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Travel in London 2023

Focus report: Elizabeth line travel trends in the first year of operation

MAYOR OF LONDON



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Travel in London 2023

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Introduction

The central section of the Elizabeth line from Paddington to Abbey Wood opened to passengers on 24 May 2022, marking the start of full operation on London's newest railway, which connects regions to the east and west of London through the central area and the London Docklands.

In the following months, subsequent milestones were achieved:

- On 24 October 2022 Bond Street station opened.
- On 6 November 2022 regular Sunday operation began and direct services were introduced between Reading/Heathrow airport and Abbey Wood and between Shenfield and Paddington.
- Finally, on 22 May 2023, almost coinciding with the first anniversary of its launch, a full, peak timetable was introduced providing direct services between Heathrow airport and the Shenfield branch in the east and increased frequencies in the central section during the peaks.

Figure 1 The Elizabeth line.



Source: Transport for London.

[Travel in London report 15](#) provided an overview of the initial transport impacts of the Elizabeth line during its first five months of operation (from May to October 2022 before the opening of Bond Street station). The present report considers the transport impacts of the first 16 months or so of operation, to autumn 2023.

This report should be seen as one of several studies over the next few years that will contribute to a complete evaluation of the Crossrail Project (which gave rise to what is now the Elizabeth line). In particular, it should be considered supplementary to the full impact assessment and evaluation pieces that TfL and the Department for Transport, co-sponsors of the Crossrail Project, are currently undertaking and will be publishing over the coming years, and which will not only look at transport impacts but also at how the new railway has contributed to London's economy and prosperity, the Mayor's aims for the Capital, and the local impacts on the areas served by the new line. For more information about this longer-term monitoring and evaluation strategy see the [Elizabeth line benefits framework](#) page on TfL's website.

The analysis in this document stems from TfL's day-to-day monitoring tools and looks primarily at the Elizabeth line itself, although it considers some of the emerging secondary impacts on other parts of the transport network where information is currently available, particularly other London Underground lines and buses. However, it

is necessarily limited in scope since the full impacts of this transformational project will take years to embed as travel patterns settle and the wider impacts on homes, jobs, and people's lives are fully realised.

A key impact of the Elizabeth line that is not covered in this report is that which relates to unlocking development potential around station catchment areas thanks to the improved connectivity and journey time savings achieved with the new services. This is the subject of a longer-term [evaluation study](#) jointly sponsored by TfL and the Department for Transport where initial findings suggest that, between 2008 and 2021, prior to the opening of the central section, 54,725 new homes were delivered within one kilometre of future Elizabeth line stations.

The main conclusions from the present report are:

- The observed **level of demand** is broadly in line with what was expected in the latest business case update. In the first year of operation, the Elizabeth line saw 155.2 million journeys, of which 128.5 million journeys took place in financial year 2022/23. It is expected that financial year 2023/24 will see this reach 200 million journeys.
- On an **average mid-week day** in autumn 2023, the Elizabeth line sees nearly 700,000 journeys, a level similar to some of the busiest London Underground lines (like the Victoria, Jubilee, Central or District lines) and higher than that of the London Overground.
- In terms of its **temporal distribution** throughout the week and during the day, the demand on the Elizabeth line sees patterns similar to other rail services in London but slightly more aligned to London Overground and National Rail services than to the London Underground.
- **Occupancy levels** on the Elizabeth line are in line with the forecasts in terms of the location, timing and extent of on-train crowding and they indicate a well-used and busy railway but without any major crowding issues, save for some very specific links and times of the day and very rarely exceeding standing densities over three people per square metre.
- The largest **source of demand** (expressed in passenger kilometres) on the Elizabeth line is thought to be related to new trip generation and mode shift from other non-rail modes. There was also noticeable abstraction from former TfL Rail services (the former eastern and western arms, as would have been expected), London Underground and National Rail services, with much smaller abstraction from other TfL rail services like DLR and London Overground.
- In terms of its impact on **buses**, evidence suggests that rather than a net abstraction of bus demand to the Elizabeth line (which has only happened on some parallel routes), the opening of the Elizabeth line could be related to a small net generation of bus demand across the whole network of about 0.4-0.5 per cent of the total number of bus journeys across London.
- Finally, customer satisfaction data shows that since its opening the Elizabeth line has consistently been scoring levels of satisfaction that are well above the scores observed on other TfL public transport modes.

Demand patterns

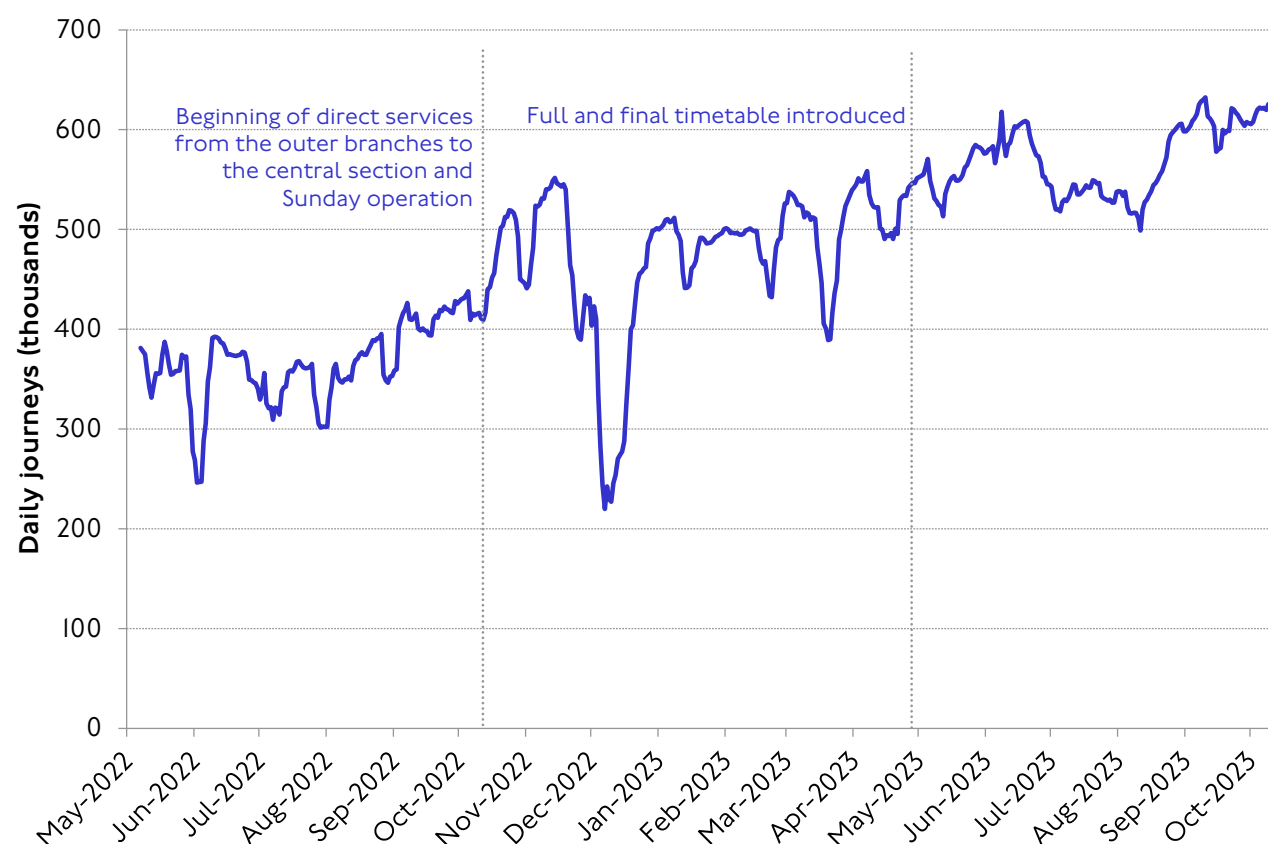
Overall demand

In its first full calendar year of operation, the Elizabeth line saw 155.2 million journeys, which corresponds to about 550,000 journeys per average mid-week day (Tuesday to Thursday) across the whole line. Within the 2022/23 financial year (from the day of opening on 24 May 2022), there were 128.5 million journeys. Note that these figures may differ slightly from others previously published. This is due to improvements to our estimates that led to some adjustments applied retrospectively as well as the exclusion of TfL Rail journeys from the financial year calculations.

Despite the unexpected challenges and disruptions posed by the coronavirus pandemic, this level of demand is broadly in line with what was expected in the latest business case update, and the 2022/23 demand is within the upper range of the post-pandemic forecasts, albeit slightly below the bottom range of the pre-pandemic forecast. Our current forecasts expect demand on the Elizabeth line to reach 200 million passengers per year in 2023/24. As of October 2023, the average daily number of journeys was over 600,000.

Figure 2 shows the trend in average weekly demand on the Elizabeth line since its opening.

Figure 2 Daily journeys on the Elizabeth line, seven-day moving average, May 2022–Nov 2023.



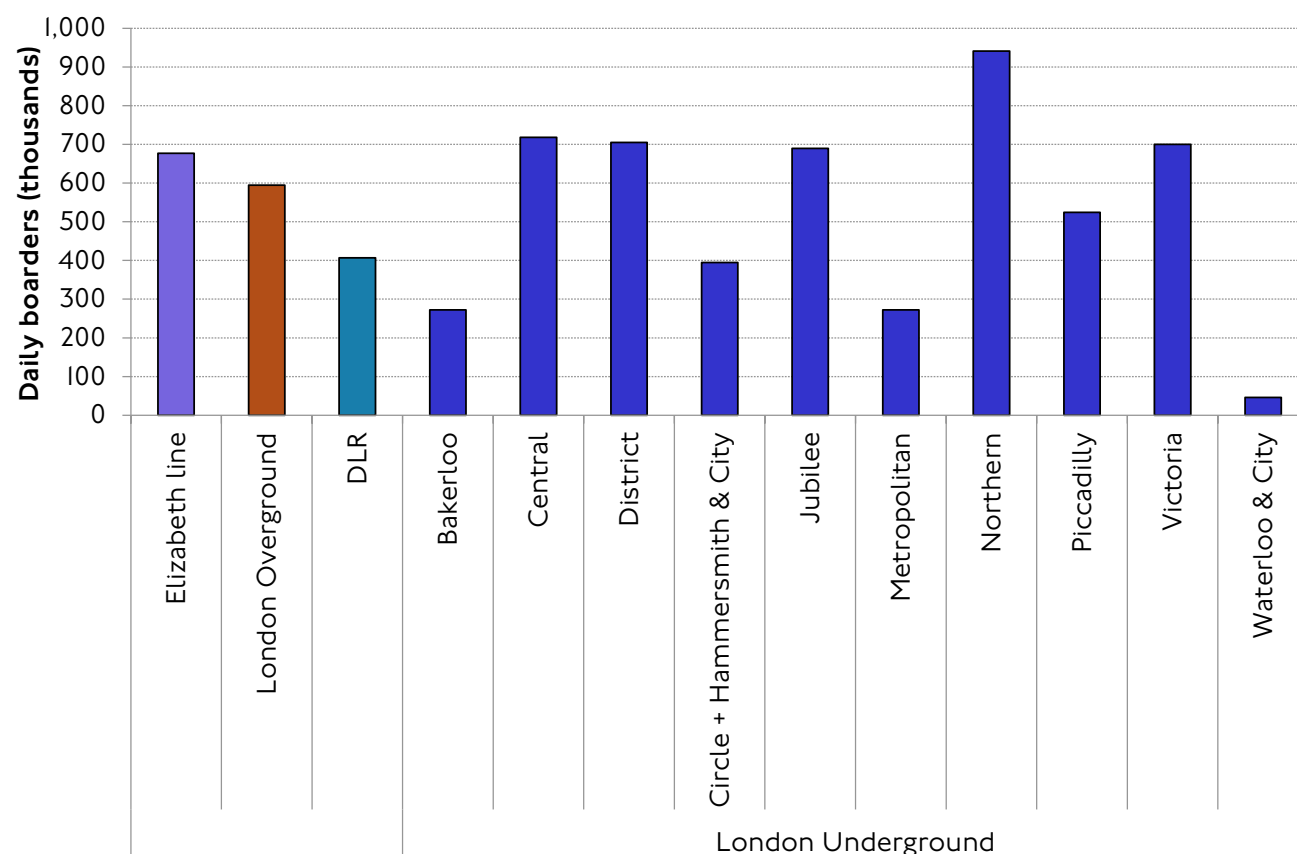
Source: TfL Strategic Analysis, Transport Strategy & Policy, based on TfL operational data.

The main features are:

- After the first few weeks of operation, the number of journeys fell slightly over the summer holiday period (as expected), but then saw a noticeable increase when the school term resumed in September. This growth continued steadily over subsequent weeks.
- The introduction of direct services from the outer branches to the central section and the start of Sunday services in November 2022 led to a step increase in demand, by almost 100,000 journeys per day on average.
- Demand continued to grow until mid-December but then fell sharply around the change of the year due to a combination of the festive holiday period and Network Rail industrial action (note that the Elizabeth line runs mostly on Network Rail infrastructure and is therefore sensitive to disruptions outside TfL's control).
- However, demand recovered by mid-January and from then on has continued to grow, albeit interrupted by holiday periods and industrial action.
- The introduction of the full and final timetable in May 2023 also triggered an acceleration of the rate of demand growth.
- After the summer holiday period, in September and October 2023, the average number of daily journeys remained slightly above 600,000.

It is useful to put this level of demand in the context of other TfL-operated rail services. Figure 3 looks at the average daily demand on the Elizabeth line on a mid-week day in a recent week in comparison with the equivalent demand on each of the London Underground lines and other TfL rail services.

Figure 3 Elizabeth line Tuesday-Thursday average daily demand compared to other TfL rail services, autumn 2023.



Source: TfL Public Transport Service Planning.

Demand by day of the week

Besides the well-known, pre-existing differences in travel demand between weekdays and weekends, one of the main post-pandemic legacies on public transport is the heterogeneity in demand within the different days of the traditional working week.

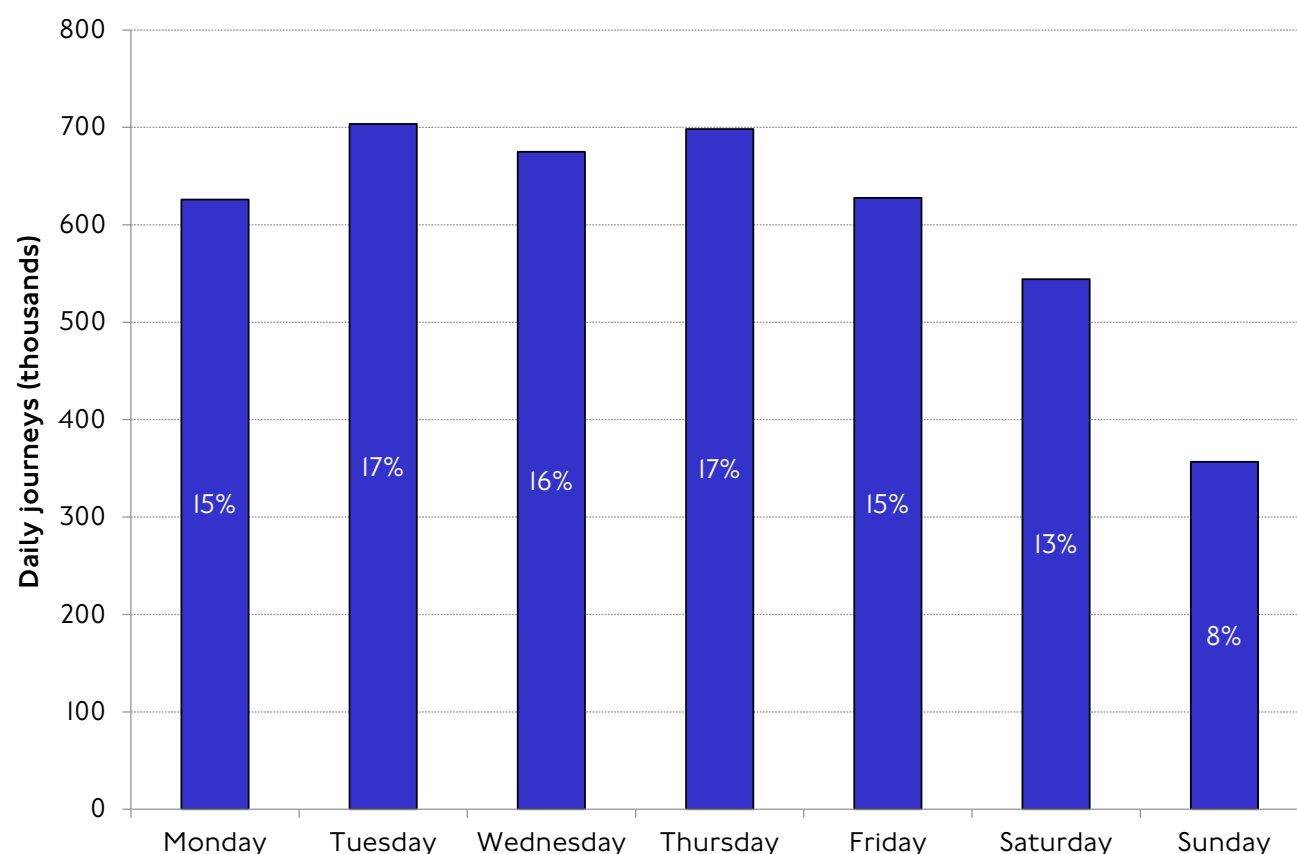
Evidence across other modes (particularly rail-based) suggests higher demand on mid-week weekdays (Tuesday, Wednesday and Thursday) with significantly lower demand on Mondays and, to a lesser extent, Fridays (particularly during the travel peaks). These trends are also seen on the Elizabeth line.

Figure 4 explores the absolute and relative (to the weekly total) demand by day of the week for an average October 2023 week.

The pattern is very similar to what is observed on other TfL rail networks, with demand on the Elizabeth line markedly higher on mid-week weekdays and Mondays the quietest day (but not too different to Fridays).

Saturday demand on the Elizabeth line is also relatively high and Sundays are the quietest day overall, again similar to what is observed on other public transport networks.

Figure 4 Elizabeth line demand by day of week, four-weeks average, October 2023.



Source: TfL Strategic Analysis, Transport Strategy & Policy, based on TfL operational data.

Note: Week commencing 23 October 2023 is excluded from the calculations because it coincided with the school half-term holidays in most schools. The percentages represent the proportion of that week's total demand on each of the days.

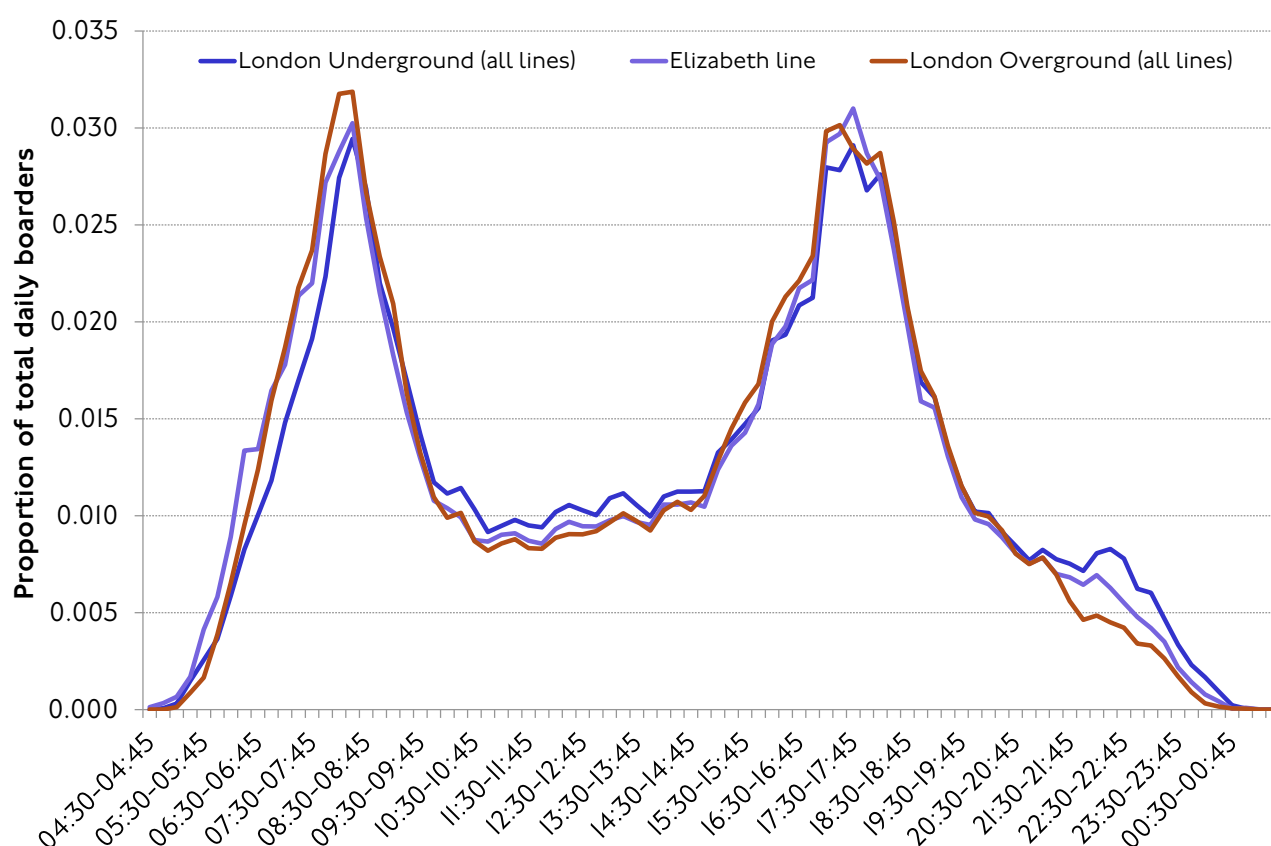
Demand by time of day

It is also useful to look at how the demand is distributed throughout the day, and how this compares to other TfL rail services.

As of autumn 2023, some 54 per cent of journeys on the Elizabeth line took place during the weekday morning and evening peaks (07:00-10:00 and 16:00-19:00). This is slightly higher than what is typically observed on the London Underground (around 52 per cent) and more similar to the pattern observed on National Rail services.

Figure 5 shows the relative profile of Elizabeth line demand (in terms of the proportion of total daily boarders) throughout the day on an average mid-week day and in relation to the London Underground and London Overground.

Figure 5 Elizabeth line Tuesday-Thursday daily demand profile compared to other TfL rail services, autumn 2023.



Source: TfL Public Transport Service Planning.

In broad terms, the profile of demand on the Elizabeth line is very similar to that of the London Underground and especially the London Overground, with two distinct peaks in the morning and evening. However, there are some subtle differences. For example, the Elizabeth line has a relatively higher proportion of its daily demand in the evening peak (compared to both the other networks) and also in the morning peak compared to the London Underground.

The fact that the demand profile is more similar to the London Overground network probably reflects the connectivity characteristics and more suburban/regional nature of these networks.

The same way that it happens on weekdays, the weekend demand profile is also very similar across the Elizabeth line, the London Underground and the London Overground, with noticeable differences mostly in the early mornings (where the Elizabeth line sees a relatively higher proportion of the daily demand) and the late evenings, where the London Underground has a higher peak related to the Night Tube services than any of the other networks and the Elizabeth line has relatively lower demand.

Train occupancy

The ideal outcome for the Elizabeth line would be a well-used but not overcrowded railway. Therefore, train occupancy is an important measure of success.

A good proxy measure for the assessment of train occupancy and crowding is standing density, which is calculated from the average number of people on board each train and the train's seating and standing capacity as the number of standing passengers per square metre. The standing density is zero when the number of passengers is below the seated capacity and therefore there are seats available. While evidence suggests that passengers start to experience discomfort once more than 60 per cent of the seats are taken, from a planning perspective it is typically considered that when the standing density exceeds two passengers per square metre there is 'crowding'.

This flexible metric can be calculated at different times of the day and by location (station-to-station link), and thus allows the identification of where and when crowding problems occur.

Overall occupancy levels

Figure 6 provides an overview of occupancy levels on the Elizabeth line during a typical mid-week day in September 2022 (once demand on the central section had settled but before the start of direct services from the outer branches to the central section) and in a recent week in October 2023, with the railway fully open.

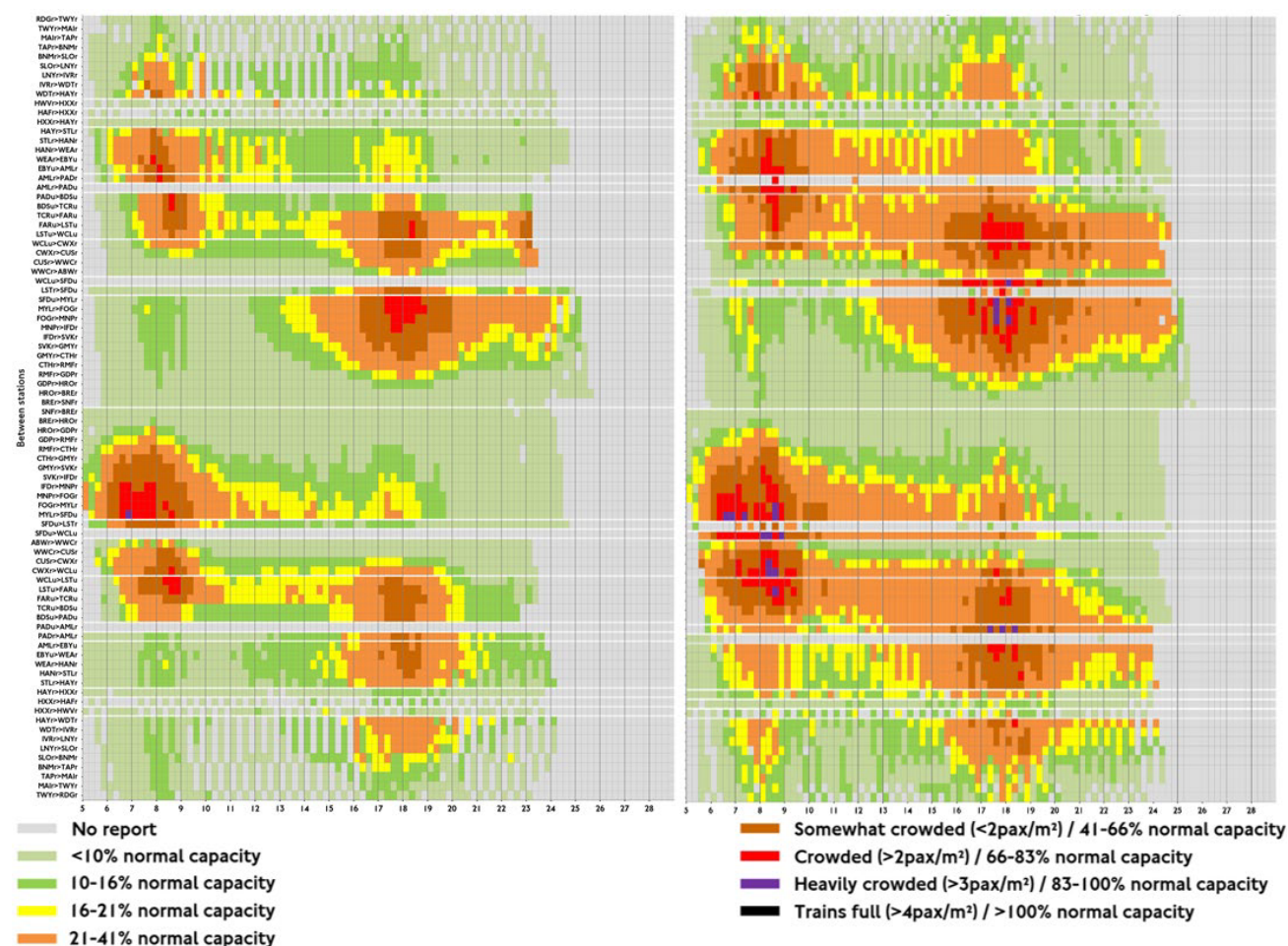
Overall, occupancy levels on the Elizabeth line are as expected by the pre-opening forecasts in terms of the location, timing and extent of on-train crowding. These levels indicate a well-used and busy railway but without any major crowding issues save for some very specific links and times of the day, which suggests sufficient capacity both for relatively comfortable travel the large majority of the time and scope for future growth.

As expected, occupancy increased following the introduction of direct services from the outer branches to the central section in November 2022, but this is a direct result of the large increase in passenger journeys and passenger kilometres that this change enabled.

On weekends (particularly Saturdays, which on other TfL rail services are busier than some weekdays since the pandemic), crowding on the Elizabeth line does not seem to have been an issue and will thus not be considered further in this section.

Capacity provision, both on trains and within stations, will be kept under continuous review to identify opportunities for timetable changes that could lead to service optimisations as well as insights into better station management and future upgrades.

Figure 6 Average Tuesday to Thursday occupancy on the Elizabeth line by station-to-station link and direction (vertical axis, with eastbound on top and westbound at the bottom) and quarter hour (horizontal axis), week of 27 Sep 2022 (left) versus week of 10 Oct 2023 (right).



Source: TfL Public Transport Service Planning.

Occupancy in the mid-week morning peak

As is the case on other modes, the busiest times on the Elizabeth line occur during the weekday morning peak (07:00-10:00), and in particular (in the post-pandemic context) on the mid-week days (Tuesday to Thursday).

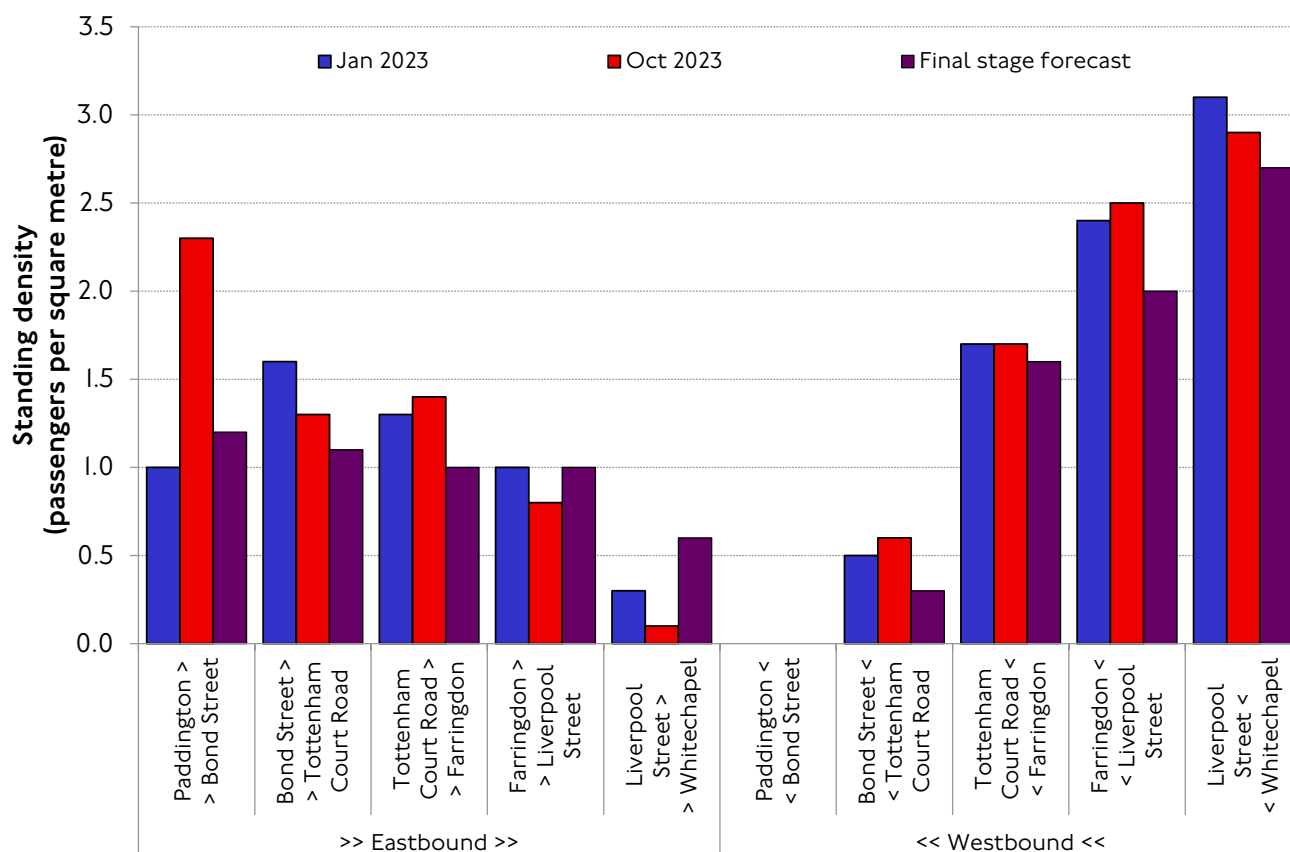
This section explores the trends in occupancy on each of the main branches of the Elizabeth line at the busiest hour within the mid-week morning peak at various representative times since the opening and compared to the modelled forecasts. In many cases, only the inbound direction into central London has any occupancy issues (with trains in the outbound direction always having seats available). When this is the case only the inbound direction is considered.

Central section

The central section (also sometimes referred as the 'core') is the tunnelled section of the Elizabeth line through central London between Paddington and Whitechapel.

Figure 7 shows the standing density on each link in this section, by direction, during the busiest hour of the mid-week morning peak at various points since the line opened.

Figure 7 Standing density on the central section of the Elizabeth line, busiest hour in the average mid-week morning peak, Jan 2023 and Oct 2023 versus modelled forecast.



Source: TfL Public Transport Service Planning.

Occupancy in the central section during the mid-week morning peak is broadly in line with expectations and remains at or below three passengers per square metre at all locations.

The busiest direction is westbound and the busiest trains are found on the eastern end of this section, between Whitechapel and Liverpool Street. Occupancy tapers off as trains move westwards through central London up to the point that seats become available west of Bond Street.

In the eastbound direction, occupancy remains well below two passengers per square metre at all locations east of Bond Street.

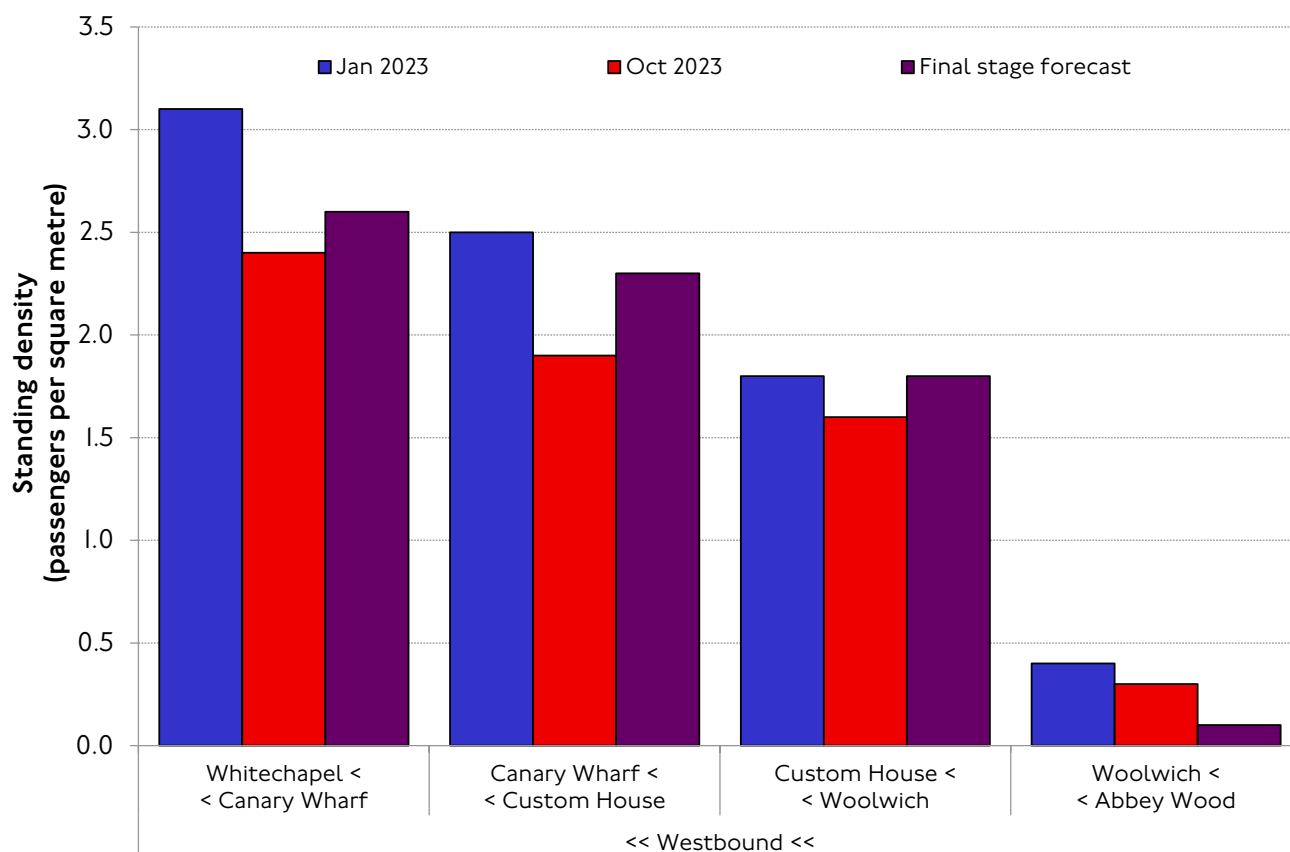
In general, as of October 2023, occupancy is similar to the forecasts at this stage of the opening, reflecting a well utilised service without major crowding issues.

Woolwich branch

The Woolwich branch is the tunnelled section of the Elizabeth line towards southeast London between Whitechapel and Abbey Wood.

Figure 8 shows the standing density on each link in this section in the westbound direction (the eastbound does not present any standing passengers) during the busiest hour of the mid-week morning peak, at various times since the line opened.

Figure 8 Standing density on the Woolwich branch of the Elizabeth line, busiest hour in the average mid-week morning peak, Jan 2023 and Oct 2023 versus modelled forecast.



Source: TfL Public Transport Service Planning.

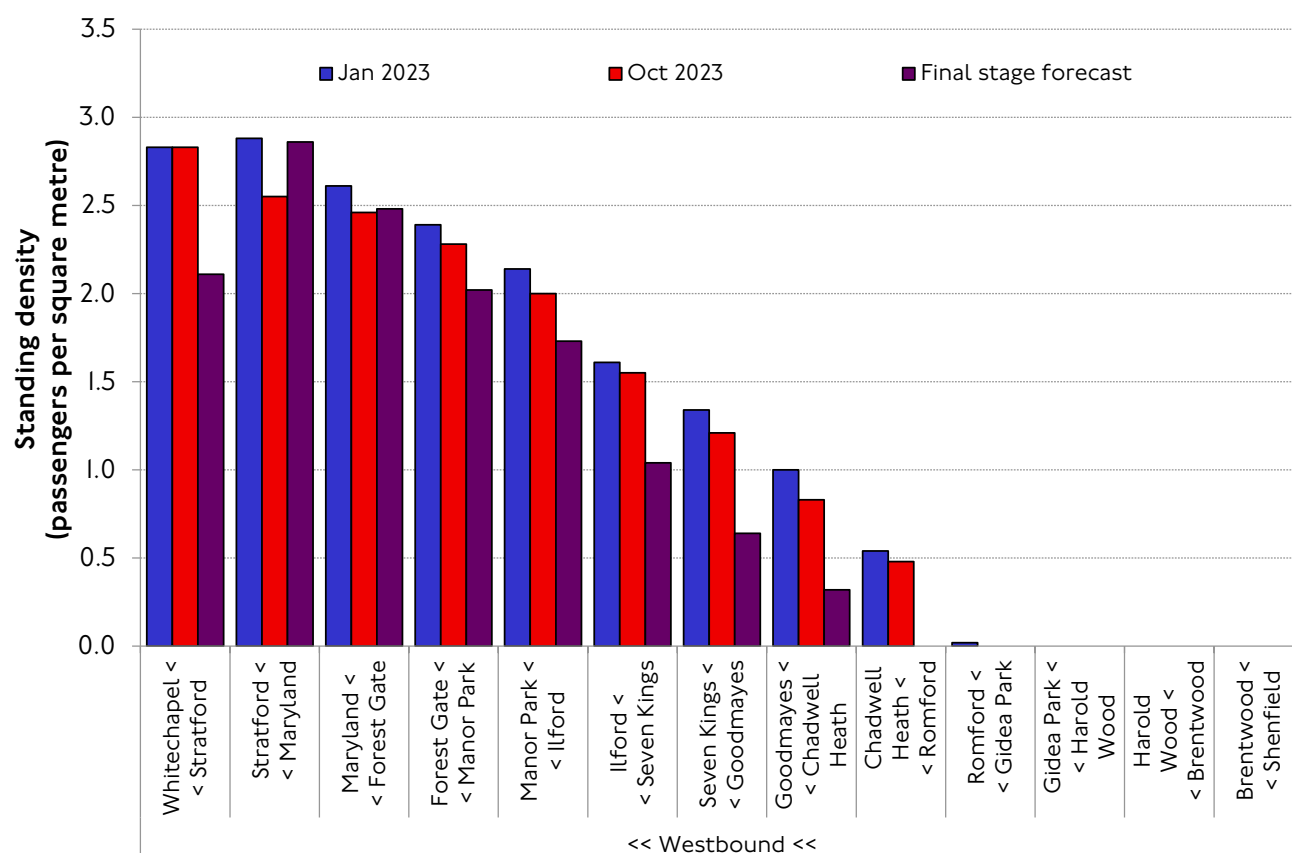
Occupancy in the Woolwich branch quickly builds up west of Abbey Wood, reaching slightly over three passengers per square metre after Canary Wharf.

Shenfield branch

The Shenfield branch is the section of the Elizabeth line towards Essex between Whitechapel and Shenfield. It mostly follows the alignment of the former TfL Rail services between Shenfield and Liverpool Street.

Figure 9 shows the standing density on each link in this section in the westbound direction during the busiest hour of the mid-week morning peak, at various times since the line opened.

Figure 9 Standing density on the Shenfield branch of the Elizabeth line, busiest hour in the average mid-week morning peak, Jan 2023 and Oct 2023 versus modelled forecast.



Source: TfL Public Transport Service Planning.

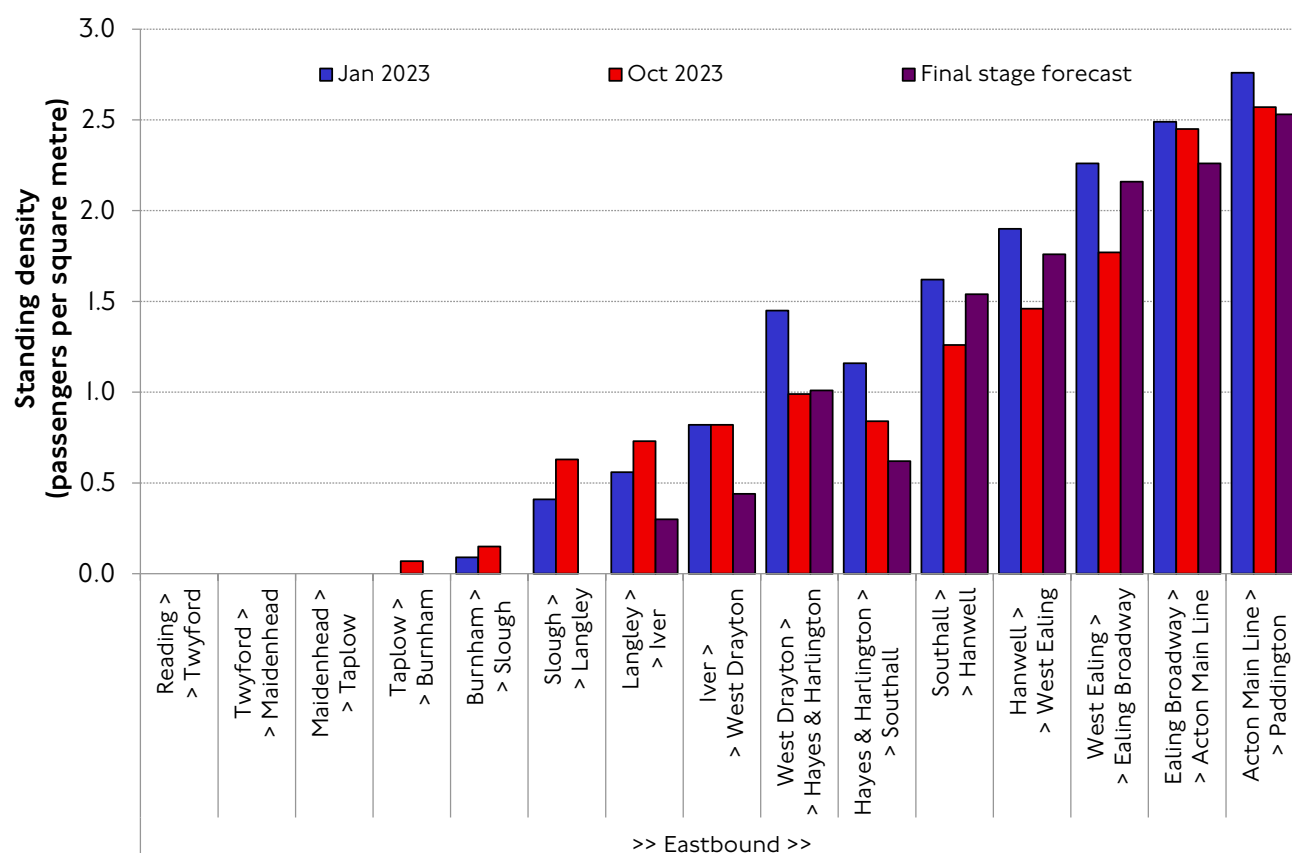
On this branch, too, demand gradually builds up westwards. Seats are usually available until Romford and standing densities steadily grow after that but do not exceed two passengers per square metre on average until after Ilford, and they never go beyond three people per square metre on average. All of this is largely in line with the expectations from the forecasts. The eastbound direction does not present any standing in the morning peak.

Reading branch

The Reading branch is the section of the Elizabeth line towards Berkshire between Paddington and Reading. It mostly follows the alignment of (and shares lines and stations with) existing Great Western Railway services into Paddington.

Figure I0 shows the standing density on each link in this section in the eastbound direction during the busiest hour of the mid-week morning peak, at various times since the line opened.

Figure 10 Standing density on the Reading branch of the Elizabeth line, busiest hour in the average mid-week morning peak, Jan 2023 and Oct 2023 versus modelled forecast.



Source: TfL Public Transport Service Planning.

On this branch occupancy is broadly as expected, too.

In this case demand slowly builds up eastward on the approach to Paddington. There are usually seats available as far as Burnham, and from then on standing densities grow steadily (save for a small drop at Hayes & Harlington, reflecting the additional capacity provided by the services from the Heathrow spur, which joins at that point) but only exceed two people per square metre after Ealing Broadway and never reach three people per square metre. The westbound direction does not present any standing in the morning peak.

Heathrow spur

The Heathrow spur is a short section of the Elizabeth line that links Hayes & Harlington on the main Reading branch with Heathrow airport, serving three airport terminals with two different railway stations. It follows the alignment and infrastructure of the former TfL Rail services (previously Heathrow Connect) and shares some of it with the competing Heathrow Express services into terminal 5.

This section does not present any crowding issues in the mid-week morning peaks and all services are operating on average with seats available. This likely reflects the fact that air travel demand (the main contributor to rail demand to the airport together with commuters) presents a different distribution with peaks at different times.

Connectivity and journey times

One of the key transformational impacts of the Elizabeth line is the improvement in public transport connectivity within the London and South East region. The new Elizabeth line services have cut journey times throughout the region and this has been followed by increases in travel demand, which have been largest where journey times have fallen the most.

Research shows that journey time is the most important driver of travel demand and the customer experience of passengers; and emerging TfL studies specifically on the Elizabeth line have shown that after nine months of operation of the Paddington to Abbey Wood services, a 10 per cent reduction in journey time led to a 6.4 per cent increase in demand (a journey time elasticity of -0.64). Furthermore, after only three months of operation on the Shenfield and Reading branches, even higher elasticities (of -0.90 and -0.92, respectively) were observed.

Reducing travel times is also a key benefit of transport projects since it allows passengers to spend their time more productively and free up time for other activities. This is particularly true for the Elizabeth line, where journey time savings and crowding relief (which also impacts generalised journey time) were the largest contributors to passenger and non-passenger benefits in the business case.

Expected journey time savings (unweighted generalised journey time)

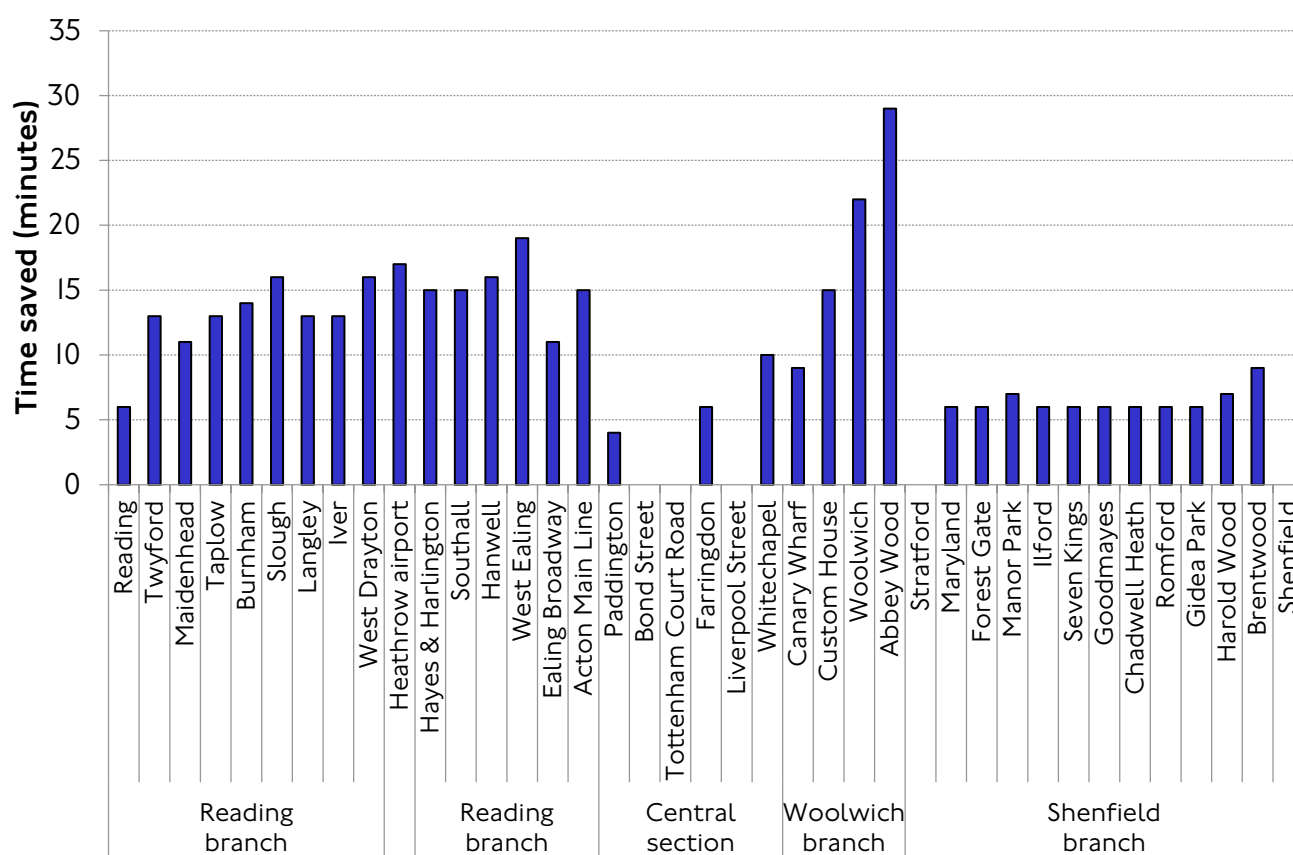
Generalised journey time is a useful connectivity metric that provides a rounded indication of the overall customer experience of a public transport user by considering not only the in-vehicle travel time between an origin and a destination but also the interchange times, waiting times and the impact of crowding and fares (through appropriate weighting). It is therefore the preferred way of measuring journey time improvements.

At this stage the full, weighted computation of this metric is not yet available for the Elizabeth line, and it will be picked up for analysis and comparison against the forecasts by subsequent studies. However, an unweighted version exists which uses some assumptions (such as random station arrival) and includes most elements (in-vehicle time, waiting time, interchange time) but not others like crowding or the impact of fares. This version is a good proxy to provide a sense of the scale of the journey time benefits being enjoyed by Elizabeth line passengers. This section looks at the early journey time saving impacts using this metric.

As a new regional line connecting areas outside London at both its ends through the city centre, the Elizabeth line has made a huge difference to the connectivity and journey times to and from the city centre.

As an example, figure 11 shows the change in unweighted generalised journey times to and from Tottenham Court Road station (at peak service) before and after the opening of the Elizabeth line.

Figure II Unweighted generalised journey time savings on the Elizabeth line to and from Tottenham Court Road during peak service after full opening.



Source: TfL Public Transport Service Planning.

Note: The times without the Elizabeth line assume the prior (stopping) service pattern and routing to destination. In some cases, other operators such as Heathrow Express, Greater Anglia and Great Western offer a faster journey time than the Elizabeth line for part of the journey.

Some features of interest are:

- The Elizabeth line has particularly improved journey times to central London from the southeast of the city (via the Woolwich branch) and Heathrow airport, with some other important journey time savings along the Reading branch, particularly in outer west London.
- While other origin and destination pairs (for example Tottenham Court Road to Bond Street, Liverpool Street or Stratford) have not seen any reductions in journey times, the Elizabeth line provides a new travel choice with an enhanced customer experience (with new, modern trains) that benefits both users of that and other lines thanks to the crowding relief on parallel routes (in the example above, the Central or the Jubilee lines).
- Furthermore, the Elizabeth line has unlocked latent rail demand on origin-destination pairs that did not have an efficient connection before, such as Tottenham Court Road to Farringdon, where passengers used to travel to nearby stations such as Chancery Lane or by other modes to avoid unattractive interchanges.

Besides the reduced travel times to central London, the Elizabeth line (in particular since the introduction of direct services from the outer branches through the central section) has also improved the connectivity to Heathrow airport, the largest airport in the region, for travellers across London and the South East region and in particular for those coming from east London and Essex.

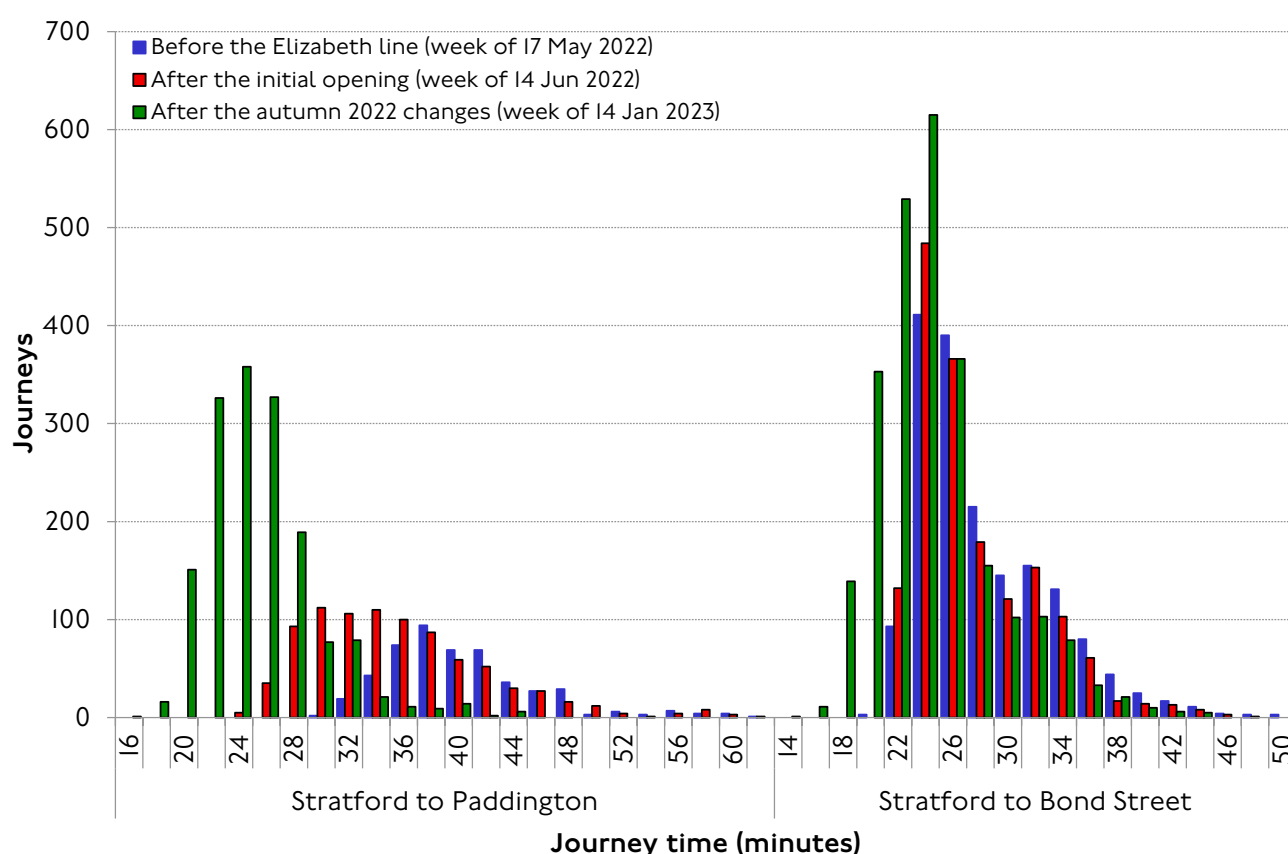
Observed journey times

In addition to the expected journey time savings discussed in the previous section, it is also possible to compare the distribution of actual journey times for specific origin and destination pairs using our Oyster database, which registers the actual time of tapping in and out on the network, as well as the number of passengers travelling.

Figure I2 illustrates, for two example origin-destination pairs, the impact of the opening of the Elizabeth line (note that these examples do not include the latest stage in May 2023, since the latest data is from January 2023) on three dimensions of travel:

- The average travel time between the origin and destination stations (shown as a ‘shift to the left’ of the peak of the distribution from longer to shorter journey times). In statistical terms, this can be seen as a reduction in the mean travel time.
- The reliability or consistency of that travel time (shown as a ‘thinning’ of the distribution as the variability of travel times reduces). In statistical terms, this can be reflected in a reduction of the standard deviation or other centrality measure.
- The increase in demand on that origin-destination pair (shown as an increase in the area covered by the bars of the histogram).

Figure I2 Distribution of journeys by actual journey time before and after the opening of the Elizabeth line, Stratford to Paddington and Stratford to Bond Street, Jan 2023 and Jun 2022 versus May 2022.



Source: TfL Data & Analytics, Technology & Data.

Future reports will expand this type of analysis and consider the demand in later stages of the phased opening as well as other representative origin and destination pairs.

Demand generation and abstraction

Like in any new transport project, the demand for the Elizabeth line would have originated from two main sources:

- Firstly, the new travel choices unlocked by the new services as well as the changes to the generalised cost of travel by different modes and routes would have attracted a proportion of trips formerly made by other means, either on other public transport services or by other modes (trip abstraction). Most abstracted trips are likely to have come from parallel public transport services (buses and rail) but some would have come from other modes, and when these were private motorised modes like cars, vans or motorcycles, this abstraction would have contributed to the Mayor's overall aim for 80 per cent of journeys in London to be made by active, efficient and sustainable modes by 2041.
- Secondly, the connectivity benefits of the new service would have also prompted the realisation of new trips that would not otherwise have been made (trip generation), thus contributing to the growth and economic success of London.

A key part of the longer-term evaluation of the Elizabeth line lies in understanding to what extent (how many trips, in what proportion) the current demand on the Elizabeth line stems from trip generation and trip abstraction, and for the latter, how other public transport services have been affected, for example in terms of freed-up capacity that could be filled up by latent demand and/or provide a better customer experience to passengers (for instance in terms of lower occupancy levels).

This section provides an overview of current estimates of trip generation and abstraction on the Elizabeth line. This assessment is still evolving because time is needed for demand patterns on the new services and for background demand factors to fully settle (in particular, in relation to the recovery from the coronavirus pandemic).

Overall demand abstraction and generation estimates

Measuring generation and abstraction is not straightforward. It requires information on what passengers would have done in the absence of the new service (counter-factual), reliable data about what actually happened, and the ability to link changes to a cause.

This is further complicated by other external factors such as population change, service changes (including disruptions from industrial action and changes to fares), the ongoing recovery from the pandemic and wider macroeconomic factors (like the increased cost-of-living pressures).

Figure I3 provides our best estimates of passenger volumes on the Elizabeth line by source at various stages of the phased opening. This is expressed in terms of passenger kilometres (as opposed to passenger journeys) because it is a better measure that considers the distance travelled and is therefore more closely aligned to revenue.

These estimates are calculated looking at all possible routes between each pair of stations and assessing whether people may have switched to the Elizabeth line for these journeys. Grouping these pairs by how much they are impacted by the Elizabeth line it is then possible to estimate the proportion of journeys that have switched, how many are new and the level of background growth.

Figure I3 Sources of patronage (passenger kilometres) on the Elizabeth line, Sep 2022, Jan 2023 and Sep 2023.



Source: TfL Public Transport Service Planning.

The main features are:

- As of September 2023, the largest share (37.8 per cent) of the Elizabeth line's demand was estimated to have been **generated or abstracted from other non-rail modes** (including buses). In this context generation includes new demand that did not exist prior to the line being open as well as 'accelerated pandemic recovery', that is, demand encouraged back onto the network after the pandemic more quickly than it would have otherwise without the Elizabeth line.
- After that, the next largest source of demand on the new line (27.5 per cent) were the former **TfL Rail** services. This was expected since these were the immediate predecessors of the Elizabeth line and shared much of the current alignment (east of Liverpool Street and between Paddington and Heathrow airport).
- Up to 16.3 per cent as of September 2023 demand was abstracted from other **London Underground** services, mostly the Central line (5.9 per cent), the Jubilee line (4.2 per cent), the Piccadilly line (2.8 per cent) and the Hammersmith & City and Circle lines (2.0 per cent).
- About 14.6 per cent of September 2023 demand on the Elizabeth line was estimated to have been abstracted from **National Rail** operators, in particular Heathrow Express (2.9 per cent), which runs parallel to the Paddington to Heathrow Terminal 5 Elizabeth line service, and Southeastern (2.8 per cent).
- Finally, smaller proportions of the Elizabeth line demand came from **other TfL rail** services, notably the DLR (3.5 per cent) and to a much lesser extent the London Overground (0.3 per cent).

- Looking at it **over time**, it is clear that the subsequent milestones in the line's opening triggered step increases in the amount of demand generation and mode shift, which continued and consolidated up to September 2023, but much more modest change among the other sources.

In interpreting these results it is important to note that during this period overall travel demand in London continued to increase as part of the pandemic recovery and this would have concealed some of the abstraction. Furthermore, some lines (notably the Jubilee, Central and the DLR) had timetable changes at some point through this period (partly in response to demand reductions prompted by the opening of the Elizabeth line) and this would have also affected the estimates. However, all in all there is clear evidence of mostly genuine abstraction from these services.

Demand generation on the bus network

As would have been expected of a transformative project like the Elizabeth line, the connectivity and journey time improvements of the new services have attracted users from a wide catchment area around the Elizabeth line stations, many of whom have chosen to use buses as feeder services to access these stations. As such, one of the key impacts of the new line has been the observed increase in bus patronage around most Elizabeth line stations (figure I4).

Between May 2022 (before the opening of the Elizabeth line) and June 2023 (after the implementation of the final timetable), bus boardings around stations on the Woolwich branch increased by 37 per cent, and on the Reading and Shenfield branches by 21 per cent. Bus demand growth around Elizabeth line stations on the central section is lower than the network average, which suggests some abstraction.

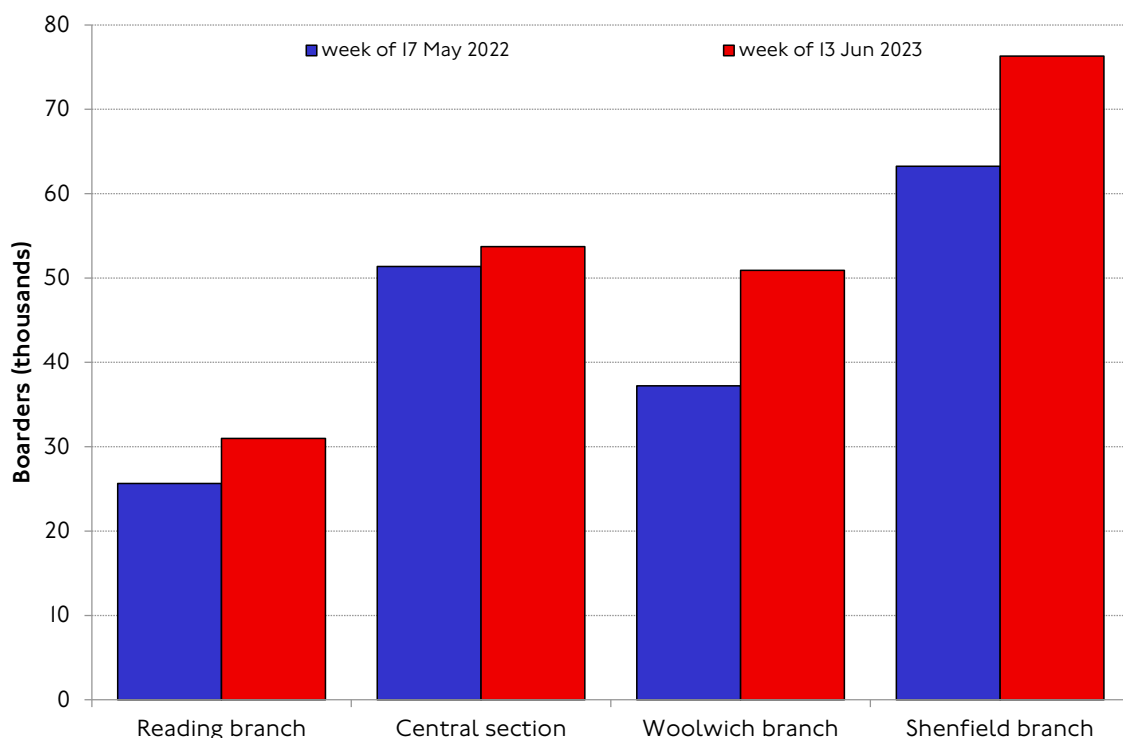
While a certain level of demand abstraction from buses was expected, particularly on routes that run mostly parallel to the Elizabeth line, further analysis has shown that this decrease is more than compensated by increases on other bus routes (mostly those directly feeding into the Elizabeth line stations).

Figure I5 shows the change in bus patronage across the same time period on four subsets of bus routes, classified according to their relationship to the Elizabeth line into parallel routes, feeder routes, mixed routes (where the parallel/feeder distinction is blurry), and a control group of routes considered largely unaffected by the Elizabeth line.

Note that this analysis has some limitations, such as the presence of several other confounding factors like changes to bus services (some of them a consequence of the Elizabeth line), changes in bus network performance, and wider impacts from the pandemic recovery. However, some of these are partially accounted for with the use of the control group, and the results nonetheless present a clear picture, namely:

- As bus patronage continued the post-pandemic recovery (with a net increase of 6.2 per cent on the control group), demand on routes parallel to the Elizabeth line declined in relative terms (that is, has recovered less than the control group, with only a 3.9 per cent increase over the same period).
- On the flip side, there has been a much larger increase in bus patronage on feeder bus routes (8.0 per cent) and mixed routes (also 8.0 per cent), suggesting a small net bus demand generation (estimated at 0.4–0.5 per cent of current total bus journeys) related to the Elizabeth line opening.

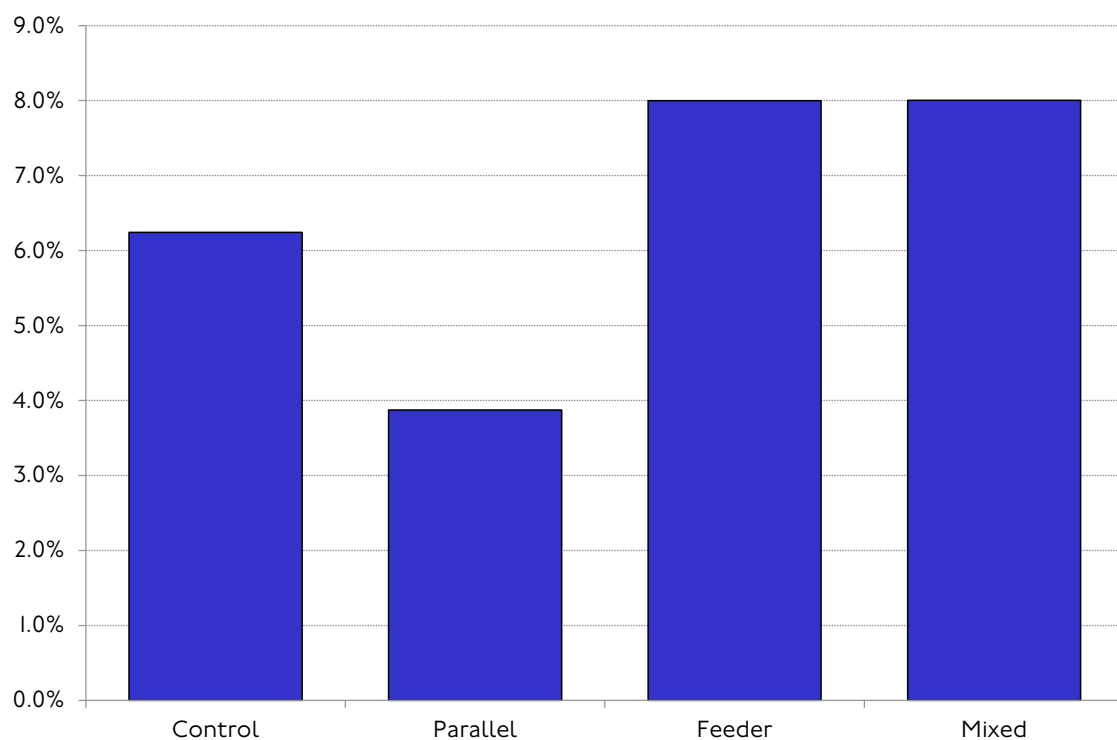
Figure I4 Bus boarders around Elizabeth line stations within Greater London, Tuesday-Thursday average, week commencing 12 Jun 2023 versus week commencing 16 May 2022.



Source: TfL Public Transport Service Planning.

Note: In this analysis, the Reading branch is considered as far as Hayes & Harlington (West Drayton is excluded because it is only served by one low-frequency bus) and the Shenfield branch to Harold Wood.

Figure I5 Change in bus patronage by route type, Tuesday to Thursday average, week commencing 12 Jun 2023 versus week commencing 16 May 2022.



Source: TfL Public Transport Service Planning.

Demand generation on the rail networks

Another observed impact of the Elizabeth line is the increase in passenger demand at many of the existing stations which are now also served by Elizabeth line services. This is particularly noticeable in central London.

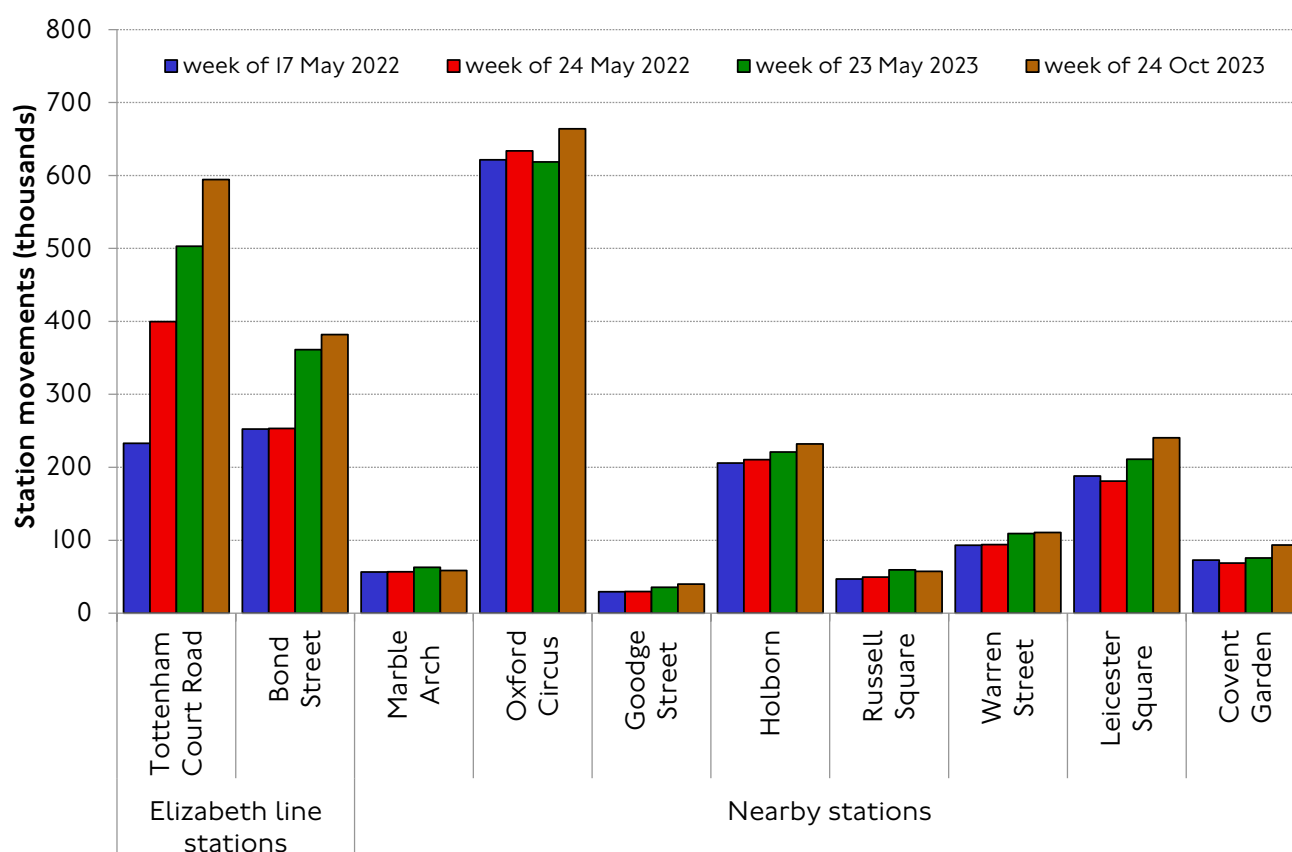
While a proportion of this 'new' demand on existing stations is expected to be abstraction from other lines, the evidence suggests that a lot of the 'new' demand seen at these stations does not seem to have been offset by reductions on bus patronage or rail demand at nearby stations, and that in fact it could reasonably be considered genuine demand generation prompted by the Elizabeth line.

This section explores these trends in each of the key London areas served by the Elizabeth line using new analysis based on average mid-week station movements.

West End

Figure I6 shows total station movements (entries, exits and interchanges) on an average mid-week day at Tottenham Court Road, Bond Street and a number of other London Underground stations in the proximity of these two Elizabeth line stations.

Figure I6 Total movements (entries, exits and interchanges) per day on stations in the West End around Elizabeth line stations, Tuesday-Thursday average, weeks of 17 May 2022, 24 May 2022, 23 May 2023 and 24 Oct 2023.



Source: TfL Public Transport Service Planning.

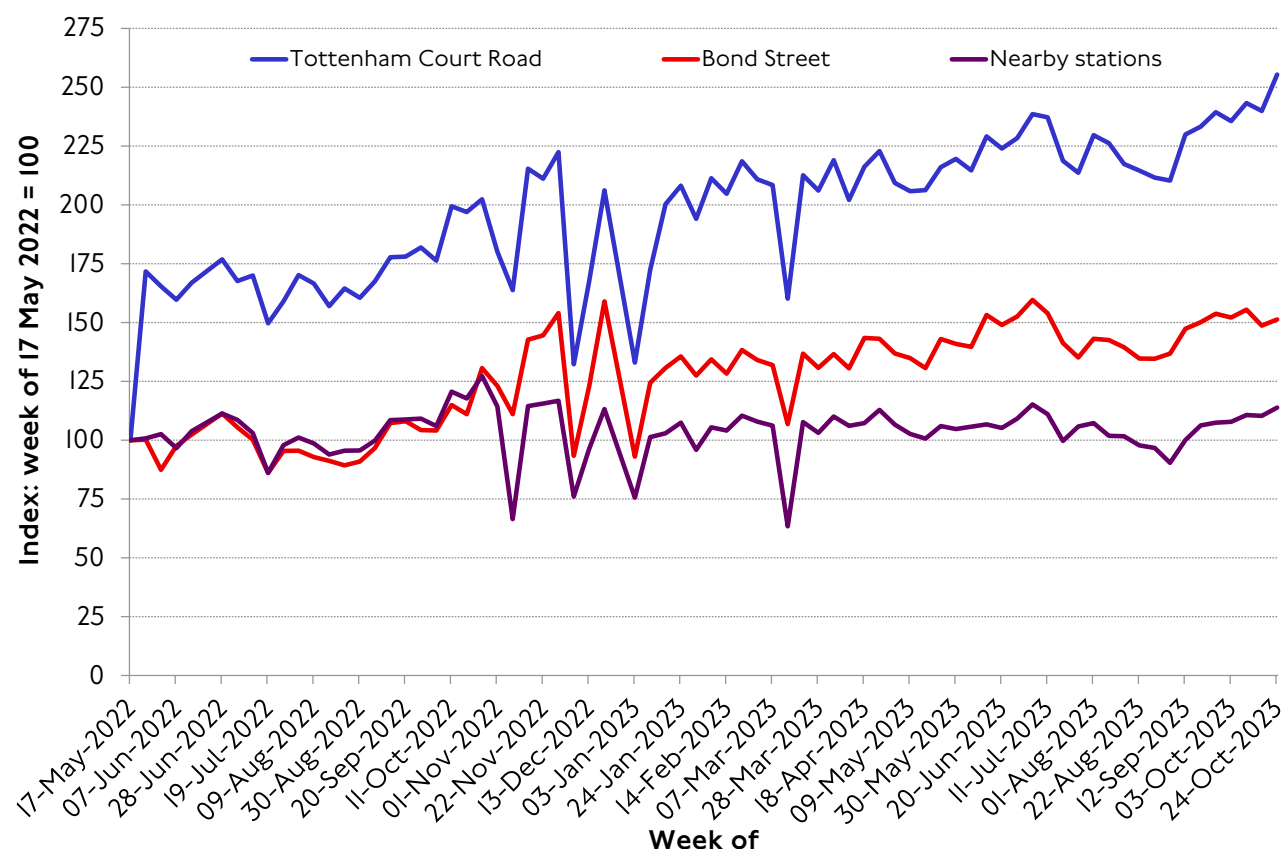
The main feature is a very significant increase in demand at Tottenham Court Road following the opening of the Elizabeth line (around 170,000 more entries, exits and interchanges per mid-week day) and a similar trend after the start of services to Bond

Street station in autumn 2022 (an additional 110,000 entries, exits and interchanges per mid-week day six months before and after it opened).

At the same time, there is very little change in demand in any of the other stations (save for seasonal effects and the ongoing pandemic recovery), and mostly with small increases across all stations, which suggests that there was little net displacement of demand from nearby stations to the two new Elizabeth line stations following the inauguration and implies a net demand generation effect.

Figure 17, which shows indexed change in total daily station movements since the opening of the Elizabeth line at the two Elizabeth line stations and at all the nearby stations combined, is another way of illustrating this net demand generation impact, where it is clear that demand at the nearby stations did not decrease that much since the opening of the Elizabeth line while demand on the Elizabeth line stations (particularly Tottenham Court Road) has been much higher.

Figure 17 Change in daily station movements on Elizabeth line stations in the West End compared to nearby stations in their vicinity, May 2022-Oct 2023.

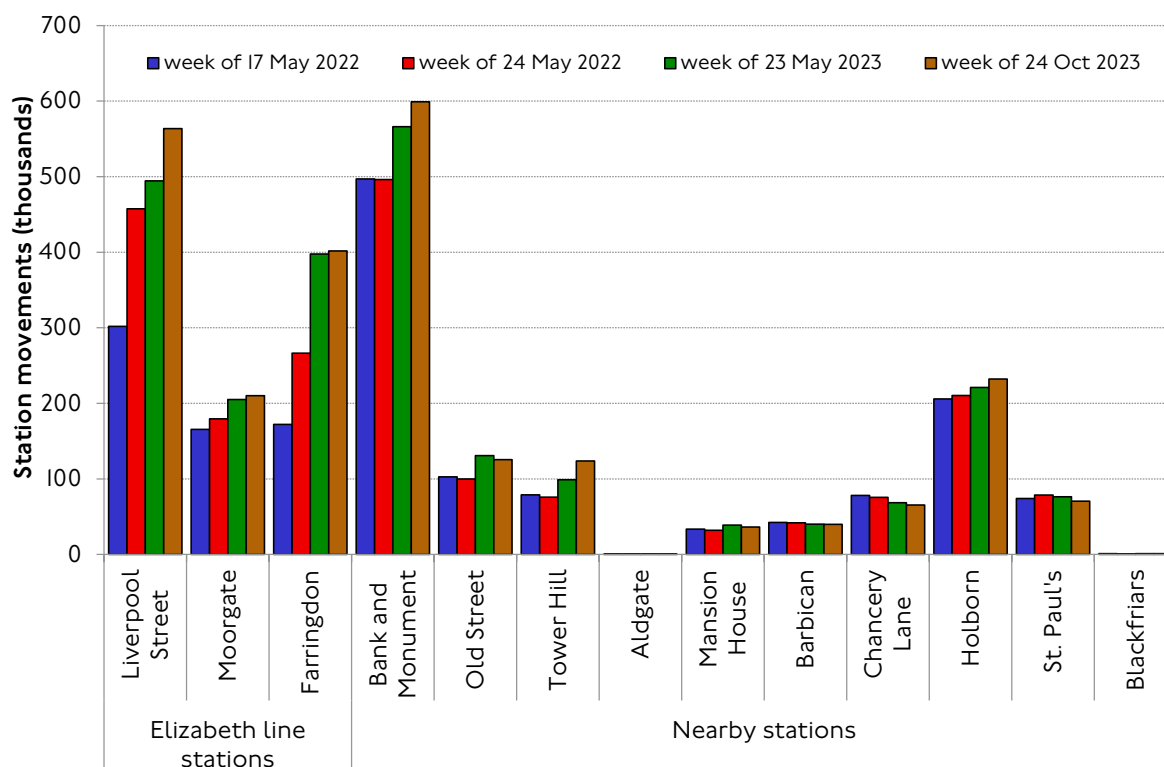


Source: TfL Public Transport Service Planning.

City

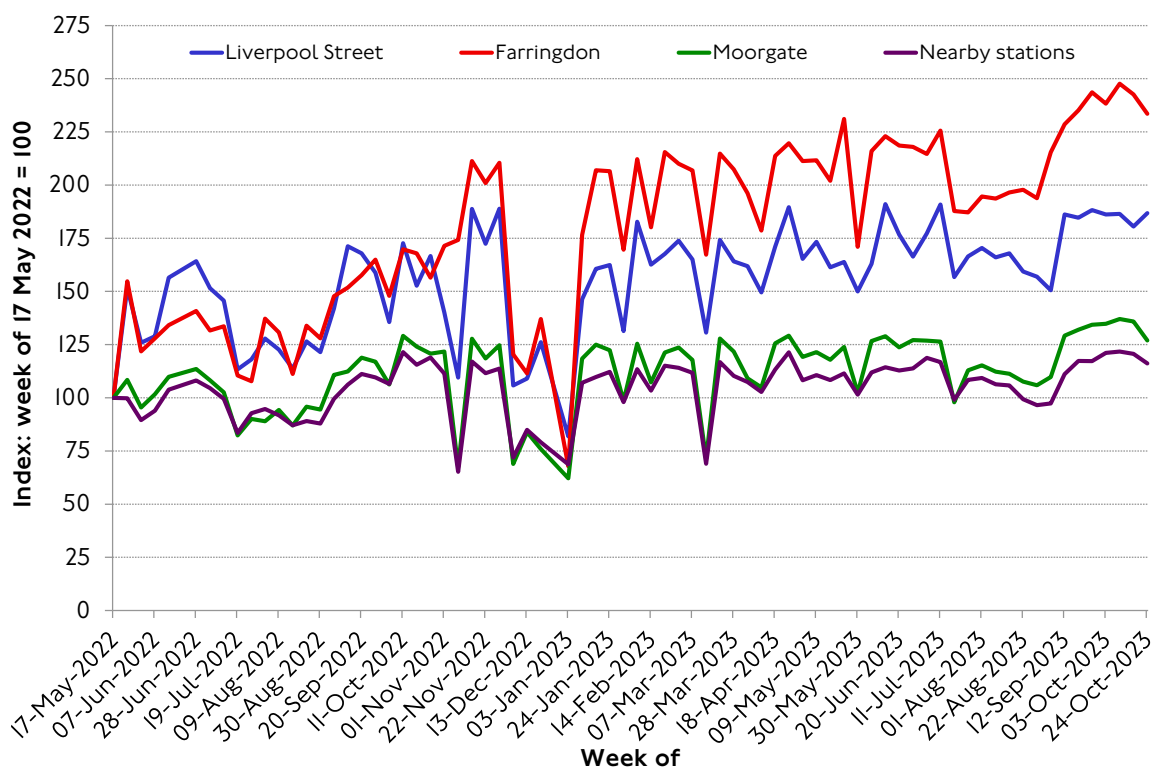
Similar conclusions can be drawn for stations in the City (see figures 18 and 19):

Figure I8 Total movements (entries, exits and interchanges) per day on stations in the City around Elizabeth line stations, Tuesday-Thursday average, weeks of 17 May 2022, 24 May 2022, 23 May 2023 and 24 Oct 2023.



Source: TfL Public Transport Service Planning.

Figure I9 Change in daily station movements on Elizabeth line stations in the City compared to nearby stations in their vicinity, May 2022-Oct 2023.



Source: TfL Public Transport Service Planning.

The opening of the Elizabeth line prompted a step increase in station movements at Liverpool Street (around 150,000 entries, exits and interchanges per mid-week day), Farringdon (around 130,000) and to a lesser extent Moorgate, with little change (but mostly small increases) at nearby stations.

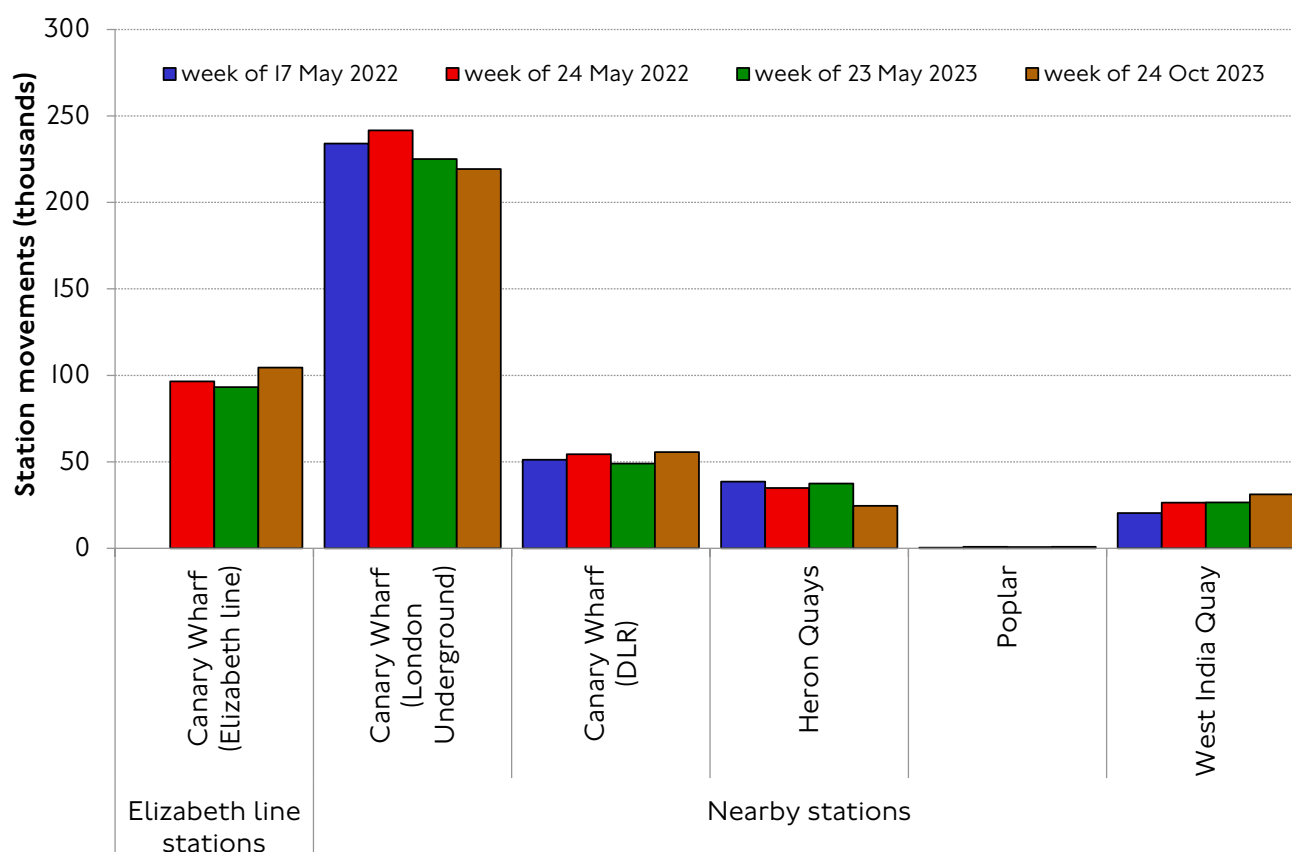
After the start of direct services from the outer branches to the central section in autumn 2022, demand on Liverpool Street (hitherto a de facto eastern terminal on the Elizabeth line, requiring interchange to continue travelling on the line) slightly reduced, but at the same time entries and exits at Farringdon increased relatively more.

Isle of Dogs

The situation in the Isle of Dogs area is slightly different because the Elizabeth line station at Canary Wharf has its separate building and gate lines and is not connected to the pre-existing stations, therefore comparisons are of a different nature.

Figure 20 shows that there was little change in demand after the opening of the Elizabeth line on most nearby stations but mostly small increases, with 'new' demand on the Elizabeth line station of a much larger order of magnitude.

Figure 20 Total movements (entries, exits and interchanges) per day on stations in the Isle of Dogs around Canary Wharf's Elizabeth line station, Tuesday-Thursday average, weeks of 17 May 2022, 24 May 2022, 23 May 2023 and 24 Oct 2023.

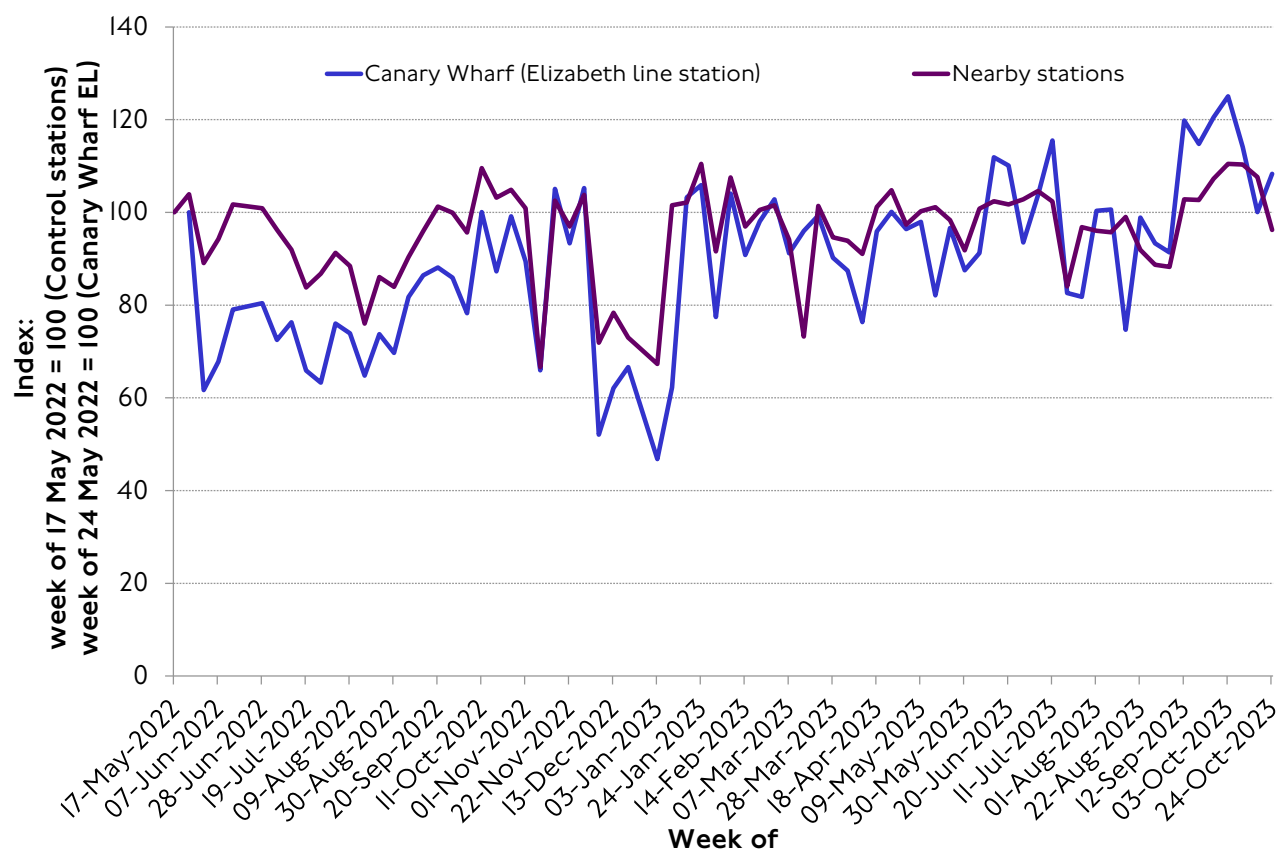


Source: TfL Public Transport Service Planning.

Figure 21 looks at these trends over time. Note that the base for the Canary Wharf Elizabeth line station index is the first week of operation in May 2022, given that this station was not open beforehand. This differs from the base for nearby stations.

The main feature here is that, despite seasonal variations, demand on both the Elizabeth line and nearby stations has been fairly static over time compared to their respective baselines, with demand on the new Elizabeth line station only clearly growing faster than the nearby stations in recent weeks in September and October 2023.

Figure 21 Change in daily station movements at Canary Wharf's Elizabeth line station compared to nearby stations in its vicinity, May 2022-Oct 2023.



Source: TfL Public Transport Service Planning.

Note: The base for the index on the Canary Wharf Elizabeth line station is week commencing 24 May 2022, but for the nearby stations it is week commencing 17 May 2022.

Woolwich

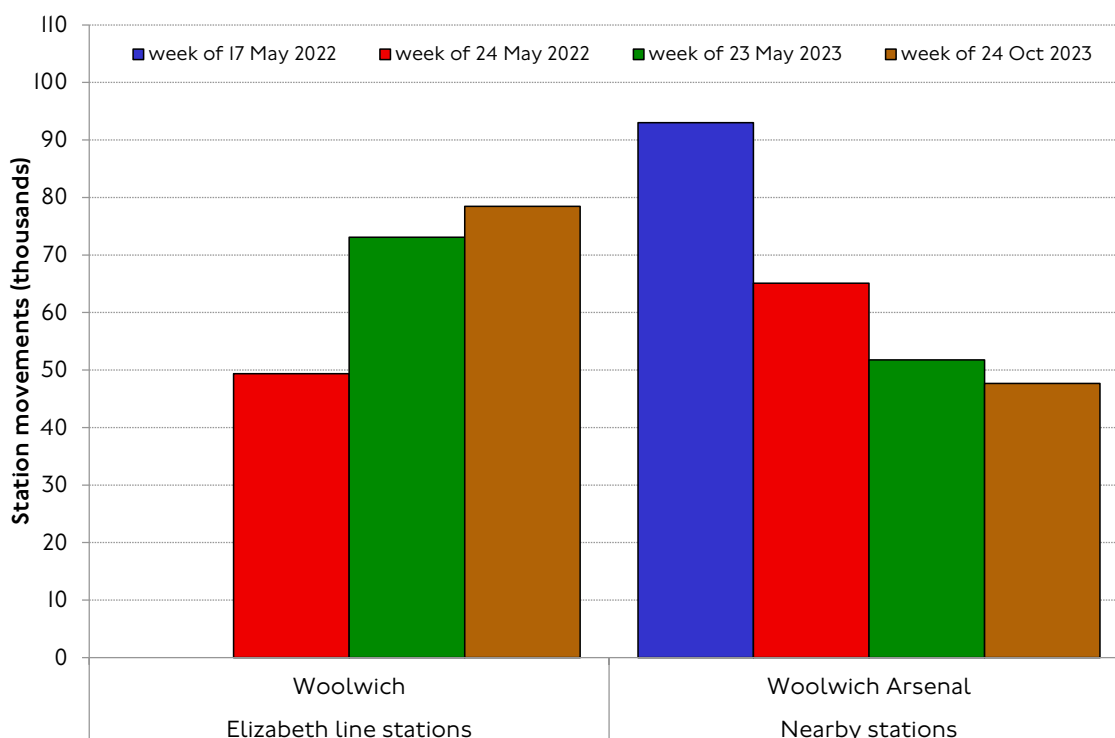
The case of Woolwich is special because it was not particularly well connected by rail before the Elizabeth line.

Figure 22 shows that in this case what happened after the opening of the Elizabeth line was a net reduction in the use of the nearby Woolwich Arsenal DLR station (by about 30 per cent, which corresponds to some 30,000 entries, exits and interchanges per mid-week day), but at the same time the demand on the new Elizabeth line station was much higher (almost 50,000 station movements per mid-week day).

Figure 23 looks at it over time. Like at Canary Wharf, since the Woolwich Elizabeth line station did not exist before the base for the index in this graph is the first week of operation, which differs from the index for the nearby station.

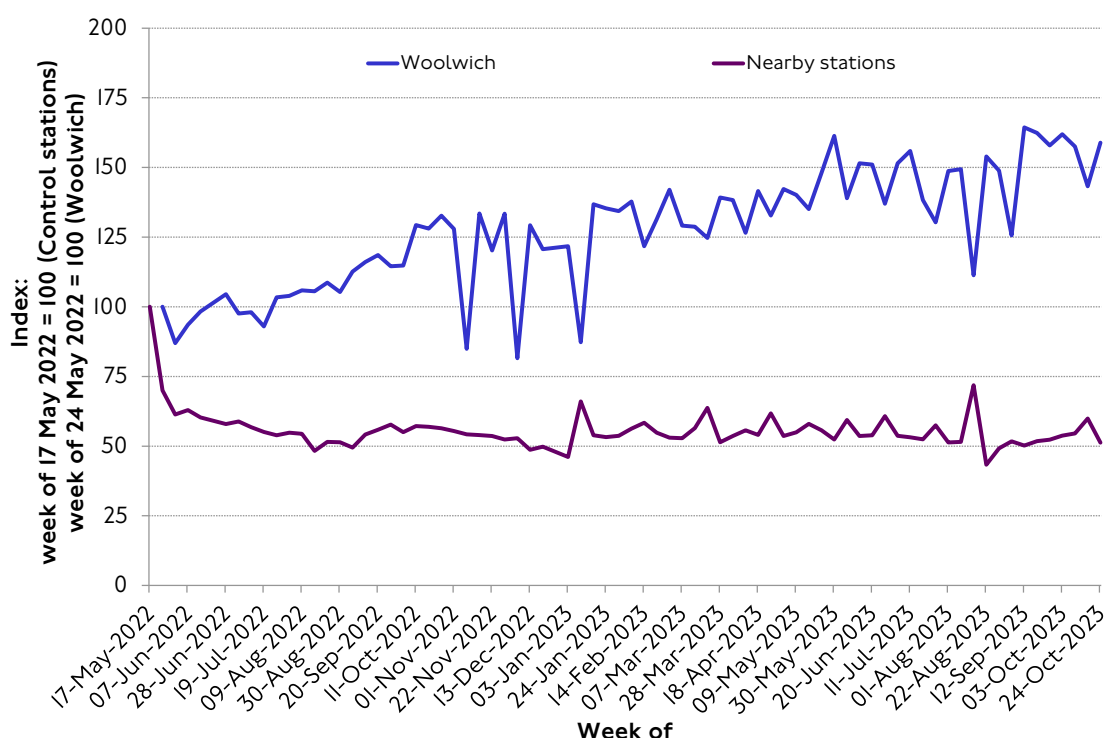
Although not shown in the graphs, a similar situation was observed at Custom House, where the enhanced connectivity to central London provided by the Elizabeth line led to a significant shift in demand from the pre-existing DLR station to the Elizabeth line.

Figure 22 Total movements (entries, exits and interchanges) per day on stations in Woolwich around Woolwich's Elizabeth line station, Tuesday-Thursday average, weeks of 17 May 2022, 24 May 2022, 23 May 2023 and 24 Oct 2023.



Source: TfL Public Transport Service Planning.

Figure 23 Change in daily station movements at Woolwich's Elizabeth line station compared to nearby stations in its vicinity, May 2022-Oct 2023.



Source: TfL Public Transport Service Planning.

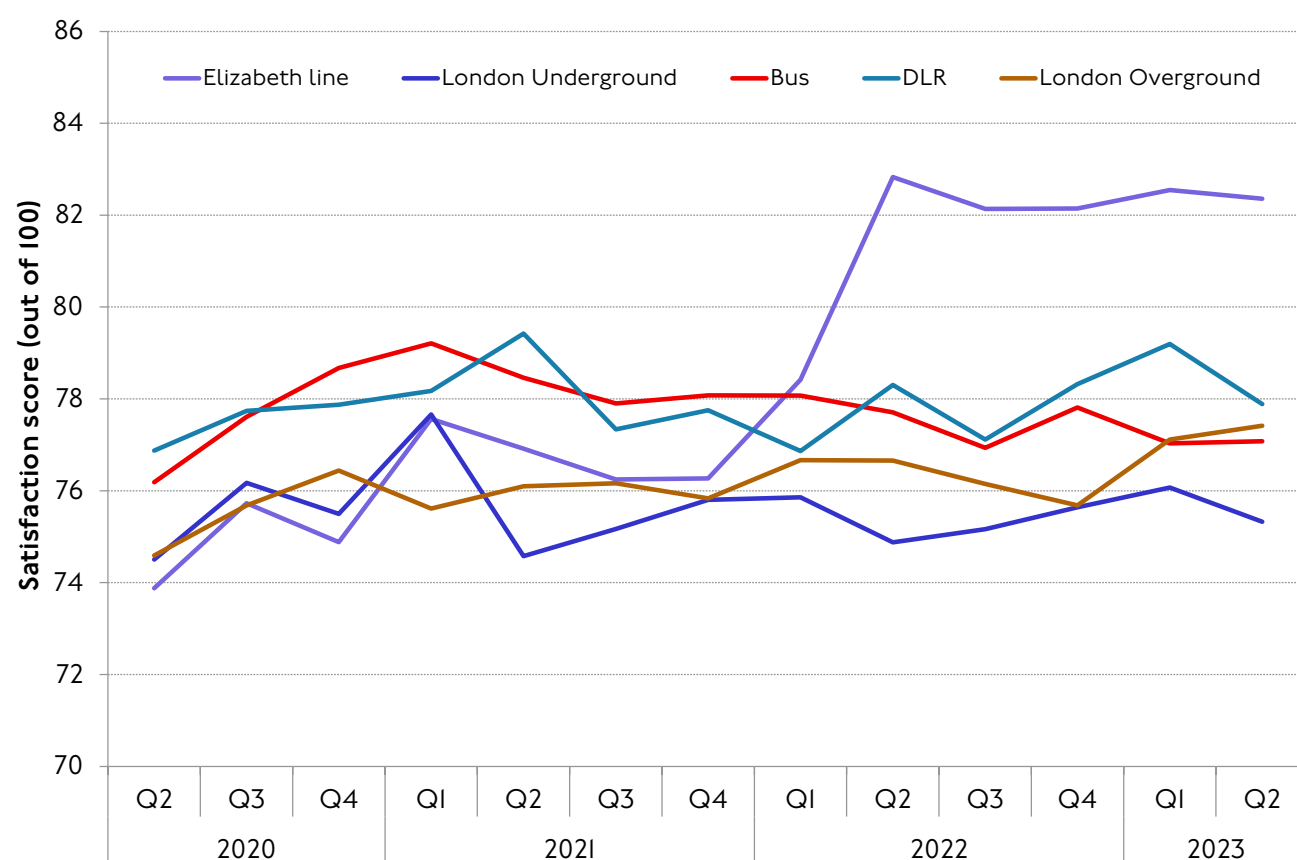
Note: The base for the index on the Woolwich Elizabeth line station is week commencing 24 May 2022, but for the nearby stations it is week commencing 17 May 2022.

Customer satisfaction

The high levels of demand on the Elizabeth line are perhaps the best proof of the very positive reception that the new railway has had among its users in the London and South East region.

But there is further evidence that the Elizabeth line is a game-changer in our customer's experience of public transport in London. Data from our Customer Pulse satisfaction survey (figure 24) shows that since its opening in the second quarter of 2022 the Elizabeth line has consistently been scoring high levels of overall satisfaction which are well above those already consistently high scores on all other TfL public transport modes.

Figure 24 Overall satisfaction with the Elizabeth line compared to other TfL services, by quarter, Q2 2020 (Apr-Jun)-Q2 2023 (Apr-Jun).



Source: TfL Customer Insight, Customer.

The Elizabeth line scores highest of all TfL modes not only in overall satisfaction but also on most of the individual scores on specific aspects of the customer experience, notably on journey time, train comfort, cleanliness and information provided.

Interestingly, the east section (Shenfield branch) scores slightly higher than the central section and the Woolwich branch (combined) and this in turn slightly higher than the west sections (Reading branch and Heathrow spur) in most satisfaction metrics.

Conclusions and next steps

The trends presented in this report cover the initial impacts on travel of what is much more than just a new railway, since the Elizabeth line will continue to have impacts on regeneration, connectivity, homes, jobs and the wider UK economy for years to come.

With a project of this scale, comprehensive monitoring, evaluation and benefits realisation work will need to be ongoing for years as the wider impacts of the scheme are fully realised and embedded.

This report should therefore be read as one of a series that TfL and the Department for Transport (partners in the Crossrail project that gave rise to the Elizabeth line) will undertake and commission over the coming years to understand all impacts of this scheme as and when these are realised and appropriate data is available for a robust evaluation.

Travel in London reports will continue to focus on the travel impacts and the evolving trends as well as on the contribution of the Elizabeth line to the Mayor's aims for transport as set out in the Mayor's Transport Strategy, such as the 2041 target for 80 per cent of trips in London to be made by active, efficient and sustainable modes, the Vision Zero for road danger and the ambition for a net zero carbon city by 2030.

TfL will also continue to keep the Elizabeth line services under constant review as demand settles following the latest timetable change in May 2023 and the ongoing recovery from the coronavirus pandemic to ensure that the benefits of this new line are optimised and enjoyed by all Londoners.