Passenger Focus
Relationship between Customer Satisfaction and Performance
Northern Rail

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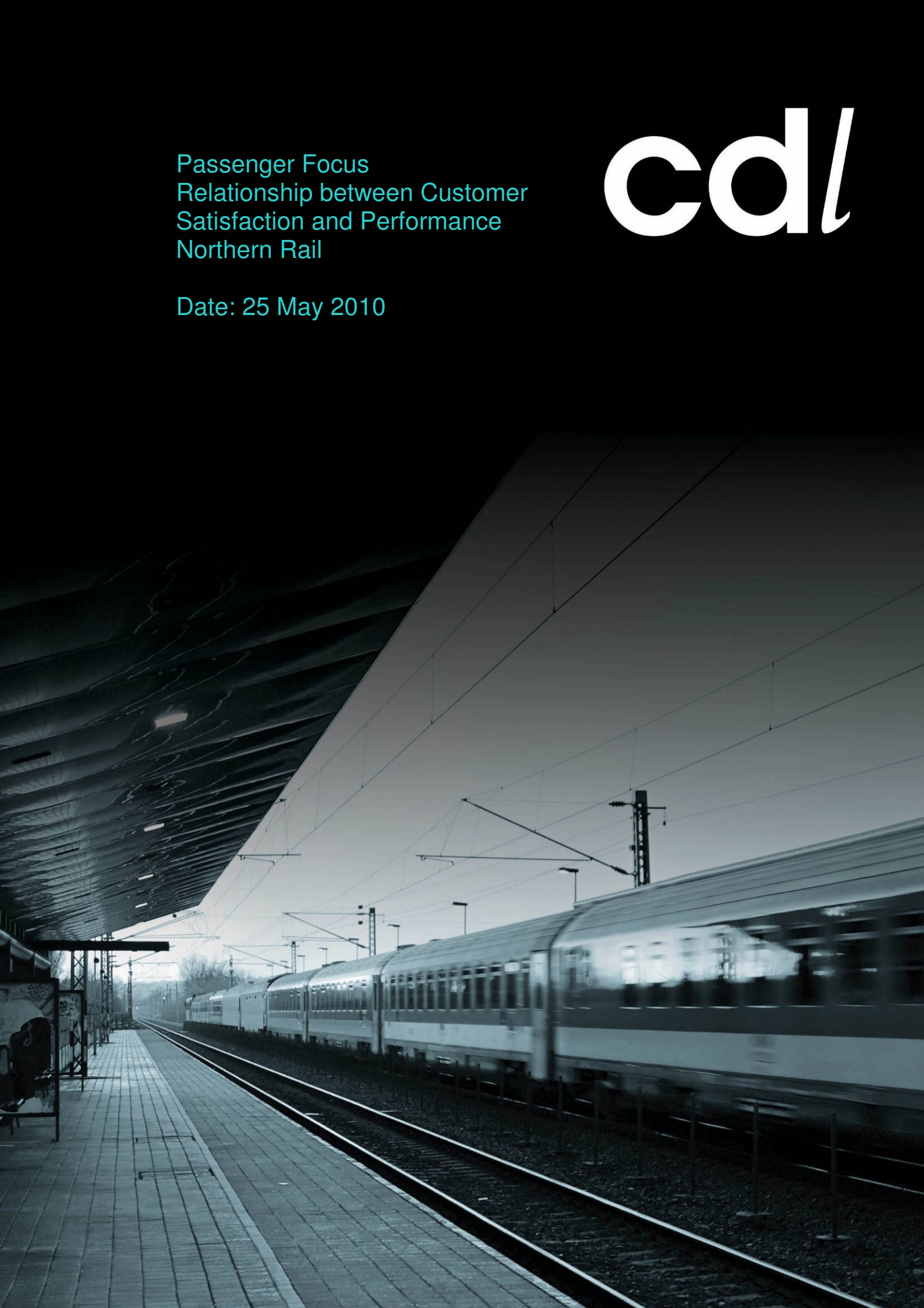

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Spirella House, 266-270 Regent Street, London W1B 3AH
Tel: 020 7494 7200 Fax: 020 7998 1644
email: cdl@cdlgroup.co.uk www.cdlgroup.co.uk

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Spirella House, 266-270 Regent Street, London W1B 3AH
Tel: 020 7494 7200 Fax: 020 7998 1644
email: cdl@cdlgroup.co.uk www.cdlgroup.co.uk

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Spirella House, 266-270 Regent Street, London W1B 3AH
Tel: 020 7494 7200 Fax: 020 7998 1644
email: cdl@cdlgroup.co.uk www.cdlgroup.co.uk

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Executive Summary

CDL undertook a study on behalf of Passenger Focus in 2009 to examine the links between train performance measures and NPS customer satisfaction for a London and South East train operator. This report provides the results of a similar study examining the links between train performance and NPS customer satisfaction for a group of non-London commuter services i.e. Northern services to and from Manchester.

The results of the study have shown the following:

- Overall satisfaction levels are broadly reflected in performance satisfaction

- Lower levels of satisfaction are recorded by passengers travelling to Manchester compared to away from Manchester, yet actual performance levels appear relatively similar in each direction.

- Performance has improved considerably on the network over the last four years, and this is reflected in NPS scores, particularly for passengers travelling to Manchester.

- In particular, performance has improved on the routes into and out of Piccadilly to the east (i.e. routes via Ashburys, Stockport and Heald Green), but there is relatively little improvement on routes serving the north of Manchester.

- There was a period of significant disruption between Oct and Dec 08 which particularly affected trains into and out of Victoria and into and out of Piccadilly from the west, and which influenced both the performance statistics and the satisfaction scores for the following NPS Wave (even though the disruption did not occur at the time of a survey).
- There is a strong linear relationship between NPS satisfaction levels and actual performance. The proportion of satisfied passengers falls by around 5% for a fall of one minute of lateness on the day of travel. This relationship remains true even at different levels of overall performance over time.

- There is no difference between satisfaction with punctuality at each level of train delay, despite varying levels of crowding.

1 Introduction

1.1 Background

Passenger Focus is the independent national consumer watchdog charged with representing the views of passengers within the UK rail industry and a mission of 'getting the best deal for rail passengers'. Amongst other objectives, Passenger Focus seeks to understand the needs and experiences of rail passengers and to secure tangible and measurable improvements for rail passengers. To support these objectives, Passenger Focus commissions and publishes the twice-yearly National Passenger Survey (NPS), which is the benchmark measure of changes in customer attitude towards all elements of UK train travel, including train services and stations.

Evidence from a wide range of research, including that of Passenger Focus, has highlighted that punctuality and reliability of train services is one of the key determinants of each Train Operating Company's (TOC) NPS customer satisfaction score. However there is frequently a disparity between performance improvements achieved by a TOC (as measured by the Public Performance Measure or PPM) and the corresponding customer NPS satisfaction result. There may be many possible reasons for this, such as: time lags between improved performance and changes in public perception, differences in the distribution of delays that are not reflected in average performance measures, and the impact of cancellations.

CDL undertook a study on behalf of Passenger Focus in 2009 to examine the links between train performance measures and NPS customer satisfaction for a London and South East train operator. This report provides the results of a similar study examining the links between train performance and NPS customer satisfaction for a group of non-London commuter services i.e. Northern services to and from Manchester.

1.2 Geographical Scope of Analysis

The study area has been selected to represent the geographical area for commuters in the Manchester area. Therefore, for example trips from Manchester Piccadilly to Liverpool Lime Street have been included, while trips from Manchester Piccadilly to Newcastle are excluded.

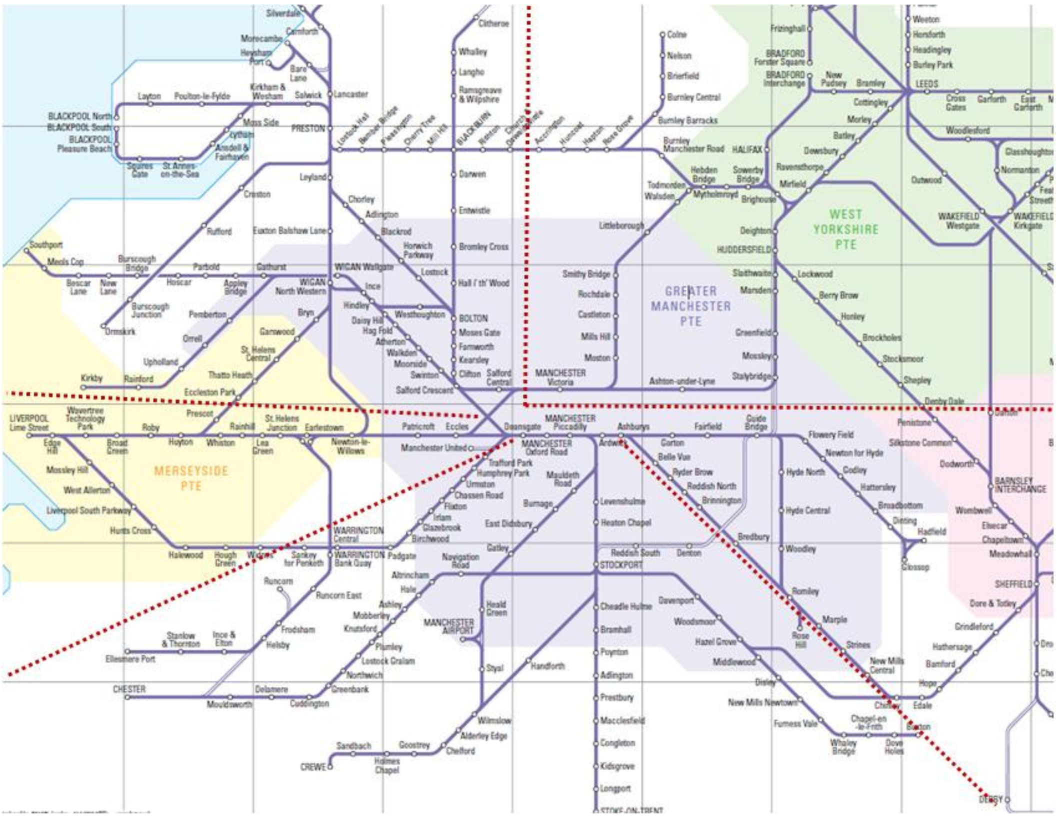
When considering passengers travelling to or from Manchester, we have defined 'Manchester' to comprise the following stations (together with their three letter code):

- Manchester Piccadilly (MAN)
- Manchester Victoria (MCV)
- Manchester Oxford Road (MCO)
- Manchester Deansgate (DGT)

For the surrounding geographical area, we have defined 5 core areas, which broadly relate to routes into the central Manchester stations. These are shown in Map 1 below, and can be broadly defined as:

- North East (NE): routes to/from Victoria via Stalybridge and Rochdale to Leeds.
- North West (NW): routes to/from Victoria / Piccadilly via Salford to Kirkby, Southport and Clitheroe.

- South East (SE): routes to/from Piccadilly via Ashburys to Sheffield and Hadfield.
- South Central (SO): routes to/from Piccadilly via Stockport and Heald Green to Chester, Crewe, Manchester Airport, Stoke and Buxton
- South West (SW): routes to/from Piccadilly / Victoria via Eccles and Trafford Park to Liverpool.



Map 1

1.3 Data

1.3.1 NPS Records

Passenger Focus conducts an NPS in the Spring and Autumn each year. Our analysis is based on data from the last eight waves (waves 14 to 21), covering a period of four years from Spring 2006 to Autumn 2009. Furthermore only weekday responses have been used in this study.

Also, only Northern records where the passenger started their trip at one of the Manchester stations, or finished the first leg of their trip at one of these stations have been included. The NPS sample is based on all Northern services, but only 40%[1] of Northern services stop at Manchester. This means that the sample size is relatively small when compared to the overall sample received for Northern by the NPS survey.

1.3.2 Train Performance Records

Data on actual performance of every Northern service which calls at Manchester over the past four years has been derived from the TOC's Bugle[2] records. This gives details of the punctuality of all scheduled trains arriving at the Manchester stations, and arriving at other core stations in the study area. This dataset also includes details of trains which were cancelled (or part cancelled for some of their route).

This analysis comprises weekday only. Weekends, Bank Holidays and the Christmas period days have been excluded.

Throughout this analysis, trains arriving early have been treated as arriving on time (i.e. no benefit is assumed for trains arriving before their scheduled time).

1.3.3 Passenger Loads and Capacity for each Train

Passenger loads were derived from the 'MOIRA' software tool. MOIRA is a standard UK rail industry timetable evaluation tool which models how customers choose between train services based on journey time, service frequency and ticket sales. MOIRA includes estimates of passenger loads on each train along its route, and so this information has been used to estimate the number of people alighting each weekday train at each location. This information can then be used to weight performance data to reflect estimated passenger volumes at each location.

MOIRA train load information has been provided for each timetable period, which has enabled us to match this information to each train on each day in the performance data.

1.3.4 Dates

Different sources of data use different terminology in the definition of date.

[1] Of the 2,589 services which Northern run in the May 09 timetable, just 1,052 stop at at least one of the 4 Manchester stations

[2] Bugle is the system which TOCs use to generate details of train performance, in terms of the lateness of every train at each monitoring location on each day

Each NPS survey is referred to as a "wave", the Spring wave is carried out over a period of ten weeks between January and April, to fit in before Easter, and the Autumn wave over ten weeks from September to November. This may be important in comparing satisfaction to performance, since the Autumn wave includes periods of traditionally low levels of performance due to leaf-fall, and Spring may include periods of affected by severe weather, such as snow, whilst the summer months are not surveyed.

The railway industry divides the year into 13x four-week periods, starting on the 1st of April each year. In terms of labelling, the year is taken as the year ending, thus the period ending in March 2008 is the thirteenth period of the 2007/08 year and referred to as 2008/P13, whilst the following period starting in April 2008 is the first period of the 2008/9 year and is referred to as 2009/P01. In this report, data may be aggregated into rail quarters, with the first quarter covering periods P01 to P03 (i.e. April to June), and whilst these do not exactly match to NPS waves a reasonable match may be used for comparison and this is shown below.

Wave	Season	Months	Year	RSP Periods	Rail Quarter
Wave 14	Spring	Jan-April	2006	2006/P11-2007/P1	2005/6 Q4
Wave 15	Autumn	Sept-Nov	2006	2007/P06-2007/P09	2006/7 Q3
Wave 16	Spring	Jan-April	2007	2007/P11-2008/P1	2006/7 Q4
Wave 17	Autumn	Sept-Nov	2007	2008/P06-2008/P09	2007/8 Q3
Wave 18	Spring	Jan-April	2008	2008/P11-2009/P1	2007/8 Q4
Wave 19	Autumn	Sept-Nov	2008	2009/P06-2009/P09	2008/9 Q3
Wave 20	Spring	Jan-April	2009	2009/P11-2010/P1	2008/9 Q4
Wave 21	Autumn	Sept-Nov	2009	2010/P06-2010/P09	2009/10 Q3

1.4 Report Structure

This report is structured as follows:

- Examination of the NPS survey sample, and the results emerging from this
- Examination of recent trends in train performance in terms of how this is reported within the industry
- Examination of recent trends in performance, as experienced by the passenger, by examining how train lateness varies by location or time of day along with variations in the number of passengers.
- Examination of correlation between the performance levels as actually experienced by the passenger, and the levels of passenger satisfaction as reported in the NPS.
- Examination of Crowding.

2 NPS Sample and Results

2.1 Introduction

In order to obtain a statistically robust assessment of passenger satisfaction, the NPS survey is managed so as to obtain results from across the whole Northern area from different sizes of station and at different times of the day, and day of week so that the views of a mix of commuters, business and leisure travellers are represented in the published results. In addition, to reduce variations due to sampling error, the number of respondents recruited at smaller stations is proportionally increased above that which the station would normally justify.

2.2 Weighting of the Survey Results

In order that the results correctly represent the views of all passengers travelling, the results are weighted to reflect the total number of passengers travelling by weekday/weekend, overall journey purpose and station category (which is a grouping based on the relative number of passengers using each station).

To maximise the chance of correctly identifying a relationship between customer satisfaction and actual performance, it is important that the basis of this weighting reflect the volumes of passengers being used in the analysis. This is particularly important since this analysis only uses a subset of Northern NPS data, i.e. those people travelling to or from Manchester.

A comparison was made between the proportions of passengers derived from the NPS weighting process (for Manchester passengers only), and of passenger volumes obtained through analysis of MOIRA train loading data. Journey purpose values were derived by taking the passenger volume on each train by ticket type as produced by MOIRA, and allocating the proportion of each ticket type to each journey purpose category using percentages published by the DfT's National Rail Travel Survey.

The results of this analysis showed a good fit for:

- Day of Week
- Journey Purpose
- Time of Day (based on both directions grouped)

More details of this analysis are included in APPENDIX A. Therefore, we concluded that the weighting used in the NPS survey would be fit for purpose for this study.

2.3 NPS Data Used in Study

There are a total of 8,878 NPS records for Northern services over the eight waves analysed (waves 14 – 21). Table 1 below shows a breakdown of these records, and highlights that just 2,075 of these relate to weekday flows within the defined scope of this study (i.e. passengers whose first recorded leg of travel is to or from central Manchester stations within the defined 'commuter' area) – 931 records for trips to Manchester and 1,144 records for trips away from Manchester.

	Passengers Surveyed	Weighted (NPS Weights)	Average Weight per Respondent
Weekdays			
To Manchester	931	52,028	56
From Manchester	1,144	69,939	61
Other	5,688	300,701	53
Weekends	1,115	110,943	100
Total	**8,878**		

Table 1

This represents broadly an average of 260 NPS records per wave, with the distribution shown in Table 2 below. This is a relatively low number of records, making it difficult to produce statistically valid results, particularly when this is split by journey purpose, time of day and location.

Wave	In Scope Records in NPS Sample	Distribution
Wave 14	335	16%
Wave 15	231	11%
Wave 16	239	12%
Wave 17	240	12%
Wave 18	253	12%
Wave 19	273	13%
Wave 20	273	13%
Wave 21	231	11%
TOTAL	**2,075**	**100%**

Table 2

Of the passengers identified as within scope who are travelling into Manchester, 81% are finishing their journey in Manchester, with the remaining 19% interchanging onto another service to continue their journey. For passengers who are travelling away from Manchester on the first leg of their journey, only 4% then interchange onto another service before completing their journey,

2.4 Overall Satisfaction vs. Satisfaction with Punctuality

For the sample of Northern passengers travelling to or from Manchester, 77% are satisfied with the overall level service, and 73% are satisfied with the level of punctuality (This compares with 75% for Northern as a whole).

Satisfaction with punctuality has improved marginally from an average of 69% in 2006 (Waves 14 & 15) to 72% in 2009 (Waves 20 & 21). Satisfaction levels were particularly poor in Autumn 2006 (Wave 15) and Spring 2009 (Wave 20).

Looking at the full four years of data, the punctuality satisfaction ratings for passengers travelling to Manchester are lower than those travelling from Manchester (see Table 3 below).

To Manchester	Punctuality Satisfaction	Overall Satisfaction
Satisfied (Net)	66%	71%
Neither, Nor	8%	13%
Dissatisfied (Net)	20%	14%
Unknown	6%	2%
Total	**100%**	**100%**

From Manchester	Punctuality Satisfaction	Overall Satisfaction
Satisfied (Net)	75%	77%
Neither, Nor	8%	12%
Dissatisfied (Net)	14%	9%
Unknown	4%	1%
Total	**100%**	**100%**

Table 3

2.5 Satisfaction with Punctuality/Reliability on Northern Services Into and Out of Manchester

Of passengers travelling to Manchester, the 19% of passengers who subsequently interchange at Manchester have higher levels of satisfaction (76% satisfied) than the passengers who finish their journey in Manchester (69% satisfied).

Figure 1 below shows how satisfaction scores for punctuality have changed over the past four years for the services within scope. This indicates that although Table 3 above indicated that passengers travelling to Manchester were less satisfied than passengers travelling from Manchester, in fact this has been skewed by records from the earlier years of NPS data.

Looking at the latest year, passenger satisfaction with respect to performance is actually now relatively similar in each direction (although still marginally better for people travelling away from Manchester). While passenger satisfaction has remained relatively stable for passengers travelling from Manchester, this measure has improved significantly for passengers travelling into Manchester. This is examined in more detail in the actual performance analysis section of this report.

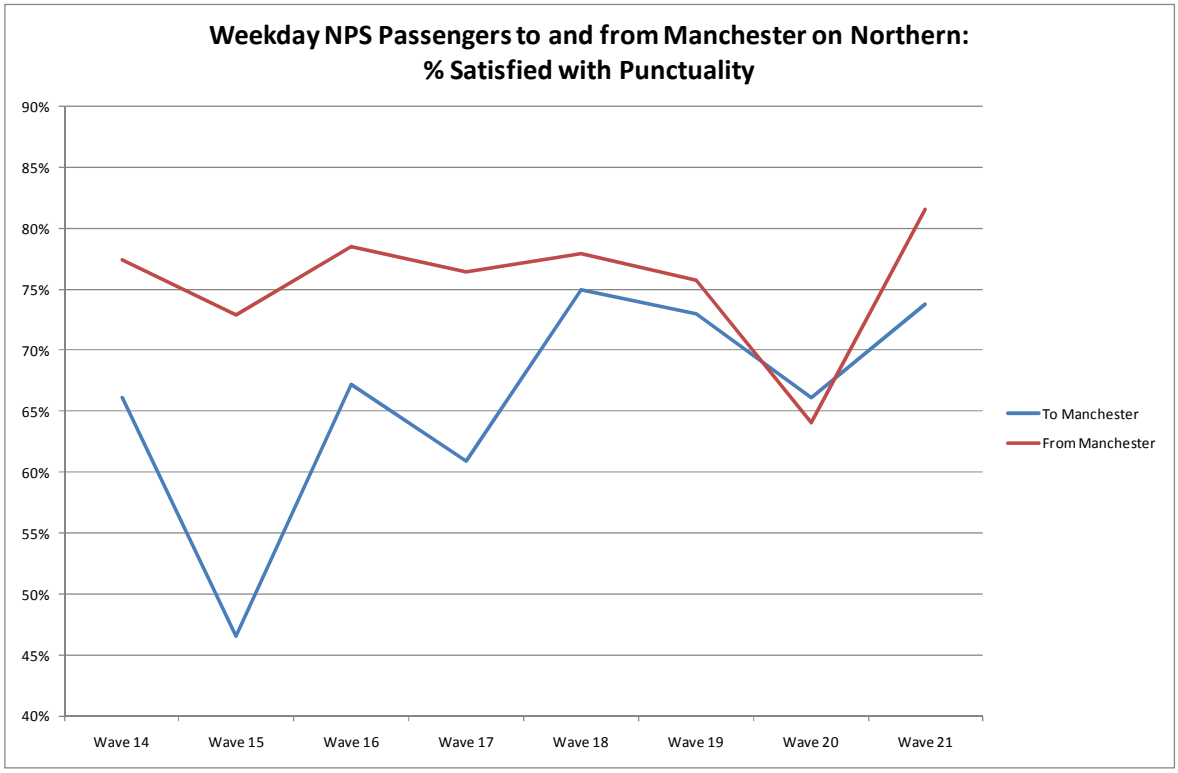


Figure 1

2.6 Satisfaction with Punctuality by Journey Purpose

As we would expect, given the selection criteria, the majority of respondents (70%) are commuters, as outlined in Table 4.

To Manchester	Sample Size	Distribution
Business	78	8%
Commute	652	70%
Leisure	201	22%
Total	**931**	**100%**

From Manchester	Sample Size	Distribution
Business	96	8%
Commute	728	64%
Leisure	320	28%
Total	**1,144**	**100%**

Table 4

Analysis of satisfaction results shows that the lowest punctuality satisfaction results are recorded by commuters travelling to Manchester, with almost 1/3rd of commuters travelling to Manchester dissatisfied, compared with 1/6th of commuters travelling from Manchester whilst only 10% of business travellers and leisure travellers are dissatisfied (see Table 5, and Figure 2). Even in the latest survey 24% of commuters remain dissatisfied compared with just 6% of business travellers and 3% of leisure travellers. It might be expected that commuter's view of performance may be reflective of performance levels over recent day and weeks, rather than this specific journey. A leisure/business passenger may travel less frequently, and so it might be expected that their records are more reflective of this specific journey experience.

The fact that commuters record lower satisfaction levels when travelling into Manchester is one which is considered further in this report in the sections on actual performance trends to confirm if this is reflective of actual performance on the network.

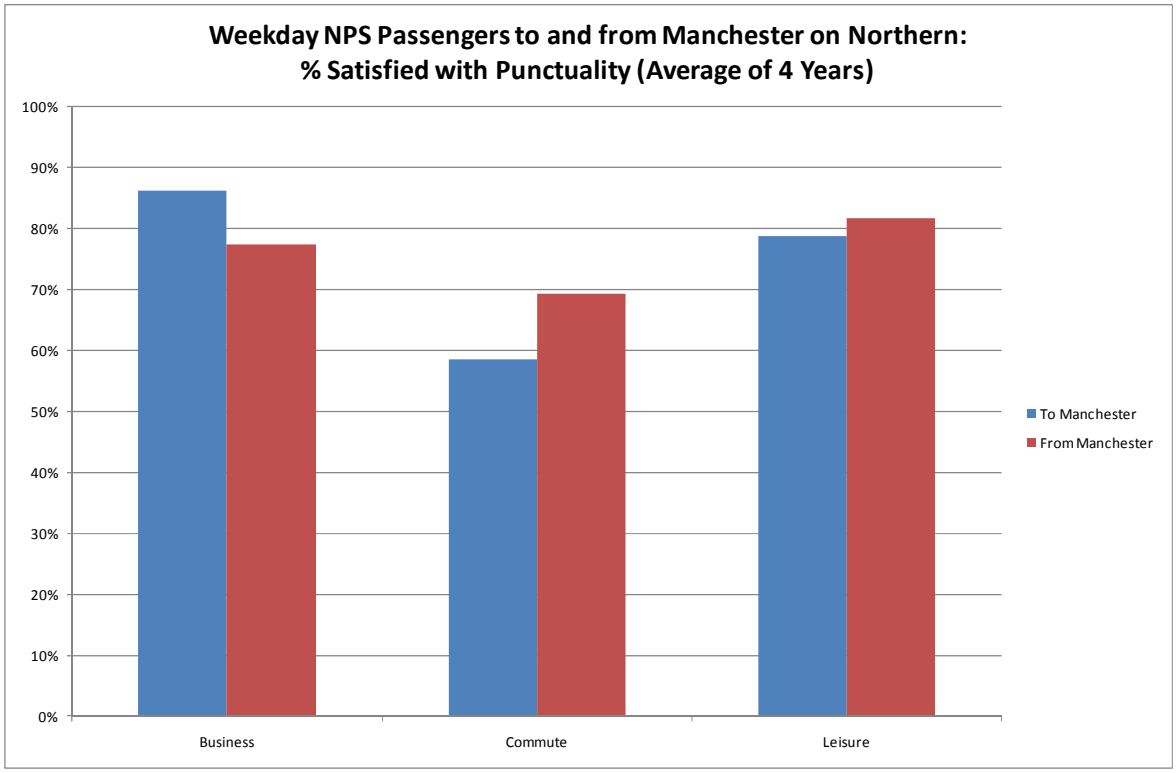


Figure 2

To Manchester	Business	Commuter	Leisure
Satisfied (Net)	85%	59%	80%
Neither, Nor	8%	14%	11%
Dissatisfied (Net)	7%	27%	9%
Total	100%	100%	100%
From Manchester	**Business**	**Commuter**	**Leisure**
Satisfied (Net)	75%	70%	81%
Neither, Nor	13%	14%	9%
Dissatisfied (Net)	12%	16%	10%
Total	100%	100%	100%

Table 5

2.7 Satisfaction with Punctuality: Conclusions

- Satisfaction with punctuality over the period has averaged 73%, increasing marginally from 69% in 2006 to 72% in 2009 (including a particularly poor satisfaction result in Spring 2009).
- Over the study period, satisfaction is higher for passengers travelling from Manchester than those travelling to Manchester, although this has equalised in recent years
- Commuters are less satisfied with punctuality than either business or leisure travellers, with almost 1/3rd of commuters travelling to Manchester dissatisfied over the study period. Even in the latest survey 24% of commuters remain dissatisfied compared with just 6% of business travellers and 3% of leisure travellers.

3 Recorded Northern Performance Levels (Train Lateness)

This section provides an overview of recent trends in recorded train performance for Northern services into and out of Manchester, and which can be then compared to observations made for passenger satisfaction levels as summarised in Section 2.

3.1 Overall Punctuality of Trains at Destination

The standard industry measure of performance is the Public Performance Measure (PPM), which reflects the proportion of scheduled trains which arrive at their final destination within 5 minutes of booked arrival time (defined as 'Time to 5' or 'T5' in this report).

For Northern as a whole, PPM has increased significantly over the past few years – from 83.7% in the 12 months to December 2004 to 91.6% in the last 12 months[3].

T5 at train destination has been calculated for all Northern services which fall within the scope of this study (i.e. trains which travel to, from or through Manchester), to provide a PPM measure for those services in-scope

For all trains Northern trains included within this study 89.3% of trains arrived within five minutes of schedule which includes an increase from 86.5% to 92.3% over the four years. Examining the number of trains arriving at their final destination within 5 minutes of schedule by quarter (rather than smoothed annual), clearly shows the poorer performance during the Autumn period, with delays caused by leaf-fall, and around 94% of trains arriving with 5 minutes in quarter 2009/10 Q2 (i.e. Summer 2009) compared to less than 90% in 2009/10 Q3 (i.e. Autumn 2009). That said, this does show an upward trend in average performance of trains at destination, and is consistent with the overall TOC performance trends.

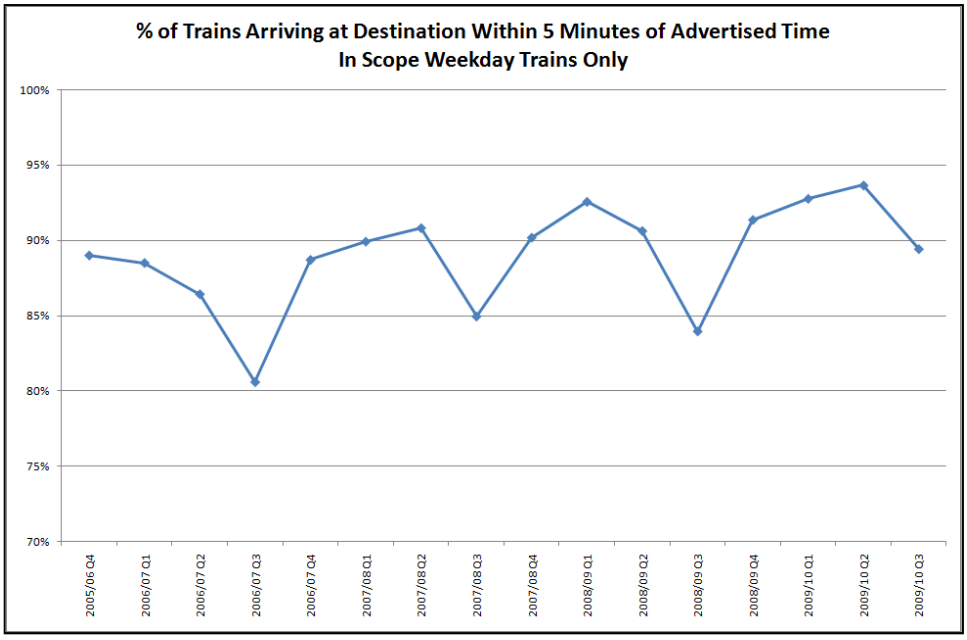


Figure 3

[3] Source: http://www.railnews.co.uk/news/general/2010/05/13-northern-wins-twoyear-franchise-extension.html

Only 40% of scheduled weekday Northern services are within the scope of this study (i.e. call at Manchester), but this shows that recent trends in performance of trains in this area is in line with that experienced by the TOC as a whole.

In the summer of 2006 (2006/7 Q2) 86% of trains arrived within 5 minutes of schedule, and just over 60% of trains arrived Right Time or Early (RTE) (68% over the whole four years). By the summer of 2009 these numbers had risen to 94% (+8 %) and 80% (+20%) respectively. This shows that RTE arrivals at destination have been improving at a faster rate than the RT5 measure.

There has also been a discernible reduction in delays during the Autumn period when services are affected by leaf-fall and when services deliver the poorest levels of punctuality. In autumn 2006 (2006/7 Q3), the T5 measure was 80% and the RTE measure was just 50% (i.e. only half of all trains arrived on time). By Autumn 2009 (2009/10 Q3) T5 had risen to 90%, +10% above 2006), and the RTE measure was 70%, +20% above 2006.

Nonetheless Q3 is when one of the two NPS surveys is undertaken each year and this may have a significant bearing on passenger sentiment. Even at the higher levels of punctuality in 2008/9, the difference between 2008/9 Q3 (when the Autumn Wave was undertaken) and 2008/9 Q4 (when the Spring Wave was completed) was 7% for RT5 (84% to 91%) and 18% for RTE (58% to 76%).

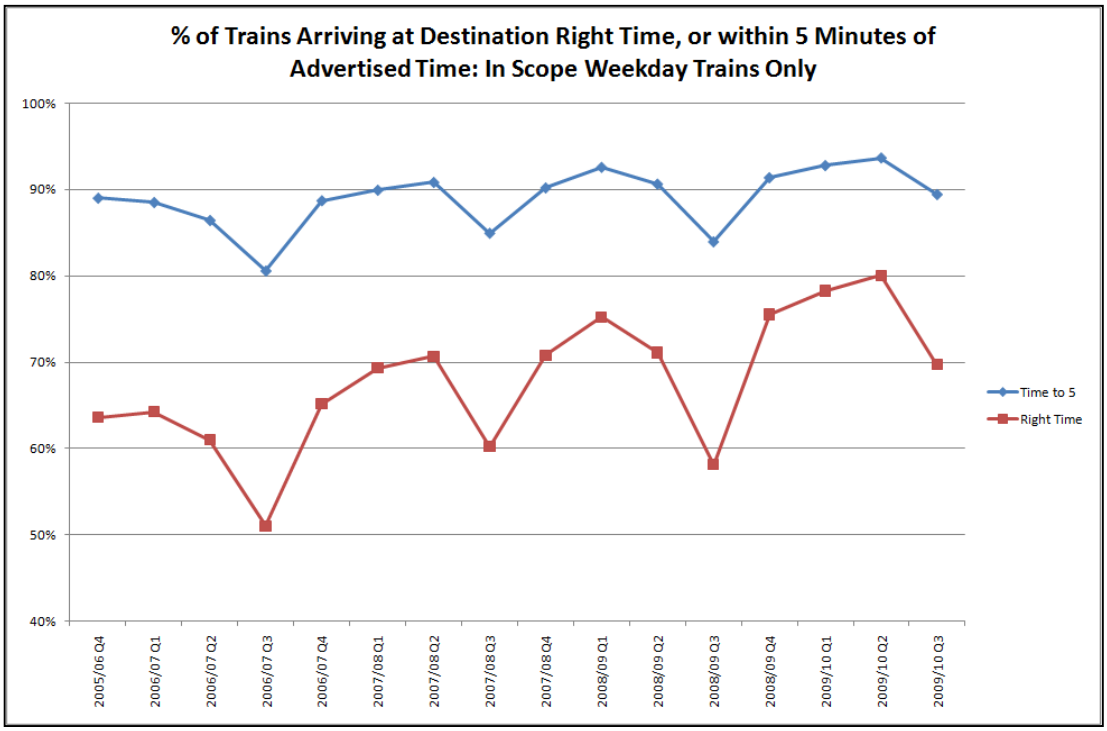


Figure 4

3.2 Cancellations

As well as trains arriving late at destination, a train will clearly fail the PPM measure (and frustrate passengers) if it is cancelled, either in full or part[4].

The recent trend in cancellations is shown in Figure 5 for trains within the study scope and with the exception of a particularly bad quarter between October and December 2008 (with three-times the normal level of cancellations), this shows an improving trend over the last 3 years, particularly in part cancellations, which will be helping drive the overall PPM improvements.

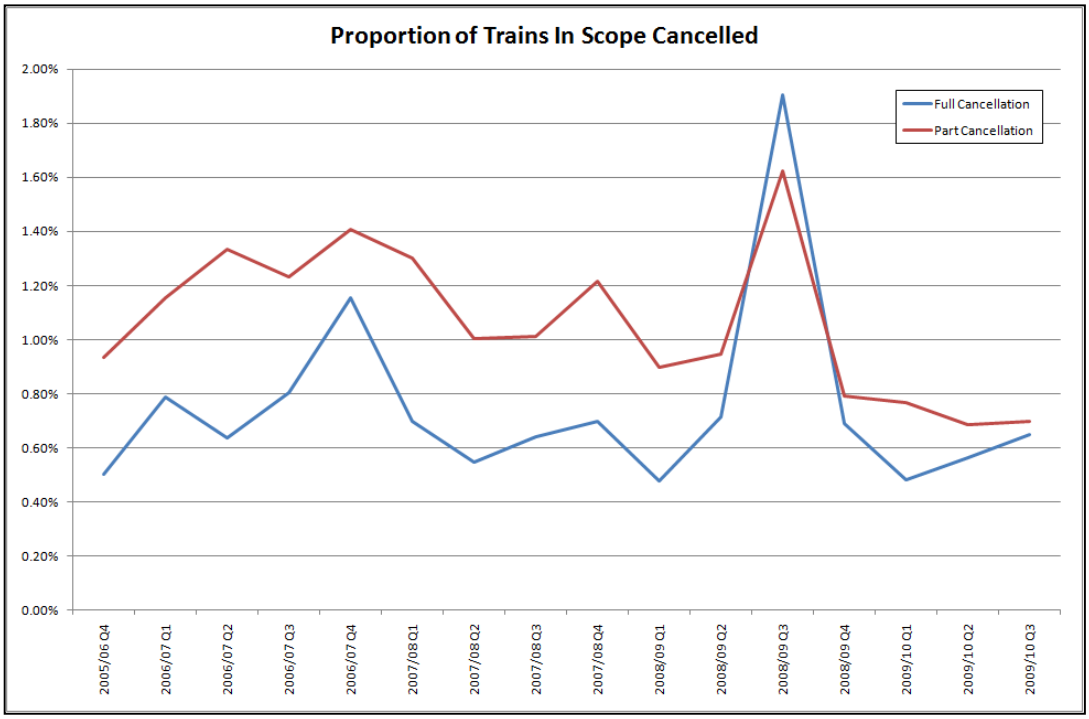


Figure 5

Looking at the cancellations in more detail, Figure 6 below shows that Northern experienced a significant increase in full cancellations towards the end of quarter 2008/-09 Q3, specifically in Periods 9 and 10 (which equate to mid November 2008 to end of December 2008). Part cancellations were not particularly affected.

Figure 7 drills into more detail to show that the problems with cancellations specifically occurred in December 2008, which falls between Waves 19 and 20 of the NPS survey. In December 2008, the level of full cancellations per day exceeded 3% on 11 out of 18 weekdays. This compared to average full cancellation levels of 0.6%

[4] A full cancellation means the train ran less than 50% of its scheduled distance, while a part cancellation means the train ran more than 50% of its scheduled distance, but failed to fulfil its complete schedule

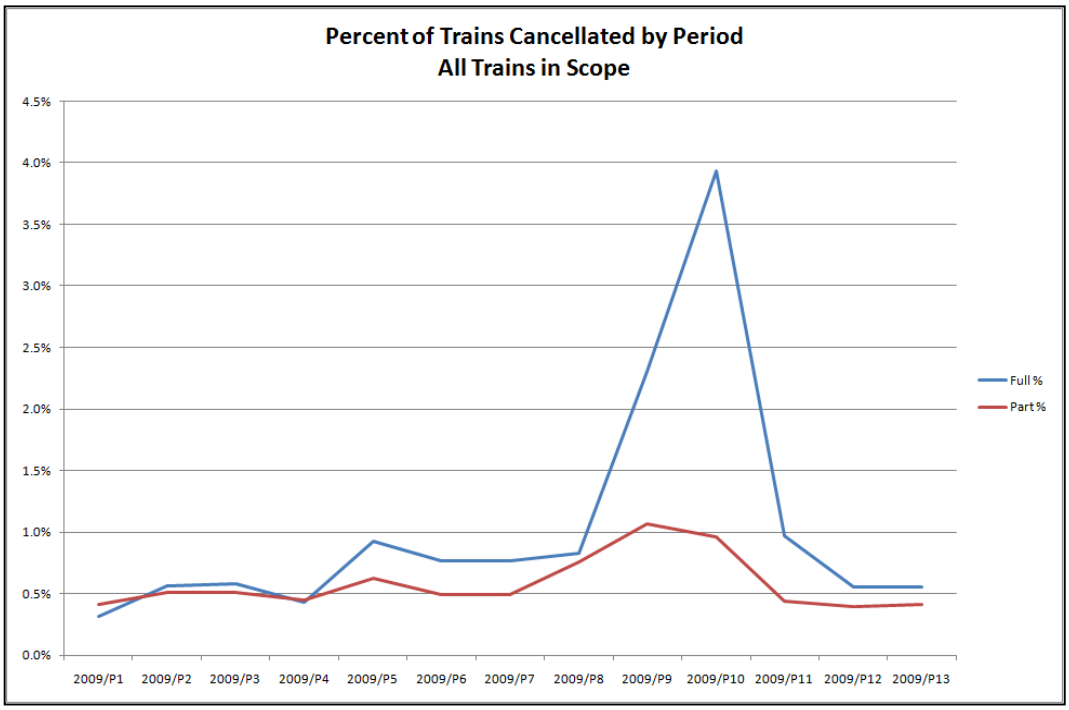


Figure 6

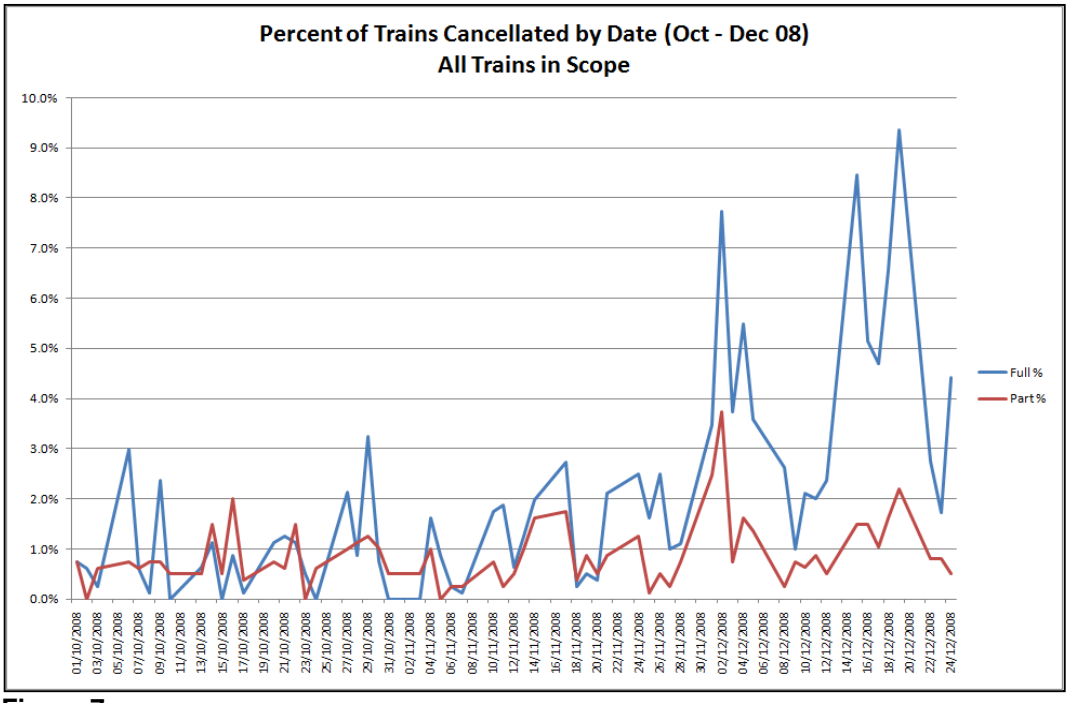


Figure 7

3.3 Average Lateness of Trains to Manchester

Of the trains which carry passengers into Manchester on each weekday, 73% of trains terminate at one of the central Manchester stations.

Figure 8 shows a comparison of average train lateness arriving at Manchester and average train lateness at destination by period for the last four years (for all trains which travel into Manchester as part of their route, e.g. includes services such as Manchester Airport to Liverpool, as well as Manchester terminating services). The trend in terms of Moving Annual Average (MAA) for each measure is also shown.

Note: To calculate an average lateness figure which also takes account of cancellations, trains which were cancelled are assumed to have a lateness figure of 30 minutes.

Across the four central Manchester stations, average train lateness is currently around 1.6 minutes for the past year (down from around 2.2 minutes 3 years ago). Average train lateness at destination is marginally lower at around 1.5 minutes, indicating that those trains which pass through Manchester do recover some lost time before final destination, although this is marginal.

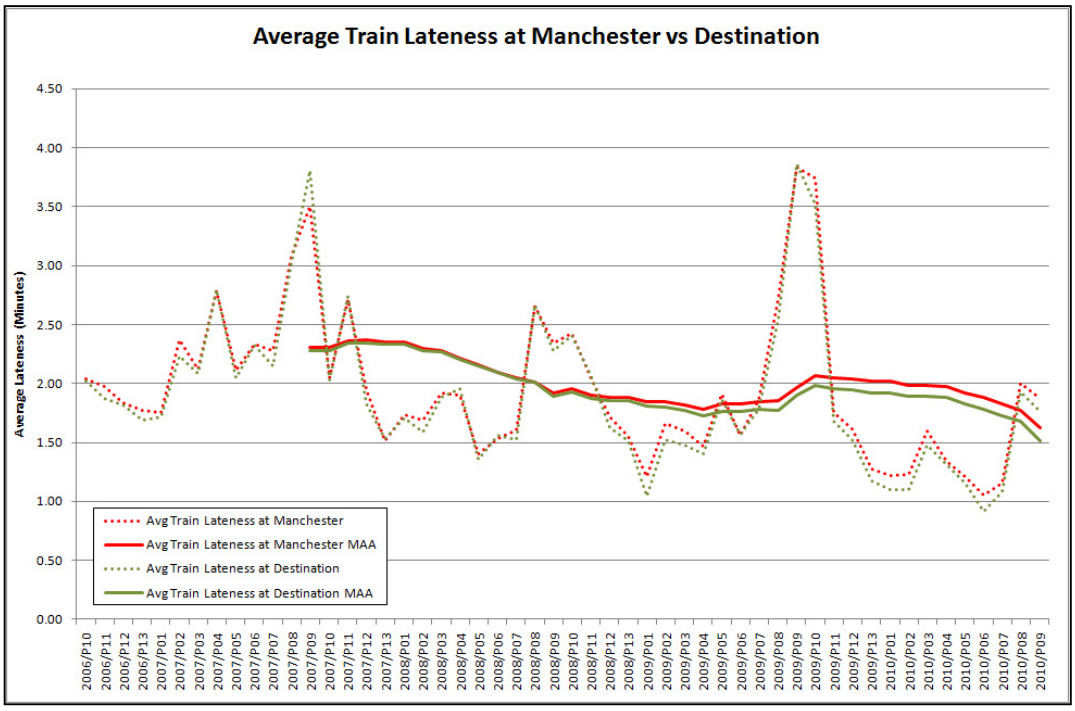


Figure 8

The effect of poorer performance in each of the Autumn periods can also be observed in these charts. As highlighted in Section 3.1, it is particularly noticeable in this chart, and subsequent charts, that the Autumn period (October – December) in 2008 was particularly bad for trains into Manchester, and which then impacts on MAA going forward.

Trends in the MAA of average lateness for trains arriving at each of the Manchester stations are shown in Figure 9 (with Manchester Oxford Road and Deansgate amalgamated).

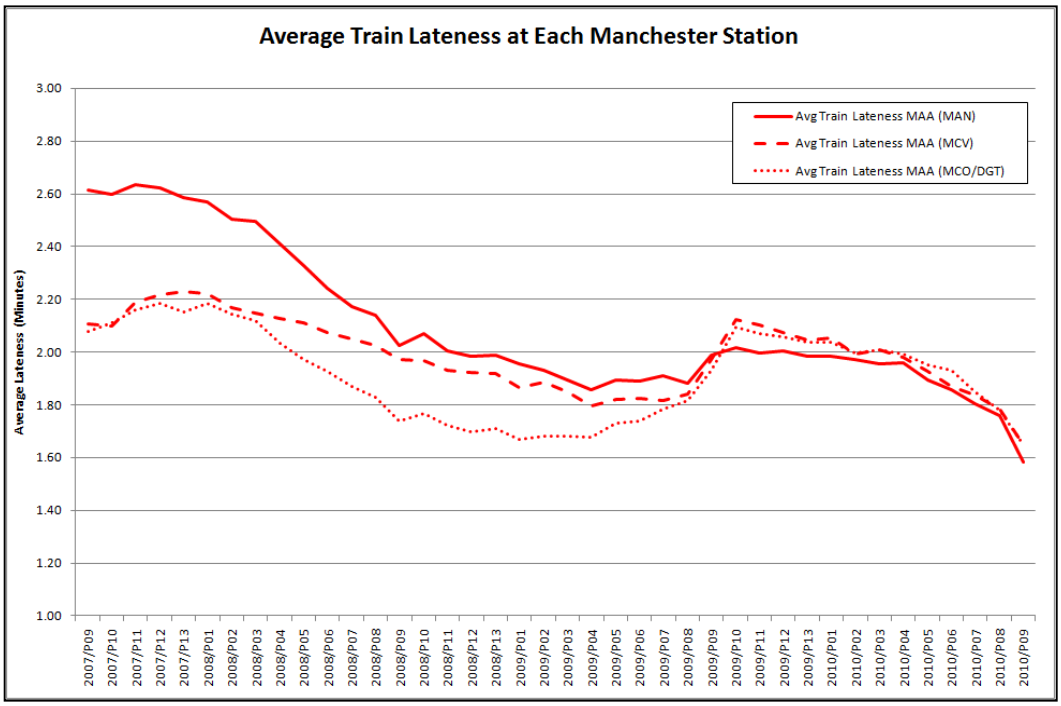


Figure 9

This shows the largest improvement in performance is that experienced by trains arriving at Piccadilly up to the end of the 2008 calendar year. However, the poor performance at the end of 2008 appears to have particularly impacted on trains (and so passengers) alighting at Victoria and Oxford Road / Deansgate. That said, average lateness has fallen by over a minute for trains at Manchester Victoria since 2006 and for all services the trend has recovered from the Autumn 2008 results and average lateness continues to fall rapidly.

To examine whether there are different performance impacts for trains coming into Manchester on different routes, Figure 10 shows the same trends but for trains arriving from each of the five routes outlined in Section 1.

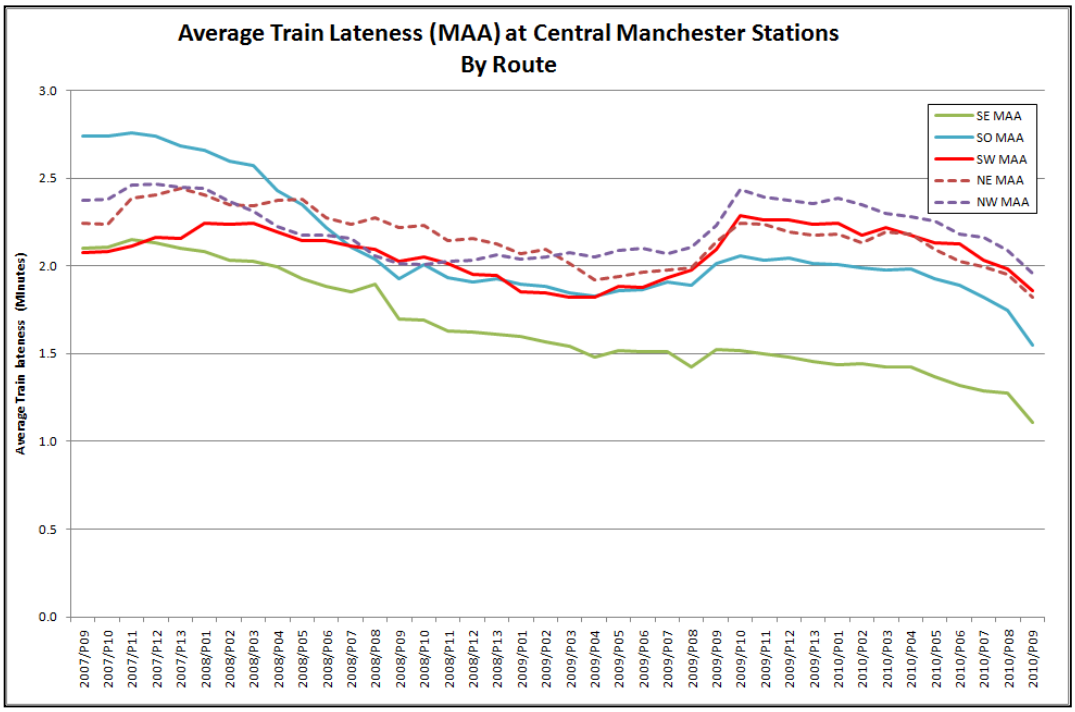


Figure 10

This clearly shows a marked improvement on the routes into Manchester from the South East (Hadfield/Sheffield routes) and the South Central (Stockport / Airport routes). This also indicates that the performance problems experienced in Oct-Dec 2008 did not materially impact those routes which come into Piccadilly station from the east (SE and SO). This may suggest certain localised effects at this time, e.g. engineering disruption on the routes into Piccadilly and Victoria from the west, or indeed at Victoria itself. However, we have not specifically investigated this.

Despite this incident in late 2008, performance in terms of average lateness of trains arriving at Manchester appears to be improving on all routes, which correlates with the observed improvement in NPS satisfaction scores for passengers travelling into Manchester as shown in Section 2.

Looking at the latest year of data only (i.e. calendar year 2009 - Figure 11), we can see that for Oxford Road and Deansgate (where there are no terminating services), there is a smaller proportion of trains that arrive more than one-minute early, but that the number of right-time trains is higher than at Victoria and Piccadilly, probably reflecting the existence of additional time in the schedules for trains at the main stations.

The distribution also shows a higher proportion of trains arriving early at Victoria than at Piccadilly.

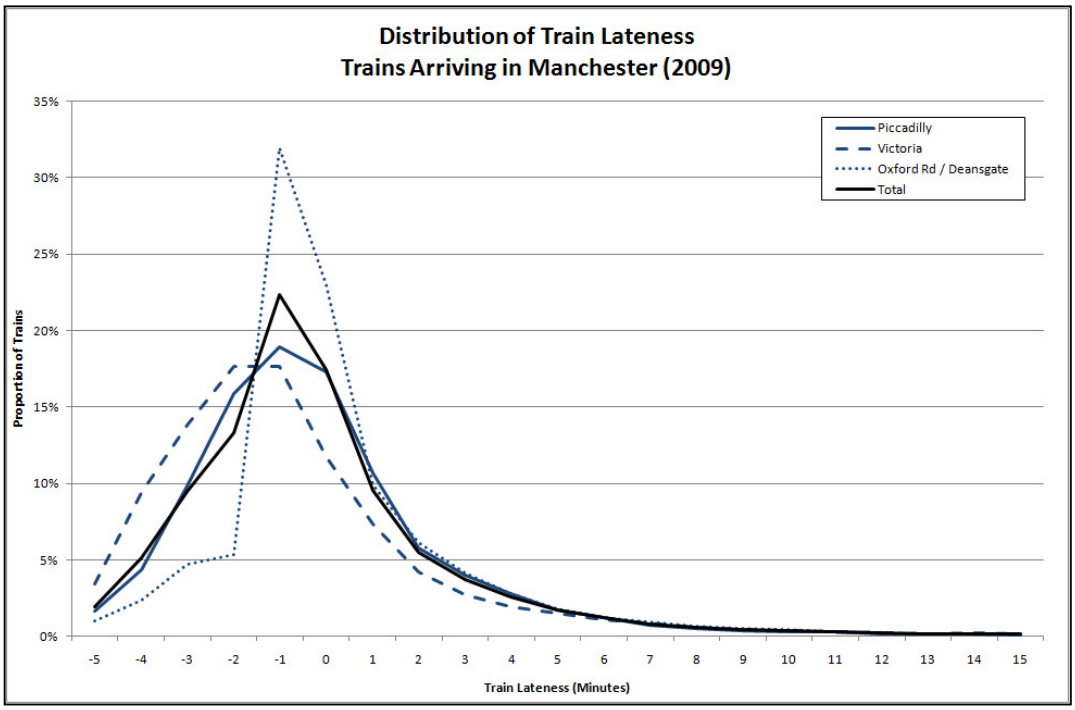


Figure 11

Figure 1 (in Section 2.5) showed that for passengers travelling to Manchester, their perception of performance (as measured by satisfaction ratings in the NPS) had significantly improved over the last four years. Figure 12 shows how the lateness distribution of trains arriving at Manchester has changed over these 4 years.

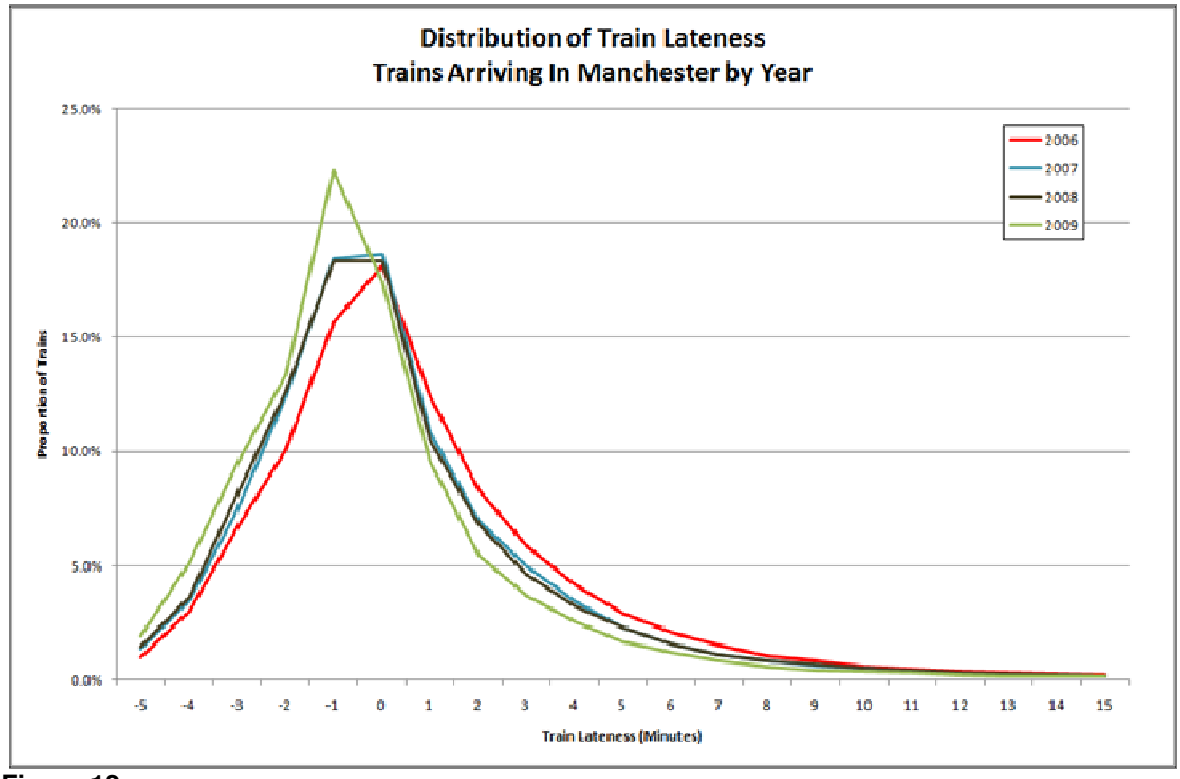


Figure 12

Table 6 below shows how actual performance has been improving over the last four years, with Right Time arrival punctuality increasing from 55% of trains to over 70%

of trains – this is a measure that is likely to be most visible to passengers. However, the significant reduction in very late and cancelled trains over this period is also a factor which may well help improve passengers perception of performance, since such events are those which tend to be remembered, and potentially influence regular passengers (i.e. commuters) when filling in surveys such as the NPS.

Proportion of Trains	2006	2007	2008	2009
Right Time / Early	55.3%	62.6%	63.3%	70.5%
Time to 5	86.0%	88.9%	88.5%	91.8%
Time to 10	94.4%	95.3%	95.0%	96.6%
Over 15 Minutes Late	1.8%	1.4%	1.5%	1.0%
Cancelled	1.5%	1.4%	1.7%	1.0%

Table 6

Figure 13 below, further illustrates how the lateness distribution of trains arriving at Manchester has changed over these four years.

Note, the increase in cancellations and very late trains in 2008 will be driven by the effects of events in late 2008, as highlighted in earlier trend charts in this section and which appear from the data to be a 'one off' effect.

3.4 Average Lateness of Trains From Manchester

For trains from Manchester, lateness has been examined for trains at destination on each of the five defined routes. The trend in average lateness at destination over the past four years is shown in Figure 13 below for all trains from Manchester (including through trains). From Figure 8 we saw that average lateness of trains *from* Manchester at their final destination is currently 1.5 minutes, which is the same as the average lateness of trains *to* Manchester. Given that over 70% of trains start or finish in Manchester, it cannot be the 'through Manchester' trains which is driving this similarity, but seemingly a genuine consistent picture for trains in each direction.

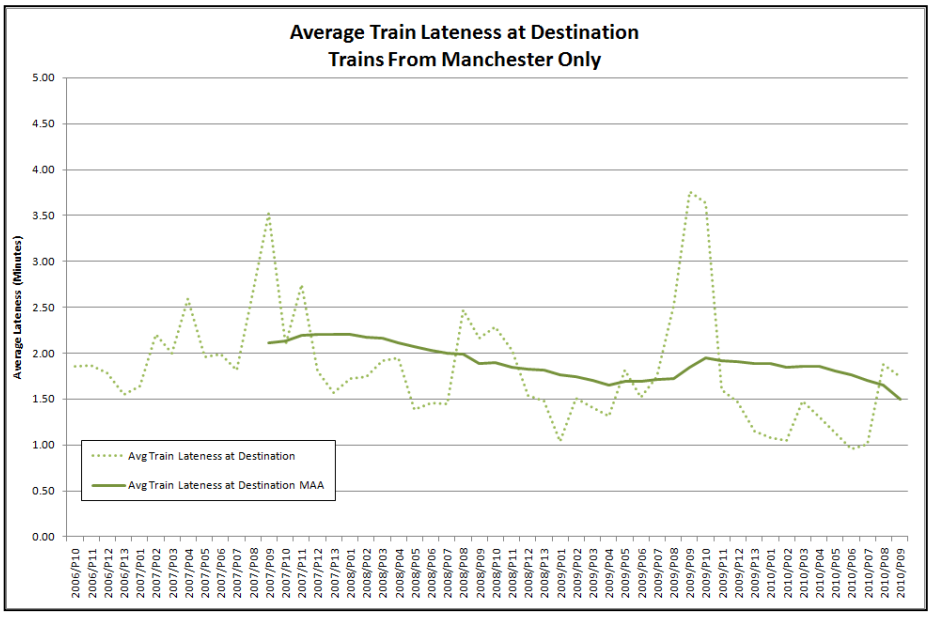


Figure 13

Figure 14 below, shows how this trend differs for trains travelling away from Manchester on each of the five routes. In particular, this shows a similar trend to that outlined in Section 3.2 for trains into Manchester, i.e. an improving trend on all

routes, particularly the South East (Hadfield/Sheffield) and South Central (Stockport/Airport) routes, with the exception of a period of serious disruption at the end of 2008.

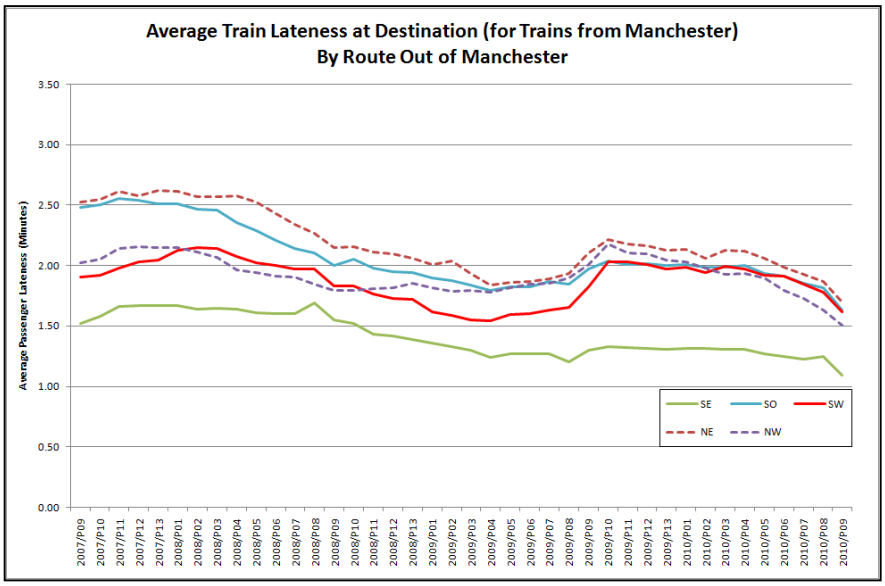


Figure 14

The improvement in performance of trains arriving at final destination, both in terms of lateness, and in level of cancellations can be seen if we plot the distribution of train lateness at final destination for all trains travelling away from Manchester, by year (Figure 15). Whilst this is consistent with the overall improvements reported by Northern in terms of PPM, it is noticeable that this improvement for trains travelling from Manchester has not translated into improvements in passenger satisfaction for those passengers travelling from Manchester, as recorded in the NPS (Figure 1).

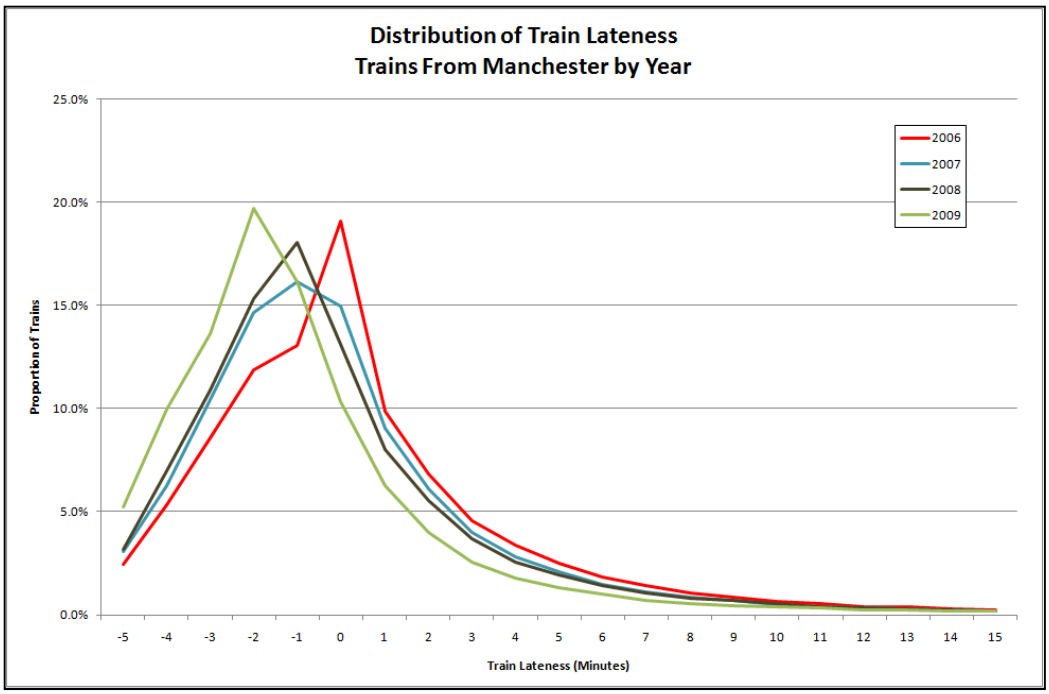


Figure 15

Proportion of Trains	2006	2007	2008	2009
Right Time / Early	62.0%	67.0%	69.1%	77.7%
Time to 5	86.7%	88.9%	88.9%	92.3%
Time to 10	94.3%	95.1%	94.8%	96.3%
Over 15 Minutes Late	1.7%	1.4%	1.5%	1.1%
Cancelled	1.5%	1.6%	1.8%	1.1%

Table 7

3.5 Average Lateness of Trains by Time of Day

Figure 16 below shows the average lateness of trains by arrival hour. The black line shows the average lateness across all four years. This demonstrates the improving trend that Northern have experienced, and this is particularly noticeable in the evening peak (arrive between 1800 and 1900) where average train lateness at destination has reduced from 3.5 minutes to just under 2 minutes.

Up to 2009, it appears that trains were about a minute later on average in the evening peak compared to the morning peak. However, this differential has reduced each year to the point in 2009 where similar levels of lateness are experienced by trains in the morning and evening peaks.

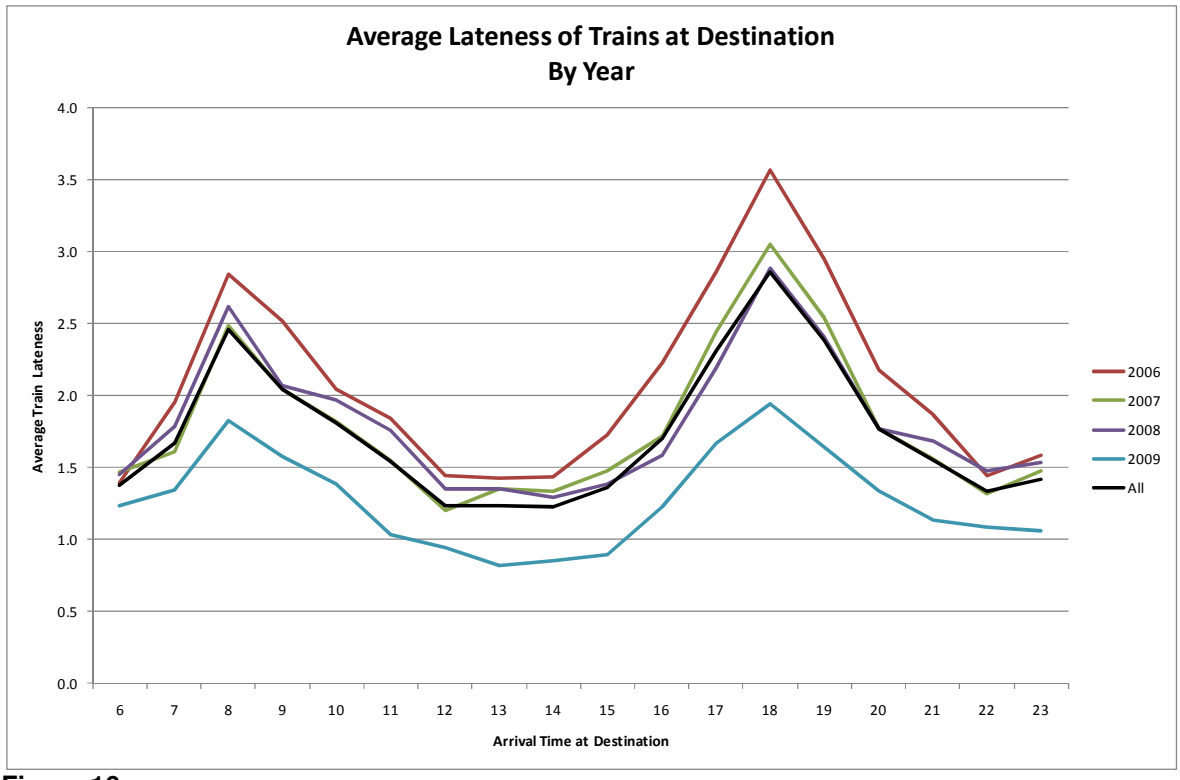


Figure 16

Looking at trains at Manchester specifically, Figure 17 below shows the average lateness of trains arriving at Manchester Piccadilly and Victoria stations by time of day for 2009 only. This shows that the average lateness of peak trains is nearly double that of off peak trains (2 minutes compared to 1 minute). The trend at Manchester broadly mirrors that of all trains at destination in that there is very little observed difference between the morning and evening peak.

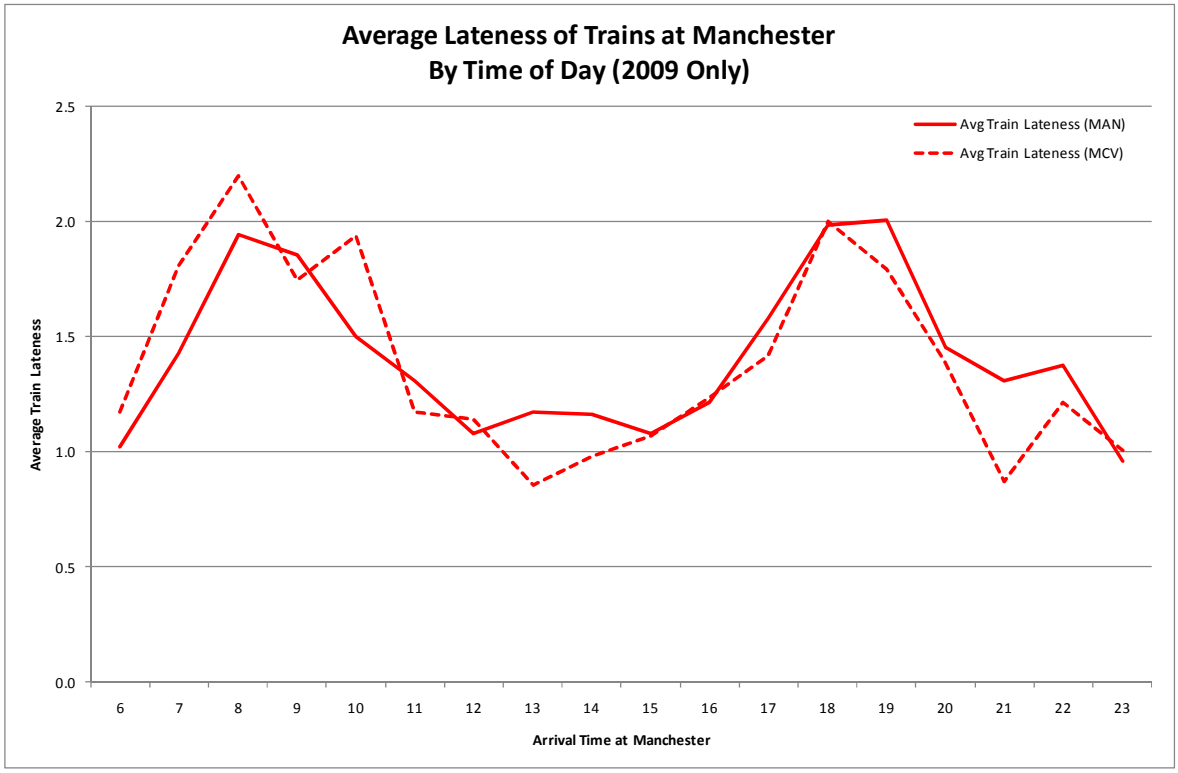


Figure 17

3.6 Average Lateness of Trains – Conclusions

- 89% of trains arrived within five minutes of schedule (RT5) and 68% arrived right time or early (RTE)
- Performance has improved significantly over the four years, with RT5 having improved from 86.5 to 92.3% and RTE from just over 60% to 80%
- Punctuality is drastically affected by the Autumn leaf-fall season. In Autumn 2006 only 80% of trains were recorded as RT5 and just 50% RTE, and whilst this has improved, the difference between summer and autumn RT5 is still 20%.
- Services were severely affected by a three-fold increase in cancellations in Autumn 2008, but have since recovered
- Average train lateness is currently around 1.6 minutes for the past year (down from around 2.2 minutes 3 years ago), with little difference between those services travelling to Manchester and those travelling from Manchester.
- Average train lateness is worse in the peak than in the off-peak, with around an average of 2 minutes delay at the height of the peak and 1 minute delay in the middle of the day
- Services to the south of Manchester, particularly in the South East and South Central areas have improved the most, with only small improvements for those services serving the north and passing through or terminating at Manchester Piccadilly

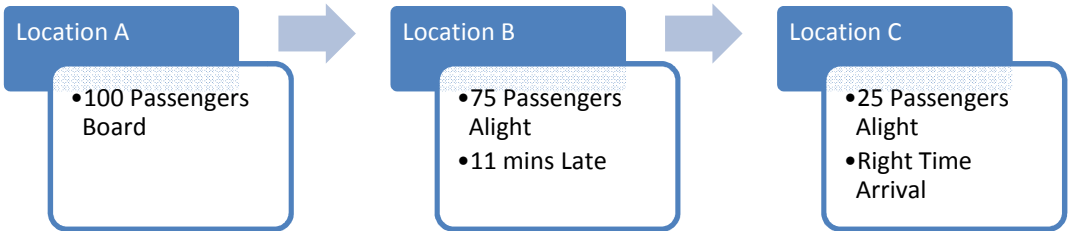
4 Passenger Lateness Analysis

4.1 Measures of Passenger and Train Lateness

Section 3 examined train lateness at destination (the measure used by the rail industry in PPM scores) and train lateness en route. However, measuring the lateness of trains in either of these ways might not necessarily fully reflect the average lateness as experienced by passengers.

Average terminating train lateness details the lateness of a service at its final destination and average train lateness shows the lateness of a train en route, but it could be that neither of these measures fully reflect how passengers are affected by delays as they do not take into account variations in volumes of passengers alighting at different stations.

For example, if for a particular train, 25% of passengers alight at the destination (location C) while 75% of passengers alight at the preceding station (Location B).



In this example lateness values are different at each station, this could be due to 'performance allowance' in the timetable for the route section approaching the destination. Measuring lateness at destination only will not give a reflective picture of the lateness experienced by the average passenger. In this example 75% of passengers suffered a 11 minute delay to their journey.

Variability between loads on train services might also be a factor if, say, peak services carrying more passengers per train, have a different lateness profile to off-peak trains.

As part of this study, we have therefore calculated a measure of passenger lateness. This is a measure of the average lateness experienced by each passenger, and is calculated based on comparing the lateness of trains at each station stop with the volume of passengers alighting at each stop.

In the example above this would be ((75 pax*11 mins) +(25 pax*0 mins))/100 pax = 8.25 average minutes lateness for the train.

As part of this study, we have therefore calculated a measure of passenger lateness. For trains to Manchester, this is simply expressed as the lateness weighted by the number of passengers at each Manchester station.

For trains from Manchester, we expect the majority of passengers to get off before the final destination of the train, and so a weighted passenger lateness figure has been derived for each station or group of stations. This is a measure of the average lateness experienced by each passenger, and is calculated based on comparing the

lateness of trains at each station stop with the volume of passengers alighting at each stop.

Two particular issues were considered in calculating this measure:

- For trains which are recorded in the performance data as cancelled at the station stop, passengers who would normally alight at this station on this train would be attributed a lateness value of 30 minutes (aimed to reflect the average lateness they would be likely to experience through having to wait for the following train).
- There are a number of stations which Northern serve where lateness is not recorded in the TRUST system. For passengers who alight at these stations, we have assumed they experience the lateness as recorded at the next station along the route where lateness is recorded in TRUST.

4.2 Average Passenger Lateness – To Manchester

There are around 4.5m passengers per annum travelling into one of the four central Manchester stations on a weekday on Northern services. Of these around 47% alight at Piccadilly, 38% alight at Victoria and 15% alight at Oxford Road and Deansgate.

Across all four central Manchester stations, average passenger lateness is currently approximately 2 minutes for the past year, an improvement of 0.5 minutes in the last three years (down from around 2.5 minutes 3 years ago). Average passenger lateness is approximately 0.25 minutes worse than average train lateness.

The recent trend in average passenger lateness is shown in Figure 18.

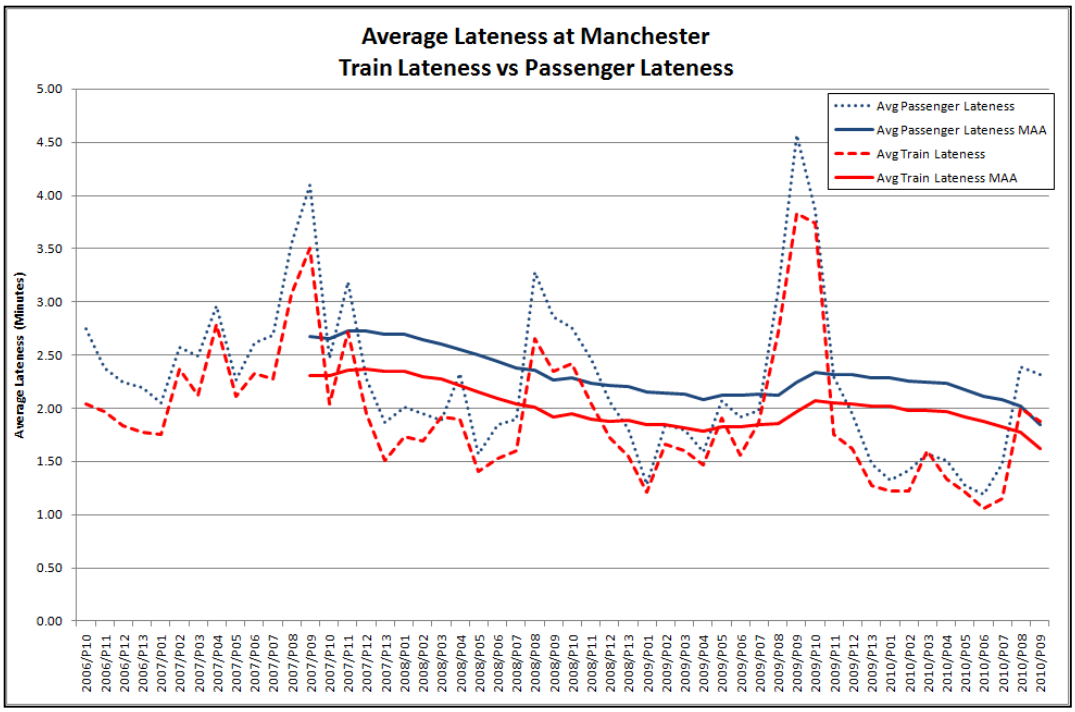


Figure 18

This will be the result of either a difference between the lateness of more highly loaded trains compared to lower loaded trains, or as a result of the difference between through services and terminating services at Manchester stations. But in

this latter case we have already seen that there is little difference between through services and terminating services.

Trends in passenger lateness at each of the Manchester stations are shown in Figure 19 below (with Manchester Oxford Road and Deansgate amalgamated).

This shows strong improvement in punctuality for passengers arriving at Manchester over the past three years (and can be seen in some improvement in NPS satisfaction scores). In particular, passengers arriving at Manchester Piccadilly will have seen their average lateness fall from 2.8 minutes in 2006 to around 1.7 minutes today.

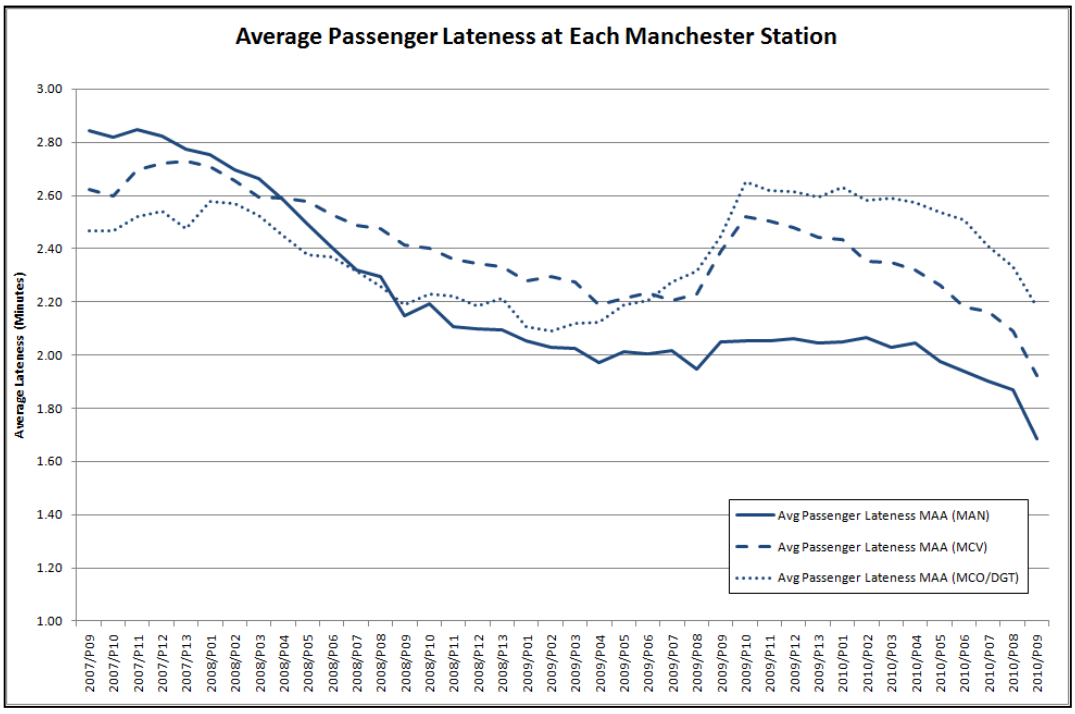


Figure 19

Further examination by route (Figure 20) provides more details on these trends with the most significant reductions in lateness being seen on the South East and South Central routes (Hadfield/Sheffield/Stockport/Airport). Average passenger lateness remains above 2 minutes on the North West and North East routes, and it is these routes that have seen the least improvement

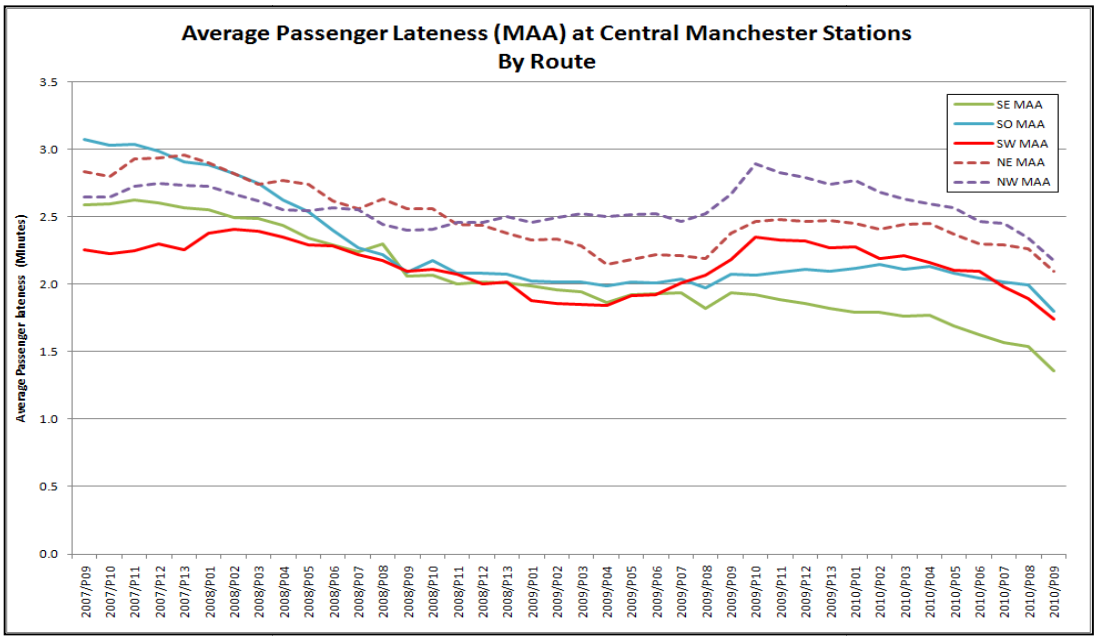


Figure 20

Although over 70% of trains arrived into Manchester on time in 2009, only 67% of passengers were estimated to have arrived on time. Similarly the proportion of passengers arriving within 5 minutes of advertised time at Manchester is lower than the proportion of trains arriving within 5 minutes of advertised time at Manchester (effectively the industry measure); see Figure 21, with key statistics in Table 8.

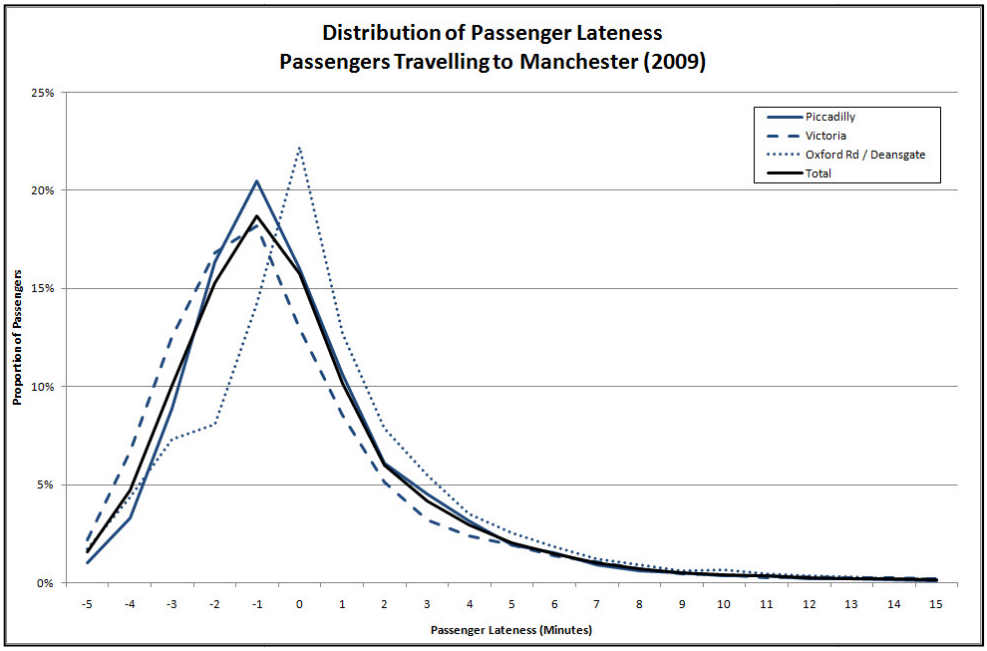


Figure 21

	Number of Passengers	Proportion of Passengers	Number of Trains	Proportion of Trains
Total	**4,510,854**	-	**161,771**	-
Right Time / Early	3,011,805	66.8%	114,049	70.5%
Time to 5	4,061,629	90.1%	148,474	91.8%
Time to 10	4,323,334	95.9%	156,098	96.6%
Over 15 Minutes Late	63,878	1.4%	1,682	1.0%
Cancelled	45,146	1.0%	1,682	1.0%

Table 8

Examining Passenger and Train Lateness at Manchester across the day indicates that there is only a small difference between the two, although as expected the higher levels of train lateness being experienced during the peak periods leads to even higher levels of passenger lateness (when more trains and passengers are travelling), particularly in the morning peak, where train lateness peaks at just under 2 minutes, but represents an average of 2.3 minutes of lateness for passengers.

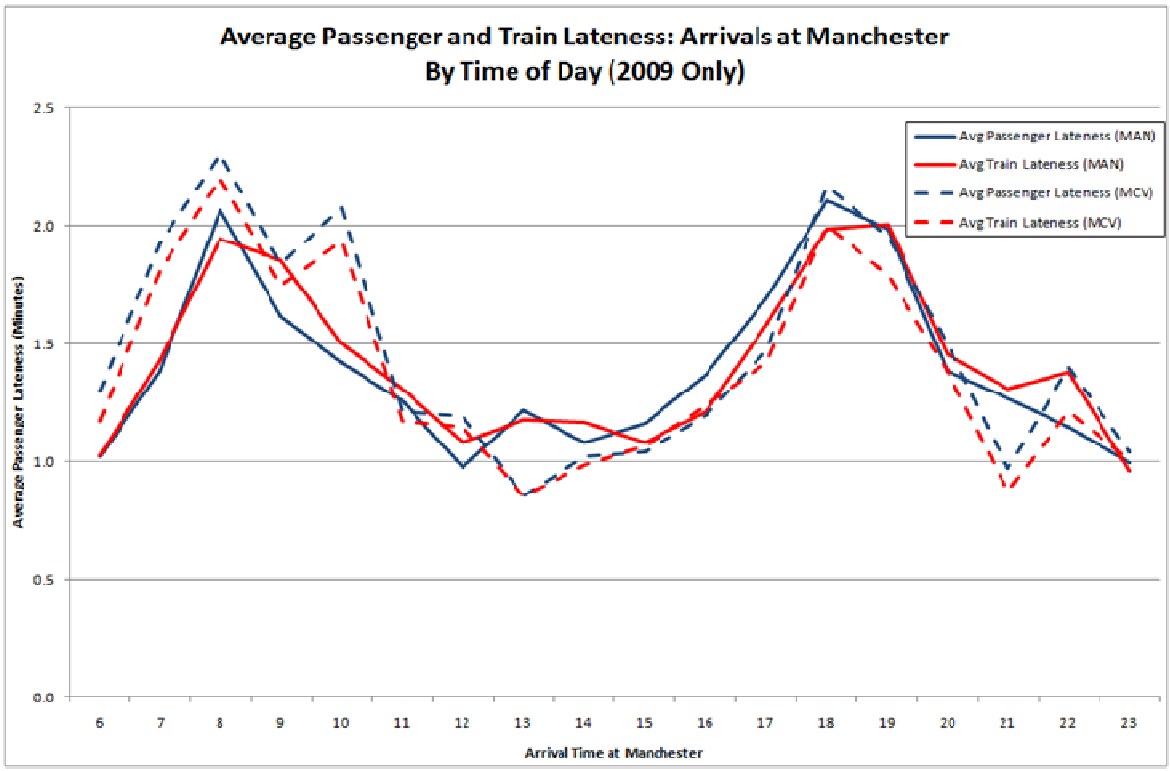


Figure 22

4.3 Average Passenger Lateness – From Manchester

For services travelling away from Manchester, most passengers will have alighted from the service before arrival at the final destination of the train and therefore may have experienced a different level of delay to that reported by the industry (effectively it would be expected that there would be a larger discrepancy compared to that observed for passengers travelling to Manchester). To some extent this is affected by the standard practice for train services to include an allowance for late running or time to use alternative platforms at the final destination of the train.

Often trains approaching their final destination (such as Liverpool Lime Street) may have a difference between the planned (working) timetable and the public (advertised) timetable. As a result, this might mean that the majority of passengers alighting at stations prior to the destination (e.g. Newton Le Willows for Manchester – Liverpool trains) might experience a slightly worse delay than that measured at destination.

There are around 7m passengers per annum in the study area who alight at a station beyond Manchester on a Northern service travelling away from Manchester. Table 9 below shows the proportion travelling to each of the five areas as defined in the section above, as well as the Top 10 locations, based on the full four years of data. So the major reductions seen in train lateness on the South East and South Central routes has only benefitted 36% of passengers, whilst almost half of

passengers (48%) travelling on services to the North East and North West will have seen only a small improvement.

Area	Distribution of Passengers
SE	11%
SO	25%
SW	18%
NE	23%
NW	24%

Station	Distribution of Passengers
Liverpool Lime Street	8%
Wigan Wallgate	7%
Leeds	5%
Southport	4%
Stalybridge	4%
Bolton Manchester	3%
Heald Green	2%
Romiley	3%
Rochdale	4%
Hadfield	3%
Other Stations	57%

Table 9

Figure 23 below show the comparison of average train lateness at destination compared with the average weighted passenger lateness. There is only a small difference between passenger lateness and train lateness of just over 0.5 minutes, although this is twice the difference observed on trains travelling to Manchester.

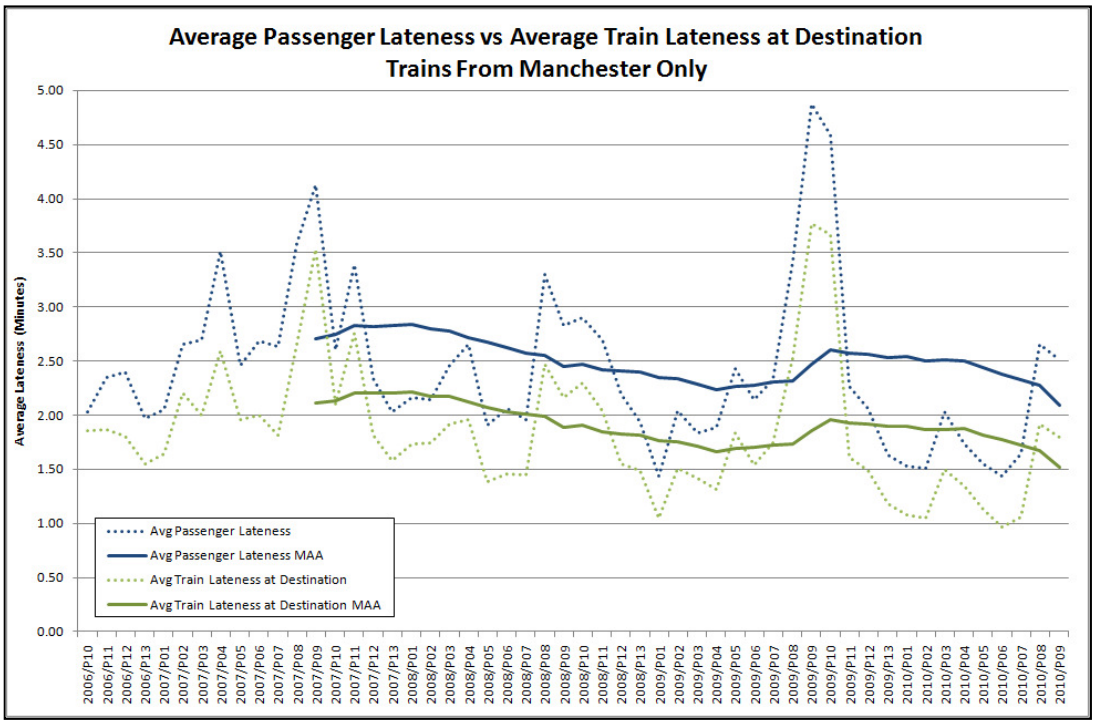


Figure 23

Examination by each route shows a similar picture to that of trains travelling into Manchester, i.e. the routes from the SE and SO have improved in terms of performance, while performance on other routes appears to have remained relatively static over the four years (although this is driven somewhat by the Oct-Dec 08 periods).

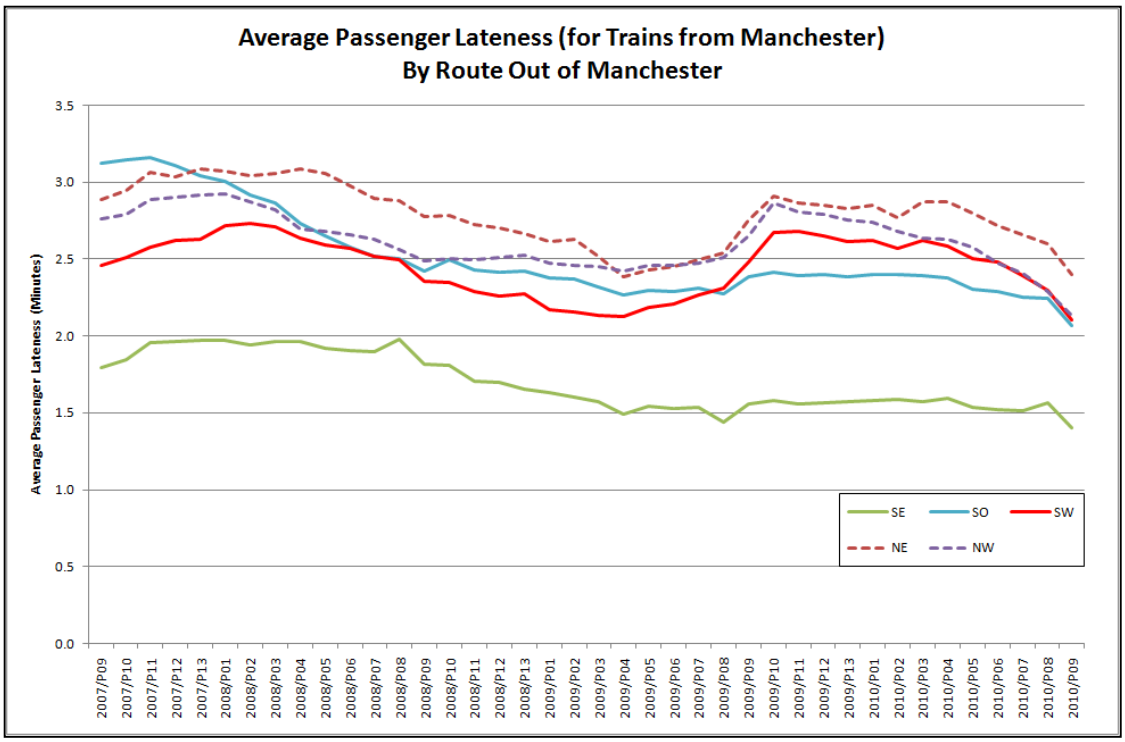


Figure 24

4.4 Average Passenger Lateness – By Key Locations

We have also looked at passenger lateness at a number of core locations where passengers alight having travelled from Manchester, and compared that to average lateness of trains at destination for the same area (e.g. South East of Manchester). To identify the core locations, we have used the NPS data, and Table 10 shows the locations with the highest frequency of passenger's alighting on a weekday.

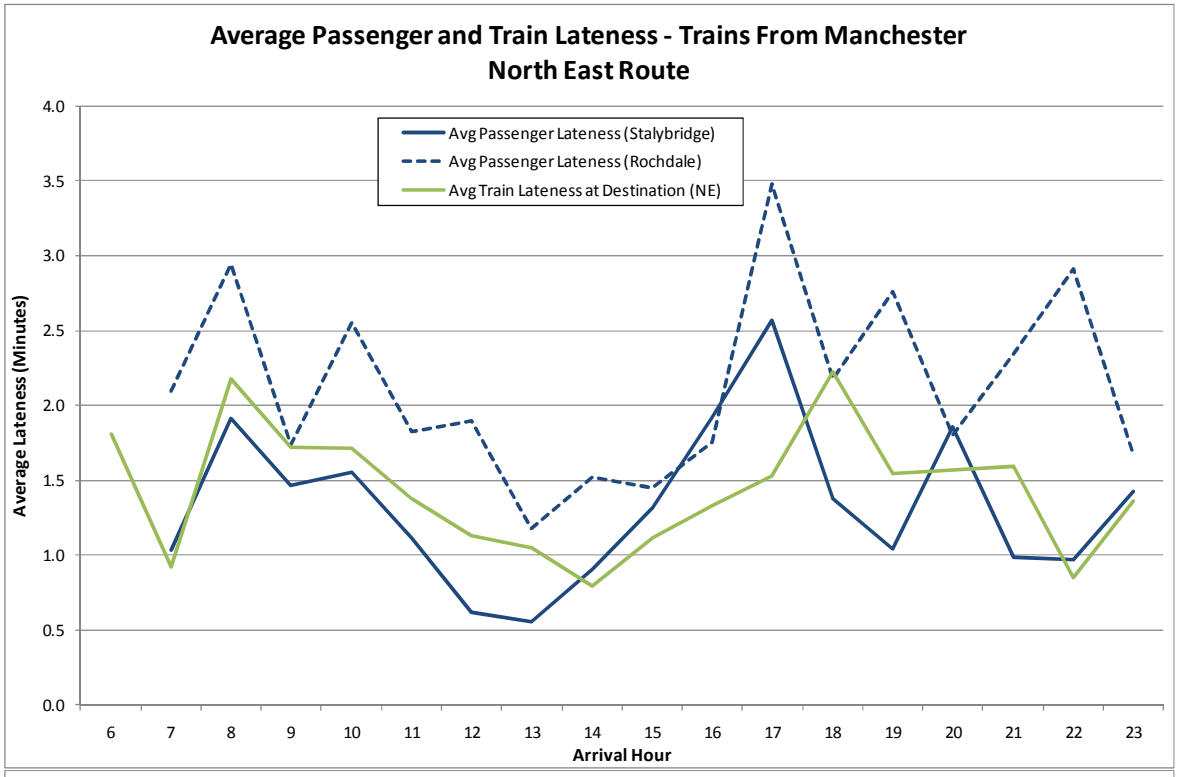
Index	Station	Area	Number of Passengers
1	GLOSSOP	South East	4,681
2	HAZEL GROVE	South Central	3,951
3	CHEADLE HULME	South Central	2,451
4	MARPLE	South East	2,094
5	HEATON CHAPEL	South Central	2,077
6	GUIDE BRIDGE	South East	1,937
7	BRAMHALL	South Central	1,851
8	ROSE HILL MARPLE	South East	1,542
9	ROMILEY	South East	1,531
10	BREDBURY	South East	1,515
11	LIVERPOOL LIME STREET	South West	1,414
12	GATLEY	South Central	1,300
13	DAVENPORT	South Central	1,274
14	WIGAN WALLGATE	North West	1,265
15	SALFORD CRESCENT	North West	1,192
45	STALYBRIDGE	North East	447
49	ROCHDALE	North East	406
87	NEWTON-LE-WILLOWS	South West	188

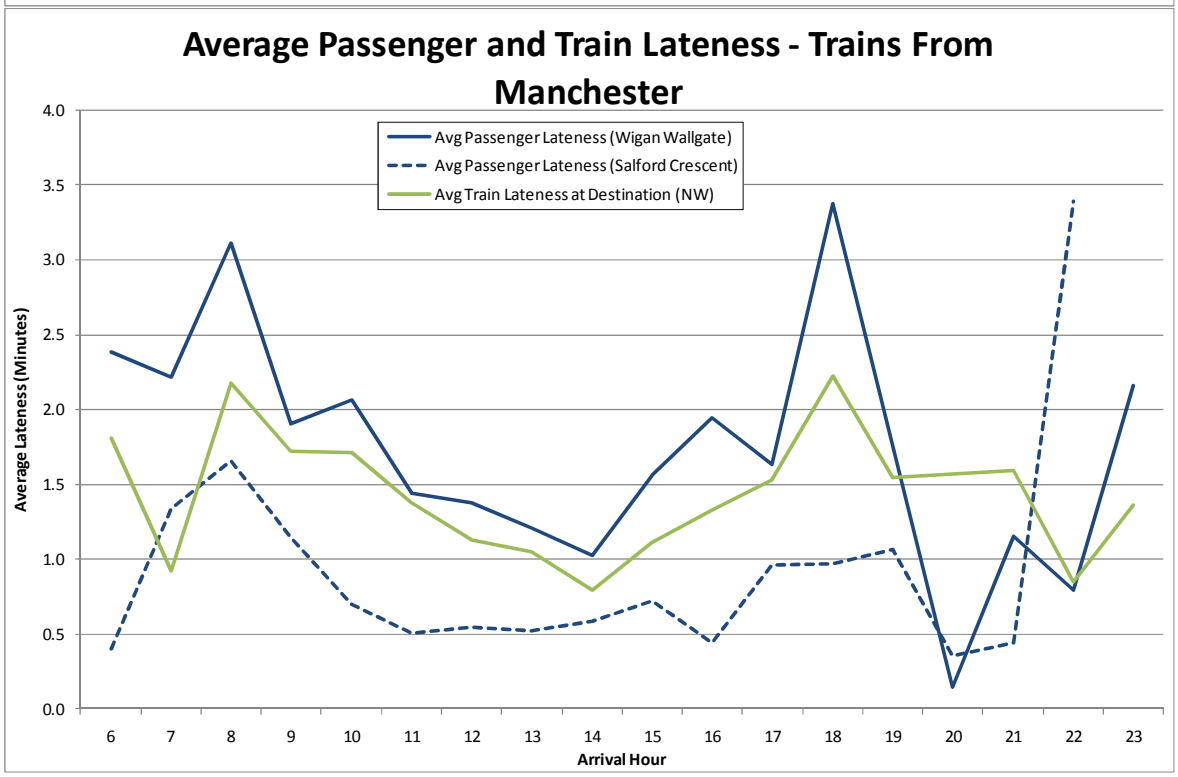
Table 10

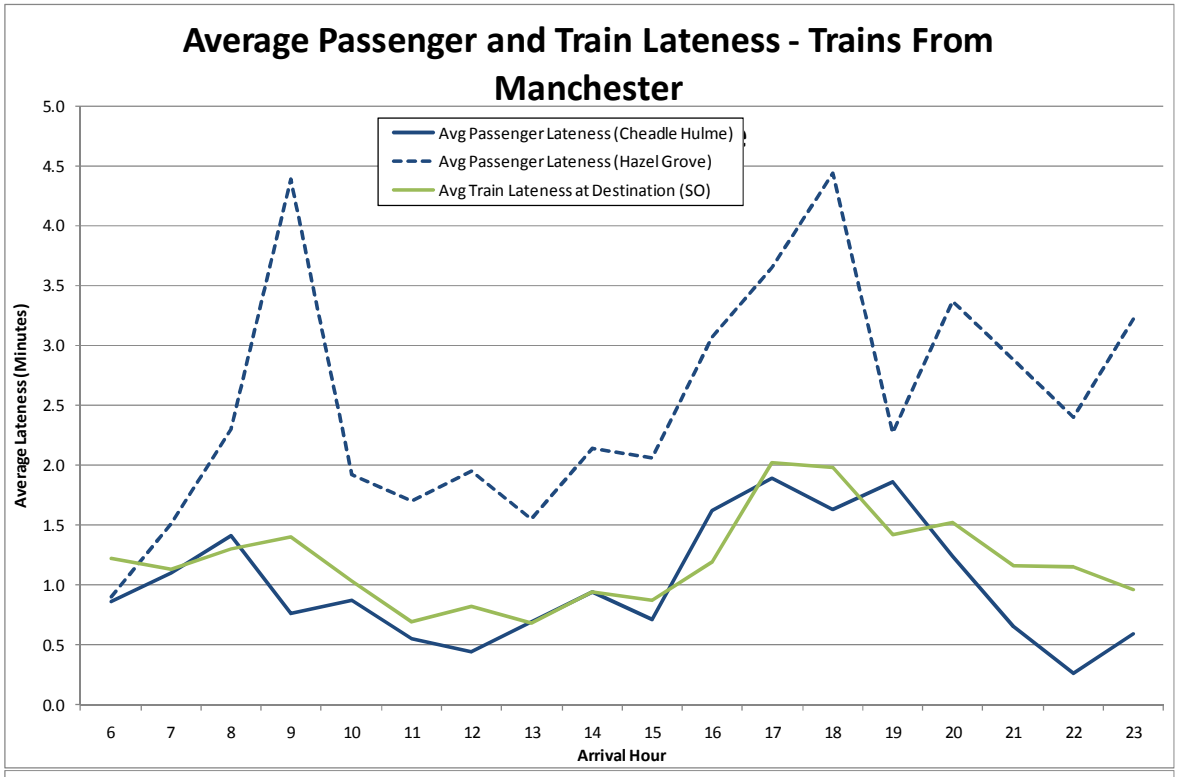
This table shows that the majority of journeys recorded in the NPS which are from a Manchester station are to stations on the South East or South Central routes out of Manchester (i.e. on the routes out of Piccadilly to the east). To examine a mix of stations, we have selected two stations from each area which are performance recording points (and aimed to give a mix of routes within areas) as follows:

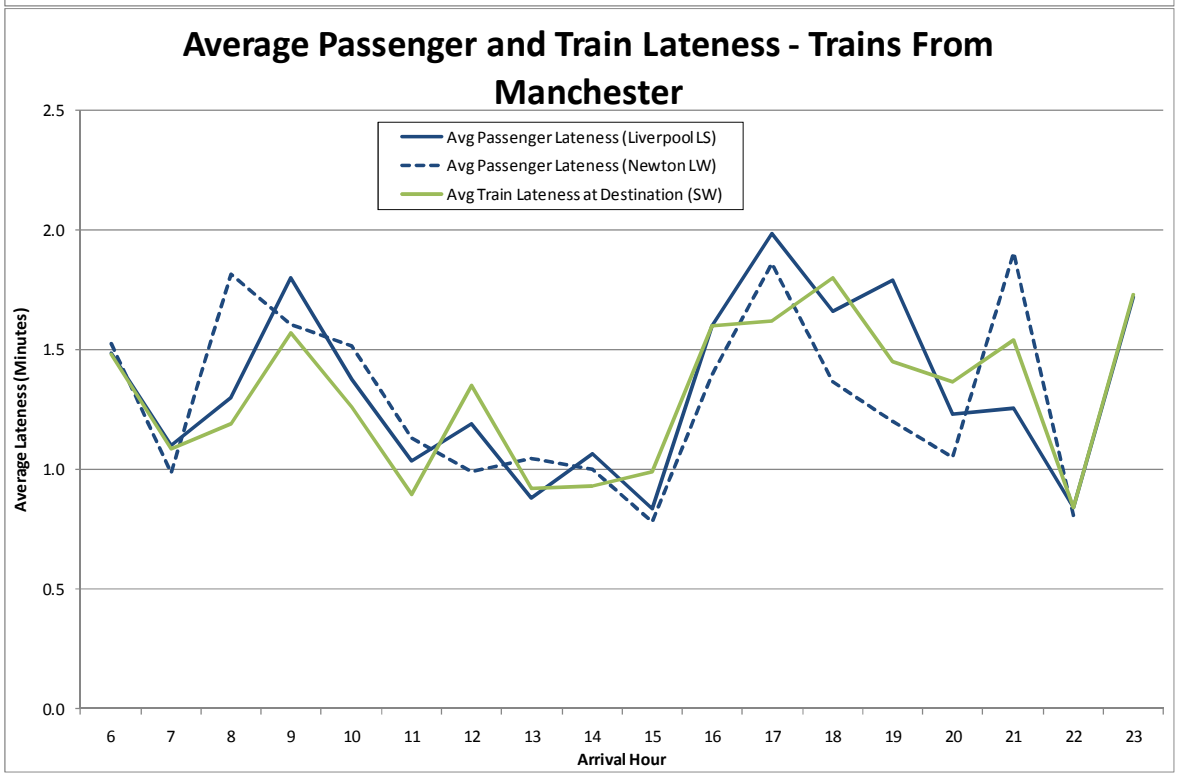
- South East: Marple and Guide Bridge
- South Central: Hazel Grove and Cheadle Hulme
- South West: Liverpool Lime Street and Newton-Le-Willows
- North East: Stalybridge and Rochdale
- North West: Wigan Wallgate and Salford Crescent

The collection of charts under Figure 25 show these trends of average passenger lateness at each location by time of day, compared with average train lateness at destination for that area, based on performance data for the latest year (calendar year 2009) only.


Average Passenger and Train Lateness - Trains From Manchester North East Route
Avg Passenger Lateness (Stalybridge)
Avg Passenger Lateness (Rochdale)
Avg Train Lateness at Destination (NE)
Average Lateness (Minutes)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Arrival Hour


Average Passenger and Train Lateness - Trains From Manchester
Avg Passenger Lateness (Wigan Wallgate)
Avg Passenger Lateness (Salford Crescent)
Avg Train Lateness at Destination (NW)
Average Lateness (Minutes)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Arrival Hour


Average Passenger and Train Lateness - Trains From Manchester
Avg Passenger Lateness (Cheadle Hulme)
Avg Passenger Lateness (Hazel Grove)
Avg Train Lateness at Destination (SO)
Average Lateness (Minutes)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Arrival Hour


Average Passenger and Train Lateness - Trains From Manchester
Avg Passenger Lateness (Liverpool LS)
Avg Passenger Lateness (Newton LW)
Avg Train Lateness at Destination (SW)
Average Lateness (Minutes)
2.5
2.0
1.5
1.0
0.5
0.0
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Arrival Hour

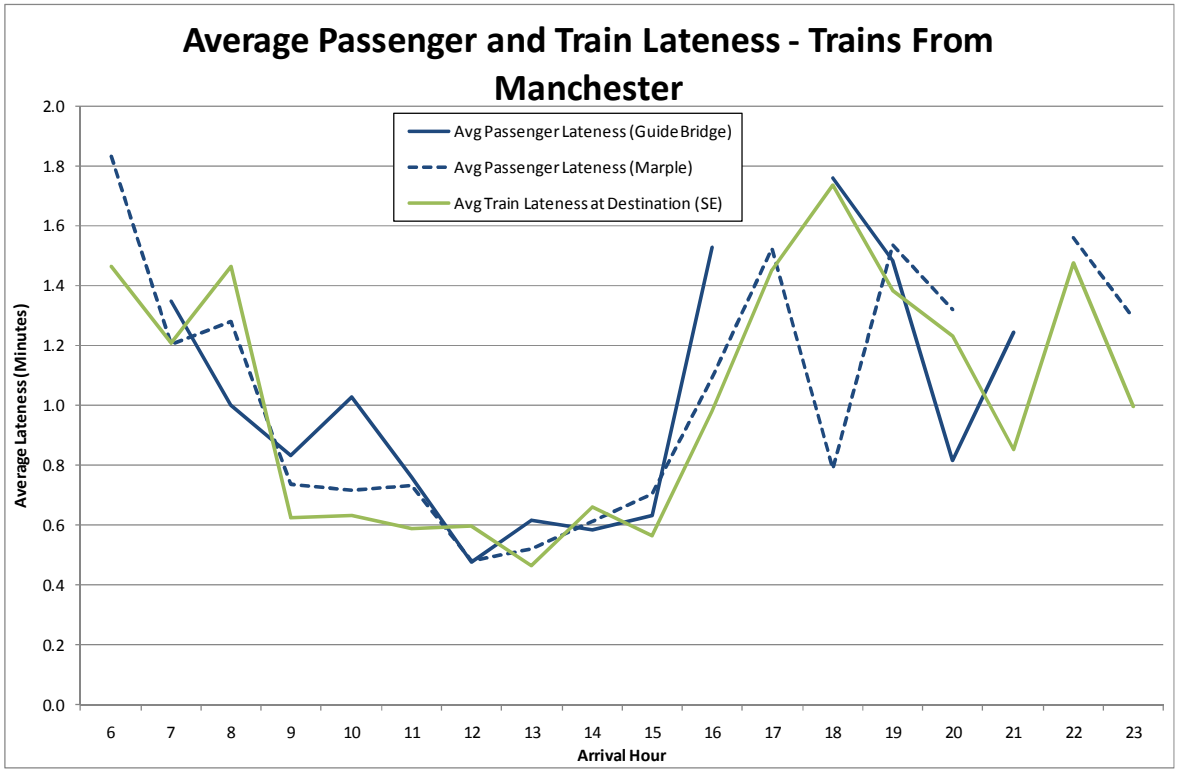


Figure 25

These charts give an indication on which routes the average lateness experienced by passengers may not be reflected in the industry measures of lateness (train lateness at destination). This clearly shows that this is markedly different by location. For example, passengers alighting at Hazel Grove will experience significantly greater lateness than passengers alighting at Cheadle Hulme, and much greater than that which would be reported based on lateness at destination. This might indicate an issue with the timetable on the route to Hazel Grove, or that there is some allowance in the timetable after Hazel Grove for trains heading out from Manchester.

In contrast, for the stations selected on the routes to the South East and South West of Manchester, the lateness experienced by passengers appears to map relatively well with train lateness recorded at the destination.

4.5 Average Passenger Lateness – Overall

- Average lateness for passengers is slightly worse than that measured for trains (i.e. average passenger lateness over past year is around 2 minutes compared to average train lateness at destination of 1.5 minutes).
- Measures of passenger lateness are slightly worse than indicated by train lateness, particularly in the peak for journeys travelling away from Manchester
- 67% of passengers arrive at their destination on time or early, with 90% arriving within five minutes.
- Reductions in passenger lateness have followed improvements in train lateness, but the biggest improvements have only benefitted a proportion of all passengers. i.e. the South East and South Central routes has only benefitted 36% of passengers, whilst almost half of passengers (48%) travelling on services to the North East and North West will have seen only a small improvement

5 Relationship between Customer Satisfaction and Performance

5.1 Variation by Journey Purpose and Length of Delay

For all NPS respondents travelling to or from Manchester over the study period, we have used the train service they actually used on the day they were surveyed, and recorded the actual level of delay experienced by each respondent on the day they were recruited to the survey.

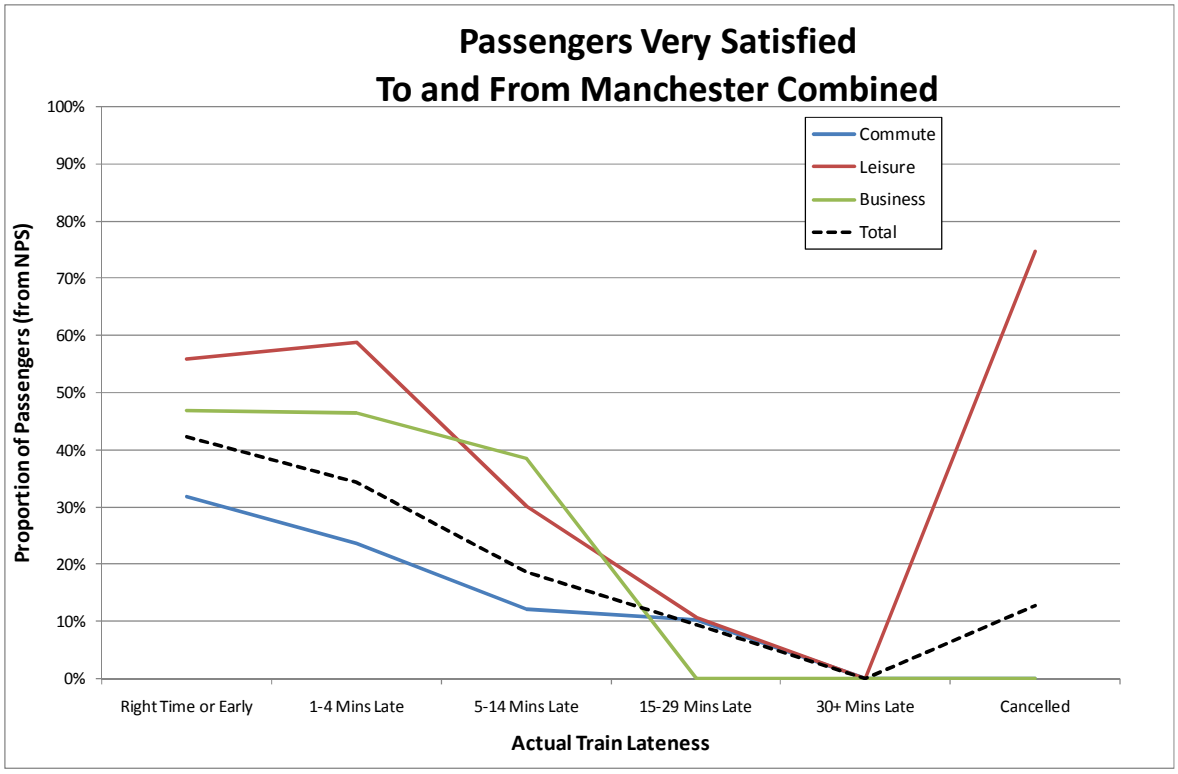
We were unable to match every single record in the NPS data to an actual train in the performance data, due to anomalies in train records which appeared in the NPS data (e.g. the details of the train recorded in the NPS data does not match to a train which was scheduled to run in that timetable / on that day). In some cases this is due to franchise changes, where a train recorded in Northern's NPS data in the earlier years of this study is now operated by First Transpennine Express (and so does not appear in the performance data supplied by Northern).

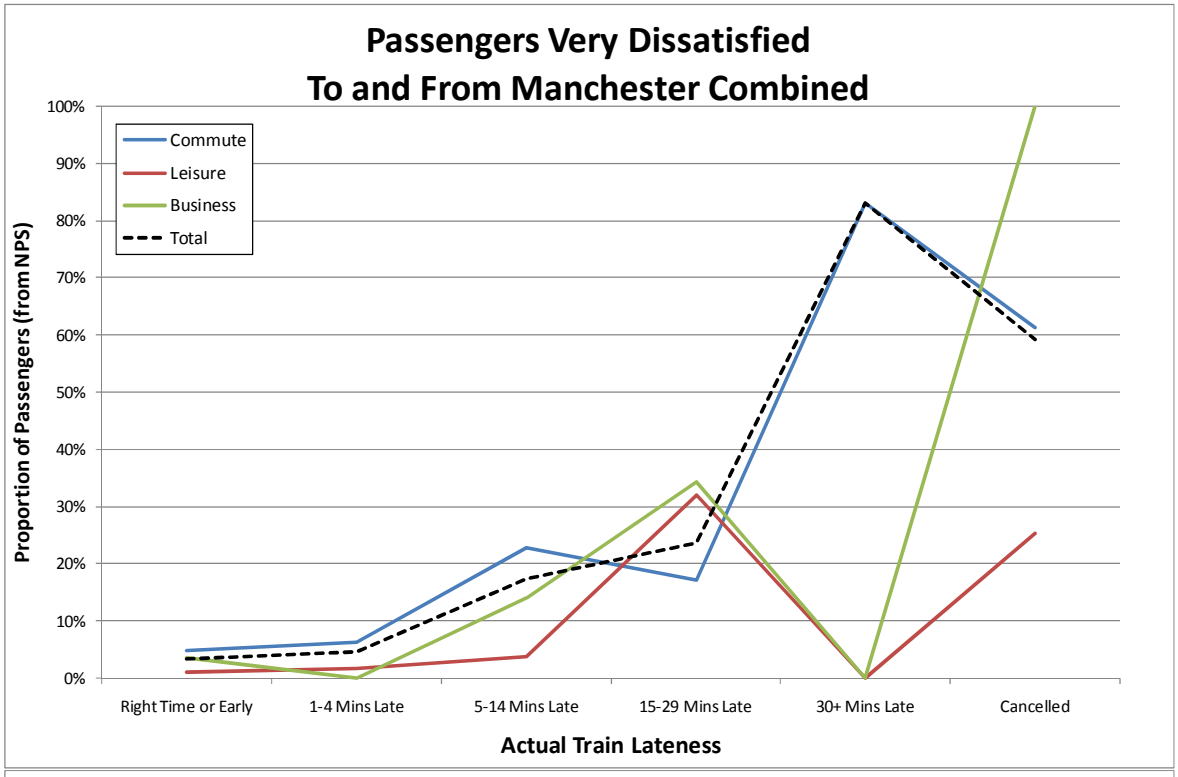
The matching rate was as follows:

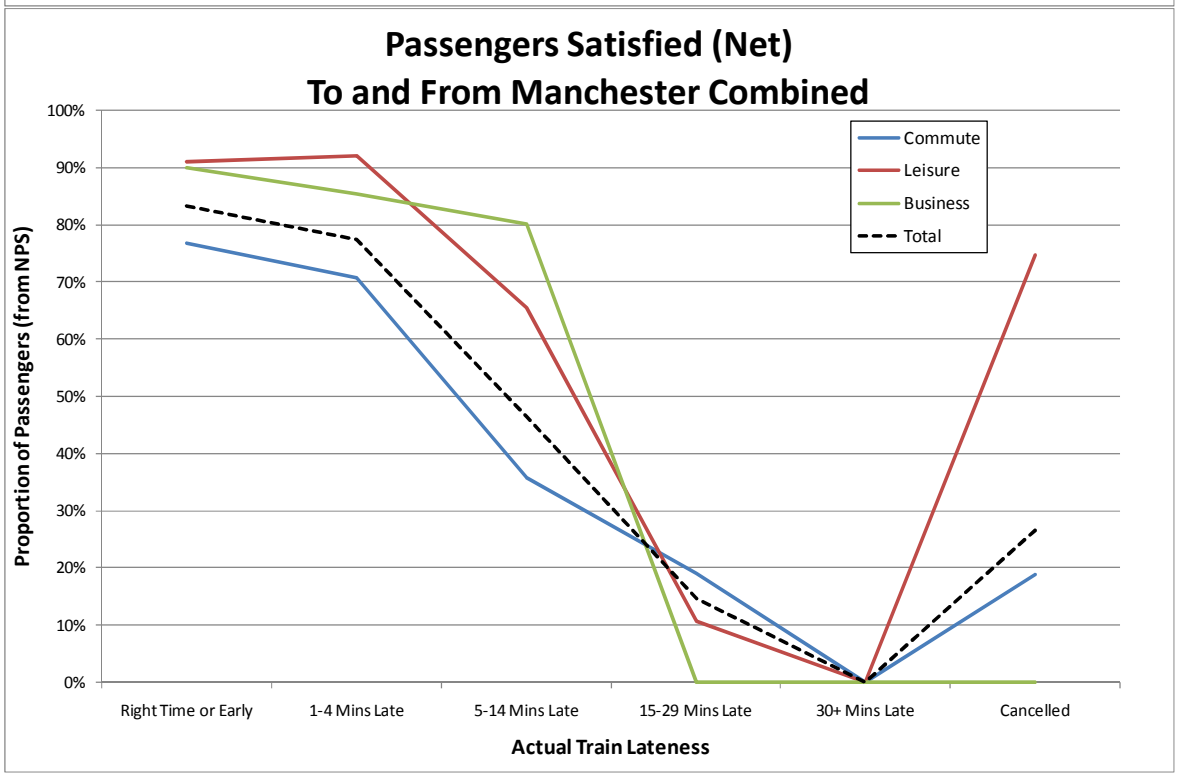
- From Manchester: 919 records matched out of 1,144 (80% match rate)
- To Manchester: 725 records matched out of 931 (78% match rate)

Analysis of this data indicates that the rating given by respondents is strongly influenced by their experience of performance on the day of the survey, and is also influenced by journey purpose as well. Most respondents in this survey were commuters (~70%), and therefore results for other journey purposes are less robust.

Figure 26 shows that even when a respondent has travelled on a train which has arrived right time or early, only 77% of commuters are satisfied (30% very satisfied), while around 90% of business and leisure passengers are satisfied (50% very satisfied).




Passengers Very Dissatisfied
To and From Manchester Combined
Proportion of Passengers (from NPS)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Commute
Leisure
Business
Total
Right Time or Early
1-4 Mins Late
5-14 Mins Late
15-29 Mins Late
30+ Mins Late
Cancelled
Actual Train Lateness


Passengers Satisfied (Net)
To and From Manchester Combined
Proportion of Passengers (from NPS)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Commute
Leisure
Business
Total
Right Time or Early
1-4 Mins Late
5-14 Mins Late
15-29 Mins Late
30+ Mins Late
Cancelled
Actual Train Lateness

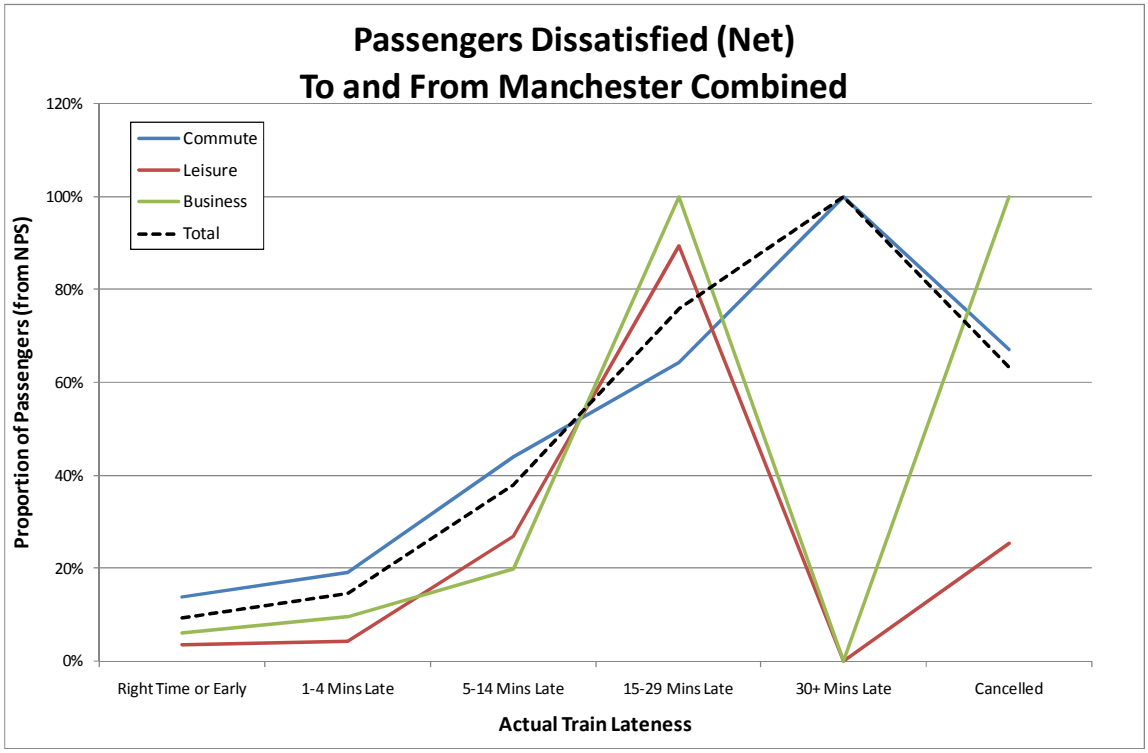


Figure 26

5.2 Variation by Direction

Across the passengers sampled to and from Manchester, those travelling from Manchester appear to be slightly more satisfied than those travelling into Manchester. This trend was observed in Section 2, and it was also observed that passengers travelling to Manchester were more satisfied in recent years compared to early years of the sample.

Figure 27

Figure 27 above shows data for the full year, while Figure 28 below shows the same trends, but separating out the first 2 years (2006 and 2007) and the latter two years (2008 and 2009) for passengers travelling to Manchester. This shows that passengers in the latter two years are generally more satisfied with performance, even when on the day it was not particularly good (e.g. in 2008-09, 60% of passengers were satisfied despite the fact their train was between 5 and 14 minutes late, compared to just over 30% of passengers experiencing similar levels of delay in 2006-07).

This potentially indicates a greater level of tolerance of passengers which for commuters could be because they have observed performance levels improving and so, even though on the day they were surveyed performance was poor, they are reflecting this general improvement in their scoring.

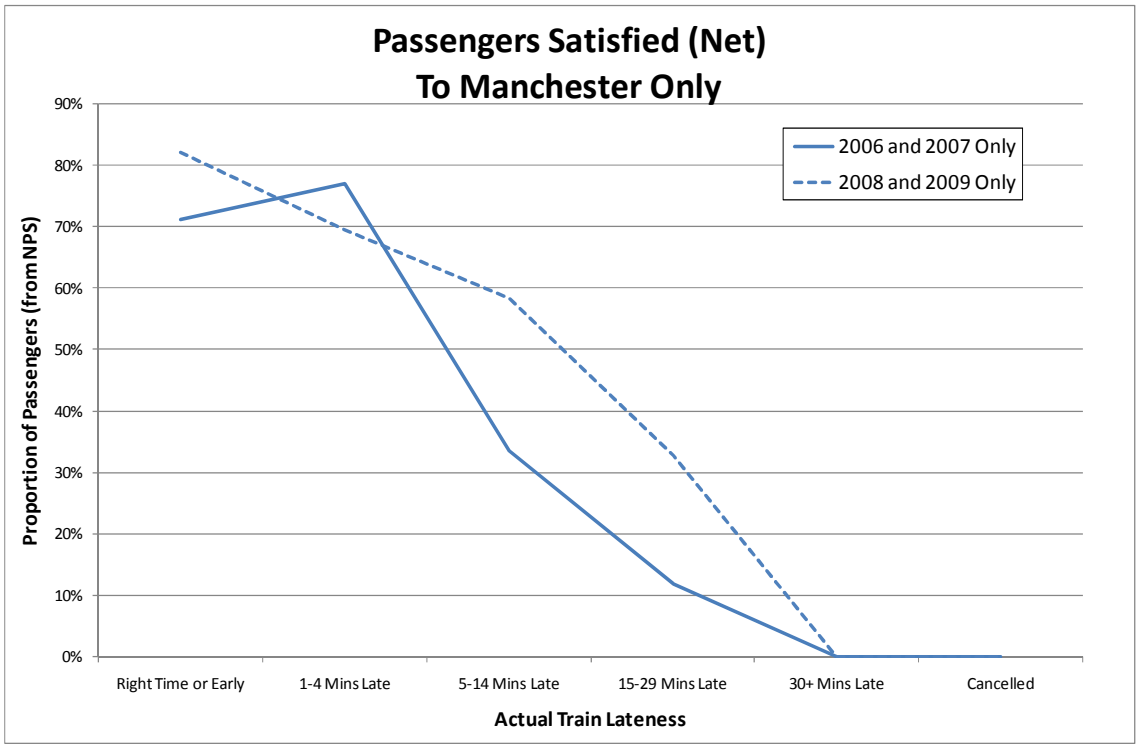


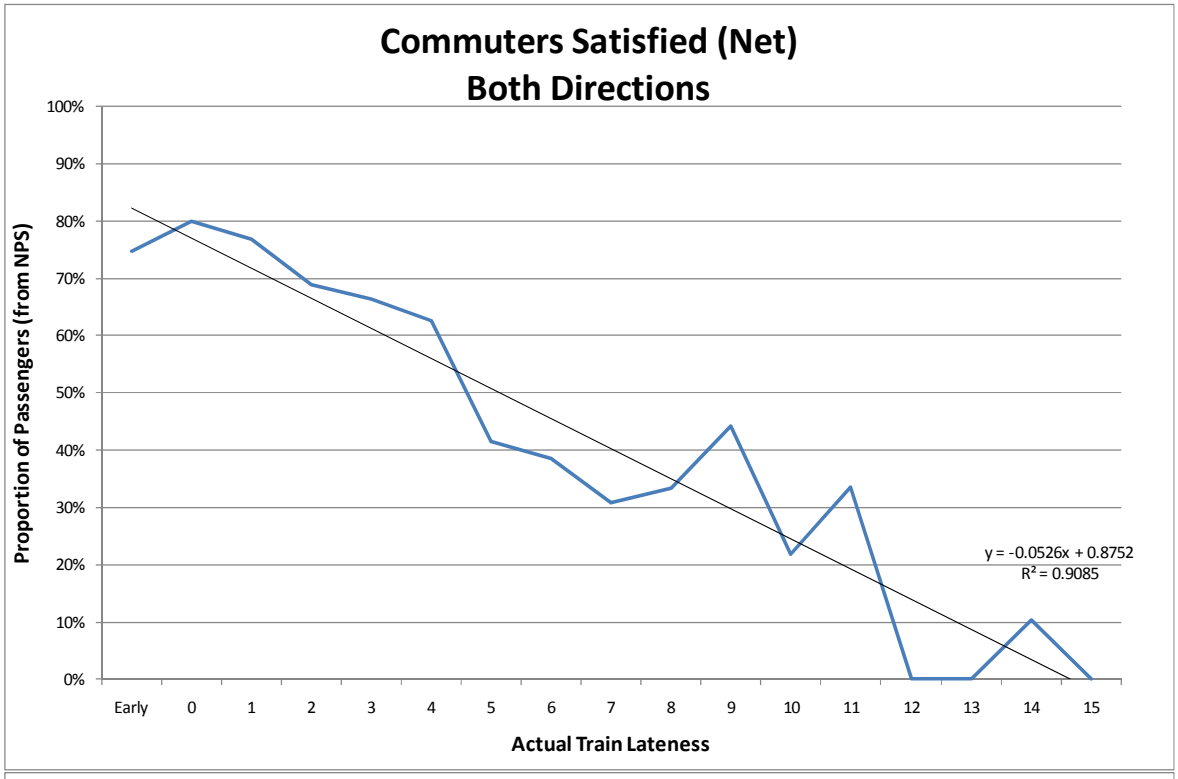
Figure 28

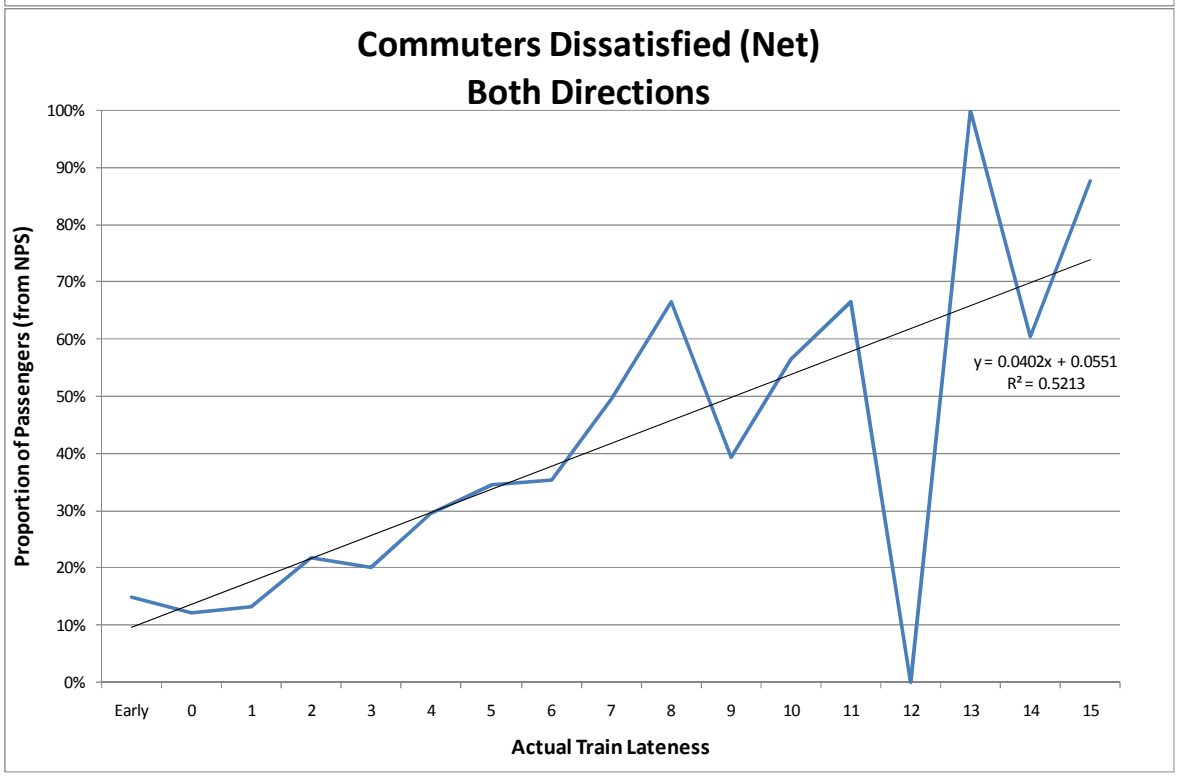
5.3 Relationship Between Delay and Satisfaction Scores on Day of Travel

Figure 29 shows the relationship between level of satisfaction and the level of delay experienced on the day, separated for commuter and leisure passengers. Both directions have been merged together.

Given the relatively short trips that passengers make on this network and the relatively small sample sizes, all trips where lateness over 15 minutes or the train was cancelled have been excluded.

These charts indicate a clear relationship between actual delay and satisfaction scores. This also appears to demonstrate that leisure passengers have a greater tolerance to small delays than commuters, with 70% of leisure passengers still satisfied with delays of 9 minutes (30% for commuters), but values thereafter fall off rapidly (NB. Small sample size).


Commuters Satisfied (Net)
Both Directions
Proportion of Passengers (from NPS)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Early
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Actual Train Lateness
y = -0.0526x + 0.8752
R² = 0.9085


Commuters Dissatisfied (Net)
Both Directions
Proportion of Passengers (from NPS)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Early
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Actual Train Lateness
y = 0.0402x + 0.0551
R² = 0.5213

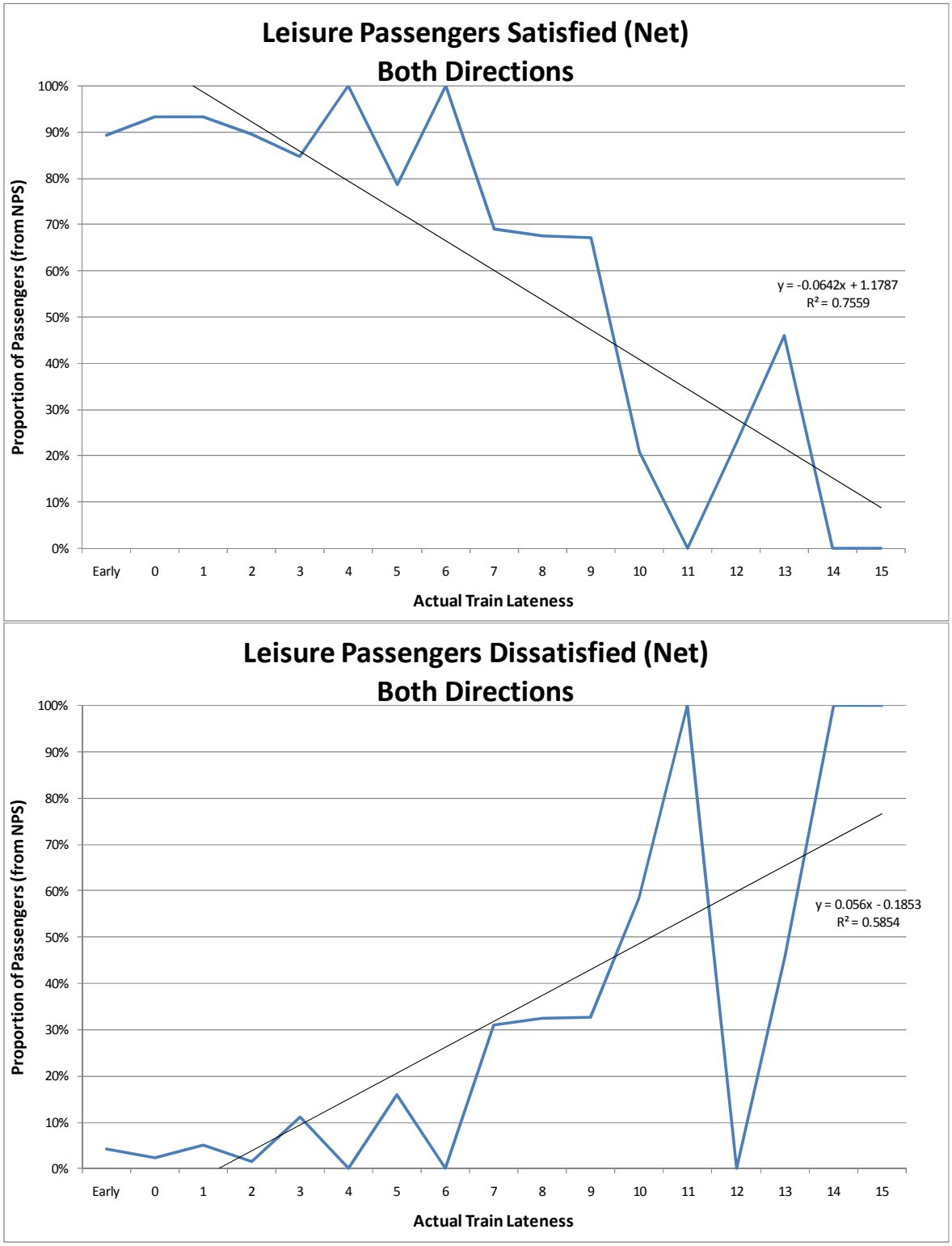


Figure 29

Figure 30 compares this relationship for satisfied commuters for all 4 years of data against data for the latter two years (2008 and 2009) to confirm that there has been no real change in this relationship despite the fact that actual performance levels (and indeed passengers perception of performance) have been improving.

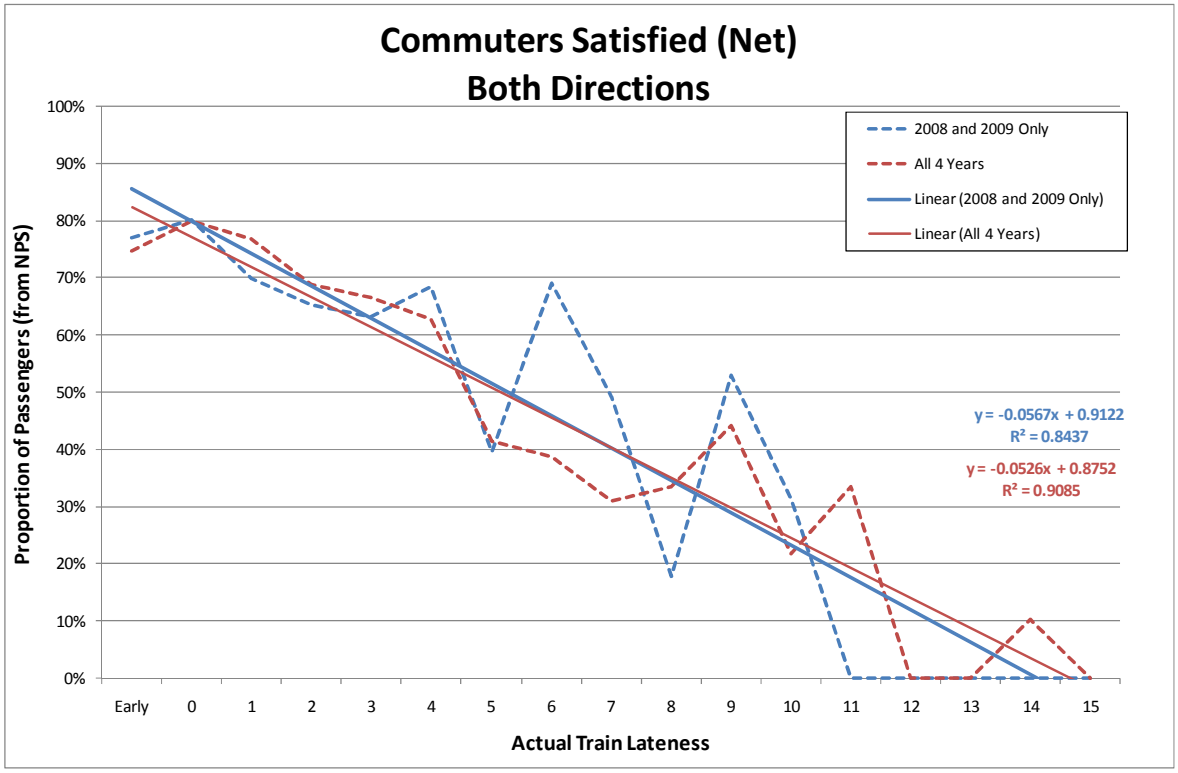


Figure 30

The gradient of the satisfied commuter's chart indicates that the proportion of satisfied passengers falls by around 5% for every minute of lateness on the day of travel.

6 Correlation Analysis

It has not been possible to create a correlation between total NPS satisfaction and various measures of overall rail performance. This is primarily due the highly variable nature of (due to small sample size) of NPS data against which rail performance may be compared. This is illustrated in Figure 31 below, and the sample sizes for each month (averaging 58) are shown in Table 11.

Aggregating performance data into quarters, or similar measure, so as to provide a larger NPS sample per observation did not improve this exercise, and this is thought to be because of the variability of performance found over the longer periods as well as the small number of observations.

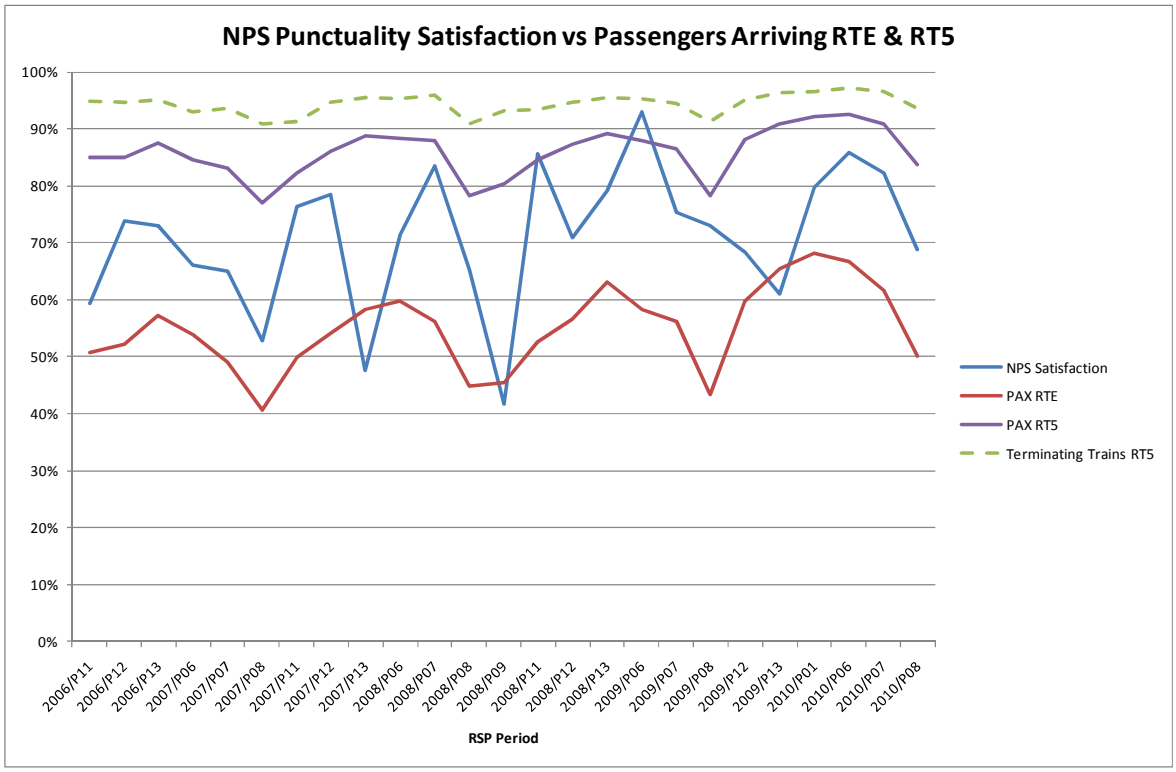


Figure 31

RSP Period	% of All Passengers Arriving RTE	% Weighted Respondents Satisfied	Weighted Respondents Satisfied	Count of Respondents Satisfied
2006/P11	51%	59%	730	17
2006/P12	52%	74%	3,071	59
2006/P13	57%	73%	7,838	156
2007/P6	54%	66%	1,450	18
2007/P7	49%	65%	3,696	52
2007/P8	41%	53%	3,552	58
2007/P11	50%	76%	2,933	54
2007/P12	54%	79%	6,119	85
2007/P13	58%	48%	1,092	29
2008/P6	60%	71%	648	13
2008/P7	56%	84%	3,240	65
2008/P8	45%	65%	4,197	84
2008/P9	45%	42%	218	5
2008/P11	53%	86%	3,754	70
2008/P12	57%	71%	4,979	93
2008/P13	63%	79%	1,664	31
2009/P6	58%	93%	1,024	11
2009/P7	56%	75%	6,250	78
2009/P8	43%	73%	8,560	110
2009/P12	60%	68%	5,228	79
2009/P13	65%	61%	6,317	86
2010/P1	68%	80%	576	8
2010/P6	67%	86%	1,503	41
2010/P7	62%	82%	3,720	82
2010/P8	50%	69%	4,075	58
Grand Total	**55%**	**71%**	**86,436**	**1,442**

Table 11

7 Relationship between Customer Satisfaction for Performance and Crowding

The previous analysis has not included any assessment of the impact crowding might have on the level of satisfaction passengers might have with performance or delays.

If we take results from Section 5 where actual lateness data for each NPS respondent has been found, we can compare how satisfaction with punctuality has varied at different crowding levels, but for the same measured value of train delay. This has been plotted in Figure 32 and shows that in general there is no difference between satisfaction of punctuality at different levels of train delay, despite varying levels of crowding.

Note: Whilst there is a discernibly lower level of satisfaction for Right Time or Early trains, where the train is considered to be crowded, this is inconsistent with other recorded values (which show strong agreement between values) and the value for 1-4 mins late for crowded services is better than for less crowded trains, and so is more likely to be an issue with sampling.

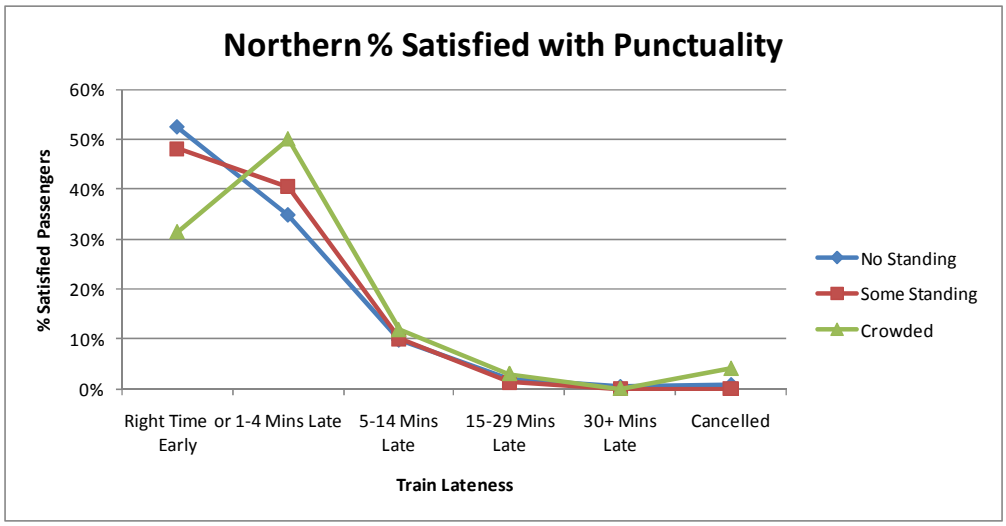


Figure 32

Satisfaction with Punctuality & Train Crowding	No Standing	Some Standing	Crowded
Right Time or Early	52%	48%	31%
1-4 Mins Late	35%	41%	50%
5-14 Mins Late	10%	10%	12%
15-29 Mins Late	2%	1%	3%
30+ Mins Late	0%	0%	0%
Cancelled	1%	0%	4%
Grand Total	**100%**	**100%**	**100%**

Table 12

8 Conclusions

- Overall satisfaction levels are broadly reflected in performance satisfaction

- Lower levels of satisfaction are recorded by passengers travelling to Manchester compared to away from Manchester, yet actual performance levels appear relatively similar in each direction.

- Performance has improved considerably on the network over the last four years, and this is reflected in NPS scores, particularly for passengers travelling to Manchester.

- In particular, performance has improved on the routes into and out of Piccadilly to the east (i.e. routes via Ashburys, Stockport and Heald Green), but relatively little improvement on routes serving the north of Manchester

There was a period of significant disruption between Oct and Dec 08 which particularly affected trains into and out of Victoria and into and out of Piccadilly from the west, and which influenced both the performance statistics and the satisfaction scores for the following NPS Wave (even though the disruptiuon did not occur at the time of a survey).

- There is a strong linear relationship between NPS satisfaction levels and actual performance. The proportion of satisfied passengers falls by around 5% for a fall of one minute of lateness on the day of travel. This relationship remains true even at different levels of overall performance over time.

- There is no difference between satisfaction with punctuality at each level of train delay, despite varying levels of crowding.

APPENDIX A Weighting of NPS Survey Data

This Appendix provides details of the comparisons made between the weighted NPS data, and that held within MOIRA to confirm that the weightings used in NPS are appropriate for the purposes of this study.

Table A1 below shows the distribution of total journeys per day of week for Northern as recorded in the NPS, compared to annual journeys on Northern as estimated in MOIRA. Note, these figures are for the whole of Northern (i.e. not restricted to those passengers within the study area).

Day of Week	NPS	MOIRA	NPS %	MOIRA %
Weekday	422,668	49,580,589	79.2%	82.0%
Saturday	77,459	6,910,461	14.5%	11.4%
Sunday	33,484	3,970,572	6.3%	6.6%
Total	**533,611**	**60,461,622**	**100.0%**	**100.0%**

Table A1

Table A2 shows the distribution of weekday journeys by journey purpose for Northern as recorded in the NPS, compared to annual journeys on Northern as estimated through MOIRA. Again, these figures are for the whole of Northern.

Journey Purpose	NPS	MOIRA	NPS %	MOIRA %
Commute	213,968	28,897,861	50.6%	58.3%
Leisure	170,523	15,186,052	40.3%	30.6%
Business	38,177	5,496,676	9.0%	11.1%
Total	**422,668**	**49,580,589**	**100.0%**	**100.0%**

Table A2

Table A3 shows the distribution of weekday journeys to and from Manchester stations by time of day as recorded in the NPS, compared to annual journeys on these flows as estimated in MOIRA.

Time of Day (Weekday)	NPS	MOIRA	NPS %	MOIRA %
0500 - 0559	0	38	0%	0%
0600 - 0659	720	614	1%	1%
0700 - 0759	10,283	3,413	9%	7%
0800 - 0859	19,144	7,042	17%	15%
0900 - 0959	8,315	4,523	7%	9%
1000 - 1059	8,050	3,600	7%	7%
1100 - 1159	5,905	2,630	5%	5%
1200 - 1259	7,108	2,263	6%	5%
1300 - 1359	5,979	2,101	5%	4%
1400 - 1459	6,030	1,847	5%	4%
1500 - 1559	7,035	2,585	6%	5%
1600 - 1659	10,940	4,333	9%	9%
1700 - 1759	11,130	6,252	10%	13%
1800 - 1859	7,869	3,735	7%	8%
1900 - 1959	3,699	1,652	3%	3%
2000 - 2059	2,595	824	2%	2%
2100 - 2159	985	322	1%	1%
2200 - 2259	0	201	0%	0%
2300 - 2359	0	104	0%	0%
Total	**115,788**	**48,079**	**100%**	**100%**

Table A3

Based on this analysis, it was decided that the NPS weightings would be appropriate for this study.