steer davies gleave

Estimates of Station Usage 2013/14

Methodology and Validation Report

Report

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Office of Rail Regulation

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Contents

Tables

Appendices

Executive Summary

Introduction

1. This report explains the information contained within the ORR's Estimates of Station Usage data set (Station Usage 2013-14.xlsx) and provides guidance on the methodology followed during the process of creating this file for the financial year 2013/14 and a summary of the validation checks undertaken as part of the production process.
2. The Estimates of Station Usage data set (referred to in the rest of this report as "Station Usage data set") consists of estimates of the total numbers of people:
   - Travelling from or to the station (entries & exits); and
   - Interchanging at the station (interchanges).
3. Information is given for all the national rail stations in England, Scotland, and Wales based on tickets sales data. These results are the most recent in a series produced for the ORR since 1997/98 and the spreadsheet is in a similar format to those previously published.
4. Station Usage data is generated from the Origin Destination Matrix (ODM), a comprehensive matrix of rail flows throughout England, Scotland and Wales, also produced by Steer Davies Gleave, and based on data produced for the MOIRA2 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 which users should be aware of and these are detailed in this report.

Methodological Development

5. Consistency with past datasets is important to enable comparisons to be made over time. However, stakeholders have indicated that they are keen to see improvements, even where this reduces consistency with historic data, provided any changes are clearly explained.
6. In the 2013/14 dataset a number of changes have been made to the PTE infills in order to improve the dataset. Over the past two years improvements have been made to the infills in the West Midlands, West Yorkshire and Greater Manchester areas and this year the PTEs where improvements have been made are:
   - South Yorkshire (SYPTE);
   - Merseyside (Merseytravel); and
   - Strathclyde (Strathclyde Partnership for Transport)

Results

7. In total entries and exits have increased by around 5.0% to 2.65bn in 2013/14. However, once the impact of methodological improvements is accounted for the underlying increase is circa 4.8%.

Limitations of the data

8. 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 of the station usage data set 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.

9. 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 and bear these in mind when using the data. The key limitations are outlined in Chapter 1 with more extensive discussion of some aspects of the limitations of the dataset included in Appendix E.

1 Introduction

Overview

1.1 Steer Davies Gleave was appointed by the Office of Rail Regulation (ORR) to produce the Estimates of Station Usage data for 2013/14, continuing the historic series that dates back to 1997/98. This report accompanies the Estimates of Station Usage data for 2013/14 and provides details of the process and outputs used to produce the statistics on behalf of the ORR. In the rest of this report the Estimates of Station Usage data set is referred to as the "Station Usage data set."

1.2 Steer Davies Gleave are providing the ORR with an MS Excel file, "Station Usage 2013-14.xlsx" containing entries, exits and interchanges made at stations throughout England, Scotland and Wales, for the financial year 1st April 2013 to 31st March 2014. For the entries and exits, figures are split into the three main categories of the available ticket products (Full, Reduced, and Season).

1.3 The underlying methodology adopted by Steer Davies Gleave in the production of the Station Usage data is consistent with that adopted by DeltaRail in the production of the Station Usage data in the years prior to 2011/12. However a number of updates to the methodology have been implemented by Steer Davies Gleave over the last three years which have been documented in this and previous annual reports.

Use of the station usage dataset

1.4 When using the station usage data, particularly when comparing with previous years, 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 entries and exits.

Improvements to the dataset

1.5 Improvements to the dataset in 2013/14 are set out in Chapter 3. A summary of improvements made over recent years are further detailed in Appendix A. The ORR continues to work with stakeholders and its own consultants to improve the robustness of the dataset by implementing methodological changes that demonstrate value and address acknowledged issues.

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 station usage data set as described in the following chapter is the best approach available. In particular its national coverage makes it suitable as a basis for the production of official statistics such as those reported by the ORR.

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

- **Non-Point to point tickets** - An overarching issue is the inherent difficulty and uncertainty associated with estimating the number of journeys associated with many rail products which do not simply represent point to point single or return journeys and furthermore the distribution of those journeys. This is a particular issue for the London Travelcard Area and PTE 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 Origin Destination Matrix (ODM) as information on the level and distribution of journeys associated with these free travel products is not recorded and will not even have point of sale information. The current approach to this in the ODM is to include this demand where data has been made available by PTEs which would generally be estimates as a result of surveys;
- **Non-LENNON Sales** - A significant proportion of sales is either not passed directly through LENNON (sold at non-railway sales points) or is included in LENNON in a format which requires additional processing and assumptions i.e. is not associated with a station to station flow;
- **Group stations** – Many products to major destinations are sold with the origin or destination as a group of stations (e.g. London Terminals, Manchester BR stations). Current industry data does not distinguish between the component stations and therefore a split between these stations has to be estimated during the production of the ODM; and
- **Ticketless travel** – Journeys associated with ticketless travel are not included in the datasets but as with journeys made on other products excluded from the datasets, some journeys would be observed in passenger counts. This is likely to be an issue on some flows and in some areas where ticketless travel is significant. As more stations have become gated over time and 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 station usage dataset as its purpose is to record bona-fide journeys on the rail network and inclusion of ticketless travel could distort business cases for new investment where these are reliant on station usage data.

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

Factors which can affect reporting of entries and exits

Adverse Weather

1.9 Cases of extreme adverse weather may cause disruption to normal railway operations, for example the collapse of the sea wall at Dawlish in February 2014. Such events can impact on travel patterns.

Gating Schemes

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

Change in Service Pattern

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

Ticket Issuing Facilities Changes or Product Changes

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

1.13 Product changes can have an effect on passengers' purchasing patterns at rail outlets thus affecting station usage data. For example, the introduction of Oyster cards at rail outlets can affect stations inside the Travelcard boundary in the London area.

Engineering Work

1.14 Significant engineering work can alter customers' travel patterns, either causing passengers to not travel, use an alternative mode or use an alternative rail route. Similarly, significant delays can alter travel patterns where, for example, Virgin customers can switch to using Chiltern services to travel between the West Midlands and London.

Advance tickets

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

Tourism

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

New/Special Stations

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

- Racecourses e.g. Newbury Racecourse;
- Sports Events e.g. Wembley Stadium;
- Exhibition Centre Glasgow;
- Airports.

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

Trend of Growth or Decline

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

Changes in the Sales of Individual Ticket Types

1.20 Miscoding of ticket information entered into LENNON can alter station usage results, although this would not be reflecting an actual change in customers' journeys.

Historic Events

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

- Years may have been affected by industrial action such as 1994/95;
- Major incidents affecting services such as Southall, Ladbroke Grove and Hatfield;
- Infrastructure changes e.g. ticket gating can significantly increases revenue -more gates have been installed in recent years which will affect the data but which does not represent higher passenger numbers.

1.22 A relevant example for the 2013/14 statistics is the storm damage to the Dawlish sea wall and other coastal lines affected by winter storms.

2 Methodological Overview

MOIRA2 Demand Matrix – Base Data

Overview

2.1 All estimates of station usage, exits, entries and interchanges included in the station count dataset, are derived from the Origin Destination Matrix (ODM), also produced by Steer Davies Gleave for the ORR. The ODM itself is, in turn derived primarily from the MOIRA2 Demand Matrix.

2.2 The MOIRA2 demand matrix is sourced from MOIRA2 and includes a comprehensive representation of travel on the national rail network. The base data for the MOIRA2 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)[1].

Underlying Base Data - LENNON

2.3 The underlying matrix of ticket sales and associated journeys and revenue used in MOIRA2 is derived from LENNON. It is based on an extract from LENNON, produced by Atos, 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 to estimate a more complete origin-destination matrix and include the associated journeys and revenue that do not appear in the underlying matrix.

2.4 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 Train Operating Company (TOC) tickets on airport flows, and tickets for TOCs which fall outside the Rail Settlement Plan.

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

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[1] 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 five PTEs in England, for each of the metropolitan counties (Merseyside, South Yorkshire, Tyne and Wear, West Midlands and West Yorkshire) with the former Greater Manchester Passenger Transport Executive being replaced by Transport for Greater Manchester from April 2011. 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.

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

Ticket Type Definitions

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

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

2.8 It should be noted that for the purposes of the station usage data, Advance products are included in the Reduced ticket category.

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

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

- **Within London Travelcard area.** Whilst the underlying matrix includes an estimate of journeys made on Day Travelcards / Travelcard seasons purchased at National Rail stations, it does not include a significant number of national rail trips made using Travelcards purchased at Tube stations, travel shops and newsagents.
- **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.
- **Trips to/from Airports.** The underlying matrix includes many trips to/from airports, but excludes all Heathrow Express journeys, and some tickets sold for Gatwick Express, Stansted Express and other airport operators.

2.10 There are also other ticket sales which are not included in the MOIRA2 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 demand matrix and therefore are not included in the ODM either.

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

2.12 The third infill, for Airports, estimates the significant number of rail journeys on 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 demand matrix.

Origin Destination Matrix (ODM) PTE Infill

2.13 For the production of the ODM the revenue and journeys associated with the MOIRA2 PTE Infill are removed and replaced with a separate estimate.

2.14 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.

2.15 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.

2.16 To maintain consistency with previous ORR statistics the PTE infill contained in the ODM has therefore historically been based on the 2008/09 MOIRA2 PTE infill (as described in para 2.14) adjusted annually using growth rates derived from National Rail Trends data. 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.

2.17 From 2011/12 onwards a number of improvements have been made in successive years to the methodology for the construction of the PTE infills. In the construction of the 2011/12 dataset a more disaggregate set of growth rates was applied at the PTE level based on LENNON data. In addition, a completely new infill was included for the West Midlands Centro PTE infill 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.

2.18 In 2013/14 new infills have also been included for the South Yorkshire (SYPTE), Merseyside, and Strathclyde (SPT) areas and these are detailed in Chapter 3.

2.19 In summary, as a result of these methodological enhancements in the Greater Manchester, West Midlands, West Yorkshire, South Yorkshire, Merseyside and Strathclyde areas over the last three years users should be cautious in the comparisons they make over time for stations in these areas.

Table 2.1 Summary Status of PTE Infills Methodology

PTE	Status
Greater Manchester	Updated infill methodology adopted for 2012/13 and 2013/14
Merseyside	Updated infill methodology adopted for 2013/14
South Yorkshire	Updated infill methodology adopted for 2013/14
Strathclyde	Updated infill methodology adopted for 2013/14
Tyne & Wear	Original 2008/09 methodology maintained.
West Midlands	Updated infill methodology adopted for 2011/12 through to 2013/14.
West Yorkshire	Updated infill methodology adopted for 2012/13 and 2013/14

Unknown Destinations

2.20 Ticket sales do not always tell us where a passenger is travelling, for example where the Origin or Destination is a London Travelcard. As in previous years, we have converted unknown destinations into an estimate of the actual stations that passengers are travelling to. The full detail of this part of the methodology appears in Appendix D.

Interchanges Methodology

2.21 An estimate of the number of people interchanging at each station is obtained by combining the number of journeys made on each flow (from the ODM) with the information on passenger journeys taken from the Central Allocations File (CAF).

2.22 The CAF is an output of the ORCATS system which predicts passenger choices of rail route and train used, and determines the allocation of passenger revenue between TOCs. Since ORCATS is a model, the CAF contains estimates rather than actual journeys. However, it is used throughout the rail industry, so it is an appropriate source of data to use for this purpose. Since CAFs are updated with the timetable, not with financial years, no CAF will match the ticket sales data exactly. The December 2013 CAF is used in the creation of the 2013/14 Station Usage.

2.23 The CAF contains:

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

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

3 Methodological Changes in 2013/14

Introduction

3.1 Consistency with past datasets is important to enable comparisons to be made over time. However, stakeholders have indicated that they are keen to see improvements, even where this reduces consistency with historic data, provided any changes are clearly explained.

3.2 In the 2013/14 dataset 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.

South Yorkshire PTE Infill

3.3 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 has been included in the 2013/14 dataset. 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. This approach is consistent with the methodology underlying the improved West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TfGM) infills incorporated in the 2012/13 statistics. At the total PTE level the impact of the new infill has been to reduce demand by 1.3m relative to the numbers reported in the 2012/13 station usage statistics. However, there has also been a significant distributional impact as can be seen in Table 3.1 which shows the top ten largest changes as a result of the new South Yorkshire infill.

3.4 It is important that in considering the changes at the stations in South Yorkshire that they are not necessarily indicative of any underlying reduction or increase in actual station usage but are the result of the methodological changes implemented in this year's data. As the overall effect of the updated infill methodology in South Yorkshire has been to reduce the number of rail journeys in the infill the impact, in this year's dataset, has been a reported fall in station usage at a majority of South Yorkshire stations. This is a function of the reduction in the total rail jouneys in the infill combined with distributional changes.

Table 3.1: Top Ten Changes (in absolute terms) in Entries and Exits due to inclusion of new SYPTE PTE Infill (2013/14)[2]

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

Merseyside PTE Infill

3.5 Currently the infill for the Merseyside area is 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 has been 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.

3.6 Since 2008/09 there have been a number of developments which mean that the 2008/09 distribution is inappropriate. Of particular importance has been a movement away from RSP products to PTE products on some routes on the edges of the Merseytravel area (e.g Town Green, Aughton Park and Ormskirk on the Northern line) which means that the existing distribution underestimates demand in these areas.

3.7 Recognising the deficiencies of the existing infill, a new infill has been 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.

3.8 The inclusion of the new infill increases entries and exits by 10.8m (5.1% of total North West entries and exits). Table 3.2 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.

[2] As all the new Mott MacDonald infills were incorporated into the Origin Ddestination Matrix (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.

3.9 It is important that in considering the changes at the stations in Merseyside that they are not necessarily indicative of any underlying reduction or increase in actual station usage but are the result of the methodological changes implemented in this year's data. As the overall effect of the updated infill methodology in Mersyside has been to increase the number of rail journeys in the infill the impact, in this year's dataset, has been a reported increase at a majority of stations in Merseyside and places outside Merseyside where PTE tickets are valid. This is a function of the increase in the total rail jouneys in the infill combined with distributional changes.

Table 3.2: Top Ten Changes (in absolute terms) in Entries and Exits with inclusion of new Merseyside PTE Infill (2013/14)[3]

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

Strathclyde Passenger Transport (SPT) infill

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

- Zonecard;
- Roundabout; and
- Daytripper

3.11 Total sales data for these tickets has been obtained from a combination of LENNON data and off rail sales figures supplied by SPT. The number of journeys on each ticket type has been established by applying appropriate trip rate proxies for each type. The data has been 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 results 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 Table 3.3.

[3] As all the new Mott MacDonald infills were incorporated into the Origin Destination Matrix (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.

3.12 **It is important that in considering the changes at the stations in Strathclyde that they are not necessarily indicative of any underlying reduction or increase in actual station usage but are the result of the methodological changes implemented in this year's data. As the overall effect of the updated infill methodology in Strahclyde has been to slightly reduce the number of rail journeys in the infill the impact, in this year's dataset, has been a reported fall at a number of Strathclyde stations, with increases at others, which is largely a function of the distributional changes in the infill.**

Table 3.3: Top Ten Changes (in absolute terms) in Entries and Exits with inclusion of new Strathclyde Infill (2013/14)[4]

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

3.13 As for 2011/12 and 2012/13 the generic methodology for separating out group stations has not been followed for Manchester BR, Wigan BR and Warrington BR. For Warrington BR and Wigan BR we have 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 has been maintained at the station level.

[4] 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.

4 Summary of Results

4.1 The following table gives the total number of entries, exits, and interchanges made over the whole network for 2013/14, compared with the previous year.

Table 4.1 Entries, Exits and Interchanges for 2012/13 – 2013/14

Year	Entries	Exits	Entries & Exits	Interchanges
2012/13	1,268,980,418	1,268,980,418	2,537,960,837	211,140,901
2013/14	1,332,561,756	1,332,561,756	2,665,123,512	226,191,748

4.2 Overall, the increase in entries and exits is around 5.0% in 2013/14 compared with the previous year, although the underlying increase once methodological improvements have been accounted for is 4.8%.

Overview of the Entries and Exits Results

4.3 In this section we set out a summary of the overall entries and exits results. The spreadsheet contains entries and exits results for 2,537 stations, compared with 2,535 last year. The table below shows the new stations that have been opened in 2013/14.

Table 4.2 Stations in 2013/14 but not in 2012/13

NLC	Name	Note
375	Energlyn & Churchill Park	New station
6794	Stratford Parkway	New station

4.4 Table 4.3 shows data for the ten stations with the highest numbers of entries and exits for 2013/14.

Table 4.3 Top 10 Stations Based on 2013/14 Entries and Exits

Rank This Year	NLC	Station Name	Entries and Exits			Rank Last Year
			2013/14	2012/13	Change	
1	5598	Waterloo	98,442,742	95,936,542	3%	1
2	5426	Victoria	81,356,330	77,346,676	5%	2
3	6965	Liverpool Street	63,004,002	58,448,814	8%	3
4	5148	London Bridge	56,442,044	53,351,116	6%	4
5	1444	Euston	41,911,706	38,299,206	9%	6
6	5143	Charing Cross	40,170,074	38,607,238	4%	5
7	3087	Paddington	35,093,628	34,143,220	3%	7
8	1127	Birmingham New Street	34,748,984	32,090,346	8%	8
9	6121	King's Cross	29,823,715	28,454,460	5%	9
10	8487	Leeds	27,729,453	26,200,916	6%	11

4.5 The total journeys made at one of the top ten stations account for a total of 509 million, 1.05% more than the 484m journeys made at the top ten stations last year. The top ten stations account for 19% of all entries and exits, the same as in 2012/13. Leeds has replaced Glasgow Central in 10th place although this is driven by methodological change (inclusion of an updated SPT infill) rather than reflecting real changes in demand.

4.6 There have been some large changes in the Merseyside, Strathclyde and South Yorkshire areas in 2013/14. This is due to changes to the PTE Infill methodology for these areas. For more information see Chapter 3.

Overview of the Interchanges Results

4.7 In all, around 226.2 million interchanges are estimated to have been made among National Rail operated services (interchanges between rail and tube or other modes are excluded except for cross-London journeys). This is an increase of 7.1% compared to the 2012/13 results (211.1 million). The ten top stations are listed in the table below. The strong growth at Stratford is likely due to growth in passengers connecting with other rail services at the station.

Overview of the Interchanges Results

Table 4.4 Top 10 Stations Based on the Interchanges made for 2013/14

Ranking 2012/13	NLC	Station Name	Interchanges			Ranking 2012/13
			2013/14	2012/13	Change	
1	5595	Clapham Junction	26,846,859	23,334,118	15%	1
2	5598	Waterloo	10,017,069	9,389,235	7%	2
3	5426	Victoria	9,005,162	8,311,851	8%	4
4	5148	London Bridge	8,815,292	8,568,138	3%	3
5	5355	East Croydon	6,905,570	6,525,943	6%	5
6	1127	Birmingham New Street	5,193,618	5,164,606	1%	6
7	6969	Stratford	4,999,629	3,671,078	36%	8
8	3149	Reading	3,828,202	3,831,718	0%	7
9	1555	St.Pancras	3,504,079	3,469,060	1%	10
10	6121	King's Cross	3,498,734	3,583,561	-2%	9

4.8 Interchanges occurred at 542 stations in 2013/14 compared to the 539 stations in 2012/13. Stations appearing for the first time in 2013/14 and those not seen this time are listed below.

Table 4.5 Changes in Interchange Stations in 2013/14 vs 2012/13[5]

	Interchanges		Reason
	2013/14	2012/13	
New			
Huntingdon	38	0	
Shepherds Bush	14,244	0	Demand growth on LOROL
Stratford Parkway	1,731	0	New Station
Old			
Rugely Town	0	19	
Stratford International	0	3,353	
Thornford	0	218	

4.9 The numbers in this table are estimated numbers for actual passenger interchanges made during the year.

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

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

5 Validation

Introduction

5.1 Checks undertaken on the station usage dataset encompass a number of elements, including:

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

It is important that the validation and comparisons made in this chapter are set in the context of the changes in the methodology for a number of the major urban areas. This will impact on direct comparison of levels of usage at stations in these areas between 2013/14 and previous years as set out in these ORR statistics. This is particularly relevant for South Yorkshire, Merseyside and Strathclyde where significant increases or decreases in usage in 2013/14 are not necessarily indicative of underlying growth or decline in actual usage but a direct result of the methodological changes.

Data Checks

Large increases and decreases

5.2 Table 5.1 shows the 10 stations with the largest proportional increases in total flow for stations with more than 10,000 entries and exits. The most common cause for large increases can be attributed to improvements to the PTE Infills.

Table 5.1 Top 10 Increases in 2013/14

NLC	Station Name	Entries and Exits			Reason
		2013/14	2012/13	Increase (%)	
6393	Conon Bridge	18,114	3,788	378%	Opened in 2012/13
9790	Dalmarnock	100,360	21,506	367%	Station was partly closed for refurbishment in 2012/13 for Commonwealth Games. Likely demand boost due to Games in 2014
2281	Ormskirk	2,058,604	727,620	183%	Improved Merseyside PTE Infill
7953	South Bank	12,544	4,704	167%	Reflects ongoing demand increases from significant timetable improvement in December 2012
2249	Sandhills	1,250,086	471,804	165%	Improved Merseyside PTE Infill
9709	Liverpool South Parkway	1,785,444	740,414	141%	Improved Merseyside PTE Infill
2283	Town Green	337,112	141,760	138%	Improved Merseyside PTE Infill
5301	Clapham High Street	1,088,500	461,490	136%	Increase associated with introduction of London Overground services between Clapham Junction and Surrey Quays in December 2012
2215	Aughton Park	179,740	78,136	130%	Improved Merseyside PTE Infill
2248	St.Michaels	873,112	387,532	125%	Improved Merseyside PTE Infill

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

5.4 As with the large increases, improved PTE infills are driving many of the large decreases. Also, the Hatfield Colliery landslip had a large impact on nearby stations.

Table 5.2 Top 10 Decreases in 2013/14

NLC	Station Name	Entries and Exits			Reason
		2013/14	2012/13	Decrease (%)	
2785	Belle Vue	10,122	18,350	-45%	Reason for decrease unclear
9618	IBM	71,128	122,590	-36%	Improved PTE Infill
6527	Kirk Sandall	95,100	161,326	-28%	Improved PTE Infill
2218	Green Lane	418,966	665,448	-26%	Improved PTE Infill
6531	Thorne South	82,196	129,736	-23%	Major disruption due to landslip near Hatfield Colliery
6707	Mexborough	200,556	312,454	-22%	Improved PTE Infill
2971	Middlewood	18,340	27,572	-21%	Large drop driven mostly by PTE infill.
3624	Conway Park	1,061,434	1,591,048	-21%	Improved PTE Infill
6528	Hatfield & Stainforth	69,454	103,018	-21%	Major disruption due to landslip near Hatfield Colliery
2237	Leasowe	600,078	889,718	-19%	Improved PTE Infill

5.5 As in the 2012/13 dataset two flags have been included in the published dataset identifying:

- Stations with more than 10,000 entries and exits a year where entries and exits have increased or decreased by more than 10%; and
- Stations with less than 10,000 entries and exits a year where entries and exits have increased or decreased by more than 25%.

5.6 These flags have been used to identify stations where further investigation should be carried out to ensure, where possible, the reported changes reflect reality. The limits set are demanding (10% of 10,000, for example could represent just two extra season ticket holders per year) and investigations have been focussed on the most significant changes but where obvious explanations for less significant changes are available these have been included in the Station Usage dataset. In total 595 stations were captured by one of the two flags.

5.7 Whilst reasons for large changes at some stations are specific to that station, in many instances there are groups of stations where there is a common cause for the changes seen. In Table 5.3 we have grouped reasons for large changes into a number of clusters, with the number of stations in each category. The largest cause of change is the use of improved PTE infills. These have mainly affected Merseyside, Strathclyde and South Yorkshire. Growth on London Overground is also a significant cause of change and follows the trend seen in 2012/13. Overall, the reasons below account for 63% of the large change stations.

Table 5.3 Summary of Large Changes

Reason	Stations affected
Improved PTE infill	117
High growth trend	57
London Overground	40
Lea Valley Lines	23
Cardiff Valleys TVMs	16
Winter Storms	16
Timetable Improvement	14
Demand decrease trend	11
Wimbledon Loop Demand Growth	9
Engineering works	9
Stations serving destinations with variable demand (e.g. stadia)	7
London Overground - Surrey Quays to Clapham Junction extension	6
Station Improvements	6
Inner Thameslink	6
Crouch Valley Line	5
Airdrie – Bathgate	5
Marston Vale Line	4
Severn Beach Line high growth	4
New station demand ramp-up	4
Crewe-Derby line Growth	4
Aberdeen High Growth	3
Hatfield Colliery landslip	3
New station	2
Ticket Gates	1

Checks at different geographical levels

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

- PTE area;
- Government Office Region (GOR); and
- Station Facility Owner (SFO).

Table 5.4 Entries and Exits by PTE and London Travelcard Area

PTE	Entries and Exits		Growth	Impacted by methodological change
	2013/14	2012/13		
London Travelcard Area	1,312,264,262	1,229,517,048	6.7%	
Greater Manchester	72,891,564	69,804,168	4.4%	
Merseyside	92,979,361	86,196,056	7.9%	Improved Merseyside PTE infill
South Yorkshire	18,991,463	20,058,546	-5.3%	Improved South Yorkshire PTE infill
Strathclyde	114,844,667	115,574,690	-0.6%	Improved SPT infill
Tyne & Wear	9,323,894	9,128,070	2.1%	
West Midlands	95,847,842	90,038,668	6.5%	
West Yorkshire	67,156,739	64,473,940	4.2%	

5.9 This table shows reasonable increases for most of the PTEs. Merseyside is showing strong growth due to a change in methodology. South Yorkshire is showing a decrease in journeys in this year due to a change in the methodology. The London Travelcard Area exhibits strong growth of 6.7% compared to the previous year.

Table 5.5 Entries and Exits by Government Office Region

GOR	Entries and Exits		Growth	Impacted by methodological change
	2013/14	2012/13		
London	1,298,793,353	1,216,779,288	6.7%	
South East	369,776,681	361,089,813	2.4%	
East	195,854,995	189,184,958	3.5%	
South West	70,895,249	69,307,542	2.3%	
East Midlands	38,950,401	38,752,850	0.5%	
West Midlands	129,261,796	121,953,360	6.0%	
North East	20,700,444	20,057,944	3.2%	
North West	211,171,075	196,617,966	7.4%	Improved Merseyside PTE infill
Yorkshire And The Humber	107,729,941	105,107,634	2.5%	Improved South Yorkshire PTE infill
Wales – Cymru	48,633,986	47,633,884	2.1%	
Scotland	173,355,591	171,475,598	1.1%	Improved SPT infill

5.10 Growth across Government Office Regions appears reasonable. Strong growth in the North West is driven by the improved Merseyside PTE infill. Overall growth in Scotland in this year is being suppressed by a smaller Strathclyde PTE infill. Similarly, overall growth in Yorkshire And The Humber is suppressed by a smaller South Yorkshire PTE infill. Underlying growth in London and the West Midlands is strong and not affected by changes to the PTE infill methodology.

Table 5.6 Entries and Exits by Station Facility Owner

SFO	Entries and Exits		Growth
	2013/14	2012/13	
Arriva Trains Wales	57,891,784	55,538,820	4.2%
c2c	50,205,811	50,961,140	1.7%
Chiltern Railways	42,520,846	38,447,304	5.3%
East Coast	34,789,484	34,000,624	2.3%
East Midlands Trains	39,511,211	39,453,813	0.1%
First Capital Connect	127,342,259	119,381,500	6.7%
First Great Western	127,388,884	124,222,049	2.4%
First ScotRail	125,342,568	124,692,896	0.5%
First TransPennine Express	23,712,878	22,813,920	3.9%
Glasgow Prestwick Airport	453,998	343,782	32.1%

SFO	Entries and Exits		Growth
London Midland Trains	80,549,827	78,939,822	4.9%
London Overground	133,638,385	116,516,158	15.5%
London Underground	61,025,280	56,799,898	7.4%
Merseyrail	75,337,514	67,792,053	11.1%
Abellio Greater Anglia	183,686,306	171,614,865	6.1%
Network Rail	675,759,832	641,782,294	5.3%
Northern Rail	116,875,117	113,900,464	2.6%
South West Trains	282,519,584	274,433,125	2.9%
South West Trains (Island Line)	1,401,600	1,543,278	-9.2%
Southeastern	192,405,708	183,268,488	5.0%
Southern	191,116,039	181,788,363	4.7%
Stobart Rail	408,430	340,814	19.8%
Virgin Trains (West Coast)	41,240,168	39,385,368	4.7%

5.11 Changes at the SFO level are within reasonable bounds, though there are some large changes to highlight. Growth at Glasgow Prestwick Airport is driven by the improved Strathclyde PTE infill and growth for Merseyrail is driven by the improved Merseyside PTE infill. Strong growth for Stobart Rail (Southend Airport) follows ramp-up demand growth in 2012/13. The large decrease in journeys on the Island Line is likely due to the impact of storms which disrupted journeys in December 2013/January 2014.

Validation against alternative data sources

Comparison with ORR journey data on the ORR data portal

5.12 The ORR produces journey data by sector and TOC and makes this available on the ORR website via its data portal through a separate data analysis exercise[6]. Growth from 2012/13 to 2013/14 from this data was 5.7% at the national level for franchised TOCs. The station usage data shows an increase of 5.0% over the same period, within the expected level of variation from the ORR data.

Comparison with PIXC data

5.13 The DfT collects count data for major cities throughout the UK. The method of collection means that for through stations it is often not possible to calculate boarders and alighters but for terminal stations this is usually possible. Using data provided by the DfT we have compared growth rates at the major London termini covered by the count data with those seen in the calculated station usage data (excluding methodological improvements for a like for like comparison).

[6] Formerly this formed part of the National Rail Trends publication

Table 5.7 Comparison of Station Usage and PIXC Growth Rates 2012/13 – 2013/14

Station	Station usage growth rate (all day, pre-methodological changes)	PIXC growth rate
Euston	9.4%	10.2%
Fenchurch Street	8.3%	0.9%
King's Cross	4.8%	1.0%
Liverpool Street	7.8%	0.2%
Marylebone	5.7%	5.8%
Moorgate	5.9%	4.7%
Paddington	2.8%	-1.5%
Victoria	5.2%	2.6%
Waterloo	2.6%	2.4%

Source: PIXC data from:

https://www.gov.uk/government/publications/rail-passenger-numbers-and-crowding-on-weekdays-in-major-cities-in-england-and-wales-2013

5.14 Euston, Marylebone and Waterloo show similar growth rates, although there is a discrepancy between the station usage and PIXC growth rates for some other stations. The PIXC counts are weekday only therefore they won't capture weekend variations. They also represent growth for a particular time of year and will not reflect changing demand conditions over the year.

steer davies gleave

A Appendix – Historical Methodological Changes

Historical Methodological Changes

A.1 In the five years prior to the 2011/12 dataset a number of improvements were made to the ODM and Station Usage methodology which are described in the section. This includes the inclusion since 2009/10 of Oyster PAYG data in the ODM which represented a significant improvement to the estimates for rail travel across London. These improvements are described in the first section of this Appendix.

A.2 Improvements in the 2011/12 and 2012/13 datasets are described separately in additional sections in this Appendix.

Historical methodology changes prior to 2011/12

A.3 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.4 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.5 When the 2010/11 dataset was constructed it emerged that the original 2008/9 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.6 Oyster 'Pay As You Go' (PAYG) was rolled out at National Rail stations in January 2010. Prior to this date Oyster PAYG was available on selected routes only and was not recorded (in LENNON) on a flow or station basis. After this date Oyster PAYG was available at all National Rail stations in the Travelcard Area and recorded by flow.

A.7 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 will be largely estimates made without the benefit of Oyster records.

Methodological Improvements post 2010/11

2011/12

Improved PTE Infill growth rate

A.8 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.9 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.10 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.11 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.12 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.13 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.14 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 Appendix 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.

Appendix 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.15 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
- Cambrian Coaster Ranger

A.16 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.17 The total number of entries and exits arising from inclusion of these journeys was 760k. Appendix Table A.2 lists the top five stations impacted most significantly:

Appendix 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

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

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

A.18 The key addition to the underlying MOIRA2 data in the construction of the station usage dataset is the breakdown of group station flows into their component stations. This is a significant task and based primarily on sales location data which is becoming less robust as increasing volumes of sales are completed via the internet.

A.19 For the purposes of the 2011/12 dataset a pilot was therefore conducted for stations within the Liverpool BR group of stations, using count data to allocate journeys between the stations. The stations that this impacted were:

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

A.20 Count data sourced from the DfT and Merseytravel enabled the calculation of the split of demand between the central Liverpool stations as shown in Appendix Table A.3. These percentages were then used to divide total central Liverpool demand, as calculated by the station usage process, between the central Liverpool stations. The same splits were applied across all ticket types.

Appendix Table A.3 Modification of central Liverpool station usage data

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

2012/13

Improved Greater Manchester and West Yorkshire PTE Infill

A.21 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.22 The impact of the methodological change at the PTE level is shown in Appendix Table A.4:

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

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

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

A.23 The new infill had a significant impact at the total level for the West Yorkshire PTE area with a 27% increase in the number of journeys on West Yorkshire PTE tickets. The impact on the total size of the GMPTE infill was much smaller but there were still significant distributional impacts as demonstrated by the presence of a number of GMPTE stations in the top ten changes from the improved infill as shown in Appendix Table A.5.

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

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

Calibration of entries and exits to count data at group stations

A.24 The key addition to the underlying MOIRA2 data in the construction of the station usage dataset is the breakdown of group station flows into their component stations. This is a significant task and the existing methodology based primarily on sales data is becoming less robust as increasing volumes of sales are completed via the internet.

A.25 For the purposes of the 2012/13 dataset we therefore undertook a significant programme of counts at a number of stations to provide a basis for allocating demand at the station group level between these stations.

A.26 In the application of the count data consistency with the underlying ODM data was maintained by controlling total entries and exits at the station group level to the total station group demand in the underlying matrix. Count data was then used to apportion the total station group demand between the individual stations. It is important to emphasise this point – the count data was only used to distribute demand between stations within each of the relevant station groups, it was not used to set the overall level of demand. Use of count data to set the total level of entries and exits by station was not implemented for a number of reasons, including:

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

A.27 Following the counts a thorough process of validation was completed, utilising, where possible, information and data provided by Train Operators to corroborate the count data. On completion of the validation it was agreed with the ORR that the outputs of the count data would be used to allocate demand between stations for the stations listed in Appendix Table A.6. Appendix Table A.6 also shows the distribution of entries and exits between the stations with the previous and new methodology. The dominant trend in the changes is an increase in demand at the smaller (and often ticket office-less) stations at the expense of the larger stations in the group.

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

Group	Station	Entries and Exits		
		Previous methodology	New methodology	Change (%)
Farnborough BR	Farnborough (Main)	3,149,316	2,859,700	-9%
	Farnborough North	328,684	618,300	88%
Bedford BR	Bedford Midland	3,448,926	3,303,270	-4%
	Bedford St.Johns	9,320	154,976	1563%
Wakefield BR	Wakefield Westgate	2,240,342	2,266,915	1%
	Wakefield Kirkgate	514,862	488,289	-5%
Maidstone BR	Maidstone East	1,796,012	1,343,900	-25%
	Maidstone West	529,796	834,293	57%
	Maidstone Barracks	120,150	267,765	123%
	Deepdene	389,786	454,909	17%
Dorking BR	Dorking	1,354,864	1,234,007	-9%
	Dorking West	40	55,774	139435%
Newark BR	Newark North Gate	1,096,442	1,179,491	8%

Group	Station	Entries and Exits		
Dorchester BR	Newark Castle	320,558	237,509	-26%
	Dorchester South	533,304	469,294	-12%
	Dorchester West	66,828	130,838	96%
Colchester BR	Colchester	4,574,692	4,291,055	-6%
	Colchester Town	459,380	743,017	62%
Portsmouth BR	Portsmouth & Southsea	2,352,460	1,965,324	-16%
	Portsmouth Harbour	1,809,936	2,197,072	21%
Hertford BR	Hertford North	1,342,800	1,338,227	0%
	Hertford East	769,974	774,547	1%

Inclusion of Freedom Pass journeys in PTE Infill

A.28 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.29 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'[7] 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.30 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.

[7] 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.31 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.32 Appendix **Error! Reference source not found.** 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.

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

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

Additions to the 'Other' infill layer

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

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

A.34 Journey estimates for these products were constructed using LENNON data and distributing journeys based on point of sale and the underlying reduced[8] ticket travel distribution of the stations covered.

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

[8] 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.

Appendix Table 5.8: Top Ten Stations Impacted by Inclusion of the 'Other' Products

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

B Appendix – Station Usage File Definition

Station Usage File Definition

B.1 The Station Usage spreadsheet (Station Usage 2013-14.xlsx) lists the entries, exits and interchanges made at stations throughout England, Scotland and Wales in the financial year 2013/14 (1st April 2013 to 31st March 2014). It also gives details about the entries and exits for different ticket categories. It contains data on entries and exits made at rail stations by passengers using the rail network. The fields included in the Station Usage data set are:

Appendix Table 5.9Station usage file

Field	Description
Station (Name, NLC, TLC)	Station Name, NLC: National Location Code, TLC: Three Letter Code, District, County, Region, NUTS2
District, Country, Region, NUTS2 Code and NUTS2 Spatial Unit for the Station	Station's geographical location
Station Facility Owner (SFO)	The company that is the station facility owner (provided by Network Rail in 2008 and updated as appropriate for changes in status)
Station Group	Name of the Group where applicable. The user of this data may wish to filter on the 'Station Group' column, or create pivot tables, to investigate the results at a group level
PTE Urban Area Station	Stations within the urban areas covered by PTE services are identified with a flag: 'PTE Urban Area Station'
London Travelcard Area	Stations with the urban areas covered by PTE services and TfL services are identified with a flag: 'London Travelcard Area Station'
Entries (Full, Reduced, Season, Total)	Entries made at the stations split by ticket categories and in total
Exits (Full, Reduced, Season, Total)	Exits made at the stations split by ticket categories and in total
13/14 Entries & Exits	Sum of Entries and Exits for 2013/14
12/13 Entries & Exits	Sum of Entries and Exits for 2012/13
13/14 Interchanges	Total Interchanges made for 2013/14
Large station Flag	Flags change in Entries and Exits greater than 10% for stations with over 10,000 Entries and Exits
Small station Flag	Flags change in Entries and Exits greater than 25% for stations with under 10,000 Entries and Exits

Field	Description
Explanation of large change	Identified reason(s) for large changes for flagged stations
Sources	Links to source(s) of information where appropriate

Regions, Counties and Districts

B.2 For all rail stations, the District, County, Region and NUTS2 Region & Code are provided for the origin and destination to describe the geographical location.

B.3 The source of this data is:

- District or the Unitary Authority – ATOC (dated January 2008) and ORR (dated January 2008)
- District, County & Region – ONS9 website (dated January 2008)
- NUTS2 Code and Description – ORR (dated January 2010)

[9] http://www.statistics.gov.uk/geography/geographic_area_listings/administrative.asp#04

C Appendix – Overview of the ORCATS allocation process

Overview of the ORCATS Allocation Process

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

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

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

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

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

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

D Appendix – Methodology: Non-Station Tickets

Methodology: Non-Station Tickets

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

D.2 The processing of ticket sales data is undertaken in the creation of the MOIRA2 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 or ODM.

Appendix Table 5.10 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 Demand Matrix
Category 6	Origin or Destination a London Travelcard Boundary Zone	MOIRA 2 Demand Matrix
Category 7	Non-National Rail Stations	MOIRA 2 Demand Matrix

Category 1 – Origin and Destination Stations Known

D.3 Both the origin and destination were known stations so no further processing is required for such flows.

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

D.4 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. This was clearly over-simplistic.

D.5 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. We believed that this

was, in general, a valid assumption to make, and no bias would be introduced into the journey figures.

D.6 From 2007/08 onwards this process is still used where all stations in the group have ticket offices, so that the relative flows from the individual stations are credible.

D.7 For example, in 2006/07 the journeys between stations in the 'Manchester BR' group and Crewe and vice-versa are shown by the column "jnys" in the table below. First the proportion of journeys from each of the individual Manchester stations to Crewe is determined, as shown in column "%split".

D.8 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.

Appendix Table 5.11 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%**	5580	11,044
2968	1243	MANCH PICC	CREWE	19,733	**75.95%**	20152	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		1478	1,685
1243	2966	CREWE	MANCH OXF RD	2,262		97287	99,549
1243	2968	CREWE	MANCH PICC	8,017		351349	359,366
1243	2970	CREWE	MANCH VICT	343		12464	12,807
1243	0438	CREWE	MANCH BR	462,578		**Remove**	
		Grand Total:	525,920			525,918	

D.9 The above methodology has been applied to all flows with more than 1,000 journeys in total, based on sales data, leaving the individual group stations (i.e. not including the 'BR Group NLC to destination' flow). For the smaller flows an average split is applied based on the flow with more than 1,000 journeys.

D.10 In addition to this generic methodology this year entries and exits for the Southend, Colchester, Portsmouth and Hertford station groups have been obtained by apportioning total station group entries and exits using count data.

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

D.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. For these groups bespoke methodology has tended to be used based on the best available data. This year entries and exits for the majority of stations in this group have been obtained by apportioning total station group entries and exits using count data.

D.12 For the remaining stations splits between stations have been fixed at an origin and destination and route code level at the proportions estimated in the 2010/11 dataset.

Category 3 – Origin or Destination is London BR

D.13 This category contained all flows that had London BR as either the origin or destination. In order to assign an appropriate London station on flows where either the origin or destination is London BR (NLC=1072) or a London Travelcard involving Zone 1, we analysed responses from the 2001 London Area Travel Survey (LATS). For journeys from any given station, we established the percentage of passengers using each London terminus.

D.14 For example, if the flow was from Ashford International to London BR, we used our pre-generated table showing the percentage spilt between the alternative London termini for passengers starting at Ashford International. From this we apportioned the exits between London Bridge, Charing Cross, Victoria and other London termini.

D.15 Stations with small sample sizes were removed from the 2001 LATS data. Where there was insufficient data in the 2001 LATS to generate the split for a particular station, a similar process with the Non London Groups methodology was applied. Firstly for all the flows with more than 1000 journeys leaving London BR and having as a destination the particular station we used split factors as above. However, if the sum of journeys was less than 1000 we assigned to the flow the top origin from the London BR stations.

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

D.16 All origins and destinations that were London Travelcard Zones that include Zone 1 were converted to ‘London BR’ under the assumption that they will travel to the same stations as point-to-point passengers and then transfer to another mode. The methodology set out above for Category 3 was then applied.

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

D.17 This category contained all Travelcards that did not include Zone 1, for example Zone R2345 London.

D.18 For flows with origin or destination a London Travelcard (excluding zone 1) we use a set of assumptions based on survey responses from the 2001 LATS. They use the starting station to work out which stations it is possible for the passenger to be travelling to, and also give the proportion of passengers travelling to each of these stations. This is based on the assumption that a passenger holding a Zones 2-6 Travelcard would travel as far as Zone 2.

D.19 This processing is undertaken during the production of the MOIRA2 demand matrix.

Category 6 – Origin or Destination a Boundary Zone

D.20 All origins and destinations that were a London Travelcard Boundary Zone were converted to 'London Travelcard including Zone 1' under the assumption that a passenger travelling from or to a Boundary Zone will hold a Travelcard that includes Zone 1. The methodology set out above for Category 3 was then applied.

D.21 This processing is undertaken during the production of the MOIRA2 demand matrix.

Category 7 – Non-National Rail Stations

D.22 This final category contains all those flows in the original ticket sales data that do not fall into one of the above categories. Refer to Appendix E for a detailed description of this data and what has been included and excluded from the ODM.

D.23 This processing is undertaken during the production of the MOIRA2 demand matrix.

E Appendix – Station Usage Dataset Limitations

Station Usage Dataset Limitations

Limitations of the LENNON data

E.1 The LENNON database captures ticket sales for the entire national rail network from many different input machines. It is as a consequence a very large 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.

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

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

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

Known Problems of Data Capture

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

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

Travelcards

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

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

Return and Single Journey Tickets

E.9 It is possible that on certain routes the cost of a return ticket could be lower than a single ticket. This leads to the cheaper return ticket being purchased even though the passenger has no intention of making the return journey by rail. This results in two journeys being recorded instead of one.

Multiple Tickets

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

Rail Staff Passes

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

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

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

Other Rail Systems

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

Journey Factors

E.15 Ticket transactions are converted into an estimate of the number of journeys made by applying a series of ticket type journey factors. Single and return tickets unambiguously translate into one and two journeys respectively, for season tickets, the factors used represent a rough historic estimate as set out in Table 9-1 overleaf.

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

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

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

Appendix Table 5.12 Journey Factors used in LENNON

Description	Journeys Per Issue
Single Journey Ticket	1
Return Journey Ticket	2

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

Data Excluded From Station Usage

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

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

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

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

- Rover and Ranger Tickets (except those included in the new 'Other' Infill in 2011/12 and subsequent years)
- BritRail Tickets
- Gate passes usually used by staff

- Passenger Charter Discounts
- Headquarters Input Items, other than those which can be identified as TfL or PTE

E.22 Finally for flows that have either Origin or Destination 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 demand matrix (refer to chapter 2).
- PlusBus – all significant flows have been included since 2007/08 and minor flows are excluded.
- Attractions – the rail element of the significant flows have been included since 2007/08, which include:
  - Bluewater Shopping Centre
  - Alton Towers
  - Whipsnade
  - Chatsworth House

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

Control Sheet

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