steer davies gleave

Origin-Destination Matrix 2015/16

Summary Report

Report
January 2017

Office of Rail and Road

Our ref: 22670602
Client ref: ORR/CT/13-33

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Executive Summary

1. The Origin Destination Matrix (ODM) forms a vital part of the Office of Rail and Road's (ORR) information about how passengers travel on the railways in England, Wales and Scotland. The ODM gives information for revenue and journeys, by ticket type, for each rail flow across the country, i.e. each combination of origin station, destination station and ticket route code.

2. This report is provided with the ODM file, and gives guidance on the methodology that has been followed during the process of creating the dataset for financial year 2015/16 (1st April 2015 to 31st March 2016).

3. The ODM shows the numbers of journeys made, and resulting ticket revenue and passenger miles, for each flow (pair of origin and destination stations) in Great Britain. Where tickets are offered via different routes, the data is also broken down into those routes. It is used as the source for the ORR's regional rail usage profiles. If further analysis is needed ORR may be able to respond to such requests.

4. Tickets are offered between every pair of stations in Great Britain, though not all combinations register a sale in any particular year. For each pair of stations, journeys and revenue figures are split between four different ticket types and between standard and first class tickets.

5. While LENNON is the major source of data for the ODM, it is augmented by a range of additional data sources to provide a more complete representation of travel on the national rail network. Since 2008/09, this has included estimates of journeys and revenue made in major urban areas on Passenger Transport Executive (PTE) sponsored tickets which were previously excluded due to issues of distributing passenger journeys to flows. In subsequent years a number of improvements have been made to the methodology used to represent journeys associated with PTE-sponsored tickets. Notwithstanding the improvements made to represent passenger journeys in the ODM, there are limitations on the data which users should be aware of and which are detailed in this report.

Methodology

6. The ODM is 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 and PTE-sponsored tickets in the major urban areas outside London.

8. The production of the ODM involves making a number of further adjustments and inclusion of additional "infills" to address identified issues The overlays include representation of journeys on selected 'Ranger/Rover' products (e.g. Anglia Plus products) and a number of adjustments are made to address known issues across the network.

9. The adjustments included in the ODM are:
    - Allocation of demand associated with tickets sold to 'London Terminals' between those terminals. These process has been enhanced in the 2015/16 station usage[1] dataset and is described in Chapter 3;
    - Allocation of demand between individual stations within station groups outside central London. For example where tickets are sold to/from 'Exeter BR' it is necessary to estimate how these journeys are distributed between Exeter Central, Exeter St. David's and Exeter St. Thomas;
    - Specific adjustments made to selected stations to account for known issues, for example Digby & Sowton.

Methodological Development

10. 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 leads to inconsistency with historic data, provided changes are clearly explained. In the 2015/16 dataset a number of methodological improvements have been implemented:
    - Improved distribution of demand in the London Travelcard Area, using data from Transport for London (TfL)'s Oyster Clicks Model (OCM);
    - Improved allocation of demand to London Terminals;
    - Improved allocation of journeys associated with sales of Ranger products on the St. Ives Bay line;
    - Updated and extended application of 'Season ticket journey allocation' adjustments.

11. **It is important to note that differences between this year and previous years' figures on these flows need to be considered in light of design changes to the methodology which affect the level and distribution of demand across flows.**

Limitations of the data

12. In the absence of a fully 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 for the development of the ODM, as described in this report, 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.

13. However, this data does have weaknesses 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 B.

[1] Estimates of Station Usage available at: **http://orr.gov.uk/statistics/published-stats/station-usage-estimates**

1 Introduction

Overview

1.1 Steer Davies Gleave was appointed by the Office of Rail and Road[2] (ORR) to produce the Origin Destination Matrix (ODM) for 2015/16, continuing the historic series that dates back to 1997/98. This report accompanies the ODM for 2015/16 and provides details of the process and outputs used to produce the dataset on behalf of the ORR.

1.2 The methodology adopted by Steer Davies Gleave in the production of the ODM is generally consistent with that adopted by Resonate[3] in the production of the ODM prior to 2011/12. As part of our work we undertook a Methodological Review in 2012 of the data and processes used to generate the ODM and identified a number of areas for improvement in the data set. A number of these were implemented in the 2011/12, 2012/13, 2013/14, and 2014/15 datasets and a further set of changes has been implemented in the 2015/16 dataset (see Chapter 4).

Use of statistics sourced from the ODM

1.3 When using statistics based on the ODM (e.g. Estimates of Station Usage data also published by the ORR[4]) it is important to be aware of:

- 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 or stations is underestimated; and
- Factors which can affect reporting of passenger journeys.

Improvements to the dataset

1.4 Improvements to the dataset in 2015/16 are set out in Chapter 4 and relate to:

- Improved distribution of demand in the London Travelcard Area, using data from Transport for London (TfL)'s Oyster Clicks Model (OCM);
- Improved allocation of demand to London Terminals;
- Improved allocation of journeys associated with sales of Ranger products on the St. Ives Bay line;
- Updated and extended application of 'Season ticket journey allocation' adjustments.

1.5 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 implementing methodological changes that demonstrate value and address acknowledged issues.

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

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

[4] Estimates of Station Usage available at: **http://orr.gov.uk/statistics/published-stats/station-usage-estimates**

Limitations of the data

1.6 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 ODM is the best approach available. In particular, its national coverage makes it suitable as a basis for the production of National Statistics such as those reported by the ORR. 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 B.

- **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)[5] areas;
- **Concessionary travel** – Most PTEs subsidise some form of free travel for passengers over a certain age 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. The current approach to this, in the ODM, is to include this demand where data has been made available by PTEs which would generally be estimates as a result of surveys. In addition, since 2012/13 an estimate of Freedom Pass journeys in the London Travelcard Area has been included;
- **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). The methodology for the treatment of these products is described in Appendix C.
- **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 TOCs 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 ODM as its purpose is to record bona-fide journeys on the rail network and inclusion of ticketless

[5] Passenger Transport Executives (PTEs) are local government bodies which are responsible for public transport within large urban areas. They are accountable to Integrated Transport Authorities (ITAs) which were formerly known as Passenger Transport Authorities (PTAs) prior to 2008 and the Local Government Act 2008. There are four PTEs in England, for each of the metropolitan counties (Merseyside, South Yorkshire, Tyne and Wear and West Midlands) with the former Greater Manchester Passenger Transport Executive being replaced by Transport for Greater Manchester from April 2011 and the former West Yorkshire PTE becoming part of the West Yorkshire Combined Authority from April 2014. 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 areas as PTEs.

travel could distort business cases for new investment where these are reliant on data from the ODM.

1.7 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 to construct the ODM the data is being pushed significantly beyond what it was originally designed for which was primarily to report and allocate revenues across train operators.

2 Matrix Definition

2.1 The ODM contains revenue, journeys and passenger miles data for each flow on the network. A flow is defined as an origin station / destination station / ticket type/ route code combination. Since this dataset is designed to show passenger journeys made, rather than "producer-attractor" figures, journeys have been split equally into the two directions of travel. The fields included in the ODM are shown in Table 2.1.

Table 2.1: ODM fields

Field	Description
Mode	This variable is used to categorize the source of the passenger journey data. Refer to Table 2.2 below.
Origin (NLC, name)	Based on ticket origin, assumed to be where passenger starts his/her journey.
Destination (NLC, name)	Based on ticket destination, assumed to be where passenger ends his/her journey.
District, County, Region and NUTS2 Region & Code for Origin	Origin's geographical location.
District, County, Region and NUTS2 Region & Code for Destination	Destination's geographical location.
Route Code and Description	Route code and description on ticket as recorded by LENNON.
Dist	Distance in miles between origin and destination. Distances for flows not previously included in the ODM, i.e. associated with newly opened stations, are derived from the distance matrix within MOIRA2.2.
Revenue	Revenue for each flow is split into the eight ticket types: • 1st Class, Full fare • 1st Class, Reduced fare • 1st Class, Seasons • 1st Class, Advance purchase • Std Class, Full fare • Std Class, Reduced fare • Std Class, Seasons • Std Class, Advance purchase Revenue is also summarised into the four main categories (Full, Reduced Excluding Advance, Advance and Seasons) and a Reduced category (Reduced plus Advance) and summarised in total.

Field	Description
Journeys	Journeys for each flow are split into the eight ticket types: • 1st Class, Full fare • 1st Class, Reduced fare • 1st Class, Seasons • 1st Class, Advance purchase • Std Class, Full fare • Std Class, Reduced fare • Std Class, Seasons • Std Class, Advance purchase Journeys are also summarised into the four main categories (Full, Reduced Excluding Advance, Advance and Seasons) and a Reduced category (Reduced plus Advance) and summarised in total.
Passenger Miles	Miles the passengers travelled – this is calculated by multiplying the total number of journeys by the 'Dist' field.
Group Station (NLC, name) for Origin	If the origin is part of a Group Station, the NLC and name is provided, otherwise this field is blank.
Group Station (NLC, name) for Destination	If the destination is part of a Group Station, the NLC and name is provided, otherwise this field is blank.
Flag	Flag = 0 (no problem), 1 (flow has failed a check), or 2 (flow has failed a check and may be significant).

Table 2.2: Mode definitions

Mode	Description
NR Sold non-travelcard	Sold by National Rail, point to point
TfL Sold travelcard	London Travelcards sold by Transport for London
NR Sold travelcard	London Travelcards sold by National Rail
PTE Sold	Sales of PTE-sponsored tickets
Airline Sold	Ticket sales for routes serving Airports, where tickets do not go through LENNON
Other	Ranger and Rover tickets, and London Freedom Passes

3 Methodological Overview

Overview

3.1 The ODM is derived primarily from the MOIRA2.2[6] Demand Matrix. The MOIRA2.2 model is the rail industry's principal planning tool and 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, airport links 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 the revised set of PTE infills that were developed and the 'Other' infills relating to selected Rover and Ranger products.

Underlying Base Data

LENNON and MOIRA2.2

3.2 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 do not appear in the underlying matrix.

3.3 There are three main cases:

- Tickets with non-geographical destinations, e.g. zonal products, Rovers;
- Tickets sold at some non-National Rail (RSP: Retail Settlement Plan) 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.

3.4 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.

3.5 Data excluded from the MOIRA2.2 demand matrix is set out in Appendix B.

Net Revenue

3.6 The MOIRA2.2 demand matrix contains Net Revenue based on the "Net Revenue" field in LENNON. Travelcard revenue in MOIRA2.2 is net (rather than gross) i.e. excludes revenue paid by TOCs to TfL for travel on the London Underground and on buses. Similarly, PTE

[6] MOIRA2.2 is the latest version of the MOIRA2 model which was released in December 2016

revenue is net i.e. for multi-modal tickets only revenue associated with travel on national rail services is included.

Ticket Type Definitions

3.7 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;
- Seasons: all multi-use tickets.

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

3.8 Infills are included within the MOIRA2.2 demand matrix to add in the missing journeys and revenue identified in para 3.3 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. In the 2015/16 MOIRA2.2 matrix a new methodology has been used to represent 'in-boundary' Travelcards based on Transport for London's (TfL) Oyster Clicks Model (OCM) – see paragraph 4.3 for further details. Also for 2015/16 an infill is included for journeys made using Freedom Passes which means that the existing infill that was previously included as part of the development of the ODM is no longer required.
- **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. The infill included in MOIRA2.2 to represent these journeys from 2015/16 is now consistent with that used in 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.

3.9 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.

3.10 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.

3.11 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)

3.12 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 3.8)
  - 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 MOIRA2.2. 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 4.
  - 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. A further enhancement was made this year to improve the distribution of journeys on Ranger products on the St Ives Bay line – see Chapter 4 for details. From 2015/16 this infill is also now included in MOIRA2.2.
- Adjustments
  - Allocation of demand associated with tickets sold to 'London Terminals' between those terminals. This process has been enhanced in the 2015/16 dataset and is described in Chapter 4;
  - Allocation of demand between individual stations within station groups outside central London. For example where tickets are sold to/from 'Exeter BR' it is necessary to estimate how these journeys are distributed between Exeter Central, Exeter St. David's and Exeter St. Thomas;
  - 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 to which passengers are travelling; 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. In 2014/15 an adjustment was made for this issue at Southend and a number of stations in its vicinity and this year a series of adjustments have been made at a number of other selected stations where a similar type of issue has been identified. Further details on these adjustments can be found in Chapter 4.
  - 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.

3.13 Further details relating to the overlays and adjustments outlined above can be found in Chapter 4 and Appendices A and C of this report.

4 Methodological Changes in 2015/16

Introduction

4.1 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. station counts), or industry systems such as TfL's Oyster Clicks Model (OCM).

4.2 In the 2015/16 ODM a number of changes have been made to improve the dataset and these are explained in the rest of this chapter, together with some quantification of their impact. In most cases the quantifications of the impacts of the changes in the sections below are made with reference to the station usage entries and exits reported in the ORR's Estimates of Station Usage statistics[7] which are also produced by Steer Davies Gleave and is based on the ODM.

London (In-boundary) Travelcard Methodology

4.3 In previous years, all London Travelcard journeys have been allocated using LATS (London Area Travelcard Survey) data from 2001. 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[8] Travelcard journeys to individual London stations. In previous productions of the ODM, Travelcard journeys were all assigned to the "London BR" code and then allocated according to the LATS data as with other journeys.

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

4.5 As a result of these methodological changes, there are a large number of significant changes to flows within the London Travelcard Area in the 2015/16 ODM. 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; therefore a direct calculation of growth between 2014/15 and 2015/16 at London stations will not necessarily reflect underlying growth.

Table 4.1 shows the top 10 increases, ranked by absolute change in the number of entries and exits due to the London Travelcard Methodology change.

4.6 Table 4.2 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 allocate Travelcard

[7] Estimates of Station Usage available at: **http://orr.gov.uk/statistics/published-stats/station-usage-estimates**

[8] Journeys wholly within the London Travelcard Area

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 4.1: 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%

Source: Estimates of Station Usage 2015/16

Table 4.2: 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%

Source: Estimates of Station Usage 2015/16

London Terminals Demand Allocation

4.7 For the 2015/16 data, the MOIRA2.2 input data has been disaggregated by individual London Terminal where this is 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, however has only been possible where a ticket is sold to a specific London Terminal.

Summary of London Terminal changes

4.8 Table 4.3 shows the changes to the MOIRA2.2 London Terminal base matrix journeys in 2015/16 compared to 2014/15. Where information is available to link journeys to specific terminals as described in paragraph 4.7, this has been done in the MOIRA2.2 base matrix, with the remainder associated with 'London BR' and allocated to London Terminals as in previous years. This shows that journeys allocated to London BR have fallen from 377.6m to 302.6m, however this has been offset by journeys being recorded to specific London Terminals. As London Travelcards have now been allocated to individual stations, there are no longer any journeys in the MOIRA2.2 base matrix with "London Travelcard" as the recorded destination. These journeys have instead been allocated in the MOIRA2.2 base matrix to stations in London (not limited to London BR stations as in previous years) as described in paragraph 4.3. Table 4.1 and Table 4.2 demonstrate that a large number of journeys are allocated away from large London Terminals as a result of the Travelcard Methodology change and as a result, the total number of journeys in the MOIRA2.2 base matrix associated with London Terminals has fallen from 660.9m to 551.2m.

4.9 It should be noted that this is a methodological change and reflects redistribution of demand across London stations. It therefore does not necessarily imply a lower number of journeys at London Terminals.

Table 4.3: Changes to London Terminal base journeys (including those associated with London Travelcard)

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 journeys allocated to London BR and London Terminals (net of journeys allocated to other London stations)	**660.9**	**551.2**

Source: MOIRA2.2 Demand Matrix

Season ticket journey adjustments

4.10 In the production of the 2014/15 Estimates of Station Usage, an adjustment was implemented for 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.

4.11 This issue initially arose as passenger counts that were undertaken at Southend Victoria implied a lower level of passenger throughput than what was estimated in the Station Usage dataset using the existing methodology. Further investigation revealed that where the prices of season tickets to London are the same from Southend Victoria as they are from places near Southend (e.g. Rayleigh & Hockley), there was scope for season ticket holders to purchase their tickets Southend Victoria <> London but actually be travelling to/from Rayleigh, Hockley etc. Buying the ticket to/from the other location can give the passenger much greater flexibility but it is misleading when the ticket sales are translated into journeys for the purpose of the estimating station usage as it is assumed that all travel is to/from the "sold" from station rather than the "issued" from station.

4.12 The flows 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. It is our intention that work to expand this list will be carried out for future publications. Table 4.4 shows the stations that have been adjusted for the 2015/16 statistics.

Table 4.4: 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

Adjustments applied

Dorking/Gatwick Airport/Reigate

4.13 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. A process 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.

4.14 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

4.15 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 have been reallocated between these stations.

Oxford/Didcot Parkway

4.16 The consultation with train operators (supported by analysis) highlighted that season tickets from Oxford to London cost the same as season tickets from Didcot Parkway to London. As the flexibility to travel into Oxford as well as London is attractive to passengers, a reallocation of journeys between these stations is considered appropriate.

Southampton Central/Southampton Parkway

4.17 Season tickets to London are marginally cheaper from Southampton Central (£5,324)[9] 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 is therefore considered appropriate.

Chalkwell/Benfleet/Leigh-on-Sea

4.18 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

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

conceivable that season ticket holders use this station to access the beach/town at weekends.

East Grinstead/Lingfield/Dormans

4.19 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

4.20 Table 4.5 shows a summary of the approximate difference to the final entries and exits made by this series of adjustments by station.

Table 4.5: 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	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

Source: Estimates of Station Usage 2015/16

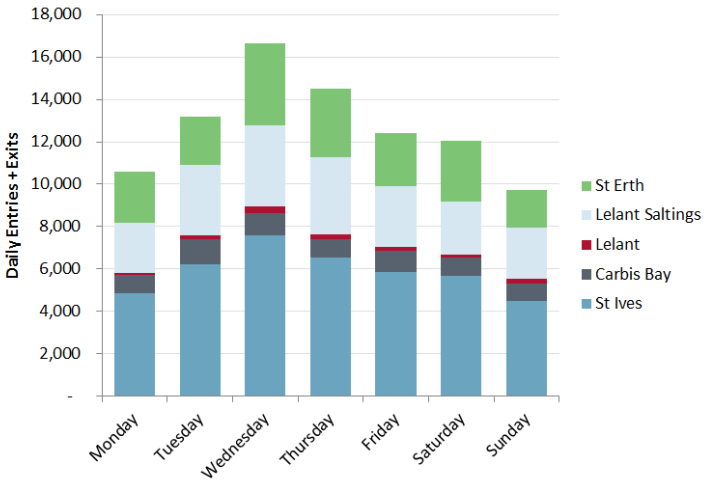
Count-based allocation of Ranger products on the St Ives Bay line

4.21 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.

Results of the survey

4.22 The observed distribution of entries and exits at each station for each day of the survey is shown in Figure 4.1.

Figure 4.1: Counted entries + exits on St.Ives Bay line 0600-2100 (1/8/2016 – 7/8/2016 inclusive)

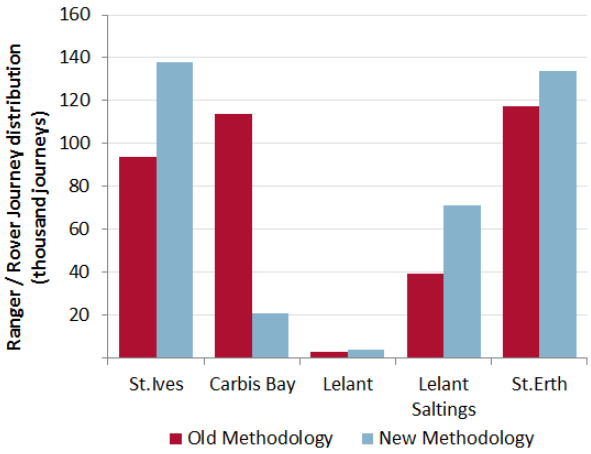


Allocation of journeys associated with St Ives Ranger tickets

4.23 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 that are implied by the count data.

4.24 The splits of Ranger/Rover journeys only (i.e. not including the point-to-point journeys) from the new methodology are shown in Figure 4.2. 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 4.2: Total infill journeys in 2015/16 under the Old and New methodology (excl. Point-to-Point journeys)



4.25 Table 4.6 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.

4.26 The table includes a percentage growth between 2014/15 and 2015/16 reported entries and exits; these changes are due to a mixture of underlying growth and the methodology change.

Table 4.6: 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%

Source: Estimates of Station Usage 2015/16

PTE Infills

4.27 From 2011/12 onwards a number of improvements have been made to the methodology for the construction of the PTE infills used in the ODM. Further details relating to the improvements made over that period are included in the Appendix and summarised in paragraph 4.28.

4.28 In 2011/12 a completely new infill was included for the West Midlands Centro PTE area based on an infill constructed for the Passenger Demand Forecasting Council (PDFC) by Steer Davies Gleave. Further improvements were made in 2012/13 with the inclusion of new infills for the West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TfGM) PTE areas based on work undertaken by Mott MacDonald for Rail in the North (RiN). In 2013/14, new infills were included for South Yorkshire (SYPTE), Merseyside and Strathclyde (SPT). In 2015/16 the PTE infills produced for the ODM have been incorporated in the MOIRA2.2 matrix.

4.29 In summary, as a result of these methodological enhancements in all of the PTE areas over the last four years, users should be cautious in the comparisons they make over time for stations in these areas.

Table 4.7: Summary Status of PTE Infills Methodology

PTE	Status
Greater Manchester	Updated infill methodology adopted for 2012/13 through to 2015/16
Merseyside	Updated infill methodology adopted for 2013/14 through to 2015/16
South Yorkshire	Updated infill methodology adopted for 2013/14 through to 2015/16
Strathclyde	Updated infill methodology adopted for 2013/14 through to 2015/16
Tyne & Wear	Updated infill methodology adopted for 2014/15
West Midlands	Updated infill methodology adopted for 2011/12 through to 2015/16
West Yorkshire	Updated infill methodology adopted for 2012/13 through to 2015/16

4.30 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.

4.31 There are 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 4.8 (ranked in order of percentage change from removing these products).

Table 4.8: 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%

Source: Estimates of Station Usage 2015/16

4.32 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).

Update to mileage calculation in the ODM

4.33 The passenger mileage values used in the ODM are sourced from historic ODM data. In order to provide mileages for flows to/from newly opened stations, missing mileages by O-D pair were sourced from the latest MOIRA2.2 distance matrix.

4.34 In order to maintain consistency with previous datasets, only the missing mileages (i.e. mileages that were not in the historic datasets) were updated with data from MOIRA2.2.

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 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 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 from 2011/12

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 4 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

Methodological Changes in 2012/13

Improved Greater Manchester and West Yorkshire PTE Infill

A.17 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.18 The impact of the methodological change at the PTE level is shown in Table A.3.

Table A.3: 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.19 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.4.

Table A.4: 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%

Inclusion of Freedom Pass journeys in PTE Infill

A.20 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.21 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.22 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.

[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.23 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 been included since it was not practical to categorise every single flow.

A.24 Appendix Table A.5 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.5: 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%

Additions to the 'Other' infill layer

A.25 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.26 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.27 The total number of entries and exits arising from inclusion of these journeys is 1.05m. Appendix A.6 lists the top ten stations impacted most significantly:

[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.

Table A.6: 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

Methodological Changes in 2013/14

Improved South Yorkshire PTE Infill

A.28 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.7, which shows the top ten largest changes as a result of the new South Yorkshire infill.

Table A.7: 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%

[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.

Station	Change in entries and exits with new infill	% Change
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.29 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.30 Since 2008/09 there have been a number of developments which mean that the 2008/09 distribution has been improved. 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 Green, Aughton Park and Ormskirk on the Northern line) which means that the previous distribution underestimates demand in these areas.

A.31 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.32 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.8 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.8: 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%

[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.

Station	Change in entries and exits with new infill	% Change
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.33 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.34 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 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.9.

Table A.9: 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.35 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

Tyne & Wear PTE Infill

A.36 In 2014/15 an infill was included for the Tyne & Wear PTE area. During the production of the 2015/16 dataset it became apparent that the products included in the infill were already included in the MOIRA2.2 demand matrix and there was no longer the need for the infill to be included as part of the ODM production.

Redistribution of demand around Southend

A.37 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;

[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.

- Prittlewell; and
- Southend Victoria.

A.38 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.39 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.40 Table A.10 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.41 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.10: 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.42 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.43 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.44 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.11.

Table A.11: 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.45 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.46 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.47 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.48 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 to be 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.12.

Table A.12: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%

B Appendix – ODM Limitations

Limitations of the LENNON data

B.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 data set. 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.

B.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.

B.3 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

B.4 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.

B.5 Human error at the point the ticket sale is entered into the input machines will also produce invalid data in LENNON.

Travelcards

B.6 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.

B.7 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.

Return and Single Journey Tickets

B.8 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

B.9 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

B.10 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.

B.11 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.

Ticketless Travel

B.12 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

B.13 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

B.14 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 B.1 overleaf.

B.15 Ticket periods of other lengths are converted to a number of journeys using a proportion of the monthly journey factor.

B.16 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.

B.17 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.

Appendix Table B.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 the ODM

B.18 Some of the LENNON data has been excluded from the MOIRA2.2 Demand Matrix, and subsequently from the ODM.

B.19 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.

B.20 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 2012/13);
- 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.

B.21 Finally for flows that have either Origin or Destination 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.
- 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

B.22 All other flows involving Private Settlement are excluded, e.g. Irish Stations.

C Appendix – Treatment of Non-Station Tickets

C.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.

C.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 C.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

C.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.

Category 1 – Origin and Destination Stations Known

C.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

C.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.

C.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.

C.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.

C.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."

C.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 C.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	

C.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.

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

C.11 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. 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

C.12 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.

C.13 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.

C.14 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

C.15 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

C.16 This category contained all Travelcards that did not include Zone 1, for example Zone R2345 London.

C.17 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.

C.18 This processing is undertaken during the production of the MOIRA2.2 demand matrix.

Category 6 – Origin or Destination a Boundary Zone

C.19 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.

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

Category 7 – Non-National Rail Stations

C.21 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.

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

Control Sheet

Document Title
Origin-Destination Matrix 2015/16

Document Type
Report

Client Contract/Project No.	SDG Project/Proposal No.
ORR/CT/13-33	22670602

Issue history

Issue No.	Date	Details
v1.00-v3.00		Drafts for ORR review
v4.00	23/01/2017	Final version

Review

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