steer davies gleave

Estimates of Station Usage 2016-17

Methodology and Validation Report
21st November 2017

Office of Rail and Road

Our ref: 22670603
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Introduction

1. This report explains the information contained within the Office of Rail and Road's (ORR) Estimates of Station Usage dataset ('*Estimates of Station Usage 2016-17.xlsx'*) and provides guidance on the methodology followed during the process of creating this dataset for the financial year 2016/17. It also includes a summary of the validation checks undertaken as part of the production process.
2. The Estimates of Station Usage dataset (referred to in the rest of this report as "Station Usage dataset") consists of estimates of the total numbers of people:
   - Travelling from or to the station (entries & exits); and
   - Interchanging at the station (interchanges).
3. Information is given for all the national rail stations in England, Scotland, and Wales based on tickets sales data and are the most recent in a series produced for the ORR since 1997/98. The spreadsheet containing the estimates is in a similar format to those published in previous years.
4. The statistics on usage are necessarily estimates based on a methodology which utilises data on ticket sales. This is then supplemented with other data and adjusted to more appropriately represent passenger movements across the national rail network. The methodology is reviewed annually and enhancements to the methodology are specified and implemented to address known issues. Often these enhancements utilise new sources of data that were not previously available.
5. In total entries and exits have increased by 0.4% to 2.939bn in 2016/17 from 2.927bn in 2015/16.

Methodology

6. The Station Usage dataset is generated from the Origin Destination Matrix (ODM), a comprehensive matrix of rail flows between stations throughout Great Britain (GB). This is also produced by Steer Davies Gleave, and based largely on data produced for the MOIRA2.2 rail planning tool which itself is derived from LENNON, the rail industry's ticketing and revenue system. **This does place some limitations on the data of which users should be aware and these are detailed in this report.**
7. The MOIRA2.2 matrix provides an estimate of journeys on the GB (England, Scotland and Wales) rail network for the duration of a financial year (April 1st – March 31st). It includes all journeys associated with point to point flows and includes overlays ("infills") to reflect travel on Travelcards in the London area, Passenger Transport Executive (PTE) sponsored tickets in the major urban areas outside London and travel on some selected 'Rover/Ranger' products (e.g. Anglia Plus). The methodologies for the production of the PTE and 'Rover/Ranger' infills included in MOIRA2.2 were largely developed as part of Steer Davies Gleave's work on the ODM.
8. The production of the ODM and the Station Usage dataset involves making a number of further adjustments to the MOIRA2.2 matrix to address known issues across the network that impact on the Station Usage estimates. The adjustments included in the Station Usage dataset are:

- Allocation of demand associated with tickets sold to 'London Terminals' between those terminals;
- Allocation of demand between individual stations within station groups outside central London. For example, where tickets are sold to/from 'Dorking BR' it is necessary to estimate how these journeys are distributed between Dorking West, Dorking and Dorking Deepdene stations;
- Allocation of demand between stations to account for specific known issues, for example adjustments are made to account for situations where passengers buy season tickets from a station other than the one they generally travel from, in order to allow additional flexibility. For example the cost of a season ticket to central London is the same from Hockley as from Southend Victoria so a passenger would buy a ticket for travel to/from Southend Victoria although normally use Hockley as this provides additional flexibility to travel to Southend Victoria.

Methodological Development

9. Consistency with past datasets is important to enable comparisons to be made over time. However, stakeholders have indicated that they are keen to see improvements, even where this reduces consistency with historic data, provided any changes are clearly explained.
10. In the 2016/17 Station Usage dataset the following methodological improvements were made:
    - Amendment to the allocation of a subset of 'London BR' journeys (see paragraphs 3.3 - 3.7);
    - Updated application of 'Season ticket journey allocation' adjustments (see paragraphs 3.8 - 3.11); and
    - Updated allocation of journeys between selected Group Stations following implementation of recommendations from a programme of passenger count surveys at selected stations (see paragraphs 3.12 - 3.13).

Limitations of the data

11. In the absence of a fully gated system or comprehensive count data, the use of ticket sales data (LENNON) as the primary source of the Station Usage dataset is the best approach available. In particular its national coverage makes it suitable as a basis for the production of Official Statistics such as those reported by the ORR.
12. Nonetheless, this data does have weaknesses when utilised for this purpose and, although some of these are catered for in the methodology, the user should be aware of these acknowledged limitations and bear these in mind when using the data. The key limitations are outlined in Chapter 1 with more extensive discussion of some aspects of the limitations of the dataset included in Appendix E.

1 Introduction

Overview

1.1 Steer Davies Gleave was appointed by the Office of Rail and Road[1] (ORR) to produce the Estimates of Station Usage dataset for 2016/17, continuing the historic series that dates back to 1997/98. This report accompanies the Estimates of Station Usage dataset for 2016/17 and provides details of the process and outputs used to produce the statistics on behalf of the ORR. In the rest of this report the Estimates of Station Usage dataset is referred to as the "Station Usage dataset."

1.2 The Station Usage dataset is generated from the Origin Destination Matrix (ODM), a comprehensive matrix of rail flows throughout England, Scotland and Wales, also produced by Steer Davies Gleave, and based on data produced for the MOIRA2.2 rail planning tool which itself is derived from LENNON, the rail industry's ticketing and revenue system.

1.3 Steer Davies Gleave have provided the ORR with an MS Excel file, ('*Estimates of Station Usage 2016-17.xlsx*') containing entries, exits and interchanges made at stations throughout England, Scotland and Wales, for the financial year 1st April 2016 to 31st March 2017. For the entries and exits, figures are split into the three main categories of the available ticket products (Full, Reduced, and Season).

1.4 The underlying methodology adopted by Steer Davies Gleave in the production of the Station Usage data is consistent with that adopted by Resonate[2] in the production of the Station Usage dataset in the years prior to 2011/12. A number of updates to the methodology have been implemented by Steer Davies Gleave over recent years which have been documented in this and previous annual reports. A summary of the methodological updates made by Steer Davies Gleave is provided in Appendix A.

Use of the Station Usage dataset

1.5 When using the Station Usage data, particularly when comparing with previous years, it is important to be aware of:

- Methodological improvements made to the dataset over time which can impact consistency between years;
- Limitations of the data and specifically factors e.g. some ticket sales not being included, that may mean that demand on particular flows and at stations is underestimated or overestimated; and
- Factors which can affect reporting of entries and exits.

Methodological improvements to the dataset

1.6 Improvements to the dataset in 2016/17 are set out in Chapter 3. A summary of improvements made over recent years are further detailed in Appendix A. The ORR continues to work with stakeholders and its own consultants to improve the robustness of the dataset by

[1] The Office of Rail Regulation was renamed the Office of Rail and Road from 1st April 2015.

[2] Resonate were formerly known as 'DeltaRail' and changed their name in August 2016.

implementing methodological changes that demonstrate value and address acknowledged issues.

Limitations of the data

1.7 In the absence of a completely gated system that allows a complete recording of flows through stations or comprehensive and robust count data the use of ticket sales data, LENNON, as the primary source of the Station Usage dataset as described in the following chapter is the best approach available. In particular its national coverage makes it suitable as a basis for the production of Official Statistics such as those reported by the ORR.

1.8 However, this data does have weaknesses when utilised for this purpose and, although some of these are catered for in the methodology, the user should be aware of these acknowledged limitations. The key limitations are outlined below. More extensive discussion of some aspects of the limitations of the dataset is included in Appendix E.

- **Non-Point to point tickets** – An overarching issue is the inherent difficulty and uncertainty associated with estimating the number of journeys associated with many rail products which do not simply represent point to point single or return journeys and furthermore the distribution of those journeys. This is a particular issue for the London Travelcard Area and Passenger Transport Executive (PTE)[3] areas. The Origin Destination Matrix (ODM) does include 'infills' that are estimated in order to account for journeys made on many of these products;
- **Concessionary travel** – Transport for London (TfL) and most PTEs subsidise some form of free travel for certain types of users including those over a certain age, students and those with disabilities. This creates a substantial additional element of demand which is very difficult to include in the ODM as information on the level and distribution of journeys associated with these free travel products is not recorded and will not even have point of sale information. The current approach to this in the ODM is to include this demand where data has been made available by TfL/PTEs which would generally be estimates based on surveys;
- **Non-LENNON Sales** – A significant proportion of sales is either not passed directly through LENNON (sold at non-railway sales points) or is included in LENNON in a format which requires additional processing and assumptions i.e. is not associated with a station to station flow;
- **Group stations** – Many products to major destinations are sold with the origin or destination as a group of stations (e.g. London Terminals, Manchester BR stations).

[3] There are six metropolitan counties in England. These are Greater Manchester, Merseyside, South Yorkshire, Tyne and Wear, West Midlands, West Yorkshire. Formerly, each of these areas had a Passenger Transport Executive (PTE), which was a local government body with public transport responsibilities. They were accountable to Integrated Transport Authorities (ITAs), which were formerly known as Passenger Transport Authorities (PTAs) prior to 2008 and the Local Government Act 2008. Following enactment of the Local Democracy, Economic Development and Construction Act 2009, all Integrated Transport Authorities have now been reformed into Combined Authorities, some with a larger geographic coverage than the ITA they replace. Some Combined Authorities (Greater Manchester, Merseyside, North East, South Yorkshire) continue to have a free-standing transport executive, whilst in others (West Midlands and West Yorkshire) the transport executive has been incorporated within the Combined Authority. In Scotland the Strathclyde Partnership for Transport is the equivalent body covering the region of Strathclyde. For convenience, in this report we continue to refer to these seven areas as PTEs.

Current industry data does not distinguish between the component stations and therefore a split between these stations has to be estimated during the production of the ODM; and

- **Ticketless travel** – Journeys associated with ticketless travel are not included in the datasets but as with journeys made on other products excluded from the datasets, some journeys would be observed in passenger counts. This is likely to be an issue on some flows and in some areas where ticketless travel is significant. As more stations have become gated over time and rail operators focus on revenue protection activities this is likely to be less of an issue than in the past in contributing to a shortfall in journeys. Finally, there is a strong argument that it is inappropriate to include ticketless travel in the Station Usage dataset as its purpose is to record bona-fide journeys on the rail network and inclusion of ticketless travel could distort business cases for new investment where these are reliant on Station Usage data.

1.9 It is important to remember that in aggregate the underlying data, from LENNON, is a rich and comprehensive data source and importantly covers the entirety of Great Britain. The issue is that when using the data source (in particular for Station Usage statistics) the data is being pushed significantly beyond what it was originally designed for which was primarily to report and allocate revenues across train operators.

Factors which can affect reporting of entries and exits

Adverse Weather and Consequential Impacts

1.10 Cases of extreme adverse weather may cause disruption to normal railway operations and can impact on travel patterns. The landslip and subsequent temporary line closure at Armathwaite on the Settle-Carlisle line in February 2016 is an example of this.

Gating Schemes

1.11 Installation of ticket gates can significantly affect not only the usage figures at that station, but also those at neighbouring stations. The gates help to ensure that customers purchase tickets, but customers may also alter their travel patterns to avoid gated stations. We would expect travel patterns to be most affected in the months following the installation of the gates.

Change in Service Pattern

1.12 Alterations in service frequency or stopping pattern would be expected to alter Station Usage figures. This is particularly apparent where a group of stations along a line show similar increases or decreases. Again, this can be a long-term trend.

Ticket Issuing Facilities Changes or Product Changes

1.13 Some London stations have both underground and National Rail trains operating. LENNON does not directly capture tickets sold by London Underground, only those sold by Train Operating Companies (TOCs). Changes in ticket facilities provided by TOCs, for example the provision of ticket machines, can therefore increase the ticket sales captured by the system.

1.14 Product changes can have an effect on passengers' purchasing patterns at rail outlets thus affecting Station Usage data. For example, the introduction of Oyster cards and, more recently, Contactless Payment can affect stations inside the Travelcard boundary in the London area.

Engineering Work

1.15 Significant engineering work can alter customers' travel patterns, either causing passengers to not travel, use an alternative mode or use an alternative rail route. The closure of the Gospel Oak to Barking line between October 2016 and February 2017 to facilitate electrification is an example. Similarly, significant delays can alter travel patterns where, for example, Virgin Trains customers on the West Coast can switch to using Chiltern Trains services to travel between the West Midlands and London.

Advance tickets

1.16 Advance tickets can be sufficiently cheap to incentivise travellers to purchase a number of tickets but only use one dependent on how their circumstances change, creating an inflated number of trips in the ticket sales data. This can be particularly true for business travel and could overstate actual journeys.

Tourism/Leisure

1.17 Stations near to tourist and leisure attractions may show significant changes in usage as a result of weather, promotions or other factors, which affect tourists' journeys.

New/Special Stations

1.18 Some stations serve a particular activity or business. Some fluctuation in usage of such stations is reasonable. Such activities include:

- Sporting Events e.g. Rugby World Cup 2015 at Twickenham, Cardiff and other stations;
- Special Events e.g. Birmingham International (for the National Exhibition Centre), Exhibition Centre station in Glasgow (for the Scottish Exhibition and Conference Centre);
- Airports, where rail demand is closely linked to airport passenger numbers e.g. Gatwick Airport, Stansted Airport.

1.19 In addition, where there are new stations, ramp up effects can cause large demand increases over a number of years.

Trend of Growth or Decline

1.20 For stations with a history of growth or decline, it is reasonable to expect this trend to continue. There are many possible reasons for these trends, such as demographic and employment changes (new developments in the vicinity), changes in rail service levels or new stations abstracting demand.

Errors in recording of Sales of Individual Ticket Types

1.21 Miscoding of ticket information entered into LENNON can alter the statistics, although this would not be reflecting an actual change in customers' journeys.

Changes in journey factors

1.22 Sales of tickets are assumed to correspond to a number of journeys. In the case of Single and Return tickets the relationship is very clear but for period tickets, e.g. weekly/monthly/annual seasons, there are a set of journey factors have been used within the LENNON system that have remained fixed for a number of years. Whilst they were likely based on reasonable estimates of ticket use made in the past it could be argued that with lifestyle and working

practice changes, e.g. greater flexible working, and ticketing arrangements that they are not as representative for today's market.

Historic Events

1.23 There are a number of factors worth taking into account when considering generic annual data:

- Major incidents affecting services such as those at Southall (1997), Ladbroke Grove (1999), Hatfield (2000) and Grayrigg (2007);
- Changes to on-train ticket sales and revenue protection policies including installing ticket gates can result in an increase in recorded journeys and revenue;
- Industrial action can have an impact on train services and consequently on rail journeys that are undertaken. For example, the 2016/17 figures will have been affected by the industrial action on the Govia Thameslink Railway franchise;
- Infrastructure changes can significantly affect recorded journeys. For example, engineering and upgrade work can result in temporary line closures and new lines and new connections between stations can increase recorded journeys (e.g. the opening of the Borders Railway in 2015).

2 Methodological Overview

Introduction

2.1 All estimates of entries, exits and interchanges included in the Station Usage dataset are derived from the Origin Destination Matrix (ODM), also produced by Steer Davies Gleave for the ORR. The ODM is in turn derived primarily from a matrix of journeys and revenue that is produced by Resonate for inclusion in MOIRA2.2.

2.2 The MOIRA2.2 matrix includes a comprehensive representation of travel on the national rail network. The base data for the MOIRA2.2 demand matrix is LENNON ticket sales, with the addition of "infills" for London Travelcards, some specific tickets to/from airports and multi-modal and zonal products sponsored by Passenger Transport Executives (PTEs). The current MOIRA2.2 matrix now includes some of the methodological enhancements that have been previously developed for inclusion in the ODM, for example a revised methodology for the PTE infills – see Appendix A – and the 'Other' infills relating to selected Rover and Ranger products – also in Appendix A.

Base Data

LENNON and MOIRA2.2

2.3 The underlying matrix of ticket sales and associated journeys and revenue used in MOIRA2.2 is derived from LENNON. It is based on an extract from LENNON, produced by Worldline, of total sales revenue and journeys for the year, broken down by flow (origin and destination National Location Code (NLC)), route code and by product type (CTOT). However, as there are known omissions in this data in respect of Transport for London (TfL) and PTE sponsored tickets, and non-National Rail tickets on some airport services, there needs to be a "matrix infilling" exercise undertaken. This enables the estimation of a more complete origin-destination matrix and include the associated journeys and revenue that either do not appear in the underlying matrix at all or at a sufficiently disaggregate flow level.

2.4 There are three main cases:

- Tickets with non-geographical destinations, e.g. zonal products, Rovers;
- Tickets sold at some non-National Rail[4] outlets, e.g. newsagents; and
- Tickets which do not appear in LENNON at all. This includes some TOC tickets on airport flows and tickets for TOCs which fall outside the Rail Settlement Plan (RSP).

2.5 Certain tickets with destination codes that are not national rail stations are included in the MOIRA2.2 demand matrix, being mapped to the corresponding rail station. These 'Rail Links' usually include a third-party element, such as to a bus zone, or tourist/leisure attraction. The MOIRA2.2 demand matrix includes the journeys and the net revenue associated with such tickets.

2.6 Data excluded from the MOIRA2.2 demand matrix is set out in Appendix E.

[4] Not part of Rail Settlement Plan (RSP)

Ticket Type Definitions

2.7 Within the base demand matrices, journeys and revenue have been sub-divided into the following four ticket types, each of which is further split by First & Standard Class:

- Full: all walk-up undiscounted single or return tickets, whether or not issued with a status discount (child, railcard etc);
- Reduced: all walk-up discounted single or return tickets, whether or not issued with a status discount (child, railcard etc);
- Advance: all advance-purchase tickets; and
- Seasons: all multi-use tickets.

2.8 It should be noted that for the purposes of the Station Usage dataset, Advance products are included in the Reduced ticket category.

Infills for London Travelcards, Major Urban Areas (PTE) & Airports

2.9 Infills are included within the MOIRA2.2 demand matrix to add in the missing journeys and revenue identified in para 2.4 in three key areas:

- **Within London Travelcard area.** Whilst the underlying matrix includes an estimate of journeys made on Day Travelcards / Travelcard seasons purchased at National Rail stations, it does not include a significant number of national rail trips made using Travelcards purchased at Tube stations, travel shops and newsagents. From 2015/16, a new methodology has been used to represent 'in-boundary' Travelcards based on Transport for London's (TfL) Oyster Clicks Model (OCM) – see Appendix A for further details. Also from 2015/16, the matrix has included journeys associated with Freedom Pass (these were previously added as an infill within the ODM).
- **Within Passenger Transport Executive (PTE) areas.** The underlying matrix excludes virtually all rail trips made on PTE-sponsored tickets, which are usually zonal and often multimodal. From 2015/16 the 'infills' representing these journeys in MOIRA2.2 have been based on a methodology originally developed for the ODM.
- **Trips to/from Airports.** The underlying matrix includes many trips to/from airports, but excludes all Heathrow Express journeys, and some tickets sold for Gatwick Express, Stansted Express and other airport operators.

2.10 There are also other ticket sales which are not included in the MOIRA2.2 demand matrix, but these are generally much less significant. It should also be noted that journeys with no associated ticket sales such as staff travel, and particularly fare evaders, are not included in the MOIRA2.2 demand matrix and therefore are not included in the ODM either.

2.11 The most significant "infills" are for the London Travelcard area (sales made by TfL), and for PTEs, since in both cases a substantial proportion of the rail journeys use multimodal travelcard-type tickets.

2.12 The third infill, for Airports, estimates the significant number of rail journeys on both Gatwick and Stansted Express, made on tickets sold outside of the RSP system i.e. not sold by National Rail outlets. Journeys on Heathrow Express are excluded from the MOIRA2.2 demand matrix.

Origin Destination Matrix (ODM)

2.13 The MOIRA2.2 demand matrix is used as the starting point for the production of the ODM and as part of this process a number of adjustments and overlays are included which can be categorised as follows:

- Overlays (in addition to those already included in the MOIRA2.2 matrix relating to the London Travelcard Area and Airports – see paragraph 2.9)
  - PTE infills – although included in the MOIRA2.2 matrix these are developed as part of the work undertaken to produce the ODM and are provided to Resonate for inclusion in the MOIRA2.2 matrix. The methodology development work to produce the revised infills was undertaken between 2011/12 and 2014/15. A summary of the current status of the PTE infills can be found in Chapter 3.
  - Ranger/Rover infills – Methodological development was undertaken to include a representation of passenger flows on a selected number of Rover and Ranger products from 2011/12. Since 2015/16 this infill has also been included in the MOIRA2.2 matrix.
- Adjustments
  - Allocation of demand associated with tickets sold to 'London Terminals' between those terminals;
  - Allocation of demand between individual stations within station groups outside central London. For example where tickets are sold to/from 'Dorking BR' it is necessary to estimate how these journeys are distributed between Dorking West, Dorking and Dorking Deepdene stations. To support this part of the methodology there is a programme of station counts that are undertaken on an annual basis at selected stations;
  - Unknown destinations: Ticket sales do not always tell us where a passenger is travelling, for example where the Origin or Destination is a London Travelcard. Unknown destinations are converted into an estimate of the actual stations that passengers are travelling to. The full detail of this part of the methodology appears in Appendix D; and
  - Individual station adjustments: There are a number of cases where adjustments are made to selected stations to account for specific known issues:
    - Adjustments at a number of stations are made to reflect circumstances where there are significant numbers of season tickets sold at a particular station (where the passenger travels from) for travel to London that allow for travel to/from a different origin station to provide flexibility. This leads to a situation where station usage, as estimated by ticket sales, can be under- or over-estimated and journeys involving those stations needs to be adjusted to reflect actual usage. Since 2014/15, an adjustment has been at selected stations where a this issue has been identified. Further details on these adjustments can be found in Chapter 3 and Appendix A.
  - The 'Digby & Sowton' adjustment – described in Appendix A and first included in the 2014/15 dataset – relating to journeys associated with a season ticket product for students which are being made to Exeter Central and Exeter St.David's on tickets with a recorded destination of Digby & Sowton.

2.14 Further details relating to the overlays and adjustments outlined above can be found in Chapter 3 and Appendix A of this report.

Interchanges

2.15 In addition to entries and exits at stations an estimate of the number of people interchanging at each station is included in the dataset. This is obtained by combining the number of journeys made on each flow (from the ODM) with the information on passenger journeys taken from the Central Allocations File (CAF).

2.16 The CAF is an output of the ORCATS system which predicts passenger choices of rail route and train used, and determines the allocation of passenger revenue between TOCs. Since ORCATS is a model, the CAF contains estimates rather than actual journeys. However, it is used throughout the rail industry, so it is an appropriate source of data to use for this purpose. Since CAFs are updated with the timetable, not with financial years, no CAF will match the ticket sales data exactly. The December 2016 CAF is used in the creation of the 2016/17 Station Usage dataset.

2.17 The CAF contains:

- Origin and destination;
- Route alternatives for each origin and destination, including all interchange points;
- Ticket type data; and
- For each flow, the proportion of passengers who choose to travel on each route alternative as calculated by the ORCATS model.

2.18 An overview of the ORCATS allocation process can be found in Appendix C.

3 Methodological Changes in 2016/17

Introduction

3.1 Consistency with past datasets is important to enable comparisons to be made over time. Nonetheless, stakeholders have indicated that they are keen to see improvements, even where this reduces consistency with historic data, provided any changes are clearly explained. Steer Davies Gleave has worked with the ORR to scope and implement methodological enhancements to address identified issues and utilise new data as it is made available whether this is from primary data collection (e.g. passenger counts at stations), or industry systems such as TfL's Oyster Clicks Model (OCM).

3.2 The number of changes made to in the 2016/17 dataset is relatively small in comparison to previous years. The changes made to improve the dataset are explained in the rest of this chapter, together with some quantification of their impact.

London BR allocation update

3.3 In the production of the 2015/16 statistics, there were a number of journeys included in the underlying MOIRA 2.2 matrix with both an origin and a destination of "London BR". The methodology used to assign BR>BR flows uses LENNON sales data to allocate journeys according to where journeys outbound from the BR stations are travelling. Investigation showed that due to the limited ticket data for London BR > Individual London Terminal flows, a large proportion of the journeys were being allocated to Kensington Olympia leading to an overstatement of journeys at that station.

Table 3.1: London BR > Individual London BR stations LENNON data (2016/17)

Origin Code	Origin Name	Destination Code	Destination Name	Issues (*)[5]	Proportion of issues
1072	LONDON BR	5143	CHARING CROSS LONDON	4	0%
1072	LONDON BR	577	FARRINGDON	5	0%
1072	LONDON BR	1555	ST PANCRAS LONDON	10	1%
1072	**LONDON BR**	**3092**	**KENSINGTON OLYMPIA**	**982**	**97%**
1072	LONDON BR	5597	VAUXHALL LONDON	1	0%
1072	LONDON BR	5142	CANNON STREET LONDON	20	2%

3.4 As shown in Table 3.1, the majority of London BR > Individual London Terminal issues recorded in LENNON in 2016/17 were between London BR and Kensington Olympia, noting that this is a very small number of issues in total and therefore not necessarily representative of the actual pattern of demand. Nonetheless, this result was being used to allocate c.2.2m London BR > London BR journeys in the underlying MOIRA2.2 matrix, with the majority of these c.2.2m journeys being attributed to flows involving Kensington Olympia flows.

3.5 In order to resolve the above issue, London BR > London BR demand has been allocated to individual London Terminal > London Terminal flows in line with the underlying MOIRA2.2 journeys between individual London Terminals. The 'Any Permitted' route code was used as

[5] Only showing stations with 1 or more issue

the basis of the allocation. For example, if 1.5% of London Terminal > London Terminal journeys on the 'Any Permitted' route code are from Charing Cross to London Bridge, then 1.5% of the London BR > London BR journeys are allocated to this flow.

3.6 Table 3.2 shows the consequent adjustment in journeys. This removes all of the London BR > London BR journeys, therefore none are allocated using the LENNON process described above.

Table 3.2: Allocation of London BR > London BR journeys between London Terminals

Journeys	Input	Output
London BR	2,163,279	-
Blackfriars	-	108,230
Charing Cross	-	131,309
Cannon Street	-	49,257
City Thameslink	-	78,866
Elephant & Castle	-	46,831
Euston	-	39,392
Fenchurch Street	-	13,452
King's Cross	-	28,325
Kensington Olympia	-	21,262
London Bridge	-	179,001
Liverpool Street	-	102,498
Moorgate	-	145,513
Marylebone	-	23,939
Paddington	-	44,934
St.Pancras	-	157,414
Victoria	-	157,552
Vauxhall	-	242,989
Waterloo (East)	-	93,466
Waterloo	-	405,273
Farringdon	-	93,775
Total	**2,163,279**	**2,163,279**

3.7 The most obvious impact of this change is that there is a decrease in recorded usage at Kensington Olympia, noting that this is a methodological change and does not imply an actual drop in the number of passengers using the station. The effect is less noticeable at the other London Terminals as the impact is spread between them, and the overall levels of usage are very high.

Season ticket journey adjustments

3.8 In the production of the 2014/15 and 2015/16 statistics, adjustments were made to account for situations where passengers buy season tickets for travel to/from a station other than the

one they generally travel from, in order to allow additional flexibility. This issue and the previous adjustments are described in detail in Appendix A but for clarity we consider the case of Southend Victoria here as an example.

3.9 On the southern fork of the Shenfield to Southend branch line which links Southend Victoria to Wickford and the Great Eastern Mainline there are a number of stations (Rayleigh, Hockley, Rochford, Southend Airport, Prittlewell and Southend Victoria) where the season ticket price to London is the same. As a result London season tickets are generally sold as being from Southend Victoria, regardless of the actual origin station. This means that the ticket sales data shows that there are more people travelling to/from Southend Victoria than is actually the case as there are passengers travelling from Prittlewell with Southend Victoria tickets, for example.

3.10 In order to account for this, LENNON sales data was used to estimate the number of tickets with Southend Victoria as the origin, but with the issuing office at one of the branch line stations. In these cases, it was assumed that the journey was actually being made from a point on the branch line and not from Southend Victoria.

3.11 For the production of the 2016/17 statistics, the analysis underpinning this reallocation was updated with 2016/17 LENNON data. Table 3.3 shows the scale of the adjustments, alongside the adjustment used in the 2015/16 statistics for comparison. In the case of Southend Victoria circa 837k journeys are redistributed to other stations on the branch line. This is a lower level of adjustment than what was used in the 2015/16 statistics due to the lower number of journeys assumed to be actually from other stations on the branch.

Table 3.3: Summary of adjustments in 2015/16 and 2016/17

TLC	Station	Adjustment to Entries & Exits (2015/16)	Adjustment to Entries & Exits (2016/17)	2016/17 Statistics with adjustment
SOV	Southend Victoria	-1,100,624	-837,043	1,877,587
RLG	Rayleigh	622,997	457,897	1,819,832
HOC	Hockley	338,473	264,199	960,116
RFD	Rochford	106,813	81,660	566,656
PRL	Prittlewell	20,672	19,163	209,708
SIA	Southend Airport	11,669	14,124	395,646
CHW	Chalkwell	-362,927	-369,670	1,562,918
BEF	Benfleet	254,019	266,759	3,844,366
LES	Leigh-On-Sea	108,908	102,912	2,341,028
REI	Reigate	-249,763	-218,053	1,193,556
RDH	Redhill	341,963	369,247	3,705,282
SOU	Southampton Central	-180,076	-151,582	6,361,392
SOA	Southampton Airport (Parkway)	180,076	151,582	1,842,710
SOE	Southend East	-130,909	-122,592	1,723,876
WCF	Westcliff	138,748	144,391	1,259,800
SOC	Southend Central	-7,839	-21,799	3,038,301
OXF	Oxford	-323,461	-356,311	6,631,498
DID	Didcot Parkway	323,461	356,311	3,554,204
EGR	East Grinstead	-135,262	-139,974	1,437,882
LFD	Lingfield	114,776	126,838	573,218
DMS	Dormans	20,486	13,136	111,430
GTW	Gatwick Airport	-101,175	-125,058	19,361,658
HOR	Horley	90,686	91,727	923,774
SAF	Salfords	3,499	12,543	125,372
XDK	Dorking BR	-85,210	-130,404	1,616,384
BTN	Brighton	-110,157	-88,372	15,993,072
PRP	Preston Park	110,157	88,372	527,116

Updated demand allocation at Group Stations

3.12 In order to validate and improve the allocation of journeys between stations within groups (e.g. Worcester BR), passenger counts have been carried out at selected group stations on the network. These counts were carried out in Autumn/Winter 2016 and have informed the allocation of demand at the following station groups:

- Dorchester BR;
- Newark BR;
- Southend BR;
- Warrington BR;
- Wigan BR; and

- Worcester BR.

3.13 The impact of updating these allocations is shown in Table 3.4 below.

Table 3.4: Count-based adjustments to 2016/17 statistics

NLC	TLC	Station Name	Station Group	Entries + Exits (2016/17, with 2015/16 proportions)	Entries + Exits (2016/17) (with updated proportions)	Entries + Exits (2016/17) (change)
5961	DCH	Dorchester South	DORCHESTER BR	488,170	459,273	-28,897
5962	DCW	Dorchester West	DORCHESTER BR	136,100	164,997	28,897
6498	NCT	Newark Castle	NEWARK BR	583,847	752,394	168,547
6499	NNG	Newark North Gate	NEWARK BR	1,069,371	900,824	-168,547
7420	SOV	Southend Victoria	SOUTHEND BR	1,518,874	1,877,587	358,713
7456	SOC	Southend Central	SOUTHEND BR	3,262,861	3,038,301	-224,560
7457	SOE	Southend East	SOUTHEND BR	1,858,030	1,723,876	-134,153
2384	WBQ	Warrington Bank Quay	WARRINGTON BR	1,176,772	1,363,569	186,797
2390	WAC	Warrington Central	WARRINGTON BR	1,916,674	1,729,877	-186,797
2363	WGN	Wigan North Western	WIGAN BR	1,466,006	1,620,278	154,272
2406	WGW	Wigan Wallgate	WIGAN BR	1,647,580	1,493,308	-154,272
4891	WOS	Worcester Shrub Hill	WORCESTER BR	620,041	818,070	198,029
4893	WOF	Worcester Foregate Street	WORCESTER BR	2,298,855	2,100,826	-198,029

4 Summary of Results

Overview of the Entries and Exits Results

4.1 The following table gives the total number of entries and exits, and interchanges made over the whole network for 2016/17, compared with the previous year.

Table 4.1: Entries and Exits and Interchanges for 2015/16 – 2016/17

Year	Entries & Exits	Interchanges
2015/16	2,927,554,422	222,156,360
2016/17	2,939,350,912	223,287,901

4.2 Overall, the increase in entries and exits is 0.4% in 2016/17 compared with the previous year.

4.3 In this section we set out a summary of the overall results, including the stations with the highest number of entries and exits, and the highest number of interchanges . The spreadsheet contains entries and exits results for 2,556[6] stations, compared with 2,553 in 2015/16. The table below shows the new stations that have been opened in 2016/17.

Table 4.2: Stations present in the 2016/17 statistics but not in 2015/16

NLC	Name	Note
6545	Edinburgh Gateway	New station/tram interchange between South Gyle and Dalmeny, opened December 2016
6544	Kirkstall Forge	New station on the Leeds-Bradford line, opened June 2016
6927	Lea Bridge	New station between Stratford and Tottenham Hale, opened May 2016

4.4 Table 4.3 shows data for the ten stations with the highest numbers of entries and exits for 2016/17. The stations in the top ten are the same as in 2015/16 with the exception of St Pancras which has replaced Clapham Junction which is thirteenth this due and is likely due to the reductions in journeys across the Govia Thameslink Railway network – see paragraph 5.10.

[6] There are 2,560 stations listed in the Estimates of Station Usage 2016/17. Note that from the 2015/16 statistics onwards, rows are also included for Manchester United Football Club station, and Heathrow Terminals 2&3, 4 and 5 stations. These are included for consistency with ORR's "*Rail infrastructure, assets and environmental 2016-17 Annual Statistical Release*" (**http://orr.gov.uk/__data/assets/pdf_file/0008/25838/rail-infrastructure-assets-environmental-2016-17.pdf**), however there are no entries and exits reported as part of the Estimates of Station Usage.

Table 4.3: Top 10 Stations Based on 2016/17 Entries and Exits

Rank This Year	NLC	Station Name	Entries and Exits		Rank Last Year
			2016/17	2015/16	
1	5598	Waterloo	99,403,096	99,148,388	1
2	5426	Victoria	75,889,396	81,151,418	2
3	6965	Liverpool Street	67,339,218	66,556,690	3
4	5148	London Bridge	47,874,250	53,850,938	4
5	1444	Euston	44,059,402	41,677,870	5
6	1127	Birmingham New Street	42,366,776	39,077,018	7
7	6969	Stratford	42,251,592	41,113,260	6
8	3087	Paddington	35,835,970	36,536,074	8
9	6121	King's Cross	33,816,396	33,361,696	9
10	1555	St.Pancras	33,492,476	31,723,686	11

4.5 The total journeys made at one of the top ten stations in the 2016/17 dataset account for a total of 522 million journeys, 0.4% less than the 524 million journeys made at the top ten stations in 2015/16. The top ten stations account for 17.8% of all entries and exits in the 2016/17 dataset, similar to the 17.9% of all journeys observed in 2015/16.

Overview of the Interchanges Results

4.6 In all, around 223.3 million interchanges are estimated to have been made among National Rail operated services (interchanges between rail and tube or other modes are excluded except for cross-London journeys). This represents a 0.5% increase over the number of interchanges recorded in 2015/16. The top ten interchange stations are listed in the table below.

Table 4.4: Top 10 Stations Based on the Interchanges made for 2016/17

Rank This Year	NLC	Station Name	Interchanges		Rank Last Year
			2016/17	2015/16	
1	5595	Clapham Junction	27,330,398	30,449,390	1
2	5355	East Croydon	6,521,665	7,054,987	2
3	5598	Waterloo	6,105,768	6,097,879	3
4	1127	Birmingham New Street	5,791,187	5,825,477	4
5	5426	Victoria	5,734,424	5,621,428	5
6	1555	St.Pancras	4,584,114	4,474,169	6
7	3149	Reading	4,108,908	3,970,335	7
8	6969	Stratford	3,872,501	3,334,614	12
9	6009	Highbury & Islington	3,837,080	2,834,363	16
10	5051	Lewisham	3,756,221	3,577,167	10

4.7 Interchanges occurred at 556 stations in 2016/17, three more than in 2015/16. Stations appearing for the first time in 2016/17 and those stations where no interchanges were recorded, but where significant interchanges were recorded in the previous year, are listed below.

Table 4.5: Changes in Interchange Stations in 2016/17 vs 2015/16[7]

	Interchanges		Notes
	2016/17	2015/16	
New			
Bracknell	33	0	
Canada Water	758	0	
Edinburgh Gateway	2,139	0	New station opened December 2016
Elmers End	93	0	
New Beckenham	462	0	
Old			
Fishguard Harbour	0	13	
Heworth	0	159	
Oxford Parkway	0	85,252	Through services from Oxford to Bicester began running December 2016, removing the need for interchange
Stratford International	0	12	

4.8 It is important to note that interchanges can change significantly from year to year for a variety of reasons. Factors such as new service patterns and changes in journey times play a part. The number of interchanges is based on the rail industry ORCATS model, which predicts passenger choices of rail route and trains used. Refer to Appendix C for more information on the ORCATS allocation process.

[7] Only showing stations with 10 or more interchanges.

5 Validation

Introduction

5.1 Checks undertaken on the Station Usage dataset encompass a number of elements, including:

- Investigation of large increases and decreases for individual stations;
- Checks at different geographical levels; and
- Validation against other data sources.

Data Checks

Large increases and decreases

5.2 Table 5.1 shows the 10 stations with the largest proportional increases in total usage for stations with more than 10,000 entries and exits.

Table 5.1: Top 10 Increases in 2016/17

NLC	Station Name	Entries and Exits			Reason
		2016/17	2015/16	Increase (%)	
6543	Bermuda Park	20,106	2,384	743%	New station in 2015/16, continued growth
7416	Coventry Arena	86,706	11,964	625%	New station in 2015/16, continued growth
9850	Cranbrook	90,458	20,404	343%	New station in 2015/16, continued growth
8562	Apperley Bridge	350,312	96,418	263%	New station in 2015/16, continued growth
3104	Bicester Village	1,311,238	413,432	217%	Services continue through to Oxford from December 2016
3121	Oxford Parkway	809,812	274,696	195%	New station in 2015/16, continued growth
2811	Farnworth	38,408	13,166	192%	Returned to previous levels after Engineering works
3891	Treorchy	186,526	70,864	163%	Strong growth at stations along the Rhondda valley line including Treorchy.
2605	Kearsley	34,908	15,512	125%	Returned to previous levels after Engineering works
3776	Eskbank	274,770	128,298	114%	New station in 2015/16, continued growth

5.3 Table 5.2 shows the 10 stations with the largest proportional decreases in total usage for stations with more than 10,000 entries and exits.

Table 5.2: Top 10 Decreases in 2016/17

NLC	Station Name	Entries and Exits			Reason
		2016/17	2015/16	Decrease (%)	
7467	Woodgrange Park	196,244	977,648	-80%	Gospel Oak to Barking Electrification works since Summer 2016
7408	Wanstead Park	212,572	1,013,078	-79%	Gospel Oak to Barking Electrification works since Summer 2016
7402	Leyton Midland Road	286,620	1,340,438	-79%	Gospel Oak to Barking Electrification works since Summer 2016
7403	Leytonstone High Road	210,496	977,634	-78%	Gospel Oak to Barking Electrification works since Summer 2016
7407	Walthamstow Queens Road	218,732	945,750	-77%	Gospel Oak to Barking Electrification works since Summer 2016
7401	Harringay Green Lanes	408,558	1,395,266	-71%	Gospel Oak to Barking Electrification works since Summer 2016
7404	South Tottenham	409,534	1,379,768	-70%	Gospel Oak to Barking Electrification works since Summer 2016
1524	Upper Holloway	415,180	1,291,668	-68%	Gospel Oak to Barking Electrification works since Summer 2016
7406	Crouch Hill	284,672	825,262	-66%	Gospel Oak to Barking Electrification works since Summer 2016
3092	Kensington Olympia	4,117,608	10,904,840	-62%	Adjustment to London stations allocation

5.4 As in the 2016/17 dataset two flags have been included in the published dataset identifying:

- Stations with more than 10,000 entries and exits a year where entries and exits have increased or decreased by more than 10% (Large station change flag); and
- Stations with less than 10,000 entries and exits a year where entries and exits have increased or decreased by more than 25% (Small station change flag).

5.5 These flags have been used to identify stations where further investigation should be carried out to ensure, where possible, the reported changes reflect reality. The limits set are demanding (10% of 10,000, for example could represent just two extra season ticket holders per year) and investigations have been focussed on the most significant changes but where obvious explanations for less significant changes are available these have been included in the Station Usage dataset. In total 603 stations were captured by one of the two flags.

5.6 Whilst reasons for large changes at some stations are specific to that station, in many instances there are groups of stations where there is a common cause for the changes seen. We have identified a number of reasons that affect multiple stations in the 2016/17 statistics. These are shown in Table 5.3.

Table 5.3: Summary of identified reasons for large changes

Reason	Description
Methodology: • London Terminals adjustment (Kensington Olympia) • Counts-based allocation at group stations • Season journeys allocation update	These changes relate to methodological updates rather than changes to the underlying demand (see Chapter 3 for detail).
Infrastructure: • Track/Signalling upgrades • New station demand growth	These relate to upgrades of infrastructure that are likely affecting demand (e.g. running through services from Bicester to Oxford).
Service changes: • Timetable changes (e.g.journey times) • Station improvements • Rolling stock improvement (e.g. lengthening) • Ticketing improvements (e.g. Smartcards)	These relate to improvements to journey opportunities or quality.
Rail operator disruption: • Industrial action • Timetable changes	These impacts relate to operator issues, including the industrial action seen on GTR, and the subsequent reduced level of service.
Weather • Settle-Carlisle line landslip • Lamington Viaduct repair work	These relate to impacts of weather-related disruption, such as the landslip that caused a temporary line closure on the Settle-Carlisle line. These impacts can be negative (reduced usage due to disruption), or positive (usage bounce-back following end of disruption)
Consistent growth/decline	These stations are those that consistently experience strong growth or decline in usage year on year. These can be due to a variety of exogenous and endogenous reasons.
Line specific growth	Strong growth has been observed on some specific geographic lines. This can be due to service changes or potentially changes to ticketing (and therefore recording).
Local factors • Airport demand • Local employment/development • Demand switch between nearby stations	Demand at some stations is strongly linked to demand for nearby airports, industrial/emplyment sites, or new housing developments. Furthermore, if multiple stations are available nearby, passengers may switch to an alternative nearby station.
Fluctuating usage at very small stations	Very small stations are often flagged due to the high percentage change implied by a relatively small change in usage. For example Shippea Hill had 12 passenger journeys recorded in 2015/16 which increased to 156 in 2016/17 which will have partly be as a result of publicity regarding the least used stations and efforts by particular individuals to stimulate visitors.[8]

[8] **http://www.bbc.co.uk/news/uk-england-cambridgeshire-38426342**

Checks at different geographical levels

5.7 It is possible that, in certain areas, changes at the individual station level might not be large enough to be flagged but as a group the results might be unexpected. For this reason we have carried out some checks at a number of levels of detail. In this section we summarise the station count data for the following aggregations of data:

- Region;
- London Travelcard/PTE area; and
- Station Facility Owner (SFO).

Table 5.4: Entries and Exits by Region

Region	Entries and Exits		Change (%)	Impacted by methodological change
	2016/17	2015/16		
London	1,456,523,790	1,471,957,408	-1.0%	
South East	379,679,336	387,436,236	-2.0%	
East	219,450,128	212,724,124	3.2%	
South West	79,034,498	75,986,168	4.0%	
East Midlands	44,162,724	42,787,546	3.2%	
West Midlands	150,596,866	143,158,798	5.2%	
North East	21,377,138	20,868,316	2.4%	
North West	229,793,300	220,056,142	4.4%	
Yorkshire And The Humber	118,598,260	114,843,470	3.3%	
Wales - Cymru	51,668,830	51,018,694	1.3%	
Scotland	188,466,042	186,717,520	0.9%	

5.8 There is reasonable growth across regions outside of London and the South East, although the relative size of the London and South East regions (in terms of Entries and Exits) means that nationwide growth is being dampened.

Table 5.5: Entries and Exits by PTE and London Travelcard Area

Area	Entries and Exits		Change (%)	Impacted by methodological change
	2016/17	2015/16		
London Travelcard Area	1,468,975,740	1,485,250,500	-1.1%	
Greater Manchester	80,745,536	74,362,052	8.6%	
Merseyside	98,814,604	97,854,900	1.0%	
South Yorkshire	20,791,096	20,595,750	0.9%	
Strathclyde	124,875,196	123,179,534	1.4%	
Tyne & Wear	9,424,754	9,171,658	2.8%	
West Midlands	113,033,192	107,072,744	5.6%	
West Yorkshire	73,370,946	71,215,672	3.0%	

5.9 Entries and exits have fallen in the London Travelcard Area, in line with a general slowing of growth across the South East. Demand in Greater Manchester has been strong, driven by the completion of disruptive engineering/upgrade works, and an increase in revenue protection activitiy (including barriers) at key stations in Greater Manchester. Growth in the West

Midlands PTE has been strong, while the growth in the other PTE areas has been broadly in line with the national trends.

5.10 Entries and Exits by Station Facility Operator (SFO) are shown in Table 5.6. Whilst changes in usage at the SFO level are generally within acceptable bounds, there are a few large changes which are due to methodological and endogenous changes:

- Govia Thameslink Railway: Impact of industrial action, reduced timetable, and wider trend in London/South East.
- London Overground: Closure of Gospel Oak – Barking line due to electrification works;
- TfL Rail: Transfer of stations from East Anglia (formerly Abellio Greater Anglia) to TfL Rail;
- Glasgow Prestwick Airport: Highly linked to airport usage;
- Stobart Rail (Southend Airport): Impact of season ticket journeys methodological update around Southend, and highly linked to airport usage.

Table 5.6: Entries and Exits by Station Facility Owner

SFO	Entries and Exits		Change (%)
	2016/17	2015/16	
TOCs			
Arriva Trains Wales	61,931,752	61,107,700	1.3%
c2c	76,286,027	74,100,074	3.0%
Chiltern Railways	47,550,612	45,347,328	4.9%
East Anglia	104,258,964	99,499,268	4.8%
East Midlands Trains	45,364,614	43,752,779	3.7%
Govia Thameslink Railway	350,332,458	364,998,906	-4.0%
Great Western Railway	111,619,463	109,474,541	2.0%
London Midland Trains	91,300,256	88,856,832	2.7%
London Overground	202,372,482	209,683,732	-3.5%
Merseyrail	79,469,080	79,101,950	0.5%
Northern	126,085,468	119,798,342	5.2%
ScotRail	133,705,696	134,899,952	-0.9%
South West Trains	295,970,098	299,680,515	-1.2%
South West Trains (Island Line)	1,256,892	1,276,194	-1.5%
Southeastern	199,600,162	198,632,496	0.5%
TfL Rail	85,520,460	85,654,382	-0.2%
TransPennine Express	25,960,095	24,861,582	4.4%
Virgin Trains West Coast	48,930,709	45,591,154	7.3%
Virgin Trains East Coast	37,042,774	36,217,485	2.3%
Non-TOCs			
Glasgow Prestwick Airport	117,870	93,026	26.7%
London Underground	124,518,466	121,240,962	2.7%
Network Rail	689,760,869	683,260,062	1.0%
Stobart Rail	395,646	425,160	-6.9%

Validation against alternative data sources

Comparison with ORR journey data on the ORR data portal

5.11 The ORR produces passenger journey data by sector and TOC and makes this available on the ORR website via its data portal and as a National Statistics release[9]. Growth from 2015/16 to 2016/17 from this data was 0.8% at the national level for franchised rail operators. The Station Usage dataset shows an increase of 0.4% over the same period.

Comparison with passenger count data

5.12 The Department for Transport (DfT) collects passenger count data for major cities throughout Great Britain. The method of collection means that for through stations it is often not possible

[9] Passenger Rail Usage, available at: **http://orr.gov.uk/statistics/published-stats/statistical-releases**

to calculate boarders and alighters but for terminal stations this is usually possible. Using data published by DfT we have compared growth rates at the major London termini covered by the all-day arrivals and departures count data with those seen in the calculated Station Usage dataset.

Table 5.7: Comparison of Station Usage and reported growth rates of all-day passenger counts at London Terminals 2015/16–2016/17

Station	Station Usage growth rate	Growth rate in all-day passenger counts (Autumn 2015-Autumn 2016)
Euston	5.7%	4.9%
Fenchurch Street	2.7%	2.8%
King's Cross	1.4%	4.0%
Liverpool Street	1.2%	1.4%
Marylebone	4.6%	5.7%
Moorgate (measured at Old Street)	22.4%	2.3%
Paddington	-1.9%	1.8%
Victoria	-6.5%	4.1%
Waterloo (measured at Vauxhall)	0.3%	2.0%

Source: *Rail passenger numbers and crowding on weekdays in major cities in England and Wales: 2016. Table RAI0201- "City centre peak and all day arrivals and departures by rail on a typical autumn weekday, by city: 2016"*
Available at: **https://www.gov.uk/government/statistics/rail-passenger-numbers-and-crowding-on-weekdays-in-major-cities-in-england-and-wales-2016**

5.13 Where there is significant variation between observed growth from counts data and the station usage growth, there are some general points to be noted, and some points specific to individual TOCs, which can explain the discrepancy.

- Firstly, the count data may also include interchanging passengers and therefore does not provide an exact comparison with the station usage entry and exit data;
- Secondly, the period over which data has been collated is different, as the counts are from Autumn 2015 and Autumn 2016, whereas the station usage figures aggregate annual passenger numbers for the years beginning April 2015 and April 2016. In this case, any external event during the counts period, or any external event during the rest of the year which was not present during the counts period, will drive a difference between the two data sources.

5.14 This explains the large changes at Paddington and to a greater extent Victoria. Paddington has been affected by more blockades and service reductions in 2016/17 then 2015/16, whereas the counts will not reflect this. Victoria's 2016/17 station usage figures include several days of industrial action on Southern, and the extended overtime ban from December 2016, whereas the counts will not have been affected to the same extent, having happened in Autumn 2016.

5.15 Moorgate has significantly higher growth in the station usage figures than the Autumn counts figures. This increase is present across the whole route, and has been attributed to train service improvements which were first introduced in the December 2015 timetable. Further difference between the two data sources could be related to the distribution of passengers between London stations.

steer davies gleave

Appendices

A Appendix – Historical Methodological Changes

Historical Methodological Changes

A.1 A series of methodological improvements have been made to the Station Usage dataset since 2006/07 and the improvements made to the ODM and Station Usage methodology are described in the section. This appendix is divided into two sections:

- **Methodology changes prior to 2011/12:** These changes were implemented by Resonate (formerly DeltaRail) who were the consultants working for the ORR to produce the statistics prior to 2011/12.
- **Methodology changes from 2011/12:** These changes are those that have been specified and implemented by Steer Davies Gleave.

Methodology changes prior to 2011/12

It should be noted that the information in this section has been reproduced from previous reports on the Station Usage statistics produced by Resonate.

A.2 Between 2006/07 and 2008/09 the accuracy and usefulness of the ODM was improved by applying new procedures on the way journeys with unknown origin and/or destination have been treated, and by including journeys that were previously excluded from the file or did not appear in the LENNON sales data. In summary, the main changes were:

- Adding in previously missing journeys, e.g. TfL sold Travelcards, and some airport link tickets - this is undertaken in the production of the MOIRA2 demand matrix.
- Rail Links such as PlusBus and Attractions. The rail element of these ticket sales is now included - this is undertaken in the production of the MOIRA2 demand matrix.
- Estimating the split of records for station groups, including London BR, into the constituent individual stations. This methodology was further refined for those groups with no ticket office at one or more stations within the group - this processing is undertaken in the ODM,
- Via the integration with the process that creates the MOIRA2 Demand Matrix, PTE ticket sales are now included, in addition to TfL sold Travelcards, and some airport link tickets – this is undertaken in the production of the MOIRA2 demand matrix.
- The method for estimating passenger journeys from ticket sales has changed. This is a result of using the MOIRA2 Demand Matrix as a starting point. The MOIRA2 Demand Matrix does not disaggregate single journeys, and so when estimating passenger journeys all ticket sales have been split equally into the two directions of travel. This will only have an impact on the ODM if there is more travel on single tickets away from a station compared to travel to the station, which is not likely to be material. Therefore in the Station Usage file, entries are the same as exits.

A.3 In 2009/10 further improvements were made:

- Adding in data for journeys undertaken by Oyster "pay-as-you-go" (PAYG) in the London area. This is undertaken within the base LENNON data, in the production of the MOIRA2 demand matrix. This applies to journeys made after 1 January 2010.
- Refinement of the methodology used to calculate journeys undertaken using PTE tickets.

A.4 When the 2010/11 dataset was constructed it emerged that the original 2008/09 figures which were given for one PTE, West Yorkshire, were not a complete record of all the rail journeys on multimodal tickets which should have been included in the PTE infill. A correction was therefore made by uplifting the West Yorkshire PTE Infill, both revenue and journeys figures, by 53% on top of the generic PTE infill growth rate. Note that within West Yorkshire PTE area, the majority of rail journeys are made on rail-only tickets, i.e. not PTE Infill tickets. Thus the overall effect of this correction was relatively small.

Oyster PAYG

A.5 Oyster 'Pay As You Go' (PAYG) was rolled out at National Rail stations in January 2010. Prior to this date Oyster PAYG was available on selected routes only and was not recorded (in LENNON) on a flow or station basis. After this date Oyster PAYG was available at all National Rail stations in the Travelcard Area are recorded by flow.

A.6 The 2009/10 data contained roughly 9 months of data prior to January 2010 and 3 months of data after, while the 2010/11 data which was wholly after January 2010 when Oyster PAYG, with data capture, had been fully implemented contains a full year of data. This lead to some very large reported growth figures for some stations within the London Travelcard (/Oyster PAYG) area. The 2010/11 figures, based on recorded use of Oyster PAYG should be accurate, but the percentage growth may be over-represented since the old figures would be largely estimates made without the benefit of Oyster records.

Methodological changes 2011/12 – 2015/16

This section summarises the methodological changes specified and implemented in the Station Usage dataset by Steer Davies Gleave in the 2011/12, 2012/13, 2013/14 and 2014/15 datasets. The descriptions of the methodological changes in this section were originally included in the Station Usage Methodology and Validation reports for those years' datasets. The methodological changes implemented in 2015/16 are described in Chapter 3 of this report.

Methodological Changes in 2011/12

Improved PTE Infill growth rate

A.7 With the initial version of MOIRA2 an improved representation of PTE demand was included in the base demand matrix based on work undertaken by Steer Davies Gleave for the year 2008/09. This included journeys from tickets sold at non-railway sales points and an estimated distribution of journeys largely based on the distribution of point to point tickets sold in PTE areas.

A.8 Subsequent versions of the MOIRA2 demand matrix have included a PTE infill but the journeys are now based directly on LENNON data and are therefore not consistent with the 2008/09 infill.

A.9 To maintain consistency with previous ORR statistics the PTE infill contained in the ODM was therefore based on the 2008/09 MOIRA2 PTE infill grown by growth rates derived from National Rail Trends data.

A.10 Up until 2010/11 the application of growth was carried out at a highly aggregate level based on growth seen for 'franchised regional operators' as reported in National Rail Trends data. In the construction of the 2011/12 dataset a more disaggregate set of growth rates were applied at the PTE level based on LENNON data to improve the appropriateness of the growth rates applied and reflect geographical variations in demand growth.

Inclusion of revised West Midlands PTE (Centro) Infill

A.11 Steer Davies Gleave were commissioned in 2011 by the Passenger Demand Forecasting Council (PDFC) to construct a PTE infill matrix for the Centro area for the rail year 2010/11. The methodology followed that used for the construction of the original MOIRA2 infill but included use of additional data sources and specific adjustments for known issues such as directionality.

A.12 This infill represented a significant improvement on the infill in the ODM and therefore as part of the 2011/12 update the PDFC infill was updated to 2011/12 data and included in the ODM and hence the Station Usage dataset.

A.13 The inclusion of the Centro infill represented a significant change for stations within the Centro area and also a number of stations not in the Centro area but where Centro tickets can be purchased for travel into the Centro area. For the majority of stations the inclusion of the infill resulted in an increase in entries and exits although in a small number of instances there was a decrease. A comparison of the 2011/12 Centro infill with the 2010/11 ODM infill is included in Table A.1. This shows that the new infill added approximately 5 million journeys (10 million entries and exits) compared to what would have been derived had the previous methodology been used.

Table A.1: Centro area infill comparison

	2010/11 ODM infill	2010/11 infill grown to 2011/12 using previous methodology	2011/12 updated infill
Journeys (m)	15.5	16.6	21.3

New 'Other' infill layer

A.14 In some non-PTE areas there are zonal products which are not captured within the MOIRA2 demand matrix (e.g. Rover and Ranger products). Whilst volumes of travel on these tickets are relatively small, in the area of use they can be significant. Therefore, in the 2011/12 update we included journey estimates for a number of Rover and Ranger products. These were:

- St Ives Group Day Ranger;
- St Ives Day Ranger;
- St Ives Family Day Ranger;
- Valleys Night Rider; and
- Cambrian Coaster Ranger.

A.15 Journeys on these products were included as an 'Other' infill in the ODM, together with journeys from some non-LENNON season ticket products previously included in the airport flow infill. Journey estimates for these products were constructed using LENNON data and distributing journeys based on point of sale and the underlying reduced ticket travel distribution of the stations covered.

A.16 The total number of entries and exits arising from inclusion of these journeys was 760k. Table A.2 lists the top five stations impacted most significantly:

Table A.2: Top five stations impacted by inclusion of the 'Other' infill

NLC	Station Name	2010/11 entries and exits	2011/12 entries and exits	Reason
3538	St.Ives	258,530	578,214	Inclusion of St Ives branch line rover products
3542	Carbis Bay	55,334	206,736	
3537	St.Erth	120,770	202,362	
3498	Lelant Saltings	17,224	101,284	
3899	Cardiff Central	11,259,968	11,502,080	Inclusion of Valley Night Rider product

Calibration of entries and exits to count data at group stations (pilot)

A.17 A key addition to the underlying MOIRA2 data in the construction of the Station Usage dataset is the breakdown of group station flows into their component stations. This is a significant task and based primarily on sales location data which is becoming less robust as increasing volumes of sales are completed via the internet.

A.18 For the purposes of the 2011/12 dataset a pilot was conducted for stations within the Liverpool BR group of stations, using count data to allocate journeys between the stations. The stations that this impacted were:

- Liverpool Lime Street;
- Liverpool Central;
- Liverpool James Street; and
- Moorfields.

A.19 Count data sourced from the DfT and Merseytravel enabled the calculation of the split of demand between the central Liverpool stations as shown in Table A.3. These percentages were then used to divide total central Liverpool demand, as calculated by the Station Usage process, between the central Liverpool stations. The same splits were applied across all ticket types.

Table A.3: Modification of central Liverpool Station Usage data

Station	2011/12 Entries and Exits old methodology	Implied split between stations	Implied split between stations from counts	Adjusted Liverpool station entries and exits
Liverpool Lime Street	11,882,144	32%	37%	13,835,314
Liverpool Central	17,497,878	47%	38%	14,209,241
Liverpool James Street	3,524,654	9%	8%	2,991,419
Moorfields	4,488,064	12%	17%	6,356,766

Methodological Changes in 2012/13

Improved Greater Manchester and West Yorkshire PTE Infill

A.20 Building on the inclusion in the 2011/12 dataset of an improved infill for the Centro area, an improved PTE infill was included in the 2012/13 dataset for two of the remaining PTEs – West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TFGM). This was produced using a process derived to construct infill demand for the Rail in the North demand and revenue model produced by Mott MacDonald and MVA for the Rail in the North (RiN) consortium and was supplied by Mott MacDonald.

A.21 The impact of the methodological change at the PTE level is shown in Table A.4.

Table A.4: West Yorkshire and Greater Manchester PTE Infill (2012/13)

PTE	Journeys (m)	
	Old Methodology	New Methodology
West Yorkshire PTE	6.83	8.67
Greater Manchester PTE	5.05	5.10

***Source**: SDG Analysis of PTE infill based on a station classification into PTEs – this necessitates a simplified treatment of cross-PTE boundary flows*

A.22 The new infill had a significant impact at the total level for the West Yorkshire PTE area with a 27% increase in the number of journeys on West Yorkshire PTE tickets. The impact on the total size of the GMPTE infill was much smaller but there were still significant distributional impacts as demonstrated by the presence of a number of GMPTE stations in the top ten changes from the improved infill as shown in Appendix Table A.5.

Table A.5: Top Ten Changes (in absolute terms) in Entries and Exits with Inclusion of New PTE Infill for GMPTE and WYPTE (2012/13)

Station	Entries and Exits (with old infill)	Entries and Exits (with new infill)	Change in Entries and Exits (%)
Leeds	24,450,682	26,200,916	7%
Huddersfield	4,022,672	4,656,700	16%
Manchester Airport	3,414,466	3,136,816	-8%
Bolton	3,313,742	3,583,392	8%
Bradford Interchange	2,782,466	3,004,718	8%
Dewsbury	1,389,050	1,603,702	15%
Manchester Piccadilly	23,358,295	23,158,477	-1%
Guiseley	945,722	1,134,560	20%
Shipley	1,497,954	1,666,542	11%
Castleford	413,318	537,898	30%

Calibration of entries and exits to count data at group stations

A.23 The key addition to the underlying MOIRA2 data in the construction of the Station Usage dataset is the breakdown of group station flows into their component stations. This is a significant task and the existing methodology based primarily on sales data is becoming less robust as increasing volumes of sales are completed via the internet.

A.24 For the purposes of the 2012/13 dataset we therefore undertook a significant programme of counts at a number of stations to provide a basis for allocating demand at the station group level between these stations.

A.25 In the application of the count data, consistency with the underlying ODM data was maintained by controlling total entries and exits at the station group level to the total station group demand in the underlying matrix. Count data was then used to apportion the total station group demand between the individual stations. It is important to emphasise this point – the count data was only used to distribute demand between stations within each of the relevant station groups. It was not used to set the overall level of demand. Use of count data to set the total level of entries and exits by station was not implemented for a number of reasons, including:

- Consistency with underlying data in the ODM matrix;
- Seasonal variation in demand would need to be accounted for on a robust basis; and
- Counts would need to be undertaken in succeeding years and on a sufficiently robust basis to ensure random variation between years was minimal.

A.26 Following the counts a thorough process of validation was completed, utilising, where possible, information and data provided by Train Operators to corroborate the count data. On completion of the validation it was agreed with the ORR that the outputs of the count data would be used to allocate demand between stations for the stations listed in Appendix Table A.6. This table also shows the distribution of entries and exits between the stations with the previous and new methodology. The dominant trend in the changes is an increase in

demand at the smaller (and often ticket office-less) stations at the expense of the larger stations in the group.

Table A.6: Stations Impacted by use of Count Data to Distribute Demand Between Group Stations (2012/13)

Group	Station	Entries and Exits		
		Previous methodology	New methodology	Change (%)
Farnborough BR	Farnborough (Main)	3,149,316	2,859,700	-9%
	Farnborough North	328,684	618,300	88%
Bedford BR	Bedford Midland	3,448,926	3,303,270	-4%
	Bedford St.Johns	9,320	154,976	1563%
Wakefield BR	Wakefield Westgate	2,240,342	2,266,915	1%
	Wakefield Kirkgate	514,862	488,289	-5%
Maidstone BR	Maidstone East	1,796,012	1,343,900	-25%
	Maidstone West	529,796	834,293	57%
	Maidstone Barracks	120,150	267,765	123%
Dorking BR	Deepdene	389,786	454,909	17%
	Dorking	1,354,864	1,234,007	-9%
	Dorking West	40	55,774	139435%
Newark BR	Newark North Gate	1,096,442	1,179,491	8%
	Newark Castle	320,558	237,509	-26%
Dorchester BR	Dorchester South	533,304	469,294	-12%
	Dorchester West	66,828	130,838	96%
Colchester BR	Colchester	4,574,692	4,291,055	-6%
	Colchester Town	459,380	743,017	62%
Portsmouth BR	Portsmouth & Southsea	2,352,460	1,965,324	-16%
	Portsmouth Harbour	1,809,936	2,197,072	21%
Hertford BR	Hertford North	1,342,800	1,338,227	0%
	Hertford East	769,974	774,547	1%

Inclusion of Freedom Pass journeys in PTE Infill

A.27 The TfL concessionary product the 'Freedom Pass' is included in the Oyster system. However, unlike paid-for Oyster products, travel on the Freedom Pass was not included in the Station Usage estimates prior to 2012/13. Given the volume of rail travel on the Freedom Pass (circa 21 million entries and exits in 2012/13) inclusion of these journeys where possible in the Station Usage dataset was highly desirable.

A.28 To facilitate the inclusion of Freedom Pass journeys TfL provided the following data to enable an estimate of Freedom Pass journeys on the rail network:

- Total journeys on Freedom Pass with touch in/out at least one end of the journey at a 'NR subsystem'[10] station for each period in the 2012/13 year
- Origin and destination breakdown of Freedom Pass journeys where the passenger touched in or out for period 4 of 2012/13 (July 2012), including a distinction between London Underground and National Rail services e.g. entries and exits at London Bridge National Rail and London Bridge London Undergound are recorded separately

A.29 Inclusion of the Freedom Pass journeys was then achieved through a two-stage process:

- Calculation of period 4 Freedom Pass journeys on National Rail/London Overground services by assigning each origin destination in the sample period 4 data as being either a National Rail/London Overground journey or not. This was required to exclude journeys not on the National Rail/London Overground network.
- Estimation of total 2012/13 Freedom Pass journeys on National Rail/London Overground by flow by using the periodic 'NR subsystem' data to inform an expansion of the period 4 journeys.

A.30 The number of Freedom Pass journeys included was necessarily a conservative estimate since it does not capture journeys where the passenger did not have to touch in or out. In addition, the smallest flows in the period 4 dataset were not being included since it was not practical to categorise every single flow.

A.31 Appendix Table A.7 shows the top ten increases in Station Usage from the inclusion of Freedom Pass journeys. This shows that the numbers of Freedom Pass journeys are sufficient to have a significant impact at even relatively heavily used stations such as West Croydon.

Table A.7: Top Ten Changes (in absolute terms) in Station Usage from Inclusion of Freedom Pass Data

Station	Entries and Exits		
	Without Freedom Pass	With Freedom Pass	Change (%)
Victoria	75,884,234	77,346,676	1.9%
Waterloo	94,673,486	95,936,542	1.3%
London Bridge	52,342,710	53,351,116	1.9%
East Croydon	20,060,778	20,965,248	4.5%
Clapham Junction	22,916,064	23,622,718	3.1%
Liverpool Street	57,856,458	58,448,814	1.0%
Charing Cross	38,140,698	38,607,238	1.2%
Stratford	25,129,740	25,564,250	1.7%
Wimbledon	18,475,254	18,902,016	2.3%
West Croydon	3,880,666	4,300,582	10.8%

[10] The NR subsystem is a set of stations which is used for recording purposes by TfL. It is composed primarily of National Rail stations but does include some joint stations (e.g. Wimbledon). As such it could not be used to provide a completely clean estimate of total National Rail Freedom Pass journeys but the periodic data was informative when scaling the detailed Period 4 data to the whole year.

A.32 From 2015/16 Freedom Pass journeys were already included in the MOIRA2.2 dataset and therefore no further adjustments were required as part of production of Estimates of Station Usage..

Additions to the 'Other' infill layer

A.33 In 2011/12 a number of zonal products outside PTE areas and not captured within the MOIRA2 demand matrix were included for the first time in the dataset as part of a new 'Other' infill layer. In the 2012/13 dataset a further five non-PTE zonal products were included. The products included were:

- Anglia Plus;
- Devon Evening Ranger;
- Devon Day Ranger;
- Ride Cornwall; and
- Freedom Travel Pass (West of England product).

A.34 Journey estimates for these products were constructed using LENNON data and distributing journeys based on point of sale and the underlying reduced[11] ticket travel distribution of the stations covered.

A.35 The total number of entries and exits arising from inclusion of these journeys is 1.05m. Appendix A.8 lists the top ten stations impacted most significantly:

Table A.8: Top Ten Stations Impacted by Inclusion of the 'Other' Products

Station Name	Entries and Exits		Change (%)	Reason
	Without "Other" Products	With "Other" Products		
Norwich	3,949,610	4,126,012	4.5%	Inclusion of Anglia Plus products
Ipswich	3,202,062	3,348,394	4.6%	
Cambridge	9,080,762	9,168,936	1.0%	
Bury St.Edmunds	501,966	566,110	12.8%	
Plymouth	2,530,000	2,579,316	1.9%	Inclusion of Devon/Cornwall Rangers
Lowestoft	411,536	459,166	11.6%	Inclusion of Anglia Plus products
Exeter St. David's	2,361,172	2,401,276	1.7%	Inclusion of Devon Rangers
Stowmarket	897,376	927,856	3.4%	Inclusion of Anglia Plus products
Thetford	264,318	287,024	8.6%	
Bristol Temple Meads	9,076,954	9,099,332	0.2%	Inclusion of Freedom Travel Pass products

[11] With the exception of the Anglia Plus product which has both Reduced and Season variants. For the Season variants of this product the underlying Full ticket travel distribution of the stations covered was used given that the coverage of Season tickets in the base matrix was limited.

Methodological Changes in 2013/14

Improved South Yorkshire PTE Infill

A.36 Building on the inclusion in the 2012/13 dataset of an improved infill for the West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TfGM) PTE areas, an improved infill for the South Yorkshire (SYPTE) PTE area was included in the 2013/14 dataset. This was produced using a process derived to construct infill demand for the Rail in the North (RiN) demand and revenue model produced by Mott MacDonald and MVA for the RiN consortium and was supplied by Mott MacDonald. This is consistent with the methodology underlying the improved West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TfGM) infills. At the total PTE level the impact of the new infill was to reduce demand by 1.3m. However, there was also a significant distributional impact as can be seen in Appendix Table A.9, which shows the top ten largest changes as a result of the new South Yorkshire infill.

Table A.9: Top Ten Changes (in absolute terms) in Entries and Exits with Inclusion of new SYPTE PTE Infill (2013/14)[12]

Station	Change in entries and exits with new infill	% Change
Doncaster	-497,139	-13%
Sheffield	-256,998	-3%
Barnsley	-150,784	-10%
Mexborough	-104,966	-34%
Rotherham Central	-69,654	-9%
Adwick	-57,110	-24%
Wombwell	49,918	30%
Bentley (South Yorkshire)	-47,014	-28%
Kirk Sandall	-45,582	-32%
Swinton (South Yorkshire)	-45,086	-11%

Improved Merseyside PTE Infill

A.37 Prior to 2013/14 the infill for the Merseyside area was derived from the generic PTE infill produced as part of the MOIRA2 Replacement project which was based on a 2008/09 base year. To produce updated estimates in succeeding years, the distribution of demand in the infill matrix was maintained and the total volume of demand grown, initially by the journey growth shown by the Regional Sector in the ORR's rail usage data and, since 2011/12, by the growth in journeys (from LENNON) on service codes associated with the Merseyside area.

A.38 Since 2008/09 there have been a number of developments which mean that the 2008/09 distribution is inappropriate. Of particular importance has been a movement away from RSP products to PTE products on some routes on the edges of the Merseytravel area (e.g Town

[12] As all the new Mott MacDonald infills were incorporated into the ODM at the same time, it is not possible to definitively isolate each infill. For the purposes of this exercise, stations within the Yorkshire and Humber Government Office Region were considered to be those affected by the new SYPTE infill.

Green, Aughton Park and Ormskirk on the Northern line) which means that the existing distribution underestimates demand in these areas.

A.39 Recognising the deficiencies of the existing infill, a new infill was produced by Mott MacDonald building on the PTE infill in the Liverpool City Region Model (LCRM) produced for Merseytravel. Unlike the other PTE infills, journeys in the Merseyside infill have been scaled to count data at an aggregate level across all affected stations where complete counts are available to ensure a robust match with 'reality'. This is possible since count data in the Merseyside area is more extensive and comprehensive across stations than in other areas.

A.40 The inclusion of the new infill increased entries and exits by 10.8m (5.1% of total North West entries and exits). Appendix Table A.10 shows the top ten changes in entries and exits by station. Some of the largest changes are outside the Merseytravel area (e.g. Chester) and this is because some Merseytravel products can be used outside the core Merseytravel area.

Table A.10: Top Ten Changes (in absolute terms) in Entries and Exits with inclusion of new Merseyside PTE Infill (2013/14)[13]

Station	Change in entries and exits with new infill	% Change
Southport	1,452,670	57%
Ormskirk	1,302,182	172%
Chester	1,204,048	39%
Liverpool South Parkway	1,025,900	135%
Waterloo (Merseyside)	1,005,970	214%
Liverpool Central	898,367	7%
Liverpool Lime Street	874,711	7%
West Kirby	851,062	314%
Sandhills	768,598	160%
Kirkby (Merseyside)	553,690	31%

Improved Strathclyde Passenger Transport (SPT) infill

A.41 A more sophisticated infill was developed by Mott MacDonald to capture demand in the Strathclyde area on a number of SPT products, namely:

- Zonecard;
- Roundabout; and
- Daytripper

A.42 Total sales data for these tickets was obtained from a combination of LENNON data and off rail sales figures from SPT. The number of journeys on each ticket type was established by applying appropriate tip rate proxies for each type. The data was distributed using Zonecard

[13] As all the new Mott MacDonald infills were incorporated into the ODM at the same time, it is not possible to definitively isolate each infill. For the purposes of this exercise, stations within the North West Government Office Region were considered to be those affected by the new Merseyside infill.

forum travel diary data and LENNON station-station reduced ticket proportions to produce an estimate of station-to-station movements. The new infill resulted in a drop in entries and exits of approximately 4.4m (2.5% of total Scotland entries and exits). The top ten changes by station are shown in Appendix Table A.11.

Table A.11: Top Ten Changes (in absolute terms) in Entries and Exits with inclusion of new Strathclyde Infill (2013/14)[14]

Station	Change in entries and exits with new infill	% Change
Glasgow Central	-1,254,874	-4%
Glasgow Queen Street	-1,025,052	-6%
Helensburgh Central	-391,278	-32%
Motherwell	-232,668	-17%
Charing Cross (Glasgow)	-154,791	-8%
Kilwinning	-138,187	-13%
Paisley Gilmour Street	131,984	3%
Johnstone	-129,954	-10%
Ayr	-124,246	-8%
Airdrie	-110,906	-9%

Other methodological variations

A.43 As for 2011/12 and 2012/13 the generic methodology for separating out group stations was not followed for Manchester BR, Wigan BR and Warrington BR. For Warrington BR and Wigan BR we maintained the same split of journeys between the respective stations as seen in 2010/11 at a flow and route code level. For Manchester BR the split was maintained at the station level.

Methodological Changes in 2014/15

Redistribution of demand around Southend

A.44 At some locations on the rail network, ticket prices are the same for a number of stations in close geographic proximity. An area where this is particularly noticeable is on the southern fork of the Shenfield to Southend branch line. This line links Southend Victoria to Wickford and the Great Eastern Mainline serving the following stations:

- Rayleigh;
- Hockley;
- Rochford;
- Southend Airport;
- Prittlewell; and

[14] As all the new Mott MacDonald infills were incorporated into the ODM at the same time, it is not possible to definitively isolate each infill. For the purposes of this exercise, stations within the Glasgow Government Office Region were considered to be those affected by the new SPT infill.

- Southend Victoria.

A.45 At these stations the season ticket price to London[15] is the same, therefore London season tickets are generally sold as being from Southend Victoria, regardless of the actual origin station. This means that the ticket sales data shows that there are more people travelling to/from Southend Victoria than is actually the case as there are passengers travelling from Prittlewell with Southend Victoria tickets, for example. In order to account for this, LENNON sales data was used to estimate the number of tickets with Southend Victoria as the origin, but with the issuing office at one of the branch line stations. In these cases, it was assumed that the journey was actually being made from a point on the branch line and not from Southend Victoria.

Example:

If a Southend Victoria to London season ticket was bought at Prittlewell, its journeys are assumed to be from Prittlewell to London.

A.46 A similar process was carried out for journeys from Westcliff to London, where season tickets to London are the same price as from Southend Central and Southend East.

A.47 Table A.13 shows the season ticket journeys before and after the adjustment. Southend Victoria journeys are redistributed among Prittlewell, Rayleigh, Rochford, Hockley and Southend Airport; Southend East and Southend Central journeys are redistributed to Westcliff only.

A.48 **The methodology associated with addressing this issue was updated for the 2015/16 statistics to be consistent with a revised methodology adopted for other stations following further scoping and analysis**.

Table A.13: Reallocated Southend to London season journeys in 2014/15 under the old and new methodology

Origin Station	Destination	New Methodology Journeys (2014/15)	Old Methodology Journeys (2014/15)
Southend Victoria	London (ALL)	130,944	1,689,770
Prittlewell	London (ALL)	383,195	56,511
Rayleigh	London (ALL)	270,238	6,997
Rochford	London (ALL)	873,041	173,084
Hockley	London (ALL)	275,511	27,085
Southend Airport	London (ALL)	43,995	23,477
Southend East	London (ALL)	372,199	446,698
Southend Central	London (ALL)	152,261	227,223
Westcliff	London (ALL)	274,576	125,115

[15] For the purposes of the Southend Area redistribution, "London tickets" include seasons to London Terminals and London Travelcards.

Pay As You Go (PAYG)

A.49 In January 2014 a change was made to the way PAYG journeys were recorded in LENNON with non-National Rail origins and destinations recorded as well as National Rail origins and destinations.

A.50 The underlying methodology used to construct the MOIRA2 demand matrix had not been updated to reflect this with the result that PAYG journeys starting or ending at a non-National Rail station were allocated by default to London BR as their origin or destination in the MOIRA2 demand matrix rather than the station at which they joined the National Rail network. For example, a PAYG journey between Canary Wharf and Clapham Junction prior to January 2014 would most likely have been recorded in LENNON as being a journey from Canada Water to Clapham Junction whereas post January 2014 it would be recorded as Canary Wharf to Clapham Junction with the result that in the MOIRA2 demand matrix is recorded as being a London BR to Clapham Junction journey.

A.51 In the 2014/15 statistics an adjustment process was included to account for the change in LENNON treatment of PAYG journeys to make the statistics more consistent with previous years. This reduced the number of entries and exits associated with London Terminals and increases entries and exits at key interchange stations. It, however, remains the case that this change in LENNON affected the last quarter of the 2013/14 statistics and therefore for some interchange stations there is a substantial increase between 2013/14 and 2014/15. The stations where this change resulted in an increase greater than 10% in 2014/15 are set out in Table A.14.

Table A.14: Percentage change in Entries and Exits due to PAYG adjustment

NLC	Station	Percentage change in Entries & Exits due to PAYG adjustment
1659	Canada Water	1091%
7474	West Ham	184%
4935	Whitechapel	175%
598	Harrow-On-The-Hill	121%
8875	West Brompton	117%
7400	Blackhorse Road	109%
1082	Shadwell	53%
6931	Seven Sisters	48%
6009	Highbury & Islington	41%
1457	Willesden Junction	36%
6969	Stratford	32%
3136	Greenford	30%
1553	Kentish Town	30%
3190	Ealing Broadway	27%
1419	Queen's Park (Gt London)	24%
7492	Barking	24%
1421	West Hampstead	19%
9587	Shepherds Bush	19%
5399	Balham	17%

NLC	Station	Percentage change in Entries & Exits due to PAYG adjustment
5081	Brixton	15%
7491	Limehouse	14%
5597	Vauxhall	12%
6953	Walthamstow Central	12%
5146	Greenwich	12%
5301	Clapham High Street	11%
5578	Wimbledon	11%
5152	Woolwich Arsenal	10%
5148	London Bridge	-10%
6965	Liverpool Street	-10%
7490	Fenchurch Street	-19%
577	Farringdon	-22%
6005	Moorgate	-28%
3092	Kensington Olympia	-33%

A.52 For the 2015/16 dataset it has not been necessary to include this adjustment as the MOIRA2.2 matrix has been updated to address this issue.

London Bridge Adjustment

A.53 Engineering work as part of the Thameslink Programme resulted in changes in service patterns to London Bridge in 2014/15. As many tickets 'to London' do not distinguish between specific terminals, the existing methodology for the production of the Station Usage statistics has been to use the proportions implied by the London Area Travel Survey (LATS) to split total journeys between specific terminals. As the LATS data does not account for the ongoing engineering work at London Bridge, an alternative approach was required to enable an adjustment in station entries and exits arising due to changes in journey patterns as a result of the London Bridge works.

A.54 Transport for London's Oyster Clicks Model (OCM) contains historical data of journeys made using Oyster cards, as well as estimates for paper tickets. This data was used to estimate the number of journeys 'to London Bridge' and the number of journeys 'to London Terminals' as a whole in the following process:

1. A list of stations which have journeys to or from London Bridge was created;
2. The OCM data was used to estimate the proportions of journeys that were made to and from London Bridge following the engineering work;
3. The proportions of London Bridge journeys implied by the OCM superceded the proportions implied by LATS; and
4. The residual splits to and from other London Terminals were scaled up or down to account for changes in London Bridge proportions, but held in the same proportion to each other as implied by the LATS data.

Example:

For a given station (Station A), the LATS implies that 25% of Journeys go to London Bridge, 50% to Waterloo East and 25% to Charing Cross. The OCM implies that the new proportion to London Bridge should be 10%. 10% of journeys are therefore assigned to London Bridge, leaving 90% of journeys unassigned. Previously, Waterloo East was assigned 2/3 of non-London Bridge journeys while Charing Cross was assigned 1/3. The remaining 90% is therefore split between Waterloo East and Charing Cross in this proportion.

Digby & Sowton Adjustment

A.55 Count data provided by the Avocet Line Rail User Group (ALRUG) suggested that the previous Station Usage estimates at Digby & Sowton were higher than expected. Additional data from First Great Western suggested that a season ticket product for students are likely a part of the cause of this discrepancy. This is due to a large number of journeys being made to Exeter Central and Exeter St.David's on tickets with a recorded destination of Digby & Sowton. These season journeys were redistributed to Exeter Central and Exeter St.Davids from Digby & Sowton. Journeys were allocated to Exeter Central and Exeter St. David's according to the proportion of season ticket journeys in the MOIRA2 matrix. The journey adjustment made at these stations is shown in Table A.15.

Table A.15:Digby & Sowton Journey Adjustment (2014/15)

Station	Journeys before adjustment (2014/15)	Journeys after adjustment (2014/15)	Percentage change
Digby and Sowton	894,020	571,510	-36%
Exeter Central	2,105,408	2,343,636	11%
Exeter St. David's	2,424,954	2,509,220	3%

Count-based redistribution of demand at Group Stations

A.56 For tickets where the destination is a station group (such as 'Bedford Stations'), demand was allocated to individual stations based on the methodology described in Appendix D.

A.57 In Spring 2015, passenger counts were conducted at a number of group stations. For 10 Station Groups (21 stations in total), the proportions of demand implied by the station counts were adopted to allocate demand between individual stations in the group. This adjustment only affects the split of total group station demand and not the absolute level of journeys to/from that station group. Where applicable, this updates the existing methodology described in Appendix A.23. Table A.12 shows the 2013/14 and 2014/15 demand allocations for the stations in question.

Table A.12: Changes arising to station group proportions from Spring 2015 station counts

Name	Station Group	2013/14 demand allocation	2014/15 demand allocation (including changes from Spring 2015 counts)
Bedford Midland	Bedford BR	95.5%	95.5%
Bedford St. Johns		4.5%	4.5%
Canterbury East	Canterbury BR	29.8%	30.1%

Canterbury West		70.2%	69.9%
Deepdene	Dorking BR	26.1%	24.7%
Dorking		70.7%	71.9%
Dorking West		3.2%	3.5%
Edenbridge	Edenbridge BR	32.1%	48.8%
Edenbridge Town		67.9%	51.2%
Falkirk Grahamston	Falkirk BR	34.1%	44.2%
Falkirk High		65.9%	55.8%
Helensburgh Central	Helensburgh BR	98.6%	98.2%
Helensburgh Upper		1.4%	1.8%
Newark Castle	Newark BR	16.8%	35.3%
Newark North Gate		83.2%	64.7%
Portsmouth Harbour	Portsmouth BR	52.8%	50.6%
Portsmouth & Southsea		47.2%	49.4%
Southend Central	Southend BR	25.8%	49.1%
Southend East		25.1%	28.0%
Southend Victoria		49.1%	22.9%
Wakefield Kirkgate	Wakefield BR	17.7%	17.5%
Wakefield Westgate		82.3%	82.5%
Worcester Foregate Street	Worcester BR	65.4%	78.8%
Worcester Shrub Hill		34.6%	21.2%

Methodological Changes in 2015/16

London (In-boundary) Travelcard Methodology

A.58 In previous years, London Travelcard journeys were allocated using LATS (London Area Travelcard Survey) data from 2001. This methodology is described in detail in Appendix D. For the 2015/16 production of the MOIRA2.2 dataset, Resonate were able to use data from TfL's Oyster Clicks Model (OCM) to allocate in-boundary[16] Travelcard journeys to individual London stations. In previous productions of the statistics, Travelcard journeys were all assigned to the "London BR" code and then allocated according to the LATS data as with other journeys.

A.59 Travelcard journeys partly outside the London Travelcard Area (out-boundary) were allocated as in previous years using the LATS data.

A.60 As a result of these methodological changes, there were a large number of significant changes to estimated usage at stations within the London Travelcard Area. This in general has re-allocated some journeys that would have previously been to central London terminals to stations outside Zone 1, for example those stations on the London Overground network. When using the 2015/16 statistics it should be noted that this significant methodological change has taken place and therefore a direct calculation of growth between 2014/15 and

[16] Journeys wholly within the London Travelcard Area

2015/16 using the published figures at London stations will not necessarily reflect underlying growth. For this reason, an additional field, "*Estimated absolute change in Usage due to 2015/16 London Travelcard Methodology*", was included so that users can identify where the methodological change is impacting results.

A.61 It should be noted that due to the complex processing and estimation techniques used to calculate this additional field, there are a number of non-London stations which have a small number of entries and exits associated with the London Travelcard Methodology change. These small differences are largely due to estimation approach used, rather than having actually been affected by the London Travelcard Methodology change.

A.62 The table below shows the top 10 increases (ranked by absolute number of entries + exits) due to the London Travelcard Methodology change. Table A17 shows the equivalent for decreases due to the change. The large increases are centred around stations outside of Zone 1, which have experienced large increases in traffic since the collection of the survey data that was previously used to allocated Travelcard journeys. The large decreases are therefore centred mostly on the large Zone 1 terminals, which are likely to have had a higher proportion of usage when the survey took place.

Table A16: Top 10 increases in usage due to London in-boundary Travelcard methodology

Increase Rank	Station name	2015/16 Entries & Exits under previous methodology	2015/16 Entries & Exits under updated methodology	Percentage change due to methodology
1	Canada Water	13,802,077	23,643,842	71.3%
2	Stratford	33,903,520	41,113,260	21.3%
3	Highbury & Islington	22,646,684	28,166,440	24.4%
4	Whitechapel	8,608,391	13,996,988	62.6%
5	Clapham Junction	28,641,908	32,282,220	12.7%
6	Shepherds Bush	5,106,387	8,653,428	69.5%
7	West Ham	6,344,402	8,778,194	38.4%
8	Balham	7,731,554	10,114,526	30.8%
9	Barking	11,113,389	13,428,608	20.8%
10	Shoreditch High Street	5,379,586	7,661,254	42.4%

Table A17: Top 10 decreases in usage due to London in-boundary Travelcard methodology

Decrease Rank	Station name	2015/16 Entries & Exits under previous methodology	2015/16 Entries & Exits under updated methodology	Percentage change due to methodology
1	Charing Cross	34,678,162	28,998,152	-16.4%
2	Waterloo	104,121,285	99,148,388	-4.8%
3	Blackfriars	14,489,288	10,467,646	-27.8%
4	Euston	45,196,881	41,677,870	-7.8%
5	Liverpool Street	69,835,807	66,556,690	-4.7%
6	Putney	11,644,951	9,028,596	-22.5%
7	London Bridge	56,120,914	53,850,938	-4.0%
8	Queen's Park (Gt London)	4,964,576	3,001,396	-39.5%

9	Kensington Olympia	12,842,773	10,904,840	-15.1%
10	Cannon Street	23,155,435	21,242,364	-8.3%

London Terminals Demand Allocation

A.63 For the 2015/16 statistics, the MOIRA2.2 input data was disaggregated by individual London Terminal where possible (for example when a ticket is bought to a specific London Terminal rather than the generic 'London BR' destination). This gives an improved reflection of journey origins and destinations.

A.64 Table A18 shows the changes to the base journeys in 2015/16 compared to 2014/15. Where information is available to link journeys to specific terminals, this has been done, with the remainder associated with 'London BR' and allocated as in previous years (this process is described in Appendix D – Category 3).

A.65 As discussed, journeys associated with London Travelcards have been allocated to individual stations or 'London BR', therefore there are no journeys associated with London Travelcards. As the new London Travelcard Methodology allocates more journeys to smaller stations and less to the London Terminals than the previous methodology, the net number of journeys associated with London Terminals is lower than in 2014/15. It is important to note that this change is due to methodology, and does not necessarily imply that journeys at London Terminals are lower than in 2014/15.

Table A18: Changes to London Terminal base journeys

Origin or Destination	2014/15 Base journeys (millions)	2015/16 Base journeys (millions)
London BR	377.6	302.6
London Travelcards	283.3	-
Blackfriars	-	5.9
Charing Cross	-	15.6
Cannon Street	-	11.4
City Thameslink	-	4.3
Euston	-	9.2
Farringdon	-	8.5
Fenchurch Street	-	6.5
King's Cross	-	4.6
London Bridge	-	36.8
Liverpool Street	-	35.4
Moorgate	-	6.4
Marylebone	-	4.4
Paddington	-	9.3
St.Pancras	-	7.8
Victoria	-	56.4
Waterloo (East)	-	7.6
Waterloo	-	55.5
Total	**660.9**	**551.2**

Season ticket journey adjustments

A.66 In the production of the 2014/15 statistics, an adjustment was implemented on the allocation of passenger demand at stations around Southend, as analysis of LENNON data revealed that season tickets issued for travel to/from Southend Victoria <> London were actually being used to travel from alternative stations on the branch (see paragraph 39A.44). This adjustment was updated and expanded to include additional stations where this issue was present.

A.67 The stations adjusted in the 2015/16 statistics were chosen through a combination of consultation with Train Operating Companies (TOCs) and analysis of LENNON sales data and therefore do not represent a definitive list of issues such as this on the GB rail network. Table A19 shows the stations that have been adjusted for the 2015/16 published statistics.

Table A19: Stations where Season ticket adjustments made (2015/16)

Station Group	Source	Diagnosis
Southend Victoria / Southend East / Rayleigh / Hockley	Previously adjusted (2014/15 statistics)	
Gatwick Airport / Horley / Redhill / Salfords	Reigate, Redhill and District Users' Association and Govia Thameslink Railway (GTR)	Large number of tickets for travel to/from Reigate bought at other stations
Reigate/ Redhill		
Dorking / Redhill / Reigate		
Brighton / Preston Park	Southern	Large number of tickets for travel to/from Brighton bought at Preston Park.
Oxford / Didcot Parkway	Great Western Railway (GWR) Analysis of LENNON data	Large number of tickets for travel to/from Oxford bought at Didcot Parkway.
Southampton Central / Southampton Parkway	Analysis of LENNON data	Large number of tickets for travel to/from Southampton Central bought at Southampton Parkway.
Chalkwell / Benfleet / Leigh-on-Sea	Analysis of LENNON data	Large number of tickets for travel to/from Chalkwell bought at other stations
East Grinstead / Lingfield / Dormans	Analysis of LENNON data	Large number of tickets for travel to/from East Grinstead bought at other stations

Southend Victoria and Southend Central

A.68 The original adjustment made to the 2014/15 statistics was updated to reflect the improved methodology made in 2015/16. It is important to note that a number of improvements have been made to the 2014/15 figures which explain the large differences observed.

A.69 The new methodology assumes that journeys are only reallocated for journeys via a specific route. For example, journeys were only reallocated on the 'via Romford' route among stations on the Southend Victoria branch. This results in fewer journeys being reallocated than under the methodology used in the 2014/15 statistics, but is more consistent with that used for other stations. This is an important improvement as it ensures that journeys are not allocated to other routes.

A.70 A calculation error relating to the allocation of Travelcard journeys under the previous (2014/15) methodology was identified, leading to an overstatement of Rochford and Prittlewell journeys and an understatement of Hockley journeys. This is estimated to have resulted in an overstatement of circa +120k journeys at Rochford (c.17% of 2014/15 usage),

+225k journeys at Prittlewell (c.53% of 2014/15 usage), and an understatement of -100k journeys at Hockley (c.10% of 2014/15 usage). The effect on other stations is less than 50k journeys. The 2014/15 Station Usage figures were therefore updated for these stations in the 2015/16 Station Usage dataset.

Southend East

A.71 This was the second original adjustment made to the 2014/15 statistics, which was updated with this improved methodology. This update involved reallocating journeys from Southend East to Southend Central. Previously the only reallocation was Southend East > Westcliff and Southend Central > Westcliff. Under the new methodology, the reallocation is Southend East > Westcliff; Southend Central > Westcliff; and Southend East > Southend Central. This reduces the net number of journeys being reallocated away from Southend Central.

A.72 A summary of the 2014/15 and adjusted 2015/16 statistics is shown in Table A20.

Table A20: Comparison of 2014/15 and 2015/16 statistics

Station	2014/15 published statistics	2015/16 Statistics (adjusted)
Southend Victoria	1,358,773	1,439,480
Rayleigh	1,864,064	1,949,600
Hockley	968,690	1,034,488
Rochford	700,214	596,634
Prittlewell	424,804	195,870
Southend Airport	520,734	425,160
Southend East	1,662,180	1,760,908
Southend Central	2,918,931	3,092,306
Westcliff	1,109,380	1,175,528

Dorking/Gatwick Airport/Reigate

A.73 Following the publication of the 2014/15 statistics, the Reigate, Redhill and District Users' Association raised a potential issue around passengers purchasing season tickets from Dorking / Gatwick Airport to London, rather than from Redhill to London. This anomaly is due to ticket prices being similar or cheaper from Dorking / Gatwick Airport than from Redhill, despite the fact that travel from Redhill is valid on such tickets. The Users' Association stated that based on their surveys, 26% of passengers at Redhill were travelling on Gatwick or Dorking season tickets. The procedure described above was carried out to reallocate journeys on season tickets away from Gatwick Airport and Dorking in proportion to where standard-class annual Season tickets were purchased.

A.74 In the evaluation of instances where a large number of tickets were bought at non-origin stations, a large number of Redhill tickets were identified as being bought at Reigate. Given the annual ticket prices are identical for the 'Any Permitted' route, there is reason to believe that passengers are purchasing Seasons from Reigate rather than Redhill in order to get added flexibility. An additional adjustment was therefore made to Reigate season journeys.

Brighton/Preston Park

A.75 The consultation with train operators highlighted numerous examples of stations with identical season ticket prices along the south coast. For this initial exercise one such example

(Preston Park), was examined where season tickets to London are the same price as they are from Brighton. Given that having the flexibility to travel into Brighton as well as London is attractive to passengers, journeys were reallocated between these stations.

Oxford/Didcot Parkway

A.76 The consultation with Passenger Demand Forecasting Council (PDFC) members (supported by analysis) highlighted that Season tickets from Oxford to London cost the same as Season tickets from Didcot Parkway to London. Given that having the flexibility to travel into Oxford as well as London is attractive to passengers, a reallocation of journeys between these stations was considered appropriate.

Southampton Central/Southampton Parkway

A.77 Season tickets to London are marginally cheaper from Southampton Central (£5,324)[17] than Southampton Airport (Parkway) (£5,404), despite Southampton Airport being closer to London. It is therefore plausible that passengers buy Southampton Central tickets even though they regularly travel from Southampton Airport (Parkway) so that they have the flexibility to travel into Southampton. A reallocation of journeys was therefore considered appropriate.

Chalkwell/Benfleet/Leigh-on-Sea

A.78 Chalkwell station is in the suburban area surrounding Southend, directly adjacent to the beach. Season tickets from Benfleet and Leigh-on-Sea to London cost the same as tickets from Chalkwell to London. Given that there are car parks at Benfleet and Leigh-on-Sea, it is conceivable that season ticket holders use this station to access the beach/town at weekends.

East Grinstead/Lingfield/Dormans

A.79 Season tickets to London from East Grinstead cost the same as tickets to London from Lingfield and Dormans. Given that East Grinstead is the largest town close to Lingfield and Dormans, it is reasonable that passengers would find the flexibility of travel to East Grinstead attractive.

Summary

A.80 Table A21 shows a summary of the approximate difference to the final entries and exits made by this series of adjustments by station.

[17] Prices for 12 month season – Any Permitted route. Source: National Rail Enquiries **http://ojp.nationalrail.co.uk/service/seasonticket/search** [Accessed: 10/10/2016]

Table A21: Summary of adjustments

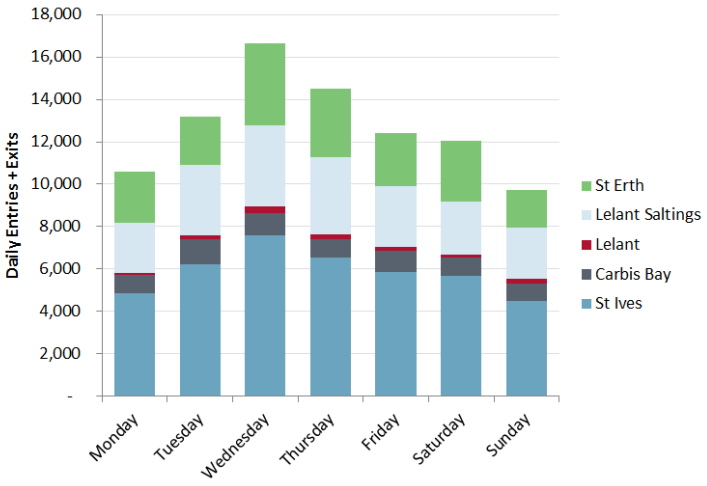
TLC	Station	Adjustment to Entries & Exits	2015/16 Statistics without adjustment	2015/16 Statistics with adjustment
SOV	Southend Victoria	-1,100,624	2,540,104	1,439,480
RLG	Rayleigh	622,997	1,326,603	1,949,600
HOC	Hockley	338,473	696,015	1,034,488
RFD	Rochford	106,813	489,821	596,634
PRL	Prittlewell	20,672	175,198	195,870
SIA	Southend Airport	11,669	413,491	425,160
CHW	Chalkwell	-362,927	1,897,547	1,534,620
BEF	Benfleet	254,019	3,469,059	3,723,078
LES	Leigh-On-Sea	108,908	2,097,546	2,206,454
REI	Reigate	-249,763	1,568,763	1,319,000
RDH	Redhill	341,963	3,547,717	3,889,680
SOU	Southampton Central	-180,076	6,539,768	6,359,692
SOA	Southampton Airport (Parkway)	180,076	1,639,356	1,819,432
SOE	Southend East	-130,909	1,891,817	1,760,908
WCF	Westcliff	138,748	1,036,780	1,175,528
SOC	Southend Central	-7,839	3,100,145	3,092,306
OXF	Oxford	-323,461	6,888,139	6,564,678
DID	Didcot Parkway	323,461	3,133,219	3,456,680
EGR	East Grinstead	-135,262	1,662,082	1,526,820
LFD	Lingfield	114,776	501,132	615,908
DMS	Dormans	20,486	104,690	125,176
GTW	Gatwick Airport	-101,175	18,130,021	18,028,846
HOR	Horley	90,686	985,324	1,076,010
SAF	Salfords	3,499	128,909	132,408
XDK	Dorking BR	-85,210	1,784,780	1,699,570
BTN	Brighton	-110,157	17,443,483	17,333,326
PRP	Preston Park	110,157	457,843	568,000

Count-based allocation of Ranger products on the St Ives Bay line

A.81 A large number of journeys on the St. Ives Bay line are made using Ranger/Rover tickets, which allow for flexible travel between any stations on the line. In previous years, journeys have been allocated to specific origins and destinations using point-of-purchase sales data. This does not allow for a robust link to be made between journeys and origins as most stations on the branch do not have ticket offices, and a large number of tickets are sold by on-platform staff which are not always recorded as a geographic location. Consequently, the ORR commissioned passenger counts to be carried out on the line in order to better allocate journeys to geographic locations. These counts were carried out between Monday 1st and Sunday 7th August 2016, in order to capture peak summer demand on the line.

A.82 The observed distribution of entries + exits at each station for each day of the survey is shown in Figure A1.

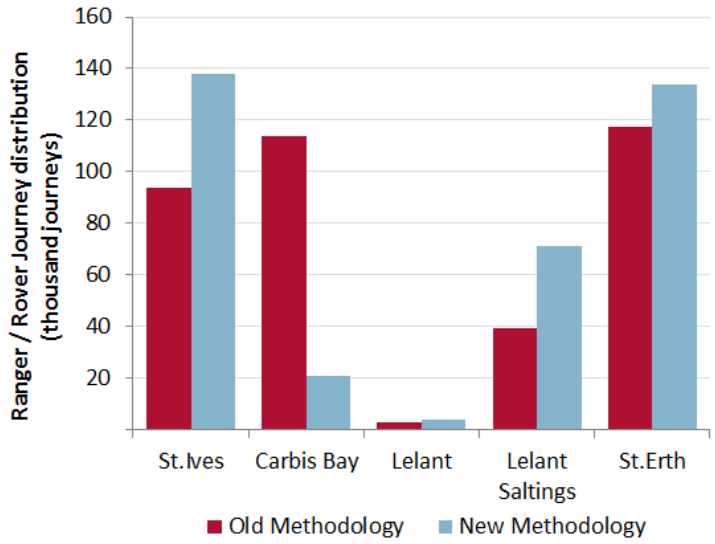
Figure A1: Counted entries + exits on St.Ives Bay line 0600-2100 (1/8/2016 – 7/8/2016 inclusive)



A.83 The counts were used to allocate journeys associated with sales of St Ives Ranger tickets where there was not a physical location for the sale. This was done by allocating journeys to origins according to the proportion of entries and exits at each station impled by the count data.

A.84 The splits of Ranger/Rover journeys only (i.e. not including the point to point journeys) from the new methodology are shown in Figure A2. There is a noticeable reduction in the allocation of demand to Carbis Bay. This is due to a larger proportion of point-to-point journeys having Carbis Bay as an origin than is implied by the usage observed in the survey. The opposite is true for St.Ives, Lelant Saltings, and St.Erth. Lelant shows low usage in both the survey and the MOIRA2.2 data.

Figure A2: Total infill journeys in 2015/16 under the Old and New methodology (excl. Point-to-Point journeys)



A.85 Table A22 shows the entries and exits on the St.Ives Bay line as reported in the 2014/15 statistics and the 2015/16 figures incorporating the changes discussed in this section. The entries and exits associated with the Ranger ticket infills are shown separately for

comparison. It should be noted that while the infill associated with Lelant is relatively small compared to the other stations, it has a noticeable effect on the final station usage numbers as under the previous infill methodology no journeys were associated to Lelant.

A.86 The table includes a percentage growth between 2014/15 and 2015/16 reported entries and exits but it needs to be borne in mind that this is a mixture of underlying growth and the methodology change.

Table A22: St Ives bay line entries + exits in 2014/15 and 2015/16

	Entries + Exits				
Station	2014/15 Infill	2014/15 Total demand	2015/16 Infill	2015/16 Total demand	%age 2014/15 – 2015/16
St.Ives	329,676	**638,754**	360,684	**657,750**	3.0%
Carbis Bay	149,908	**231,800**	106,611	**191,408**	-17.4%
Lelant	508	**2,874**	6,291	**8,104**	182.0%
Lelant Saltings	91,094	**116,798**	103,034	**125,064**	7.1%
St.Erth	101,045	**204,806**	157,540	**257,802**	25.9%

PTE Infills

A.87 In the production of the 2015/16 dataset it was identified that some products (specifically add-on tickets associated with local Metros and Airport links) that formed part of the infill were already included in the MOIRA2.2 dataset. For the 2015/16 dataset these products have been removed from the PTE infills to ensure they are not double-counted. The relevant products are:

- Leeds-Bradford Airport bus link products;
- Manchester Metrolink add-on products;
- Liverpool Airport bus link products;
- Tyne & Wear Metro (incl. Newcastle Airport) add-on products; and
- Strathclyde Airport, Ferry, and Glasgow Subway add-on products.

A.88 There were a total of 983,707 journeys associated with these products in the 2015/16 statistics. Under the previous methodology station usage would have been overstated by approximately this amount. Whilst this represents a very small number of journeys in aggregate, due to the nature of the products there is a more significant impact on specific stations. The top ten stations affected are shown Table A23 (ranked in order of percentage change from removing these products).

Table A23: Approximate impact of removing double-counted infill products

Rank	Station Name	Published 2015/16 statistics	Estimated 2015/16 usage if double counting was included	Percentage reduction due to removing double counting
1	Prestwick International Airport	93,026	142,599	-34.8%
2	Altrincham	507,592	685,253	-25.9%

3	Ardrossan Harbour	111,086	136,090	-18.4%
4	Wemyss Bay	166,472	181,100	-8.1%
5	Riding Mill	27,986	30,320	-7.7%
6	Hyde Central	81,512	85,378	-4.5%
7	Wylam	105,572	110,279	-4.3%
8	Reddish North	174,334	181,413	-3.9%
9	Levenshulme	512,654	533,227	-3.9%
10	Marple	454,858	472,000	-3.6%

A.89 The largest impacts on the 2015/16 statistics are at Prestwick International Airport (due to the double-counted airport products not being included), Altrincham (interchange with Manchester Metrolink), and Ardrosson Harbour (due to the double-counted ferry products not being included).

B Appendix – Station Usage File Definition

Station Usage File Definition

B.1 The Station Usage spreadsheet ('Estimates of Station Usage 2016-17.xlsx') lists the entries, exits and interchanges made at stations throughout England, Scotland and Wales in the financial year 2016/17 (1st April 2016 to 31st March 2017). It also gives details about the entries and exits for different ticket categories. It contains data on entries and exits made at rail stations by passengers using the rail network. The fields included in the Station Usage dataset are shown in Table B.1.

Table B.1: Station Usage file

Field	Note
NLC	National Location Code
TLC	Three Letter Code; sourced from National Rail
Station Name	Station Name
Region	Source: OS BoundaryLine (2015)
Local Authority	Source: OS BoundaryLine (2015)
Constituency	Westminster Parliamentary Constituency (as at December 2015), Source: OS BoundaryLine (2015)
OS Grid Easting	The Easting reference for the station, using the Ordnance Survey (OS) grid. Sourced from NAPTAN (2016).
OS Grid Northing	The Northing reference for the station, using the Ordnance Survey (OS) grid. Sourced from NAPTAN (2016).
Station Facility Owner (SFO)	The company that is the station facility owner (updated for position as at end 2016/17)
Station Group	Name of the Group where applicable. The user of this data may wish to filter on the 'Station Group' column, or create pivot tables, to investigate the results at a group level
PTE Urban Area Station	Stations within the urban areas covered by PTE services are identified with a flag: 'PTE Urban Area Station'
London Travelcard Area	Stations with the urban areas covered by PTE services and TfL services are identified with a flag: 'London Travelcard Area Station'
SRS Code	Strategic Route Section (SRS) code associated with the station
SRS Description	Description of the Strategic Route Section (SRS)
NR Route	High level Network Rail (NR) grouping
CRP Line Designation	Gives the Community Rail Partnership (CRP) Line Designation as listed by the DfT, if applicable. Note: this does not include Service Designation Community Rail Partnerships
Entries and Exits (Full, Reduced, Season, Total)	Entries and Exits made at the stations split by ticket categories and in total

Field	Note
16/17 Entries & Exits	Sum of Entries and Exits for 2016/17
15/16 Entries & Exits	Sum of Entries and Exits for 2015/16
16/17 Interchanges	Total Interchanges made for 2016/17
Large station change Flag	Flags change in Entries and Exits greater than 10% for stations with over 10,000 Entries and Exits
Small station change Flag	Flags change in Entries and Exits greater than 25% for stations with under 10,000 Entries and Exits
Explanation of large change	Identified reason(s) for large changes for flagged stations
Source for explanation of large change	Links to source(s) of information for explanations of change, where appropriate

Station Codes

B.2 There are a number of stations where it is noted that the station TLC ("Three Letter Code") in the Station Usage dataset is not the same as that used in ATOC (now Rail Delivery Group)'s "Master Station Names" file.[18] For the 2015/16 statistics the TLC has been updated in the publication dataset to match the TLC on the ATOC master list. We have also updated some station names to match the ATOC master list. These changes are shown in Table B.2.

Table B.3: Station Names/Codes – MOIRA2.2 vs ATOC Master Name

Station Name in historic datasets	Station TLC in historic datasets	Updated Station Name	Updated TLC
Anerley	ANY	Anerley	ANZ
Butlins Penychain	BPC	Penychain	PNC
Canada Water	CAW	Canada Water	ZCW
Ebbsfleet International	EBB	Ebbsfleet International	EBD
Ebbw Vale Town	EBW	Ebbw Vale Town	EBB
Fambridge	FAM	North Fambridge	NFA
Farringdon	FAR	Farringdon	ZFD
Heysham Harbour	HHB	Heysham Port	HHB
Liverpool South Parkway	LSP	Liverpool South Parkway	LPY
London Road Guildford	LON	London Road Guildford	LRD
Lostock Parkway	LOT	Lostock	LOT
Salford	SFD	Salford Central	SFD
Whitechapel	WCA	Whitechapel	ZLW
Woodham Ferrers	WDF	South Woodham Ferrers	SOF

[18] **http://data.atoc.org/**

C Appendix – Overview of the ORCATS allocation process

Overview of the ORCATS Allocation Process

C.1 This section gives an outline of the Central Allocations File (CAF), which is used in producing the interchange figures, and the ORCATS process which is used to create the CAF.

C.2 Most of the train tickets that are sold are inter-available – the customer has a choice of routes and operators. For example, when a customer buys a ticket to travel from Leicester to Leeds, that customer may travel on various combinations of East Midlands Trains, East Coast, CrossCountry Trains and Northern, and may interchange at Doncaster, Sheffield, Derby or Nottingham. LENNON captures the sale of the ticket, but unless the ticket has stringent route restrictions, the route actually taken by the customer is not recorded.

C.3 The route taken by any particular customer may never be known, but some route options are more attractive than others. The customer is more likely to choose a faster, more frequent service than a slower, less frequent one. This likelihood can be translated into the proportions of customers choosing each route option, on a particular flow. (A 'flow' represents all journeys from a given origin station to a given destination station, irrespective of the route taken.) The revenue received from all customers on that flow should be split between different operators to reflect the proportion of customers which each operator carried.

C.4 ORCATS was developed to model the choice made by the customers, and to allow revenue to be split between operators. It applies passenger choice modelling to the train timetable, to determine the relative attractiveness of different route alternatives. It then weights the results by journey mileage.

C.5 For any given timetable, ORCATS works out the possible routes between each origin and destination, and calculates the percentage of the passengers that are expected to choose each route based on the services in that timetable.

C.6 The output from ORCATS is the Central Allocations File (CAF). This lists the proportion of journeys on each flow (or origin-destination pair) estimated to be made by each route alternative. For journeys involving interchanges, each leg of the journey is listed. By combining this information with the ODM data, which contains journeys for all flows, the number of interchanges occurring at individual stations has been estimated.

D Appendix – Methodology: Non-Station Tickets

Methodology: Non-Station Tickets

D.1 Ticket sales do not always tell us where a passenger is travelling. Ticket sales can be divided into the seven categories listed in table below. Ticket sales data has been converted into an estimate of the actual stations that passengers are travelling from/to.

D.2 The processing of ticket sales data is undertaken in the creation of the MOIRA2.2 demand matrix, and then subsequently in the creation of the ODM. For each of the flow categories, the table below states where the flow is processed: MOIRA2.2 or ODM.

Table D.1: Categorisation of ticket sales in LENNON

Flow Category	Description	Processing
Category 1	Origin and Destination Stations Known	No processing required
Category 2	Origin or Destination a Group Station (excl. London BR)	ODM
Category 3	Origin or Destination is London Terminals	ODM
Category 4	Origin or Destination a London Travelcard including Zone 1	ODM
Category 5	Origin or Destination a London Travelcard excluding Zone 1	MOIRA2.2 Demand Matrix
Category 6	Origin or Destination a London Travelcard Boundary Zone	MOIRA2.2 Demand Matrix
Category 7	Non-National Rail Stations	MOIRA2.2 Demand Matrix

D.3 In the descriptions below any reference to the methodology used prior to 2011/12 is drawn from documentation produced by Resonate when they were the ORR's consultants producing these statistics. From 2011/12 onwards a number of changes have been made in the methodology in order to better represent the distribution of demand between Group Stations (Category 2) by using passenger count data as described in Appendix A of this report.

Category 1 – Origin and Destination Stations Known

D.4 Both the origin and destination were known stations so no further processing is required for such flows.

Category 2a – Origin or Destination a Group with all Stations Having a Ticket Office

D.5 In 2005/06 all origins or destinations that were a group station (with the exception of London BR) were changed to the major station within the group. For example, all ticket sales to or from Reading BR were recoded to Reading.

D.6 In 2006/07 the ODM was based on the journeys from ticket sales to the individual stations within a group. We assumed that passengers travelling to the stations in a group would act in the same way as passengers travelling from the stations in that group. It was believed that this was, in general, a valid assumption to make, and no bias would be introduced into the journey figures.

D.7 From 2007/08 onwards this process is still used where all stations in the group have ticket offices, so that the relative flows from the individual stations are credible.

D.8 For example, in 2006/07 the journeys between stations in the 'Manchester BR' group and Crewe and vice-versa are shown by the column "jnys" in the table below. First the proportion of journeys from each of the individual Manchester stations to Crewe is determined, as shown in column "%split."

D.9 Then these proportions are applied to both the 'Manchester BR to Crewe' and 'Crewe to Manchester BR' flows, giving the breakdowns to individual stations shown in column 'BR portion'. These are added to the base values to give "Total Journeys", before the 'Manchester BR to Crewe' and 'Crewe to Manchester BR' flows are deleted, to avoid double counting. The slight discrepancy between the 'Grand Totals' is due to rounding error.

Table D.2: Example of breaking down journeys to/from a BR group of stations

Orig	Dest	Origin Name	Destination Name	Jnys	%Split	BR portion	Total Jnys
2963	1243	DEANSGATE	CREWE	83	0.32%	85	168
2966	1243	MANCH OXF RD	CREWE	5,464	21.03%	5,580	11,044
2968	1243	MANCH PICC	CREWE	19,733	75.95%	20,152	39,885
2970	1243	MANCH VICT	CREWE	700	2.69%	714	1,414
0438	1243	MANCH BR	CREWE	26,533		Remove	
1243	2963	CREWE	DEANSGATE	207		1,478	1,685
1243	2966	CREWE	MANCH OXF RD	2,262		97,287	99,549
1243	2968	CREWE	MANCH PICC	8,017		351,349	359,366
1243	2970	CREWE	MANCH VICT	343		12,464	12,807
1243	0438	CREWE	MANCH BR	462,578		Remove	
		Grand Total:	525,920			525,918	

D.10 The above methodology has been applied to all flows with more than 1,000 journeys in total, based on sales data, leaving the individual group stations (i.e. not including the 'BR Group NLC to destination' flow). For the smaller flows an average split is applied based on the flow with more than 1,000 journeys.

D.11 Since 2011/12 a number of station passenger counts have been undertaken at individual stations within some of the BR station groups in order to support a revision to how the total demand is split between the individual stations. Since 2012/13 progressively more station groups have a count based methodology for apportioning total demand amongst its member stations. In the 2015/16 Station Usage dataset the following Group Stations use passenger counts to calculate the split between individual stations:

- Bedford BR (Bedford Midland, Bedford St. Johns);
- Canterbury BR (Canterbury East, Canterbury West); ;
- Colchester BR (Colchester, Colchester Town);
- Dorchester BR (Dorchester South, Dorchester West)
- Dorking BR (Deepdene, Dorking, Dorking West);
- Edenbridge BR (Edenbridge, Edenbridge Town);
- Falkirk BR (Falkirk Grahamston, Falkirk High);
- Farnborough BR (Farnborough Main, Farnborough North);
- Helensburgh BR (Helensburgh Central, Helensburgh Upper);
- Hertford BR (Hertford East, Hertford North);
- Maidstone BR (Maidstone Barracks, Maidstone East, Maidstone West);
- Newark BR (Newark Castle, Newark North Gate);
- Portsmouth BR (Portsmouth Harbour, Portsmouth & Southsea);
- Southend BR (Southend Central, Southend East, Southend Victoria);
- Wakefield BR (Wakefield Kirkgate, Wakefield Westgate); and
- Worcester BR (Worcester Foregate Street, Worcester Shrub Hill).

Category 2b – Origin or Destination a Group with some Stations Having no Ticket Office

D.12 For this class of stations the above process breaks down because the proportion of journeys **to** the group stations with no ticket offices will tend to be estimated as zero because the sales **from** those stations are necessarily zero. For these groups bespoke methodology has tended to be used based on the best available data. This year entries and exits for the majority of stations in this group have been obtained by apportioning total station group entries and exits using count data.

D.13 For the remaining stations splits between stations have been fixed at an origin and destination and route code level at the proportions estimated in the 2010/11 dataset.

Category 3 – Origin or Destination is London BR

D.14 This category contained all flows that had London BR as either the origin or destination. In order to assign an appropriate London station on flows where either the origin or destination is London BR (NLC=1072) or a London Travelcard involving Zone 1, we analysed responses from the 2001 London Area Travel Survey (LATS). For journeys from any given station, we established the percentage of passengers using each London terminus.

D.15 For example, if the flow was from Ashford International to London BR, we used our pre-generated table showing the percentage spilt between the alternative London termini for passengers starting at Ashford International. From this we apportioned the exits between London Bridge, Charing Cross, Victoria and other London termini.

D.16 Stations with small sample sizes were removed from the 2001 LATS data. Where there was insufficient data in the 2001 LATS to generate the split for a particular station, a similar process with the Non London Groups methodology was applied. Firstly for all the flows with

more than 1000 journeys leaving London BR and having as a destination the particular station we used split factors as above. However, if the sum of journeys was less than 1000 we assigned to the flow the top origin from the London BR stations.

Category 4 – Origin or Destination a London Travelcard including Zone 1

D.17 All origins and destinations that were London Travelcard Zones that include Zone 1 were converted to 'London BR' under the assumption that they will travel to the same stations as point-to-point passengers and then transfer to another mode. The methodology set out above for Category 3 was then applied.

Category 5 – Origin or Destination a London Travelcard excluding Zone 1

D.18 This category contained all Travelcards that did not include Zone 1, for example Zone R2345 London.

D.19 For flows with origin or destination a London Travelcard (excluding zone 1) we use a set of assumptions based on survey responses from the 2001 LATS. They use the starting station to work out which stations it is possible for the passenger to be travelling to, and also give the proportion of passengers travelling to each of these stations. This is based on the assumption that a passenger holding a Zones 2-6 Travelcard would travel as far as Zone 2.

D.20 This processing is undertaken during the production of the MOIRA2.2 demand matrix.

Category 6 – Origin or Destination a Boundary Zone

D.21 All origins and destinations that were a London Travelcard Boundary Zone were converted to 'London Travelcard including Zone 1' under the assumption that a passenger travelling from or to a Boundary Zone will hold a Travelcard that includes Zone 1. The methodology set out above for Category 3 was then applied.

D.22 This processing is undertaken during the production of the MOIRA2.2 demand matrix.

Category 7 – Non-National Rail Stations

D.23 This final category contains all those flows in the original ticket sales data that do not fall into one of the above categories. Refer to Appendix E for a detailed description of this data and what has been included and excluded from the ODM.

D.24 This processing is undertaken during the production of the MOIRA2.2 demand matrix.

E Appendix – Station Usage Dataset Limitations

Station Usage Dataset Limitations

Limitations of the LENNON data

E.1 The LENNON database captures ticket sales for the entire national rail network from many different input machines. It is as a consequence a very large dataset. With all large data sources there will always be input errors resulting in a certain amount of invalid data. Generally such errors will be small, and are more likely to occur in the journeys rather than revenue fields.

E.2 Checks are performed on the data when the MOIRA2.2 demand matrix is compiled, but due to the size and complexity of the dataset it is not possible to validate each and every entry.

E.3 We have used similar information extensively in the last ten years or more, and have found the data to be reliable, particularly when examining the data at an aggregated level.

E.4 There are a number of areas where we know that LENNON does not capture the data correctly, or instances where it is not possible to derive passenger journeys from ticket sales data. These areas are expanded upon below.

Known Problems of Data Capture

E.5 The data in LENNON from which the ODM is derived is based on ticket transactions. In order for the data to be included in the ODM it must include an origin station and a destination station. However if this is not the case then the data will automatically be excluded.

E.6 Human error at the point the ticket sale is entered into the input machines will also produce invalid data in LENNON.

Travelcards

E.7 As Travelcards are for multi-modal travel they allow the purchaser to make journeys on the rail system and on other modes. Equally, tickets purchased elsewhere on the local transport system will be valid for rail travel. Therefore LENNON gives only a partial picture of the rail travel in conurbation areas, such as: London, Birmingham, Glasgow, Leeds, Liverpool, Manchester, Newcastle and Sheffield.

E.8 The ODM contains reasonably robust estimates of journeys within London and other conurbation areas where travelcards are widely used. An infill for London Travelcards has been included in the ODM since 2006/07, and an infill for PTE tickets is included from 2008/09. Both these infills have been subject to methodological enhancements in recent years.

Return and Single Journey Tickets

E.9 It is possible that on certain routes the cost of a return ticket could be lower than a single ticket. This leads to the cheaper return ticket being purchased even though the passenger has

no intention of making the return journey by rail. This results in two journeys being recorded instead of one.

Multiple Tickets

E.10 It is possible to buy special cheaper tickets between certain stations for example under a promotion by one of the train companies. In these cases a local ticket may be bought to gain access to a main station and a second ticket bought for the rest of the journey. This results in two journeys being recorded in the ODM and will not accurately represent the journey undertaken.

Rail Staff Passes

E.11 Prior to the privatisation of the rail network, British Rail employees and their families were eligible to various levels of free or reduced rate rail travel. When the various rail companies were converted to private companies, this benefit often continued.

E.12 If you consider the network as a whole, the effect of staff passes is unlikely to be significant. However, it may be significant on certain routes, for example on routes out of Derby due to large concentration of companies in Derby relating to British Rail both pre and post privatisation.

E.13 Ticketless Travel: On every route on the network there will always be passengers who travel without purchasing a ticket. This is referred to as ticketless travel. As LENNON data is derived from ticket transactions it cannot reflect this travel.

Other Rail Systems

E.14 There are a number of rail systems in operation in the country that are not covered by LENNON. For Heathrow Express and Eurostar revenue and journeys data were not available.

Journey Factors

E.15 Ticket transactions are converted into an estimate of the number of journeys made by applying a series of ticket type journey factors. Single and return tickets unambiguously translate into one and two journeys respectively, for season tickets, the factors used represent a rough historic estimate as set out in Appendix Table E.1.

E.16 Ticket periods of other lengths are converted to a number of journeys using a proportion of the monthly journey factor.

E.17 Therefore the journeys data in the ODM represents an assumed number of journeys made based on the ticket type sold and the above journey factors. In particular it should be noted that the journeys data has not been cross-checked against other data sources of the actual number of journeys made on the network.

E.18 These journey factors have been used within the LENNON system for a number of years at their current values. The source of the factors is unclear, and there is some indication that they were based on reasonable estimates of ticket use made in excess of fifteen years ago. It can therefore be argued that these journey factors do not provide an accurate estimate of the number of journeys that result on the rail system at present, or in any ODM.

Table E.1: Journey Factors used in LENNON

Description	Journeys Per Issue
Single Journey Ticket	1
Return Journey Ticket	2
Return Journey 2 Persons	4
3 Day Return/ 6 Single Journeys	6
4 Day Return/ 8 Single Journeys	8
5 Day Return/ 10 Single Journeys	10
6 Day Return	12
5 Day Single	5
1.5 Journeys	1.5
Weekly Ticket	10.3
10 Day Return/ 20 Single Journeys	20
2 Weekly Ticket	22
Seasons-Variable Periods	***
Monthly Ticket	45
Not Used	0
3 Monthly Tickets	135
Not Used	0
6 Monthly Tickets	270
Summary Group Codes	***
Annual Ticket	480
8 Day Ticket	22
22 Day Ticket	44
14 Day Ticket	30
50 Journeys	50
10 Weeks	103

Data Excluded From Station Usage

E.19 Some of the LENNON data has been excluded from the MOIRA2.2 Demand Matrix, and subsequently from the ODM.

E.20 All the products that were classified into the 'miscellaneous' ticket pot were excluded. These products were:

- Car Parking
- Railcard Sales
- Penalty/Excess Fares
- Seat Reservations
- Sleeper Supplements.

E.21 Also excluded from the analysis were all the flows that had either an Origin or Destination that did not represent a geographical location (these are mainly "I codes"), e.g.

- Rover and Ranger Tickets (except those included in the new 'Other' Infill in 2011/12 and subsequent years)
- BritRail Tickets
- Gate passes usually used by staff
- Passenger Charter Discounts
- Headquarters Input Items, other than those which can be identified as TfL or PTE

E.22 Finally for flows that have either Origin or Destination as a Private Settlement Code some are included and some are excluded.

- PTE tickets and TfL sold London Travelcard records from LENNON are removed, and replaced with an estimate of all rail travel using these tickets via 'infill's to the MOIRA2.2 demand matrix (refer to Chapter 2).
- PlusBus – all significant flows have been included since 2007/08 and minor flows are excluded.
- Attractions – the rail element of the significant flows have been included since 2007/08, which include:
    - Bluewater Shopping Centre
    - Alton Towers
    - Whipsnade
    - Chatsworth House

E.23 All other flows involving Private Settlement are excluded, e.g. Irish Stations.

Control Sheet

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