other EL stations

Total base: 4,987

Responses from the survey also show that overall, 62 per cent of surveyed passengers feel that the opening of the Elizabeth line had a positive impact on their access to employment opportunities (see Figure 5). When breaking these down to sections of the line, the Southall to Acton Main Line branch, the Stratford to Shenfield branch and the Canary Wharf to Abbey Wood branch show the largest reported impact (70 per cent, 71 per cent and 73 per cent respectively). The central branch (Paddington to Whitechapel) showed somewhat lower perceived impacts (59 per cent on Figure 5) which likely reflects the fact that central London is better connected, and has better access to jobs in general, meaning that the Elizabeth line opening likely made less difference to people living in or travelling from this area. This could also reflect the fact that fewer people live around Elizabeth line central London stations relative to other areas along the line.

This general sentiment is supported by several respondents' comments from the passenger survey:

- "I wouldn't have applied for jobs in Canary Wharf (due to long commute times), if the Elizabeth line hadn't opened."

- "I wouldn't have taken my job if it hadn't been for the Elizabeth line. It has had a very positive effect on my enjoyment of travelling to and from work."

- "Southeast London has benefited so much from this line. I have just taken a job in Ealing because of the Elizabeth line."

There is evidence of regeneration occurring around Elizabeth line stations but relationship with the line opening has yet to be established

One of the key expected indirect outcomes of the Elizabeth line opening is to support wider regeneration of local areas.

Figure 35 and Figure 36 show the overall impact of the opening of the Elizabeth line on the areas it serves according to surveyed passengers by their place of residence. 71 per cent of surveyed passengers viewed the Elizabeth line's overall impact on its service area as 'Very positive', and 21 per cent as 'Somewhat positive'. Satisfaction is highest for the South Eastern branch of the line (Canary Wharf to Abbey Wood), with 77 per cent of surveyed passengers indicating that the impact of the Elizabeth line on the area it serves as been either 'Very positive', and 17 per cent 'Somewhat positive' (compared to 71 per cent 'Very positive', and 21 per cent 'Somewhat positive' for all respondents). This could reflect the provision of new transport routes in this area of London, which has historically been underserved by London Underground and other transport links, particularly areas such as Abbey Wood. The Western branch (Reading to Hayes & Harlington), while still very positive, saw the relatively lowest level of satisfaction, with six per cent of passengers indicating that the impact of the Elizabeth line on the area it serves as been either 'Very negative' or 'Somewhat negative'. Negative impacts, although representing a minority of respondents, were also reported by passengers surveyed who indicated their home postcode being around Slough, Ealing and between Ilford and Romford. No negative impacts were reported by passengers living in central London, although this might also be due to proportionately lower numbers of people living in these areas. Further analysis on reasons for perceived negative impacts around specific stations will need to be undertaken through interviews conducted as part of this evaluation.

Figure 35: Overall impact of the opening of the Elizabeth line on the areas it serves (positive responses), Elizabeth line route (Source: Passenger survey)
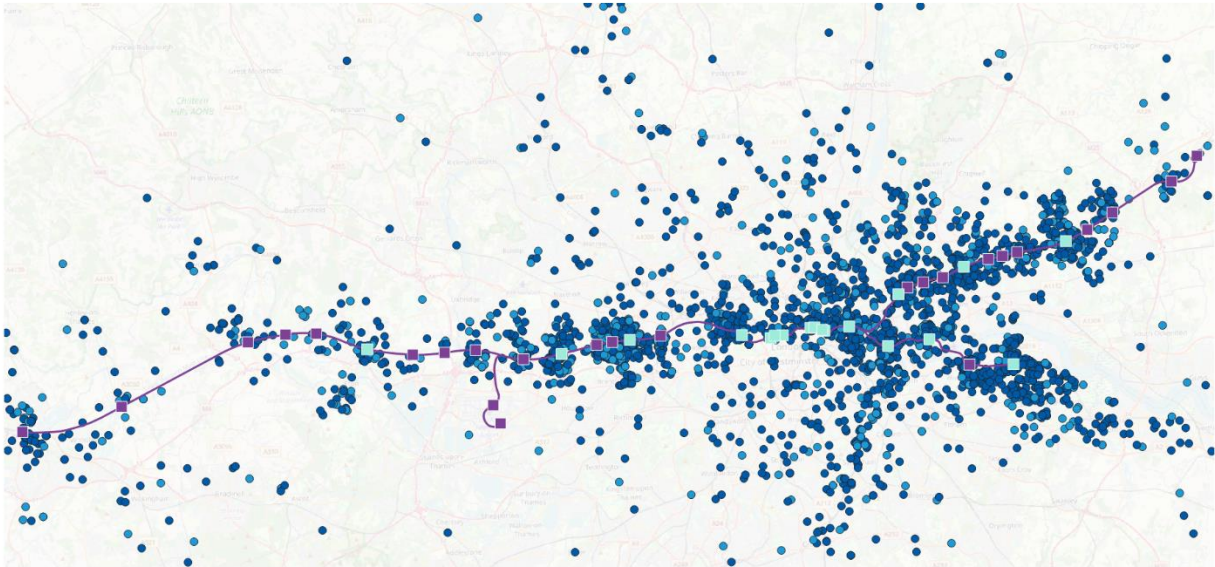
Q31: In your opinion what has been the overall impact of the opening of the Elizabeth line on the areas it serves?

— Elizabeth line network

Stations
- ▪ Survey stations
- ▪ Other EL stations

Impact of the Elizabeth line
- ● Very positive
- ● Somewhat positive

Total base: 4,987

Figure 36: Overall impact of the opening of the Elizabeth line on the areas it serves (negative responses), Elizabeth line route (Source: Passenger survey)
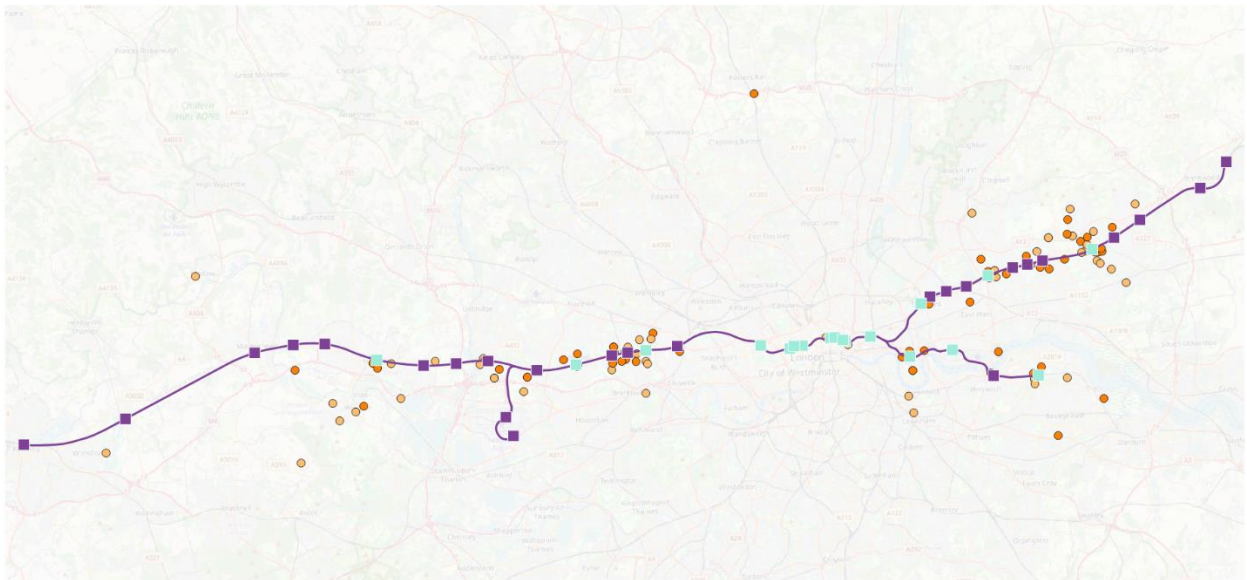
Q31: In your opinion what has been the overall impact of the opening of the Elizabeth line on the areas it serves?

— Elizabeth line network

Stations
- ▪ Survey stations
- ▪ Other EL stations

Impact of the Elizabeth line
- ● Somewhat negative
- ● Very negative

Total base: 4,987

In addition to improving access to jobs, the Elizabeth line opening is also expected to make some areas more attractive, especially to developers and employers. This could result in new homes, jobs and business activity in these local areas.

For the 2015 to 2022 period, employment numbers in areas within one kilometre of Elizabeth line stations increased at a faster rate than the London average (an increase of 15 per cent and increase of 13 per cent respectively), with inner London stations outperforming the rest of the areas (21 per cent increase). Employment around outer London Elizabeth line stations only picked up again in 2022, in line with the outer London average (Figure 37).

Further monitoring of employment figures and econometric analysis will look into differential impacts of the line on specific areas, with effects ranging from incentivising job growth in some locations to incentivising increased commuting from others.

For central London stations, the more established employment hubs (like Canary Wharf or Farringdon) experienced a much smaller increase in jobs (2.4 per cent or 3,900 jobs and 6.2 per cent or 4,000 respectively) while smaller and developing employment hubs seem to be growing faster, possibly due to their capacity to accommodate new jobs: Paddington and Tottenham Court Road in the west (35 per cent or 13,400 jobs and 13 per cent or 11,000 jobs respectively), and Custom House (32 per cent or 1,700 jobs) next to Canary Wharf. Abbey Wood (11 per cent or 500 jobs) and Ilford (13 per cent or 2,500) have both experienced a more substantial increase in employment (from a low base) compared to the average of outer London and South East Elizabeth line station areas (1 per cent), which might point towards transformational change happening in these locations.

Figure 37: Employment change around Elizabeth line stations from 2015 to 2022 (2015 = 100) (Business Register and Employment Survey, ONS)
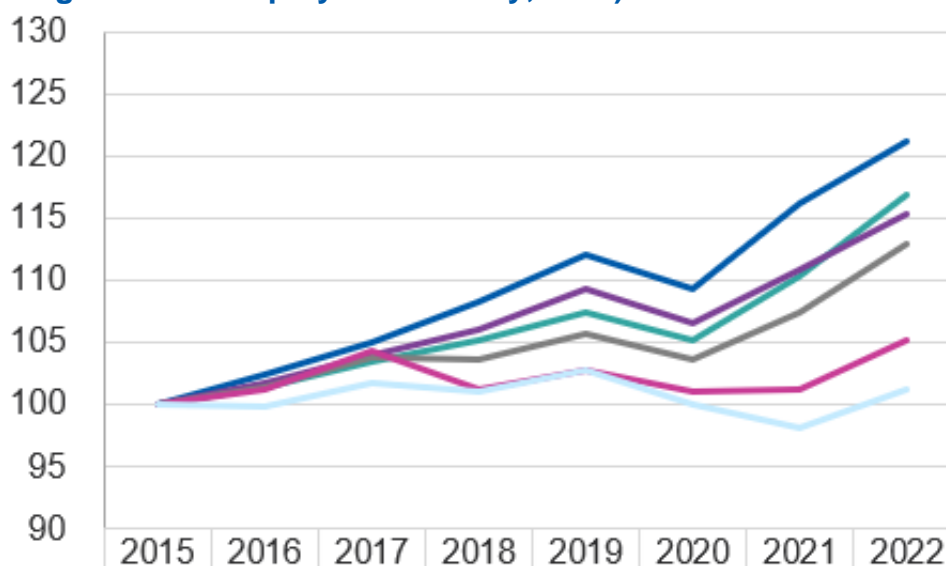
Area	2015	2016	2017	2018	2019	2020	2021	2022
—— Elizabeth line – inner London stations average	100	102	105	108	112	109	116	121
—— Inner London average	100	101	103	105	107	105	110	117
—— Elizabeth line average	100	102	104	106	109	107	111	115
—— London average	100	101	104	104	106	104	107	113
—— Outer London average	100	101	104	101	103	101	101	105
—— Elizabeth line – outer London stations average	100	100	102	101	103	100	98	101

Complementary to the analysis on employment densities and employment numbers around Elizabeth line stations, Gross Value Added (GVA) and claimant counts were monitored to identify any additional early signs of economic impacts of the line opening.

GVA per job, or output per job, is a measure of productivity used by the Office for National Statistics. It measures GVA (which is an estimate of the volume of goods and services produced in aggregate across industries for a geographic area) divided by the number of filled jobs used to create it.

Around Elizabeth line stations, GVA per job grew at faster rate than the London average over the period 2015 to 2020, with inner London stations outperforming both the London average and the outer London Elizabeth line stations (Figure 38). The latest available data from 2020 shows that GVA/job levels appear to have been considerably affected by the pandemic around outer London and South East Elizabeth line stations, which might point to wider economic changes occurring in these areas as a result of several macroeconomic factors (the pandemic, new hybrid working patterns and the opening of the Elizabeth line among others). It will be important to further monitor GVA/job levels and observe whether any changes in specific places can be observed as a result of the line opening.

Figure 38: GVA per job change around Elizabeth line stations from 2015 to 2020 (Index 2015 = 100) (Source: ONS)
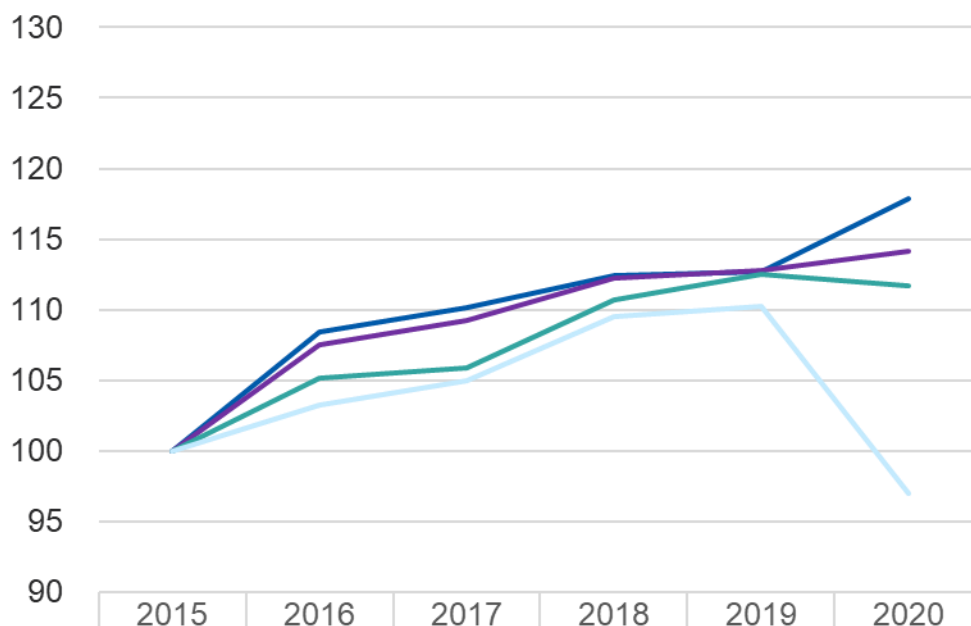
Area	2015	2016	2017	2018	2019	2020
— Elizabeth line – inner London stations average	100	108	110	112	113	118
— Elizabeth line average	100	107	109	112	113	114
— London average	100	105	106	111	112	112
— Elizabeth line – outer London stations	100	103	105	109	110	97

Social 'exclusion' describes a state in which individuals are unable to participate fully in economic, social, political and cultural life. Participation may be hindered when people lack access to material resources, including income, employment, land and housing, or to such services as education and health care.

The Claimant Count is the number of people who are receiving benefits principally for the reason of being unemployed. As benefits claimed are linked to income, it is also a good proxy for estimation of population with low earnings. Data on claimant counts has been collected over the period from 2015 up to September 2023 to monitor any changes or outstanding trends along specific parts of the line.

Although these numbers spiked during the pandemic, they progressively decreased in 2021 and 2022, before slowly increasing again from January 2023 in line with London figures (Figure 39) and UK-wide claimant count numbers. Areas located within one kilometre of Elizabeth line stations have been witnessing proportionately higher growth of claimants since the pandemic, with a widening gap since 2023. This might indicate that the Elizabeth line is not yet fully realising its expected benefits in terms of reducing social exclusion, but it will need further monitoring and analysis to compare them across counterfactuals at a later stage of the evaluation, once more data is available.

Figure 39: Claimant count change around Elizabeth line stations from 2015 to September 2023 (Index 2015 = 100) (Source: ONS)
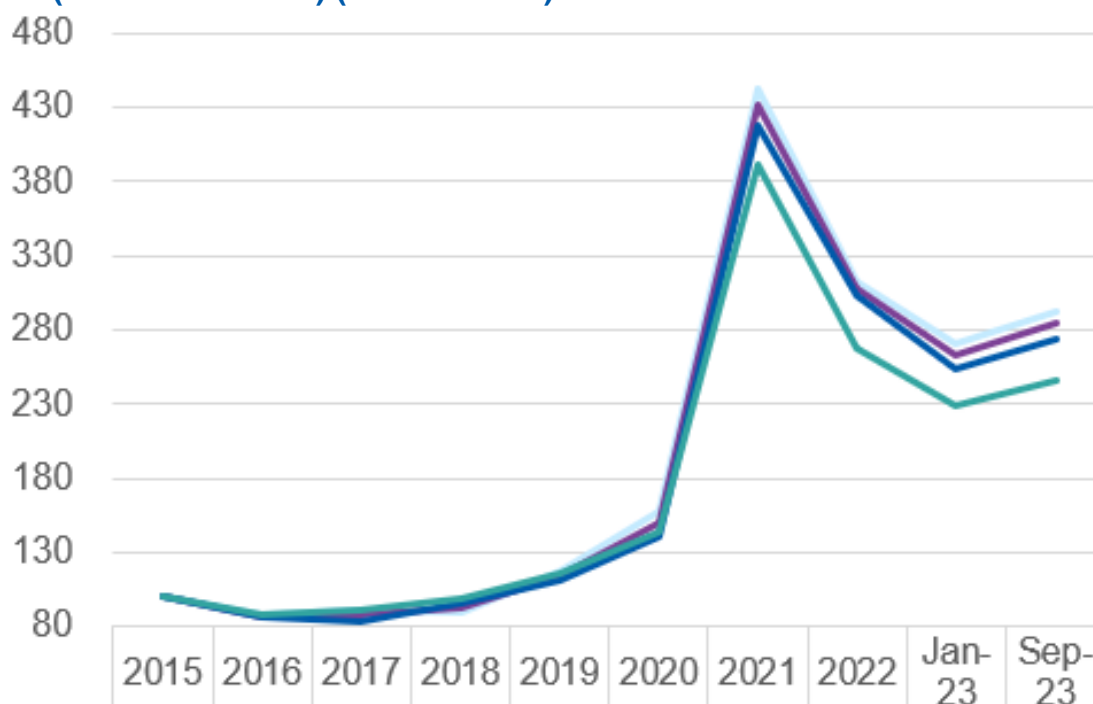
Area	2015	2016	2017	2018	2019	2020	2021	2022	Jan – 23	Sep - 23
Elizabeth line – outer London stations average	100	87	90	90	118	158	443	312	270	293
Elizabeth line average	100	87	87	92	115	150	432	308	262	284
Elizabeth line – inner London stations average	100	86	83	95	111	141	418	303	253	273
London average	100	88	91	98	116	144	391	268	228	246

The regeneration impacts on specific areas around Elizabeth line stations are also expected to materialise through increased attractiveness of areas around stations to developers and employers, resulting in delivery of additional business floorspace and new homes well linked to employment hubs.

Analysis of office floorspace evolution shows a stable trend across London for the period 2015-2019 (Valuation Office Agency, Non-domestic rating: stock of properties including business floorspace 2023), while it was slowly increasing around Elizabeth line stations, with a significant growth for outer London stations between 2017-2018, driven by the opening of office spaces at Heathrow airport (Figure 40). Since the pandemic, office space stock has been decreasing, reflecting both the lockdowns and shifts in the working patterns, with increased numbers of employers reducing their demands for office spaces. Areas around the Elizabeth line remained more resilient to this shock than the London average. However, more localised evidence suggests that some places have strongly benefitted from the Elizabeth line opening. For example, based on data from JLL in 2023,

in the Paddington area, more than 500,000 square feet of office space was in use since the Elizabeth line opened, with vacancy rates around six per cent; and Romford experienced record leasing activity in Q4 2022 and Q1 2023 (around 32,000 square feet leased), equalling pre-pandemic levels.

Figure 40: Office floorspace change from 2015 to March 2023 (Index 2015 = 100) (Source: Valuation Office Agency)
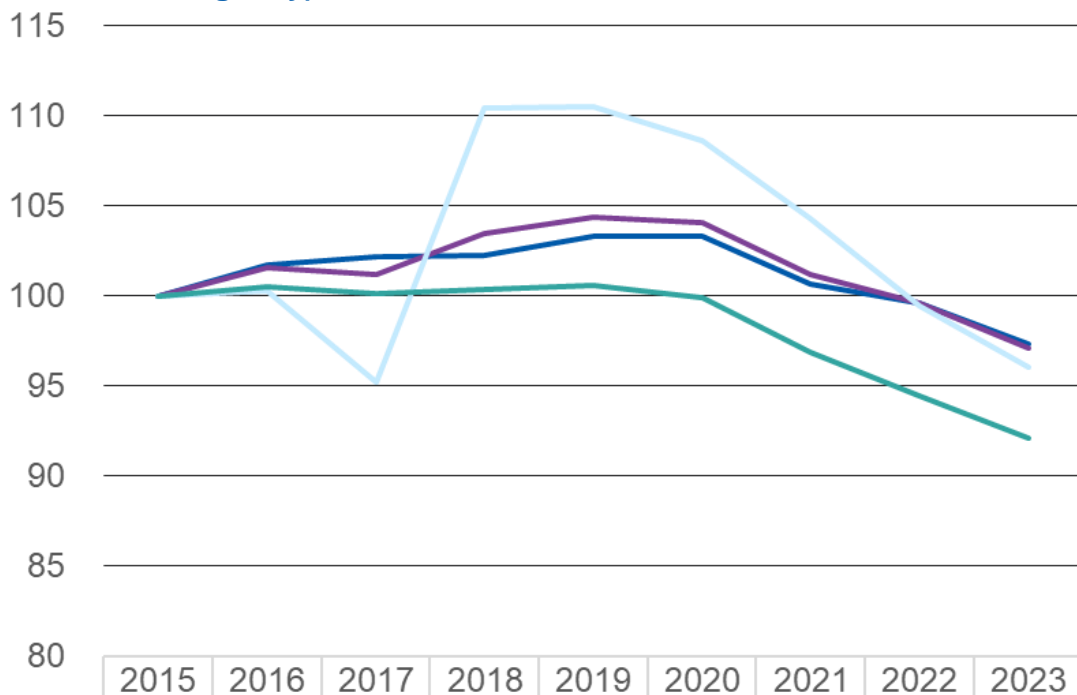
Area	2015	2016	2017	2018	2019	2020	2021	2022	2023
Elizabeth line – inner London stations average	100	102	102	102	103	103	101	100	97
Elizabeth line average	100	102	101	103	104	104	101	100	97
Elizabeth line – outer London stations average	100	100	95	110	111	109	104	99	96
London average	100	101	100	100	101	100	97	94	92

The evolution of the residential property stock around stations has been monitored using data from the Valuation Office Agency (Number of properties by property build period, 2023) at an LSOA level.

Figure 41, Figure 42, Figure 43, Figure 44 and Figure 45 illustrate the spatial distribution of housing delivery rates at the LSOA level, suggesting faster rates of housing deliveries in LSOAs around Elizabeth line stations. Inner London Elizabeth line stations have experienced the highest growth of stock for the 2015 to 2022 period (

Figure 46), mainly driven by housing deliveries around Canary Wharf (close to 14,000 new homes delivered) and to some extent Custom House (around 2,400 new homes).

Figure 41: Residential properties stock change 2015-2022, Reading to Hayes and Harlington (LSOA level) (Valuation Office Agency)
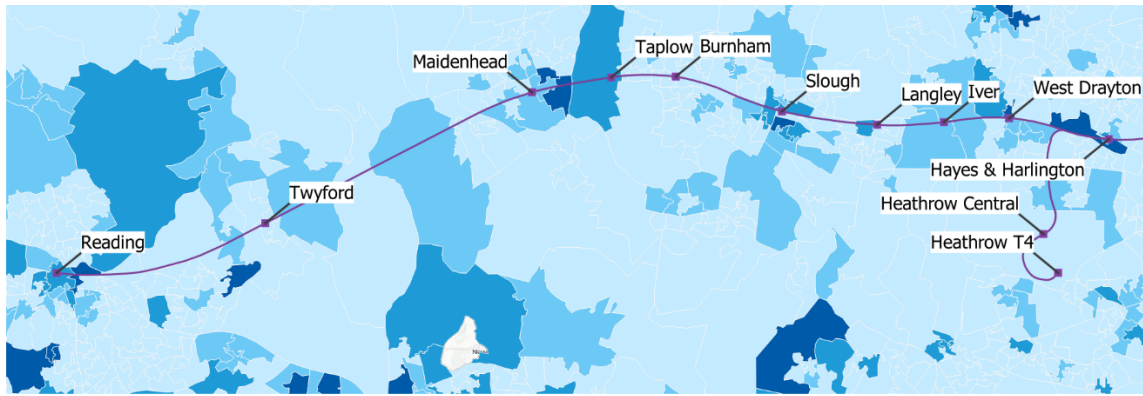
Residential properties change 2015-2022

- Elizabeth Line Stations
- Elizabeth Line Network

Residential properties stock % change
(2015-2022)
- 0 - 5%
- 5 - 10%
- 10 - 20%
- 20 - 50%

Figure 42: Residential properties stock change 2015-2022, Southall to Acton Main Line (LSOA level) (Source: Valuation Office Agency)
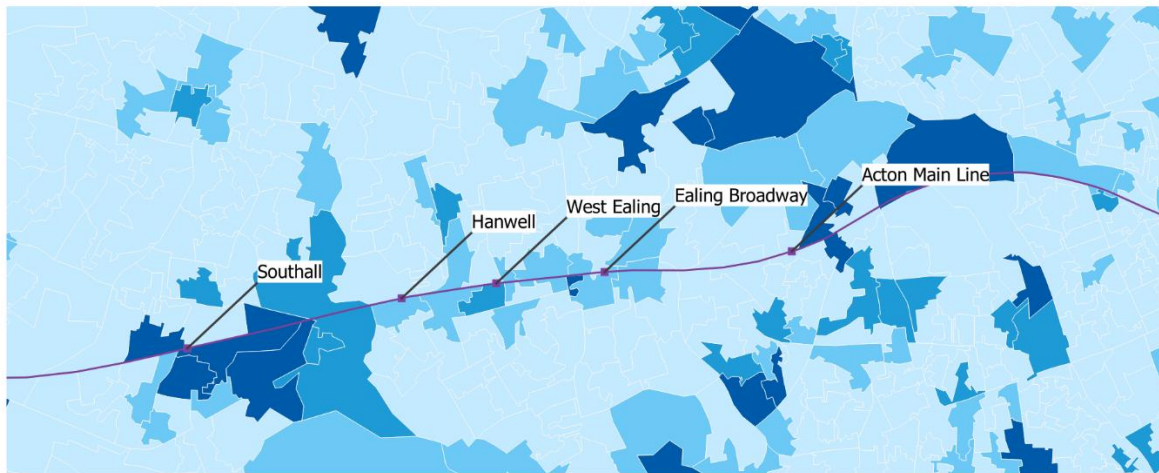
Residential properties change 2015-2022

- Elizabeth Line Stations
- Elizabeth Line Network

Residential properties stock % change
(2015-2022)
- 0 - 5%
- 5 - 10%
- 10 - 20%
- 20 - 50%

Figure 43: Residential properties stock change 2015-2022, Paddington to Whitechapel (LSOA level) (Source: Valuation Office Agency)
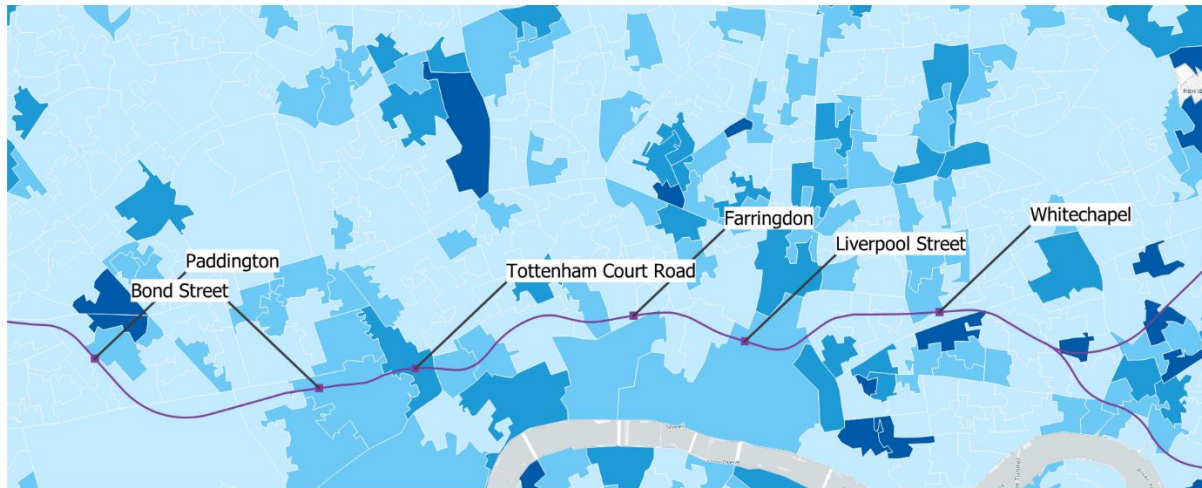
Residential properties change 2015-2022

- Elizabeth Line Stations
— Elizabeth Line Network

Residential properties stock % change (2015-2022)
- 0 - 5%
- 5 - 10%
- 10 - 20%
- 20 - 50%

Figure 44: Residential properties stock change 2015-2022, Canary Wharf to Abbey Wood (LSOA level) (Source: Valuation Office Agency)
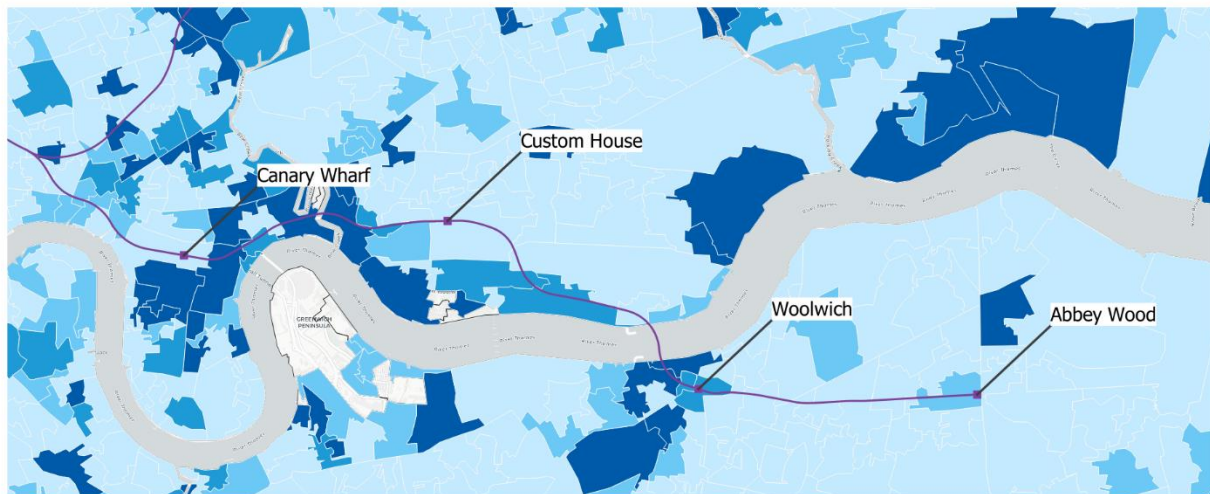
Residential properties change 2015-2022

- Elizabeth Line Stations
— Elizabeth Line Network

Residential properties stock % change (2015-2022)
- 0 - 5%
- 5 - 10%
- 10 - 20%
- 20 - 50%

Figure 45: Residential properties stock change 2015-2022, Stratford to Shenfield (LSOA level) (Source: Valuation Office Agency)

Residential properties change 2015-2022

- Elizabeth Line Stations
- Elizabeth Line Network

Residential properties stock % change (2015-2022)
- 0 - 5%
- 5 - 10%
- 10 - 20%
- 20 - 50%

Complementary to the maps illustrating residential properties stock change analysis of trends since 2015 reveals that inner London Elizabeth line stations have experienced a sustained growth in delivery of new homes (both new built or converted), with stronger growth around Canary Wharf and to a certain extent around Custom House. While outer London and South East stations' stock of residential properties grew in line with the London average until 2019, there has been an uptick in housing delivery since, suggesting a potential effect of the line opening and delivery of housing schemes around Elizabeth line stations (Figure 46).

Figure 46: Residential property stock growth from 2015 to 2022 (Index 2015 = 100) (Source: Valuation Office Agency)
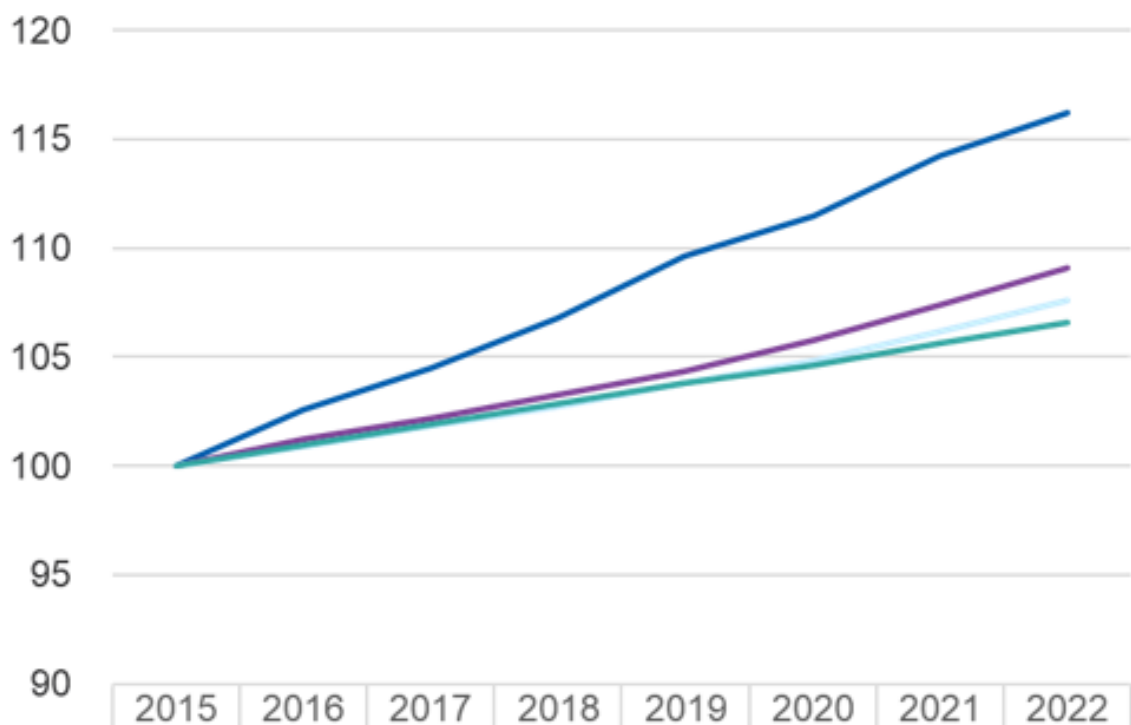
Area	2015	2016	2017	2018	2019	2020	2021	2022
— Elizabeth line – inner London stations average	100	103	104	107	110	112	114	116
— Elizabeth line average	100	101	102	103	104	106	107	109
— Elizabeth line - outer London stations average	100	101	102	103	104	105	106	108
— Elizabeth line – London average	100	101	102	103	104	105	106	107

Further analysis on residential development was undertaken using data on future residential development pipeline from the Greater London Authority (London datastore) for approved residential units within a radius of one kilometre around Elizabeth line stations within London. The residential pipeline at the end of each financial year is calculated using data from the Planning London Datahub (PLD), which is supplied by applicants and planning authorities. There are currently around 51,000 approved units in the pipeline, with most properties qualified as "market for sale" (65 per cent). Intermediate and social rent units represent 19 per cent of the pipeline.

Canary Wharf has the biggest residential pipeline within one kilometre of the station with around 10,500 residential units planned (Figure 47). Acton Main Line, Southall and Woolwich all have more than 5,000 units planned (5,700, 5,300 and 5,100 respectively)

(Figure 47). Stations east of Stratford and located within London all show a very limited pipeline (3,780 residential across the 10 stations between Maryland and Harold Wood, with Romford accounting for almost 50 per cent of this on Figure 47).

Figure 47: Residential one-kilometre pipeline around Elizabeth line stations (within London) (Source: Greater London Authority)

Station	Value
West Drayton	187
Heathrow T4	52
Hayes And Harlington	2,732
Southall	5,346
Hanwell	740
West Ealing	1,015
Ealing Broadway	405
Acton Main Line	5,700
Paddington	1,217
Bond Street	1,081
Tottenham Court Road	1,454
Farringdon	483
Liverpool Street	281
Whitechapel	1,698
Canary Wharf	10,554
Custom House	4,143
Woolwich	5,146
Abbey Wood	1,105
Stratford	4,091
Maryland	113
Forest Gate	348
Manor Park	131
Ilford	811
Seven Kings	341
Goodmayes	133
Chadwell Heath	52
Romford	1,812
Gidea Park	19
Harold Wood	24

In line with findings on residential property stock, population growth in areas around Elizabeth line stations has been higher than for the whole of London between 2015 and 2020, with outer London and South East stations performing slightly below this, witnessing a three per cent population increase from 2015 to 2020 (Figure 48).

Both Farringdon and Canary Wharf experienced an increase of above 50 per cent – suggesting that even if these stations started from a low base, these areas may have seen transformational change during the period of analysis. This analysis will need to be updated with post-pandemic data on population change once more recent data is available.

Figure 48: Population change from 2015 to 2020 (Index 2015 = 100) (Source: ONS)
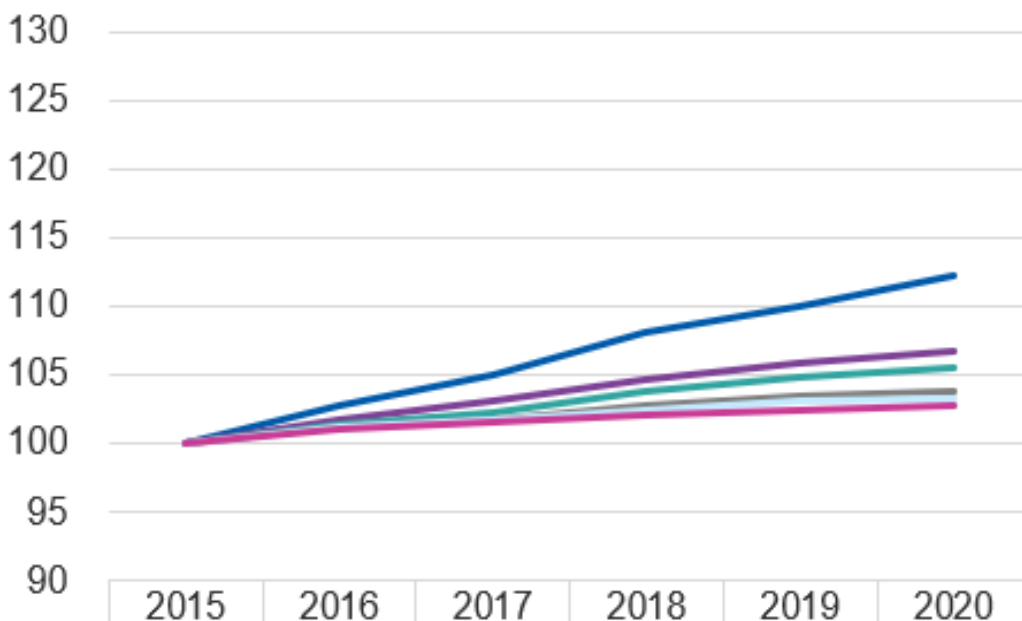
Area	2015	2016	2017	2018	2019	2020
— Elizabeth line – inner London stations average	100	103	105	108	110	112
— Elizabeth line average	100	102	103	105	106	107
— Inner London average	100	101	102	104	105	106
— London average	100	101	102	103	103	104
— Elizabeth line – outer London stations average	100	101	102	102	103	103
— Outer London average	100	101	102	102	102	103

The increase in demand for housing can also be observed through housing prices which reflect pressure and demand on the market. Median housing prices (HM Land Registry, House Price Index, 2023) around Elizabeth line station areas were growing at a similar pace, faster than the London average for the period 2015-2018 (17 per cent increase for the Elizabeth line average, inner and outer London stations areas against 11 per cent for the London average). A steep decline started in 2019 and persisted throughout the pandemic, resulting in a decline in house prices. The market, however, recovered and exceeded pre-pandemic levels from 2021 to March 2023 (Figure 49).

Recovery in inner London stations appears to be progressing at a slower pace, whereas outer London has witnessed the most substantial growth in prices over the reporting period (an increase of 30 per cent). A range of factors might explain this. The rate of new home delivery is notably higher around inner London Elizabeth line stations compared to outer London stations (Figure 49) which may have implications for market prices. This could also reflect potential increased attractiveness of outer London Elizabeth line stations, both due to improved connectivity and new hybrid working patterns since the pandemic, allowing for remote working and longer commutes undertaken on a less frequent basis, making suburban areas more attractive and reinforcing demand and price growth around these places.

Data from JLL in 2023 analysis suggests that increases in housing prices have been largest for some of the outer London Elizabeth line stations, with Abbey Wood (17 per cent increase), Ilford (14 per cent increase), Romford (nine per cent increase) and Southall (13 per cent increase) experiencing the highest growth in prices per square foot over the past three years.

These impacts on housing prices and affordability will need to be further monitored, considering both indications of regeneration and potential impacts on local communities. The qualitative interviews conducted around specific case study stations will further explore these themes.

Figure 49: Median housing prices growth from 2015 to March 2023 (Index 2015 = 100) (Source: HM Land Registry)
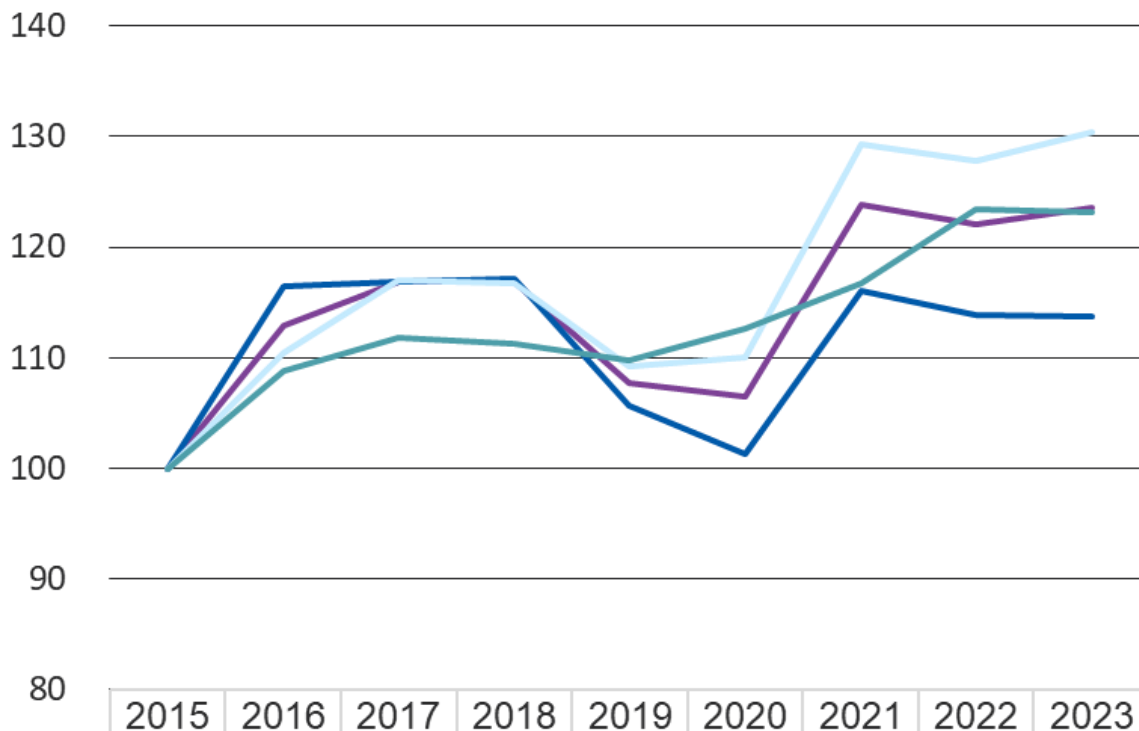
Area	2015	2016	2017	2018	2019	2020	2021	2022	2023
— Elizabeth line average	100	113	117	117	108	106	124	122	124
— Elizabeth line - inner London stations average	100	116	117	117	106	101	116	114	114
— Elizabeth line – outer London stations average	100	111	117	117	109	110	129	128	130
— London average	100	109	112	111	110	113	117	123	123

Comments provided in the passenger survey demonstrate passenger perceptions around the regeneration impact of the line:

- "Very positive. The opening sped up the gentrification of some areas (such as Woolwich) where new (re)developments are in place or about to start."

- "I'm still waiting on the gentrification of my area to bring in more professional commuters and increase the standard of living."

- "There has been a big effect on house prices, making property in Reading and Basingstoke less affordable."

- "House prices have rocketed in areas where the Elizabeth line is, which makes it very hard for first time buyers to get a property."

The Elizabeth line opening could be affecting ways people travel for leisure and education but evidence remains too limited

Social impacts monitored as part of this first post-opening evaluation mainly look into the effects of the Elizabeth line opening on access to opportunities for education, leisure and culture as well as impacts on social exclusion.

In relation to access to education, leisure and culture, initial data gathered from the survey suggests that the Elizabeth line is delivering social benefits for travellers and residents across the wider London area. Slightly more than one in three passengers (31 per cent) using the line said that it changed where they travelled for leisure (Figure 50) with an additional 35 per cent stating it influenced how often they travelled, suggesting they might be using it for purposes other than work. Furthermore, analysis from passenger survey results in section 5 shows that 15 per cent of passengers travelling for leisure-related reasons would have travelled to a different destination in the absence of the Elizabeth line, with 7 per cent opting not to travel at all.

Figure 50: 'Has the opening of the Elizabeth line influenced any of the following?', all passengers, by branch (Source: Passenger survey)
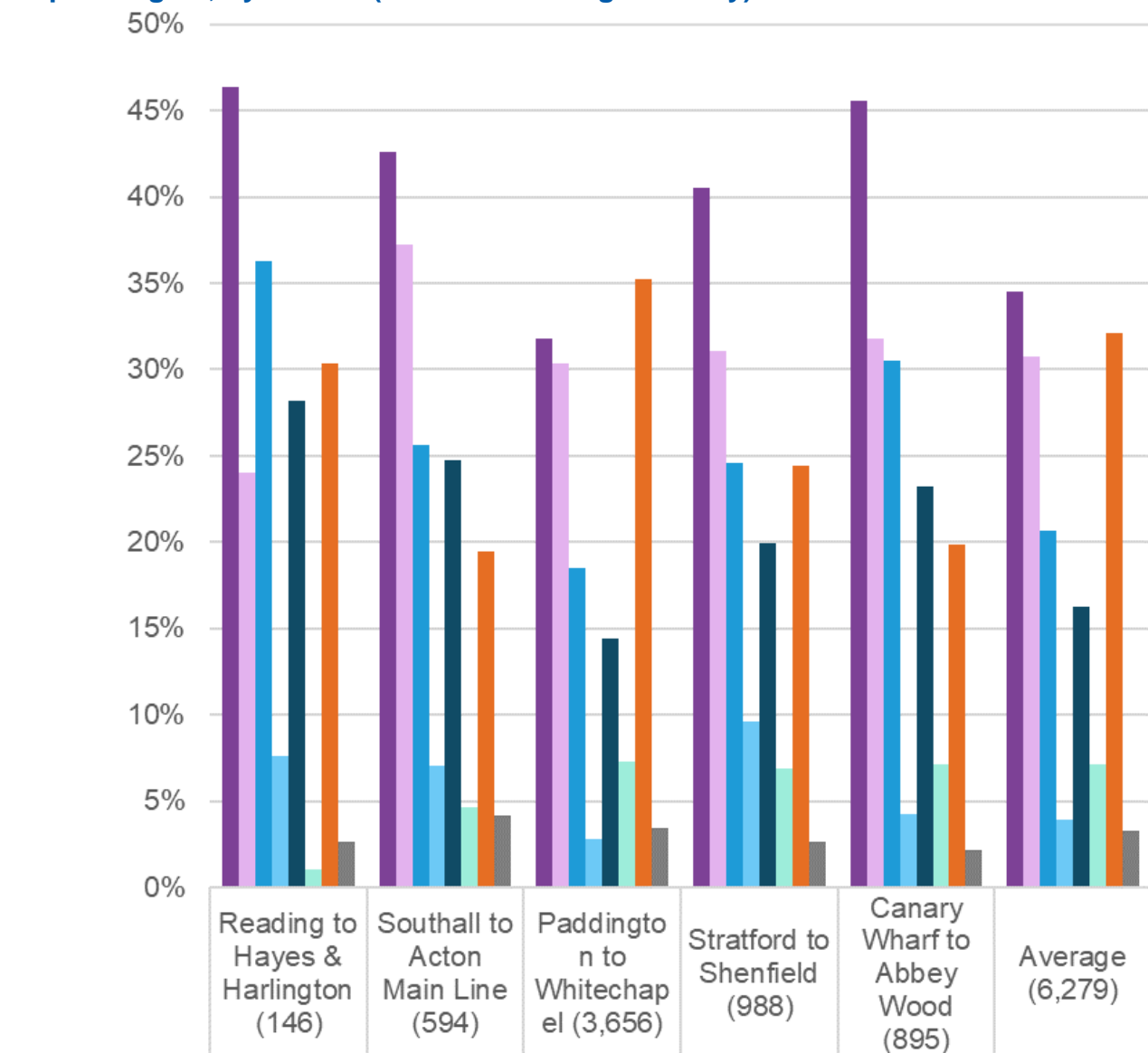
"Has the opening of the Elizabeth line influenced any of the following?'	Reading to Hayes & Harlington	Southall to Acton Main Line	Paddington to Whitechapel	Stratford to Shenfield	Canary Wharf to Abbey Wood	Average
■ Yes, how often I travel	46%	43%	32%	41%	46%	35%
■ Yes, where I travel for leisure	24%	37%	30%	31%	32%	31%
■ Yes, where I work	36%	26%	19%	25%	30%	21%
■ Yes, where I study	8%	7%	3%	10%	4%	4%
■ Yes, where I live	28%	25%	14%	20%	23%	16%
■ Yes, other	1%	5%	7%	7%	7%	7%
■ Don't know	3%	4%	3%	3%	2%	3%
■ No, none of these	30%	19%	35%	24%	20%	32%

Total base: 6,279 (Note: due to multiple selection possible, responses sum to greater than 100%)

Figure 51 illustrates these impacts on leisure, showing a specifically marked pattern in South East London as a whole, with many areas not directly served by the Elizabeth line still having passengers living there and stating that the line influenced where they travelled for leisure. This underlines the line's role in increasing London's catchment area for leisure activities and the benefits beyond the immediate areas around stations that will need to be further investigated through interviews and future evaluation activity.

Figure 51: Home postcode of passengers saying the opening of the Elizabeth line has influenced where they travel for leisure (Source: Passenger survey)
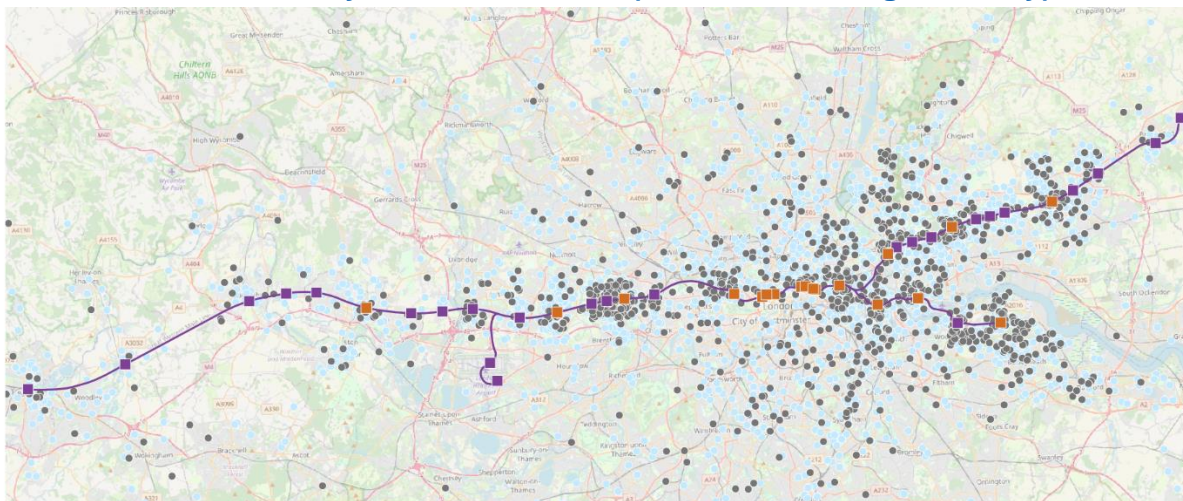
Q30: Has the opening of the Elizabeth line influenced any of the following?

—— Elizabeth line network

Stations
- ■ Survey stations
- ■ Other EL stations

• Q30: The EL influenced where I travel for leisure

All survey responses

• All other responses (home postcode)

Base: 4,987

Anecdotally, the Elizabeth line opening also increased access to education with four per cent of survey respondents (out of all those who indicated the Elizabeth line had influence on where they travel) indicating the Elizabeth line influenced where they travel for education, with higher numbers on both ends of the line (8 per cent for the Reading to Hayes and Harlington branch, and 10 per cent on the Stratford to Shenfield branch) (see Figure 50). This is supported by some statements from the passenger survey:

- "Incredible pace of train. Very impressed. Station area around my home a bit nicer now. I might not have been able to go to a language class and now I can. More of London is open to me as I can get to past hard to reach places much faster it's unbelievable."

- "Fast connection between QMUL university campuses."

- "I am really glad that the line is fully open and functioning – it means I can reach my university and all my placement hospitals using one line!"

- "Personally, the Elizabeth line has positively impacted me in a lot of ways. The main reason I am able to travel to the university I always wanted to go is because of this service. So, I am very grateful for it."

Effects of the Elizabeth line opening on sustainable growth and development will need to be further investigated

The Elizabeth line is expected to encourage more active travel and reduce carbon emissions from trips made by car. Although it is early to measure these outcomes, survey responses can help address this question. Overall, 66 per cent of passengers using the Elizabeth line in the morning peak (07:00-10:00) walked to the train station where they first boarded a train. This figure was higher on the Southall to Acton Main Line (71 per cent) and Paddington to Whitechapel sections (68 per cent), while the Reading to Hayes &

Harlington section had the highest share of Elizabeth line users getting to their starting station by car or van (29 per cent) (Figure 25).

These differences are illustrated by Figure 52, which shows the spatial distribution of all surveyed passengers using the Elizabeth line, by first mile mode and origin postcode. Outer London catchment areas are more likely to use a car or taxi/minicab to get to their station, especially in the west, while good public transport provision in the East could contribute to higher usage of public transport and walking to the first station where respondents started their journeys.

Figure 52: 'How did you get to your first station from where you started your journey?', Elizabeth line passengers, by origin postcode (Source: Passenger survey)
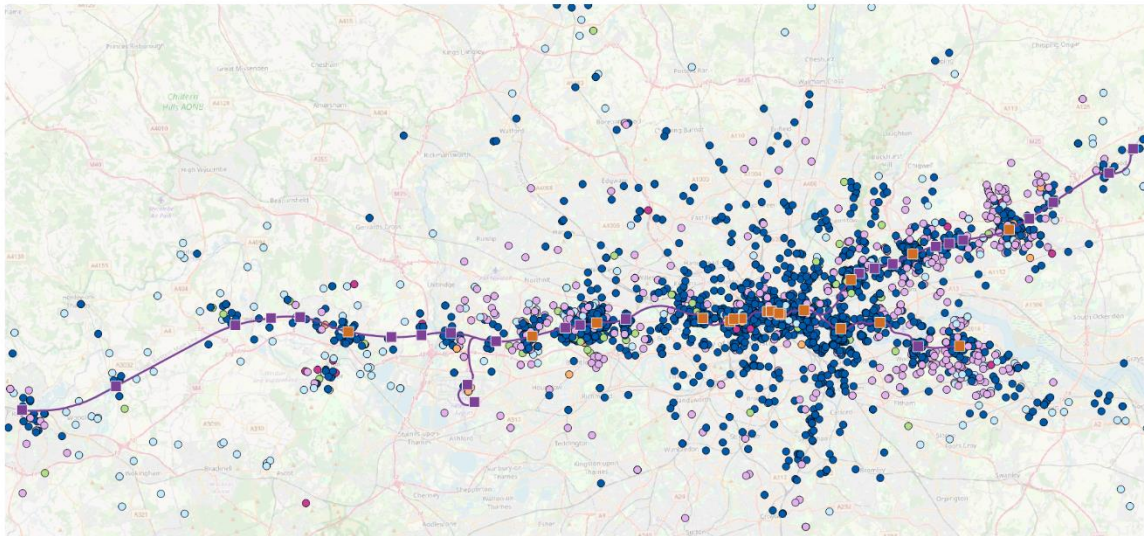
Q11: How did you get to your first station from where you started your journey?

— Elizabeth line network

Stations
- ■ Survey stations
- ■ Other EL stations

How did you get to your first station from where you started your journey?
- ○ Car/Van
- ● Taxi/Minicab
- ● Other
- ● Public transport
- ● Bicycle
- ● Walked all the way

Base: 3,834

Discussion

The findings from the wider impacts monitoring point to a significant amount of change that has taken place both in direct areas around Elizabeth line stations and across London over the study period. While it is too early to attribute these changes directly to the Elizabeth line's opening and more robust analysis will be needed over the next few years, there are some early signs of change that may reflect the delivery of this new transport link.

The connectivity Improvements have benefited all places along the line, with increased employment densities, and a wider catchment area for jobs in the entire wider London and South East area. Evidence gathered from the survey clearly underlines the spatial spread of Elizabeth line users, and notably of those who indicated that the line influenced where

they worked, far beyond immediate areas around stations, with the South East of London being among the biggest beneficiaries.

When it comes to regeneration impacts, the effects on local employment remain to be fully demonstrated, with most of the growth happening in central London areas, where it is difficult to disentangle the effect of the line from other factors, while outer London stations on average have experienced similar employment growth to the outer London average.

Monitoring of residential data and new homes delivery suggests that inner London stations are outperforming the London average over the period 2015 to 2022 (16 per cent increase and seven per cent increase respectively), driven by growth in Canary Wharf (38 per cent), Custom House (24 per cent) and Stratford (31 per cent) among others, while a clear uptick since 2019 around outer London and South East Elizabeth line stations can be observed. In parallel, sustained property price growth is observed, specifically for non-central London stations, which could be related to early effects of the Elizabeth line opening on the residential property market. However, no causal link can be confirmed at this stage, and this should be further investigated in a future post-opening evaluation study.

Finally, data collected in the passenger survey, which asked customers to provide their postcode of where people travel for work, leisure and education, highlights positive perceptions of the Elizabeth line. The mapped data suggest that this is particularly true for cross-river connections on the Abbey Wood branch, which could indicate an effect of the Elizabeth line's opening as a catalyst for transport-orientated development, and bringing previously underserved communities closer to opportunities in central and west London. This will need to be further evidenced and demonstrated in future econometric studies.

These early findings are also being tested as part of this study through qualitative interviews with a variety of stakeholders and across different stations and sections on the line. Results from this additional stream of work will be presented in the Final Evaluation Report from this study.

Findings will also need to be further investigated in future post-opening evaluation studies using additional data and robust evaluation methods.

8. Conclusion

The first year of operation of the Elizabeth line has shown tangible impacts on transport connectivity in London. The early findings shown in this report suggest that some of the expected outcomes are being realised for some passengers, such as faster journey times, easier journey routing, better journey experience and enhanced accessibility. Growth in demand and consistently high customer satisfaction show that users are enjoying the benefits, and early evidence suggests that the Elizabeth line may lead the post-pandemic recovery of London's transport network.

Summary of findings

The primary research question focused on understanding the improvements in connectivity and transport performance and subsequent changes in demand.

Section 3 presents evidence of how the line has increased transport connectivity across the whole of London, particularly for areas which previously had poor accessibility. Improved cross-river connections are seen particularly around the Abbey Wood branch, providing a step change in connectivity for local communities. Initial findings indicate that the connectivity enhancements brought about by the Elizabeth line have correlated with an increase in trip numbers across London's public transport network. Journey time and fewer interchanges were identified by those surveyed as the top two reasons for using the line – both closely associated with connectivity.

Section 4 validates and expands on the evidence regarding new trip generation after the opening of the Elizabeth line. It concludes that there is evidence of new trip generation following the Elizabeth line opening, which aligns with the Theory of Change. The total number of trips on the TfL network increased immediately after the opening and has continued to grow. The fastest growth in trips between October 2022 and October 2023 happened on the Heathrow branch as it improved connectivity between central London and the airport, due to continued recovery of air travel demand, and the return of workers at Heathrow airport.

It was expected that the London transport network would become less crowded following the addition of the Elizabeth line. The analysis found that usage of parallel lines declined, which suggests that crowding on these lines have decreased. Also, the results of the passenger survey suggest that reduced crowding was less important for users. As part of the next stage of evaluation, the correlation between trip generation and the opening of the Elizabeth line needs to be supported by robust econometric analysis to confirm causality.

The analysis reported in Section 5 points to evidence of abstraction within the rail network, which suggests that further mode shift may be happening. Analysis undertaken to date also suggests that the introduction of the Elizabeth line has led to demand shift from London Underground, the DLR and National Rail. Abstraction from these modes is estimated to account for around 35 per cent of Elizabeth line demand. Similarly, as the demand for the Elizabeth line has risen, trips on parallel routes have declined and become lower than trips on comparator routes. At this stage, the scale of mode shift from bus, road and active travel has not been assessed.

Section 6 illustrates that the upgraded stations and new services have positively impacted the public transport experience, with customer satisfaction being driven by the provision of direct and fast routes, and increased chances of finding seating. Customer satisfaction for the line has been high since the opening, with the Elizabeth line consistently outperforming other lines. This is likely to be driven by faster and more direct journeys as well as reduced

crowding, but feedback from the passenger survey also highlights other aspects of passenger experience, including journey comfort and improved conditions on the trains compared to other modes of transport. Despite challenges such as declining punctuality scores, customer satisfaction has remained consistently high. The final report will investigate this further using a longer time series.

The monitoring and analysis detailed in Section 7, focusing on the impact on local communities, particularly in terms of regeneration and the delivery of new homes, reveal preliminary indications of change in the vicinity of Elizabeth line stations, potentially linked to enhanced connectivity. However, to establish a concrete connection between these impacts and the opening of the Elizabeth line, further investigation through econometric analysis and primary data collection is needed. This comprehensive analysis is planned to form part of the subsequent stages of the evaluation.

Early evidence suggests that some socio-economic impacts may have begun to be felt around Elizabeth line stations, including increased employment opportunities, business growth, and housing development – the analysis undertaken in this report cannot attribute these impacts to the opening of the line. These benefits are expected to emerge more fully over time and are expected to be addressed in future evaluation activity.

Looking ahead

The initial findings outlined in this report indicate that the Elizabeth line is on track to deliver some of the anticipated benefits set out in the Theory of Change. However, for certain outcomes, such as mode shift, trip generation and regeneration, it is too early to attribute observed changes solely to the opening of the line. Additionally, effects will continue to occur, and it is expected to take longer than 18 months (from the opening of the central section in May 2022 until the last data point included in this analysis in November 2023) for impacts and outcomes to emerge and be captured by this analysis. Reaching a full understanding the impact of the line is further complicated by the presence of confounding effects such as recovery from the pandemic and the current economic climate. It is possible that further demand growth is yet to be realised due to these two factors.

The Final Evaluation Report will make use of additional data sources on road and public transport usage across the wider study area to provide a more detailed view on each of the research questions. Making use of mobile network data, which covers the London, the South East region, Essex and Hertfordshire, the analysis will provide a better understanding of trends beyond Greater London. It will also include non-experimental analysis that will determine the causality of the emerging impacts and trends that will be set out. Finally, a full exploration and analysis of interviews conducted with key stakeholders, which will provide context and perspective on data insight, and bring the story of benefits brought by the Elizabeth line to life, with real life examples and localised case studies.

Appendix A: List of terms

Term	Definition
Abstraction	Demand abstraction is the concept of demand moving away from existing modes or routes towards a new route. It is the effect of overall demand being constant, but moving between routes/modes rather than demand being comprised of totally new trips.
Branch	Section of a line comprising more than two stations, such as the section of the Elizabeth line between Reading and Hayes & Harlington.
Capacity	Defined as maximum volume of transport passengers that can be handled in standard conditions on the transport network for a limited period.
Day 1	TfL demand data formulated specifically for the Elizabeth line that uses rail ticket data, contactless and Oyster 'taps'.
Demand-weighted average journey time	Journey times have been averaged using a demand-weighted average, which means the average takes into account the number of people making the journey.
DfT	Department for Transport.
DUNNART	TfL weekly demand data based on contactless and Oyster 'taps' comprising the rail, light rail and London Underground components of the network. It is based on station entries and exits and trips distributed onto the network to estimate customers boarding, alighting and interchanging, and link-level demand.
First-mile mode	The mode of transport used by passengers to access their primary mode of transport. In this report, the first-mile mode refers to the mode used to arrive at the station where they picked up a passenger survey.
Impact category	A categorisation based on a blend of modelled scenarios with and without the Elizabeth line, and a manual exercise from TfL Public Transport Service Planning. It classifies links into three groups according to their relationship to the Elizabeth Line: parallel links offer similar journeys, feeder links provide access to the Elizabeth Line, and comparator links are considered largely unaffected by the Elizabeth line. Note: this analysis has some limitations such as the presence of confounding factors like service changes and wider impacts from the pandemic recovery.
Interchange	Passengers changing trains, lines or modes at stations, stops or transport hubs.
Journey time	Time in minutes taken to travel between two points.

Term	Definition
Last-mile mode	The mode of transport used by passengers to travel from their primary mode of transport to their final destination. In this report, the last-mile mode refers to the mode used to depart from their final destination station to their destination location.
Link	Section of a line between two stations. Link-level demand is the number of trips between two stations on a particular line.
London and the wider South East	The study area for the evaluation that encompasses the regions of Greater London and Southeast England, plus the counties of Essex and Hertfordshire. This includes the two key regions where the impacts of the Elizabeth line are expected to be evidenced, plus the two remaining counties adjacent to London.
Mobile network data (MND)	Mobility data captured by the O2 mobile network which provides origin-destination (OD) level aggregate and anonymised data on person mobility by road and by rail.
Middle layer Super Output Areas (MSOA)	Geographical areas developed by the Office for National Statistics that comprise between 2,000 and 6,000 households and have a usually resident population between 5,000 and 15,000 persons. MSOAs fit within local authorities.
Natural Language Processing (NLP)	NLP is a branch of artificial intelligence (AI) that enables computers to understand, interpret and process natural human language in a meaningful way. In this report, the NLP model was used to map the topics discussed in the free-text responses, clustering the most commonly raised issues.
NUMBAT	TfL annual demand data representing a typical autumn weekday, based on contactless and Oyster 'taps' comprising the rail, light rail and London Underground components of the transport network. It is based on station entries and exits and trips distributed onto the network to estimate customers boarding, alighting, interchanging and link-level demand.
ODX	TfL journey level data at OD level (from one MSOA to another MSOA) that provides journey time information based on contactless and Oyster 'taps' comprising all components of the transport network (bus, rail, light rail and London Underground).
Origin-destination (OD)	Refers to the start and end points of a passenger journey and is always a pair.
Peak periods	The peak periods referred to in this report are 07:00 – 10:00 and 16:00 – 19:00 combined.
Reliability	Reliability is the overall consistency of service provided by a transport mode. For the purposes of this report, it is the punctuality of services measured by percentage of trains arriving on time at stations. In London and the South East, a train is defined as on time if it arrives at the destination less

Term	Definition
	than five minutes (four minutes, 59 seconds or less) of the planned arrival time.
Static job-weighted accessibility	This is a spatial measure of the access any MSOA has to employment. The higher the static job-weighted accessibility, the better the access (in journey time) to the highest number of jobs. It is calculated using two variables; the inverse of MSOA to MSOA journey times, weighted by total number of jobs in destination MSOA.
TfL	Transport for London.
Theory of Change	A comprehensive description of how and why the aims, objectives and benefits are expected to happen as a result of the intervention, in this case the Elizabeth line.
Through-running	Direct services from the Elizabeth line's outer branches to/through the central section.
TfL rail network	TfL services: DLR, Elizabeth line, London Overground, London Trams and London Underground.