SEMMMS A6 to Manchester Airport Relief Road

Public Transport Model Validation Report

Report for DfT

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mvaconsultancy

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Summary

In order to produce demand forecasts of the SEMMMS Relief Road, as well as to provide inputs for operational analyses, and economic and environmental appraisals, MVA Consultancy constructed a variable demand model system. The model system, known as SEMMMS Variable Demand Model (SEMMMS VDM), combines MVA's bespoke demand model with a validated SATURN highway model (SEMMMS8 SATURN) and a PT-TRIPS public transport model (SEMMMS8-PT). The models make use of the same data sources, data structures and functional algorithms as the GMSPM2 (Greater Manchester Strategy Planning Model) model system.

SEMMMS8-PT was developed as part of the SEMMMS VDM model system, which will be used for demand forecasting and appraisal of the SEMMMS relief road. The scheme does not include any public transport interventions and therefore, the impacts on public transport users are expected to be small. However, the modelling of mode choice is important to facilitate the calibration of the demand model, to identify the likely scale of impacts of the scheme on public transport users, and to reflect the change in the relative level of service of car and public transport.

This report is the model validation report for the public transport model (SEMMMS8-PT). This model has been developed from the public transport model from the GMSPM2 model system (SPM2-PT), which was used successfully to provide supporting evidence for AGMA's Transport Innovation Fund (TIF) bid, with the coverage extended into north Cheshire.

Model Details

Model validation has followed the advice within TAG Unit 3.11.2.

The public transport assignment model was developed using the TRIPS suite of software. The base year for the SEMMMS VDM, and therefore SEMMMS8-PT is 2009. The model covers the following time periods, in each case representing an average hour within the time period:

- morning peak: 0700 to 0930;
- inter-peak: 0930 to 1600;
- evening peak: 1600 to 1900; and
- off peak: 1900 to 2300.

Fare tables were derived separately for bus, rail and Metrolink. The fare tables represent the cost of making a one-way journey, taking into account the mix of ticket types used and types of users. Distance based fare tables have been calculated for all the separate modes.

Validation

The validation of the model before matrix estimation indicated that the model was not adequate for use.

Matrix estimation was undertaken to smooth the inconsistencies between the data. The post matrix estimation matrices were examined to ensure that the data had not undergone significant changes.

The validation exercise was repeated following the matrix estimation, and produced modelled outputs much closer to observed data.

Suitability of Model

This report has demonstrated that the SEMMMS8-PT model is suitable for the appraisal of a large highway scheme through providing an appropriate estimate of the demand for and generalised cost of travel by public transport within the Area of Influence. This means that the model is a suitable tool for the modelling of mode choice within SEMMMS VDM, and also to provide an indicative assessment of the benefits of the scheme for public transport passengers. However, the model is not suitable for the appraisal of a major public transport investment.

1 Introduction

1.1 Background

1.1.1 A consortium of local authorities (Stockport Metropolitan Borough Council, Manchester City Council and Cheshire East Council) and Manchester Airport Group has been working between 2010 and 2012 to prepare a submission to DfT for part-funding of the SEMMMS A6 to Manchester Airport Relief Road (see Figure 1.1). The scheme is based on the recommendations of the South East Manchester Multi Modal Strategy (SEMMMS) commissioned by central government in 1998, which highlighted a number of transport improvement opportunities that would benefit the local area. The relief road was a key element of that strategy and is designed to improve surface access to, from and between Manchester Airport and local town and district centres and employment sites, reduce the impact of traffic congestion on communities in Stockport, South Manchester and Northeast Cheshire, regenerate these communities through reduced severance and improved accessibility, and provide an improved route for freight.

1.1.2 The proposed scheme will connect the A6 at Hazel Grove with the M56 at Manchester Airport. It consists of approximately 10 Km of new dual two lane carriageway and seven new junctions, and will also incorporate the existing 4 km section of the A555 dual carriageway to the south of Bramhall.

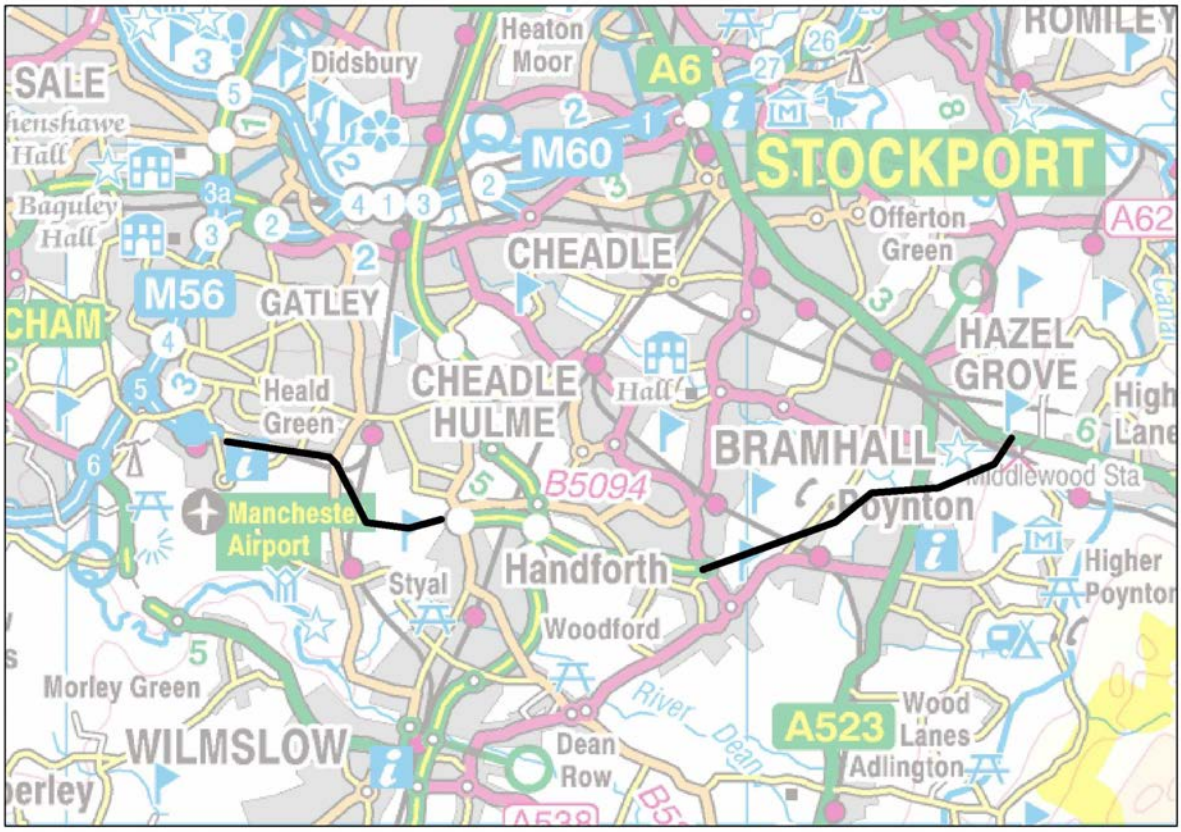

Figure 1.1 SEMMMS A6 to Manchester Airport Relief Road

1.1.3 In order to produce demand forecasts of the SEMMMS Relief Road and to provide inputs for operational analyses, economic and environmental appraisals, MVA Consultancy constructed

a variable demand model system. The model system combines MVA's bespoke demand model with a validated SATURN highway model (SEMMMS8 SATURN) and a PT-TRIPS public transport model. This model system is known as SEMMMS Variable Demand Model (SEMMMS VDM) and is illustrated in Figure 1.2. The models make use of the same data sources, data structures and functional algorithms as the GMSPM2 (Greater Manchester Strategy Planning Model) model system.

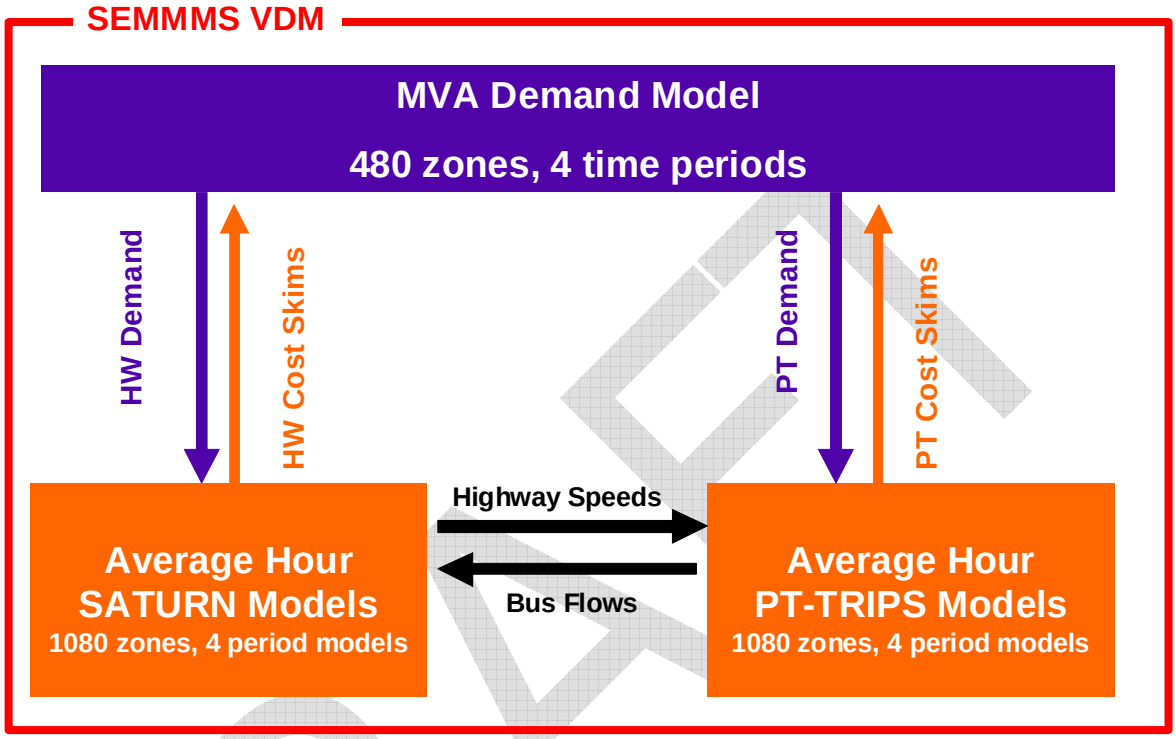

Figure 1.2 SEMMMS Model System Overview

1.2 SEMMMS Public Transport Model

1.2.1 SEMMMS8-PT was developed as part of the SEMMMS VDM model system, which will be used for demand forecasting and appraisal of the SEMMMS relief road. The SEMMMS8-PT model was developed during 2010, and reported in version 1.0 of this validation report. This version of the report reflects updates to the model that were made during 2011-2012, and reports on the revised model validation. The version of the public transport model reported in this report is known as (SEMMMS8-PT)

1.2.2 The scheme does not include any public transport interventions and there is no reason to assume that bus operators will make significant use of the relief road. Therefore, the impacts on public transport users are expected to be small and the main focus of the modelling will be on the highway and demand models.

1.2.3 The Department for Transport's Transport Analysis Guidance (TAG) Unit 3.10.3 states that it is almost always desirable to include some representation of modal choice in variable demand modelling but that the importance of mode choice in the appraisal should determine the level of detail to be employed for different modes. It is therefore necessary that mode choice is included in the model, enabling the impacts of the highway scheme on demand for

public transport to be quantified. Including mode choice in the model will also facilitate calibration of the demand model to published elasticity values.

1.2.4 This leads to the requirement for an estimate of the generalised cost of travel by public transport. The changing relative generalised cost of travel by car and public transport through time means that it is necessary to estimate both the base and future year costs of travel. The most efficient method for deriving such generalised costs is through the use of a PT model covering the area of influence of the scheme. The effort required to develop SEMMMS8-PT has been minimised by making use of demand and supply data from the existing validated SPM2-PT model, which covers Greater Manchester.

1.2.5 The SEMMMS relief road is likely to improve access for both short and long distance car journeys. This means that more than one public transport mode may offer a competitive alternative to car. Therefore, the advice in TAG is that the demand model should include a higher level car/public transport modal split mechanism, with a separate split between the available public transport modes below this in the hierarchy. The approach to be adopted for the SEMMMS VDM is consistent with this guidance, with SEMMMS8-PT undertaking the sub-mode split as part of the route choice process, and passing public transport generalised costs to the demand model.

1.2.6 The demand representation included within SEMMMS8-PT is largely synthetic for the area of influence of the scheme. However, trip end estimates were derived making use of highly disaggregated land-use data and locally derived trip rates. Where observed travel demand was included within SPM2-PT, these demands were included in SEMMMS8-PT. SEMMMS8-PT includes a detailed network representation and contains all of the public transport services within the area of influence.

1.2.7 The highway scheme for which SEMMMS VDM was developed could be expected to impact on public transport trip making in the following ways:

- by changing the costs of car travel by provision of a new alignment and through changes in congestion and;
- by changing the costs for travel by bus as a result of changing congestion.

1.2.8 By including a PT model within SEMMMS VDM it has been possible to quantify the scale of both these impacts. Although SEMMMS8-PT will be used primarily to allow mode choice within SEMMMS VDM, it could also be used to provide an indicative assessment of the benefits of the scheme for public transport passengers, although as already stated these are anticipated to be small.

1.2.9 Although SEMMMS VDM will be fully compliant with TAG in terms of the requirements of assessing the SEMMMS Relief Road, only partial information has been available for validating the PT model within the area of influence of the scheme. SEMMMS8-PT is therefore **not** fully validated to the requirements of TAG/DMRB as would be required for producing major scheme business cases for public transport investment. MVA consider this to be an appropriate approach for this application, as SEMMMS VDM was not developed to appraise scheme interventions other than the A6 to Manchester Airport Relief Road. The reason for this is that the other potential interventions were investigated and appraised during the Multi-Modal study, with a number of the public transport recommendations, such as bus priority, already implemented. SEMMMS8-PT provides appropriate estimates of generalised

cost for use in the mode choice component of SEMMMS VDM, in the context of assessing the SEMMMS Relief Road.

1.2.10 The structure of the SEMMMS VDM modelling system will be such that a fully compliant public transport model can be added to the model system at any point in the future.

1.3 Other Reports

1.3.1 Three other documents should be read in conjunction with this report:

- SEMMMS8 SATURN Local Model Validation Report (LMVR) produced by Transport for Greater Manchester (TfGM) Highways Forecasting Analytical Services (HFAS) in February 2012;
- SEMMMS VDM Model Development Report produced by MVA in February 2012; and
- Forecasting Note produced by MVA in February 2012.

1.4 Contents of This Report

1.4.1 Following this introductory Chapter, the remainder of the Report is structured as follows:

- Chapter 2 provides an overview of the requirements for calibration and validation of public transport models, and sets out our approach to calibration and validation for SEMMMS8-PT;
- Chapter 3 outlines the specification of the model;
- Chapter 4 outlines the data used in updating the model;
- Chapter 5 describes the validation of the public transport network;
- Chapter 6 describes the validation of the public transport matrices;
- Chapter 7 describes the validation of the model prior to the application of matrix estimation techniques;
- Chapter 8 describes the validation of the model following the application of matrix estimation techniques; and
- Chapter 9 presents the conclusions of the model validation report.

2 Overview

2.1 DfT Guidance on Validation

2.1.1 Model validation has followed the advice given in TAG Unit 3.11.2 issued in January 2006. This unit provides detailed guidance relevant to all areas of road and public transport assignment modelling. The section of particular interest to the validation of public transport models is Section 10 "The Validation of Public Transport Passenger Assignment Models". The recommended approach to validation can be summarised as:

- trip matrix validation – comparison of sector-sector movements in the demand matrices with observations of passenger flows obtained across entire screenlines and cordons;
- network validation – checks of the accuracy of the coded network;
- service validation – checks of coded PT services and flows against observed counts and timetables; and
- assignment validation – comparison of modelled and observed passenger flows across cordons and screenlines, and passengers boarding and alighting in urban centres.

2.1.2 Current DfT guidance does not give advice on reporting structure. We have therefore followed earlier DfT guidance[1] which recommended that the validation report for public transport models follows the structure set out in Volume 12 Section 2 Appendix B of the Design Manual for Roads and Bridges (DMRB). The elements required of the validation report, as specified in DMRB, are set out in Table 2.1 along with the location of the information in this report.

[1] "Major Scheme Appraisal in Local Transport Plans Part 3: Detailed Guidance on Forecasting Models for Major Public Transport Schemes" June 2002

Table 2.1 DMRB Validation Report Structure

DMRB Requirement	Location
A description of the model and its development (including evidence of the fit achieved to calibration data, and a description of any sensitivity tests undertaken, and their results)	Chapter 3
A description of the data used in building and validating the model	Chapter 4
Evidence of the validity of the network employed, including journey times	Chapter 5
A validation of the trip matrices employed	Chapter 6
A validation of the trip assignment	Chapters 7 and 8
A validation of any other special features (e.g. higher tier model inputs, trip end models, mode choice models etc)	Not Applicable
A present year validation, if appropriate	Not Applicable

2.1.3 DfT guidance on the following topics is summarised in the remainder of this section under the following headings:

- trip matrix validation;
- network validation;
- services validation;
- assignment validation; and
- calibration techniques.

Trip Matrix Validation

2.1.4 Comparison of sector-to-sector trips in matrices with observed cordon/screenline counts should be reported. It is recommended that at this level of aggregation the differences between assigned and counted flows should in 95% of cases be less than 15%.

Network Validation

2.1.5 The accuracy of the coded network geometry should be systematically reviewed.

Services Validation

2.1.6 Modelled public transport journey times should be compared with timetables. No specific guidance on what constitutes "acceptable" is offered in this regard.

2.1.7 Modelled flows of public transport vehicles should be compared with roadside counts.

Assignment Validation

2.1.8 The validation of the assignment model should involve comparing modelled and observed:

- passenger flows across screenlines and cordons, usually by public transport mode and sometimes at the level of individual service; and
- passengers boarding and alighting in urban centres.

2.1.9 Modelled screenline flows should be within 15% of the observed flows, while individual flows should be within 25% except where observed flows are particularly low (less than 150 passengers per hour). It is also recommended that a check between modelled and annual public transport patronage is carried out (where available) to demonstrate that the general scale of patronage is correct.

Calibration Techniques

2.1.10 TAG Unit 3.11.2 recommends techniques with which the assignment model may be calibrated to produce a higher degree of validation. These are:

- adjustments to the zone centroid connector times and costs;
- adjustments to network and service details;
- adjustments to in vehicle time factors;
- adjustments to walk and wait time factors;
- adjustments to interchange penalties;
- adjustments to trip loading algorithm parameters;
- path building and trip loading algorithm changes; and
- segmentation of demand.

2.1.11 These are presented roughly in the order in which they should be considered. Any adjustments must be plausible.

2.1.12 TAG unit 3.11.2 also states that matrix estimation may be used to adjust the trip matrices if the matrices do not validate satisfactorily. It recommends that the changes brought about by the matrix estimation process are examined to check for particular distortions. Count data used as constraints in the estimation should be checked for consistency in the case that distortions are introduced to the matrices.

2.2 Approach to Calibration and Validation

2.2.1 As the main focus of the SEMMMS modelling is the demand and highway models, the validation of the public transport model has been less of a priority. While the public transport model has been included within the model system, it is purely to enable the assessment of the impact of the highway scheme on public transport and therefore it is not considered that the validation must be as rigorous as if it were for the assessment of public transport schemes.

2.2.2 As such, the area of influence of the scheme has been the main focus in the calibration and validation of the public transport model, with the full model area validation viewed as a secondary matter.

2.2.3 The demand matrices have been produced from the observed elements of the SPM2-PT matrices, with unobserved movements created using Census data, observed trips rates and distributions developed from the 2001 Census Journey to Work data. Matrix estimation has been used within the PT-TRIPS transport modelling software suite to improve the fit between modelled and observed passenger flows.

2.2.4 In summary, our approach to model calibration and validation was as follows:

- Undertake network validation (checking of network geometry and service coding; bus and rail speeds; route choice and public transport mode share for selected journeys).
- Undertake matrix validation prior to matrix estimation (involving the comparison of sector-sector matrices with corresponding screenline counts and matrix totals with patronage estimates.
- Undertake assignment validation prior to matrix estimation (comparison of modelled and observed bus occupancy; and rail and Metrolink boarding and alighting counts).
- Review assignment parameters and algorithms as listed in paragraph 2.1.10 to assess if validation could be improved.
- Apply matrix estimation.
- Repeat assignment validation.

3 Model Specification

3.1 Introduction

3.1.1 This chapter sets out the structure of the public transport assignment model and the values of model parameters that have been used. The remainder of this chapter discusses:

- the study area and extent of the model;
- modelled time periods;
- network definition;
- the representation of fares;
- matrix development methodology;
- the assignment algorithm;
- assignment parameters;
- wait curves used in assignment; and
- further modifications of assignment parameters made during calibration.

3.2 Study Area and Zoning Methodology

3.2.1 The development of the SEMMMS8-PT model, like that of the SEMMMS VDM and SEMMMS8 SATURN models, takes the GMSPM2 model as the starting point but with the model area extended to cover the area over which the SEMMMS Relief Road will have an impact. This area is known as the Area of Influence (AofI), and is shown in relation to the Greater Manchester boundary in Figure 3.1. An interim version of the SEMMMS8 SATURN model was used to identify the AofI on the basis of the scale of highway vehicle flow changes resulting from implementation of the scheme, and the detailed model coverage was then extended to cover the portion of the AofI that lies outside of the Greater Manchester boundary.

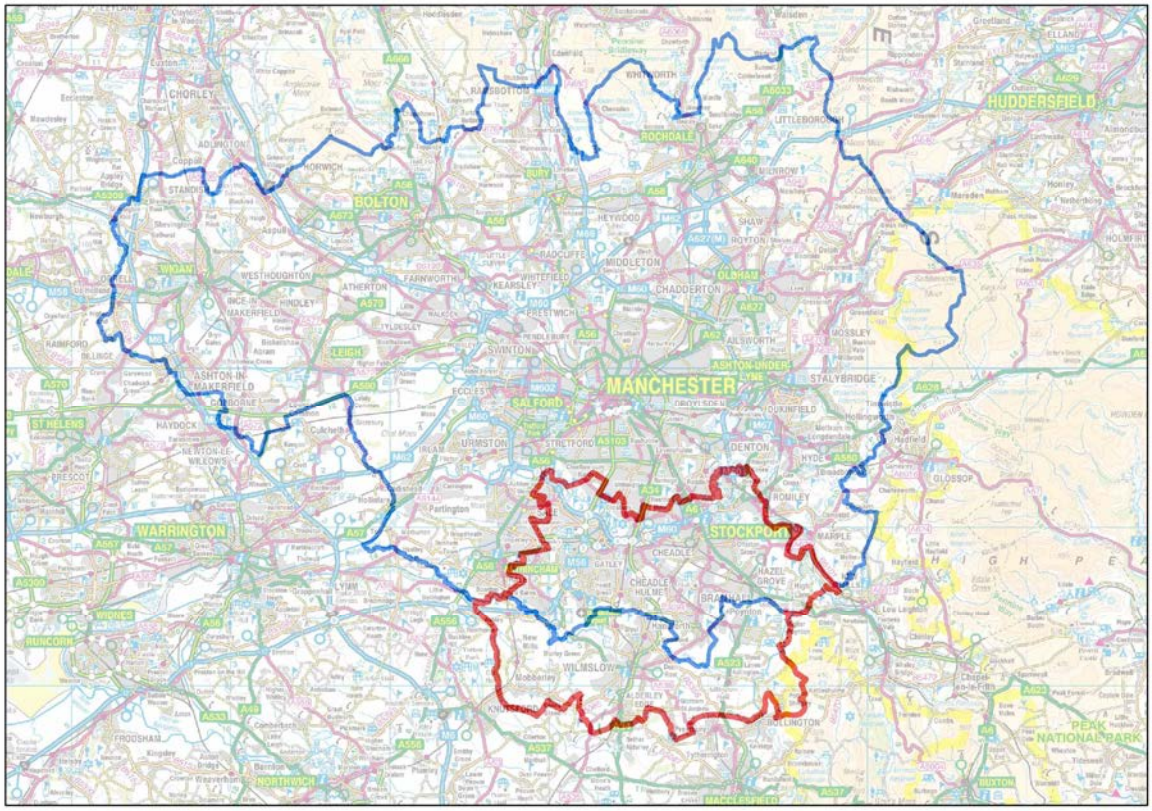

Figure 3.1 SEMMMS8 Area of Influence (Red line is AofI, Blue line is Greater Manchester)

3.2.2 SEMMMS VDM takes generalised cost inputs from the SEMMMS8 highway and PT models which requires the zones in the supply models to nest within the VDM zones to allow costs from the supply models to be passed to the VDM. However, it does not necessarily require a 1:1 correspondence between zone systems of the assignment models and the demand model. Operating the demand model at a more aggregate level than the assignment models speeds up demand model run time, reduces model data storage requirements and is beneficial when matrices are lumpy, ie subject to a degree of sampling bias.

3.2.3 The SEMMMS VDM zone system was developed using the following principles:

- Identical zone system in assignment and demand models across the AofI, which covers parts of South Manchester and Cheshire East, allowing for accurate representations within the demand model of travel patterns associated with future developments and their loading points in the assignment models.
- Demand for travel to/from Manchester Airport terminals was aggregated from the eight zones in the assignment models to a single zone in the VDM. Whereas a highly disaggregate zoning system across Manchester Airport improves accuracy of traffic loading in the assignment models, this level of aggregation is not appropriate for demand response modelling. Air travellers' response to changing Airport access costs can be thought of in terms of the whole journey from home to the check-in desk as opposed to a particular car park or public transport terminus. This is particularly important for mode choice so that the total costs of travel by car to the desk can be compared with public transport costs, rather than comparing costs to reach a car park.

For this reason a single demand model zone is used to represent demand to/from Manchester Airport terminals.

- Approximately 3:1 correspondence in zone system between assignment models and demand model across the rest of Greater Manchester to make use of the existing GM-TIF suite of models. The zones in the TIF demand modelling, using GMSPM2, correspond to wards so that planning data could be readily compiled.
- For much of the north of England, which is beyond the AofI full representations of travel demand are included in the demand matrices for these zones although supply coverage becomes progressively simplified further away from the AofI. Simplifying the zoning system for this area between the demand and assignment models significantly speeds up demand model run time and reduces model data storage requirements and can be beneficial if matrices are lumpy.
- Identical zone system in assignment and demand models for the external zones, defined as those for which only fully observed travel demand is included in the demand matrices.

3.2.4 The zones in each supply model must nest within the VDM zones to allow costs from the supply models to be passed to the VDM. In theory the PT and highway models could have different zones so long as both systems could be aggregated to the zone system used in VDM. In the Area of Influence the VDM and highway model use the same zone system so that the demand changes which results from cost changes in generalised costs can be most accurately estimated. So:

- the PT model zones must nest within the VDM zones; and
- it has been decided that the same zones will be used in the highway model and VDM in the AofI.

3.2.5 These two factors mean that the PT model zones in the AofI must either be the same as, or nest within, the highway model zones. As the model is not designed to appraise PT schemes it would not be appropriate for the PT model zones to be more detailed than the highway model zones. The SEMMMS8 PT assignment models will therefore have the same 1080 zones as the SEMMMS8 highway assignment models.

3.2.6 Table 3.1 shows the nesting relationship between the zone systems of the PT assignment models and SEMMMS VDM. In total there are 480 zones in the SEMMMS VDM and 1080 zones in the PT assignment models.

Table 3.1 SEMMMS VDM Zoning and Nesting Relationship with the Zoning of the SEMMMS8 Highway Assignment Models

Model Area	Number of SEMMMS8 PT Assignment Zones	Number of SEMMMS VDM zones	Ratio
Area of Influence	190	190	1:1
Rest of Greater Manchester and North of England	875	275	3.33:1
External Zones	15	15	1:1
All Zones	**1080**	**480**	**2.30:1**

3.2.7 The zone systems for the highway assignment model and VDM are shown in Figures 3.2. and 3.3.

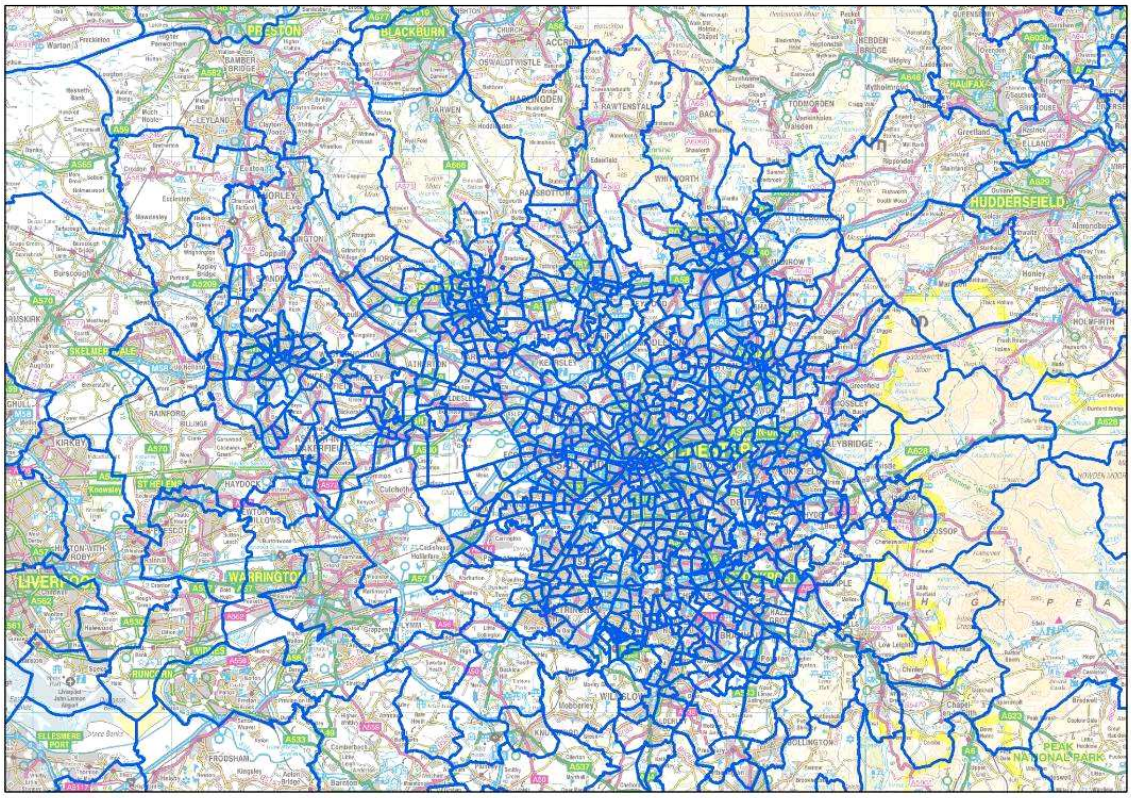

Figure 3.2 Zone System

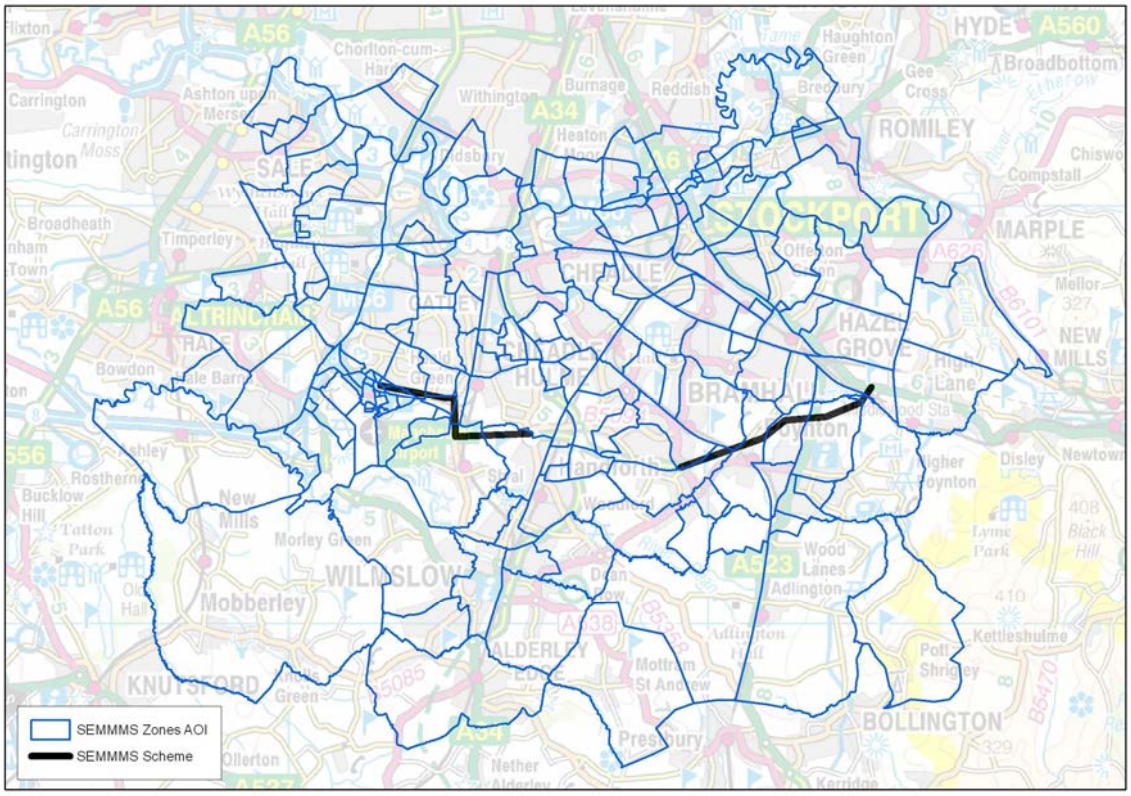

Figure 3.3 SEMMMS Scheme and Area of Influence Zone System

3.3 Modelled Time Periods

3.3.1 The base year for the SEMMMS VDM, and therefore SEMMMS8-PT is 2009. The model covers the following time periods, in each case representing an average hour within the time period:

- morning peak: 0700 to 0930;
- inter-peak: 0930 to 1600;
- evening peak: 1600 to 1900; and
- off peak: 1900 to 2300.

3.3.2 The principal role of SEMMMS8-PT is to provide inputs to the mode choice model in SEMMMS VDM. Therefore the PT model and VDM have the same time periods.

3.4 Network Definition

3.4.1 A number of datasets have been used to develop the public transport supply representation for the SEMMMS8-PT model. The datasets used for the model development were chosen as they were readily available for input to the model, are consistent with the SATURN model and have come from reliable sources.

3.4.2 The public transport networks were developed by:

- converting the SEMMMS8 SATURN highway networks, which contains all of the road network relevant to the study, to PT-TRIPS format including extracting of network speeds from the SATURN networks;
- adding in the rail, Metrolink, walk and centroid connector links from SPM2-PT, which is a validated public transport model; and
- Checking the coverage of walk and rail links in the AofI, updating and adding new links where necessary, and thoroughly reviewing the centroid connectors in the AofI.

Bus Speeds

3.4.3 The speeds on the highway links in the network were taken from the SEMMMS SATURN model, with it being recognised that the time it takes buses to traverse a link will be a function of the time it takes a car to traverse the link. Buses travel along the link at lower average speeds than cars, as they need to stop and pick up/set down passengers. Therefore, the bus speed on links has been calculated using the formula set out below:

Bus Speed = Average Car Speed x Factor

3.4.4 The factor which is applied to the free flow time has been calibrated using timetable times and observed bus journey times. Observed bus journey times were available for this purpose for services within Greater Manchester, however for services in the AofI outside of Greater Manchester timetable times have been used. The factor was first calculated using a trial and error approach, comparing the modelled and observed journey times for a series of different factors. A single factor was derived across all the model time periods and the final factor used was 0.8.

Public Transport Services

3.4.5 The bus services in SEMMMS8-PT have been taken from the 2008 version of SPM2-PT and updated to build on the new SEMMMS8-PT network. These bus services were taken from GMPTE's database of bus services using automated processes. Bus services operating the the AofI that extend across the Greater Manchester boundary in to Cheshire were fully reviewed and updated in line with the timetables current at the time of the initial model development..

3.4.6 Bus services within the AofI that were not in the existing SPM2-PT lines files were taken from the SEMMMS8-SATURN model or added from information from timetables. The 2008 rail services were also taken from the updated 2008 version of SPM2-PT. and checked for accuracy within the AofI, with any required services added. Metrolink services were taken directly from the SPM2-PT lines file, which have been fully reviewed during the testing of Metrolink schemes using the SPM2-PT model.

3.4.7 The process of reviewing and updating the lines files in the AofI included the following stages:

- the checking of the services coded into the model, with new services added and withdrawn services removed; and
- the checking of the coded headways against the current service headways.

3.4.8 As the bus speeds in SEMMMS8-PT are required to change in line with changes in car speeds over time the bus service definitions did not include any timing information. As noted earlier, observed bus journey times and timetable times were used to calibrate the factors to apply to the average car speeds in calculating bus speeds.

3.4.9 A summary of all public transport services included is provided in Appendix A.

Centroid Connectors and Walk Links

3.4.10 The walk links and centroid connectors were taken directly from SPM2-PT, updated and added to provide adequate coverage within the AofI. Centroid connectors have a speed of 4.8kph to reflect walking speed, except those with a length of greater than 1.6km which were coded with a speed of 45kph to reflect access by a mechanised mode. These long centroids are used in external zones, with the length of the link reflecting the need to travel to a mainline station to catch a rail service into the detailed area.

3.5 Fares

3.5.1 The public transport fares in SEMMMS8-PT take the form of distance based fare tables and are based on those used in SPM2-PT, which in turn were taken from the Countywide PT model. Fare tables were derived separately for bus, rail and Metrolink. The fare tables represent the cost of making a one-way journey, taking into account the mix of ticket types used (single, return, period tickets, etc) and types of users (adults, children or concessionary). Distance based fare tables have been calculated for all the separate modes for the following reasons:

- TRIPS allows only one fare structure to be applied in each assignment;
- bus fares operate on a stage basis, but stage location information is not available in a consistent format – therefore a distance based approximation has been used; and
- rail fares are related to distance travelled.

Bus Fares

3.5.2 Bus fare tables were derived by comparing fares paid for a sample of some 109,000 journeys (from the Continuous Passenger Sampling (CPS) data) with distances estimated from the service database. As the CPS data do not provide information on the time of day of the journey fare tables are not differentiated by time period. The approach to defining the fare tables is summarised below:

- estimated one-way fares were calculated for each journey observed in the CPS data (eg return fares were halved);
- crow-fly distances between stages were calculated from the service database and factored by 1.2 to estimate the distance between stages;
- average fares for 100m, 250m, 500m and 1000m bands were calculated and graphed; and
- fare tables were derived from the 250m band averages as this was the most detailed level at which there was a clear increasing pattern of fare vs distance (at the 100m level average fares for many bands were lower than for the previous band).

Rail Fares

3.5.3 Rail fare tables were derived by comparing average one-way station-to-station fares (calculated from CAPRI data) with distances taken from the National Rail Timetable. CAPRI data are not available by time of day and therefore rail fare tables are not differentiated by time period. The approach to defining the fare tables is summarised below:

- average one-way station-to-station fares were calculated from CAPRI data by dividing revenue by journeys;
- distances for all stations to Piccadilly and Victoria stations were calculated – these movements account for a very large proportion of all rail demand in the study area;
- average fares for 250m, 500m, 1000m and 2000m bands were calculated and graphed; and
- fare tables were derived from the 2000m band averages as this was the most detailed level at which there was a clear increasing pattern of fare vs distance.

Metrolink Fares

3.5.4 Metrolink fare tables were derived from Ticket Vending Machine (TVM) data for January to March 2005 and station-to-station distances (estimated from the TRIPS network model). TVM data are available by time period and therefore separate peak and off-peak fare tables have been calculated. The approach to defining the fare tables is summarised below:

- average one-way station-to-station fares were calculated from the TVM data;
- a matrix of station-to-station distances was calculated from link lengths as coded in the TRIPS model;
- average fares for 250m, 500m and 1000m bands were calculated and graphed; and
- fare tables were derived from the 1000m band averages as this was the most detailed level at which there was a clear increasing pattern of fare vs distance.

3.5.5 As all stations on the Eccles Line between Eccles and Pomona fall within one zone, fare tables were derived separately for the Eccles and Bury / Altrincham Lines.

3.5.6 The above fare relationships were factored to the SPM2-PT base year of 2005 using data provided by GMPTE which varied by sub-mode and were further factored to 2009, at 2002 prices, for SEMMMS8-PT. The resulting fares relationships are shown in Figure 3.6 below:

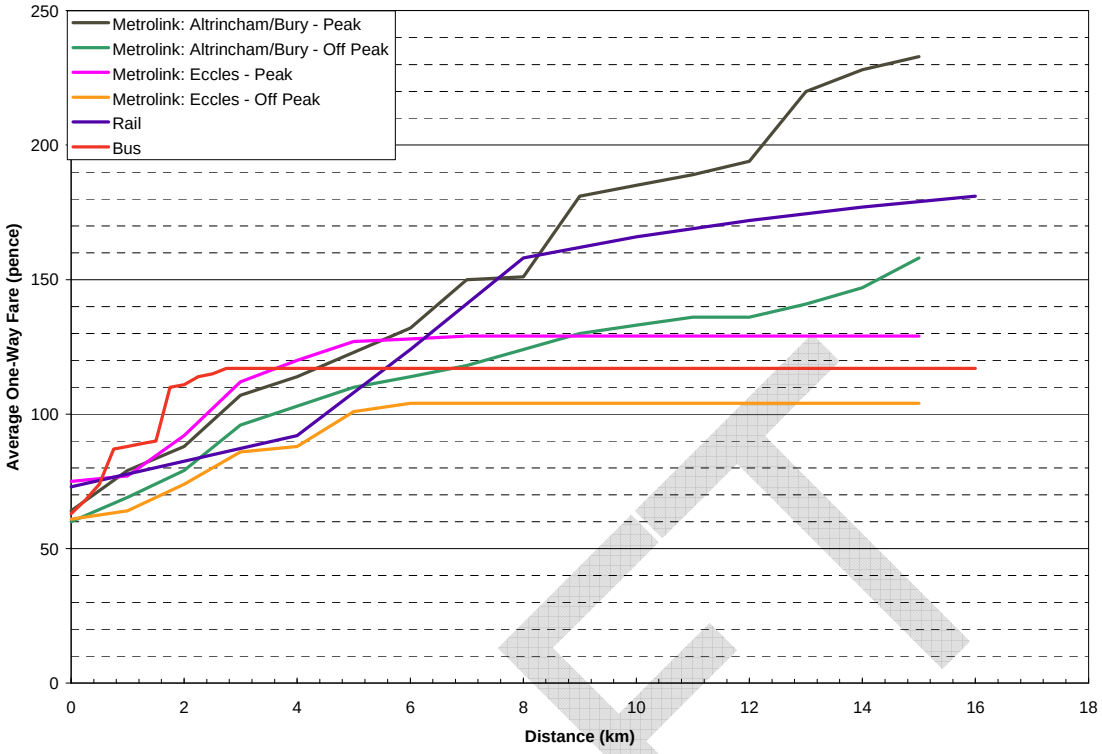

Figure 3.4 Fare Table

3.6 Matrix Development

3.6.1 The collection of new origin/destination data was not possible in the time available, nor warranted given the purpose of the model for the appraisal of a road scheme such as the proposed SEMMMS link road. Therefore, the matrix development process was based largely on the matrices developed for GMSPM2 and the SPM2-PT model. The following steps were implemented in the development of the SEMMMS8-PT matrices:

Step 1

- Details of the methodology adopted for matrix development in SPM2-PT are presented in Appendix B. In summary:
  - GMATS and M60 After origin / destination surveys were used to estimate trips in the "forward" direction (outbound from district centres and northbound across M60 After survey cordons) with expansion factors derived by TfGM HFAS;
  - GMATS and M60 After origin / destination surveys were transposed;
  - movements which were observed on more than one cordon or partially observed were identified using the network model;
  - an initial matrix for movements not captured by GMATS or M60 After origin / destination surveys was developed from available data (eg local origin / destination surveys, CAPRI data, Metrolink Ticket data, Census, etc);
  - matrices from GMATS / M60 data were combined with the infill matrix; and
  - matrix smoothing techniques were applied.

- The matrices represent "true" origin and destination. For example, in the case of a home-to-work trip consisting of a car access leg to a rail station and a public transport leg the origin is recorded as the home zone and the destination recorded as the workplace zone. A separate TRIPS process is implemented prior to assignment which modifies the matrices such that the origin zone in the above example will be re-allocated to the rail station.
- The above process was adapted to produce average hour matrices of observed public transport movements for each time period;

Step 2

- synthetic demand matrices for all unobserved movements were created using Census data, observed trips rates and distributions developed from the 2001 Census Journey to Work data; and

Step 3

- the observed and synthetic matrices were combined to produce the initial average hour assignment matrices for input to the calibration of the public transport model.

Derivation of Trip Ends

3.6.2 The approach can be summarised as follows:

Home Based Purpose Trip Ends

- Derive trip rates from the GMATS Household Interview Survey (HIS) by 32 household categories, 10 home based purposes and for each of the 4 modelled time periods included in SEMMMS VDM.
- Derive production trip end estimates for each home based purpose and time period by combining the trip rates with zonal population extracted from the 2001 Census at OA output area, disaggregated to the SEMMMS8 1080 zone system using Code-Point data and converted to a 2009 forecast using growth factors extracted from TEMPRO v6.1.
- Derive attraction trip end estimates by splitting total home based productions for each purpose and time period using purpose/time period specific attraction weights. Attraction weights were derived by disaggregating TEMPRO zone attraction data (from TEMPRO v6.1) to the SEMMMS8 1080 zone system using purpose specific land-use data.

Non-Home Based Purpose Trip Ends

- Derive appropriate trip rates from GMATS HIS to calculate total non-home based trips by purpose and time period.
- Total non-home based trips by purpose and time period are disaggregated symmetrically to origin and destination trip ends at the SEMMMS8 1080 zone level, using a set of weights. These weights were derived from home based trip attractions by purpose, themselves weighted to reflect the propensity of a non-home based trip to be undertaken following a particular home based purpose. These home based to non-

home based purpose relationships were derived using trip chain data extracted from GMATS HIS.

Distribution

3.6.3 The AofI trip ends were distributed using the travel to work matrix, including for non-commute purposes. This was undertaken as the most pragmatic solution to ensure we produced a robust prior matrix as quickly as possible. For most large buffer zones we want PT demand to be distributed mostly within the local area, and gravity models are liable to produce a large number of long distance PT trips (Sheffield to Liverpool etc. which is particularly unsuitable for purposes such as education). This could be tempered by using a "stronger" parameter but it is not obvious how strong it should be or how it should be calibrated. Using the travel to work matrix would appear more defendable in this scenario, given the purpose of the public transport model for this study and the timescales for model development.

3.7 Assignment Algorithm

3.7.1 A multi-path assignment algorithm was used, allocating trips between origin / destination pairs to paths with similar levels of service. PT-TRIPS presents the user with options regarding the assignment algorithm, including whether or not to use the following sub-models:

- Sub-Mode Choice Model – where the choice of sub-mode is made at the start of the trip;
- the Enhanced Service Model – where the allocation of trips between services is influenced by fare and journey time in addition to frequency; and
- the Crowding Model – where the journey time is adjusted to reflect the fact that passengers do not like to travel in crowded conditions.

3.7.2 The Sub Mode Choice Model puts the choice of mode (bus or rail) at the top of the choice hierarchy. The model uses a logit relationship to allocate demand between sub-modes based on the difference in generalised costs. Consider a case where two bus services and one rail service are available, each offering the same level of service (ie fare, journey and frequency). Without the sub-mode choice model each service would be allocated one-third of demand. With the sub-mode choice model half of the demand would be allocated to bus and half to rail. The sub-mode choice model was used as it is a plausible representation of passenger behaviour. This is consistent with the approach adopted by MVA for other recent studies.

3.7.3 Assignment using PT-TRIPS is a two step process involving path building and loading. In the path building, a set of "reasonable" paths are built between each origin / destination pair. The principle is that a service with a higher generalised cost may be considered if it turned up first. All components of generalised cost are considered in the path building process.

3.7.4 The standard Service Model allocates trips between the services in the choice set in proportion to the number of departures per hour, and does not consider fare and journey time. (Fare and journey time do affect the composition of the choice set). An alternative approach, known as the Enhanced Service Model (ESM), is available which allocates trips to

using a logit relationship including fare and journey time in the cost of using the service. As it is more reasonable to believe that fare and journey time should influence the choice of service the Enhanced Service Model will be used.

3.7.5 A Walk Choice Model is applied to select between alternative walk routes.

3.7.6 The sensitivity of the Sub-Mode Choice Model, Enhanced Service Model and Walk Choice Model to differences in costs is governed by scale factors. The scale factors for the sub-mode choice model was set to -0.1 as recommended in DfT's Variable Demand Modelling Advice (VaDMA) and User Friendly Modelling Advice (UFMA). The scale factor for the ESM was set to the TRIPS default value of -1.

3.7.7 TAG Unit 3.11.1 states that "crowding should only be modelled where it is likely to have a significant effect on traveller behaviour or where an effect on crowding is one of the objectives of the scheme." Therefore, given crowding on public transport services is not perceived to be an issue in the AofI, and that the objectives of the scheme do not include relieving public transport crowding, the modelling of crowding has not been included in SEMMMS8-PT.

3.8 Assignment Parameters

3.8.1 The parameters listed below were defined for the assignment process, as described in this section:

- value of time;
- in-vehicle time factors;
- walk and wait time factors;
- boarding and interchange penalties; and
- wait curves.

Value of Time

3.8.2 A behavioural value of time for assignment purposes has been derived from TAG unit 3.5.6 utilising local public transport mode and purpose splits. The calculated value of time per hour is £5.25 for all time periods (2009 prices, 2002 values). An outline of the derivation is included in Appendix C.

In-vehicle Time Factors

3.8.3 In-vehicle time factors of 1.00 for Bus, 0.95 for Rail and 0.9 for Metrolink were applied. These factors were calibrated using a trial-and-error approach during the development of the Countywide and SPM2-PT models.

Walk and Wait Time Factors

3.8.4 The latest government advice on appropriate factors to apply to out of vehicle time for modelling purposes, as set out in "Major Scheme Appraisal in Local Transport Plans Part 3:

Detailed Guidance on Forecasting Models for Major Public Transport Schemes"[2] is to use a factor of 1.6 for both walk and wait times.

3.8.5 Other research and studies suggest that the walk time may range from 1.3 to 2.1 and that the wait time may range between 1.3 and 2.5.

3.8.6 The existing SPM2-PT model uses factors of 1.9 for walk and 1.9 for wait time. As these factors are within normal ranges they were adopted for initial tests and reviewed as part of the calibration process.

Boarding and Interchange Penalties

3.8.7 Boarding and interchange penalties are generalised cost adjustments applied in the assignment process to represent the perceived inconvenience of using a particular sub-mode or interchanging between services. These penalties are defined by sub-mode in the case of boarding penalties and by sub-mode pair in the case of interchange penalties, and are applied in addition to any walk and wait time.

3.8.8 Boarding penalties and interchange penalties have to be considered together because boarding penalties are applied at every boarding of a vehicle including those that constitute an interchange between vehicles. The scale of the appropriate penalty to apply is affected by the approach used to represent the walk links that represent access to stations and bus stops. In SEMMMS8-PT, these links have been coded with average walk speeds applied to the distance to the station yielding the walk-time to the station. The walk times therefore omit the time taken to access the correct platform. This time is built into the boarding penalty.

3.8.9 Previous studies and government advice recommend boarding penalties of 2-10 minutes, and interchange penalties of anything from 2-15 minutes. SPM2-PT used a boarding penalty value of 2.5 minutes, applied to all modes, which has been carried forward in to SEMMMS8 PT.

Wait Curves

3.8.10 Wait curves are used to convert headway to wait time. The calculated wait time will reflect both time spent waiting at the stop or station as well as the inconvenience of scheduling ones journey around infrequent services.

3.8.11 A common assumption is that wait times would equal half of service headway. An alternative form of curve, taken from the Rail Passenger Demand Forecasting Handbook is in Figure 3.5. The PDFH curve follows the intuitive "half of headway" rule for frequent services (up to a 10 minute headway) and then tapers so that for less frequent services the wait time will be less than half the headway. The PDFH curve was applied to the SEMMMS8-PT model, in preference to the simple half-headway rule. The PDFH curve better reflects that passengers will not wait for very long times for infrequent services, but does not have an arbitrary maximum wait time.

[2] www.dft.gov.uk/stellent/groups/dft_localtrans/documents/page/dft_localtrans_504021.hcsp

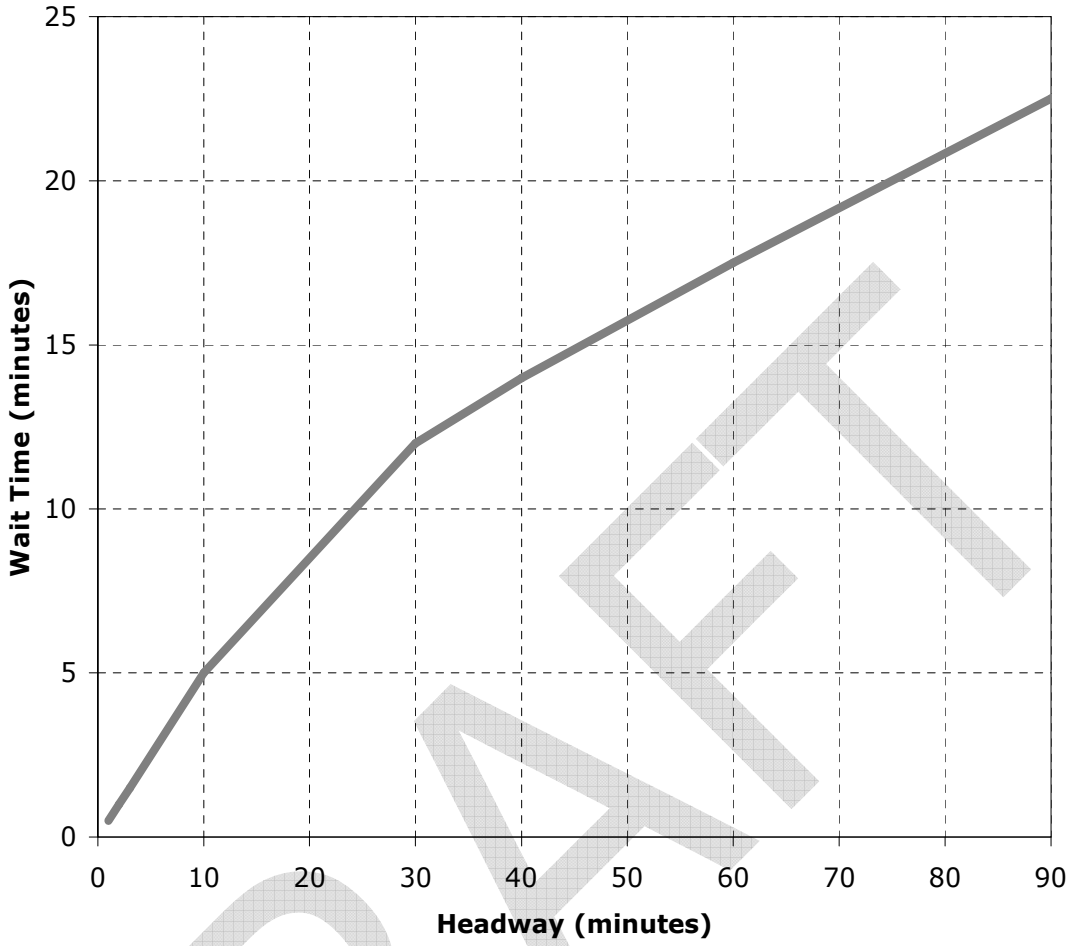

Figure 3.5 SEMMMS and PDFH Wait Curves

3.9 Modification to Assignment Parameters

3.9.1 In the course of the calibration process it was necessary to modify some of the assignment parameters. A summary of the changes and refinements applied is presented in Chapter 7.

4 Data Used

4.1 Introduction

4.1.1 Numerous sources of data were exploited in creating the Countywide public transport model of Greater Manchester, on which SPM2-PT and SEMMMS8-PT is based. As the SEMMMS8-PT model is presently only to be used as to generate reasonable mode-choice behaviour, no new data collection was undertaken as part of the current study. Cheshire East Council was asked for any existing data in the AofI which could be used in SEMMMS8-PT but none were available.

4.1.2 Data are required which describe the **transport networks** in Greater Manchester. These data include:

- representation of road, public transport and walk networks; and
- inventories of public transport services, including routes, fares, headways and operators.

4.1.3 The use of these data to develop the network models was described in section 3.4.

4.1.4 A related class of data are bus journey time data. These data were used to ensure that the model correctly represents the levels of service offered by buses.

4.1.5 Data were also required in order to develop **representations of public transport demand**, ie how many trips are made between areas of Greater Manchester. For this study, demand data were taken from GMATS and M60 After passenger surveys supplemented by ticket sales data, Census Journey-to-Work data and local passenger surveys. The use of these data was described in section 3.6.

4.1.6 A final category of data is **counts of passengers**. These data were used to expand samples of data collected through surveys and also to validate the results of the model. Such count data include records of boardings and alightings at bus stops and railway stations, and also counts of the numbers of passengers on-board public transport vehicles at selected points in the network.

4.1.7 The remainder of this chapter contains summaries of:

- existing supply data;
- bus journey time data;
- existing demand data; and
- passenger count data.

4.2 Supply Data

4.2.1 The supply representation of the SEMMMS8-PT model was developed from the SEMMMS8 SATURN model. Rail, Metrolink and walk links were added from SPM2-PT, with a review and update of the coverage within the AofI undertaken.

4.2.2 The specification of bus services in SEMMMS8-PT has been taken from the 2008 version of SPM2-PT and updated to build on the SEMMMS8-PT network. Bus services extending across the Greater Manchester boundary in to Cheshire were fully reviewed and updated in line with the latest timetables.

4.2.3 The 2008 rail and Metrolink services were also taken from the updated 2008 version of SPM2-PT. and the rail services were checked for accuracy within the AofI, with any required services added.

Bus Journey Time Data

4.2.4 GMPTE have provided bus journey time data collected as part of CPS, for most of the Greater Manchester area. In particular, South Manchester has extensive route coverage, as some routes were evaluated in the Before and After M60 surveys. These data are contained in spreadsheets and record:

- operator;
- route number;
- survey date;
- scheduled departure time; and
- actual time at each stage.

4.2.5 A list of the surveyed routes is provided in Appendix D.

4.3 Demand Data

4.3.1 The use of demand data for developing the trip matrices used in the model is described in section 3.6. The datasets which have been used are illustrated in Figure 4.1 and Figure 4.2 and are described below. The figures illustrate that there are only a small number of surveys within the area of influence. However, these surveys are very close to the proposed scheme.

Autumn 2002 Greater Manchester Area Transport Surveys (GMATS)

4.3.2 Origin / destination surveys were conducted in the regional and district centres in Autumn 2002 between 7am and 7pm. Self-completion survey forms were distributed to passengers at rail and Metrolink stations and on buses which cross the cordons shown in Figure 4.1. GMATS data records the true origin and destination of the journey along with information on journey purpose, access and egress modes and car availability. The GMATS data also contains the time of the return leg of the journey. The bus data records the cordon crossing location and bus service number. The rail data records the train ID and start and end station.

4.3.3 Boarding and alighting counts were conducted for all surveyed rail services. Outbound, but not inbound, bus passenger counts were conducted to complement the GMATS surveys.

M60 After Origin / Destination Surveys

4.3.4 M60 After surveys were conducted in 2003 as part of a programme to asses the impacts of the completion of the orbital motorway. The methodology was similar to that used for the GMATS surveys. Surveys were undertaken at rail and Metrolink stations and in the northbound direction across the cordons shown in Figure 4.1.

Salford University and Golborne Origin / Destination Surveys

4.3.5 Origin /destination surveys undertaken at Salford University and Golborne (near Wigan) dating from 2004 were included when the Countywide PT model and SPM2-PT were created, and have been retained in SEMMMS8-PT although will contain very little information relating to the AofI.

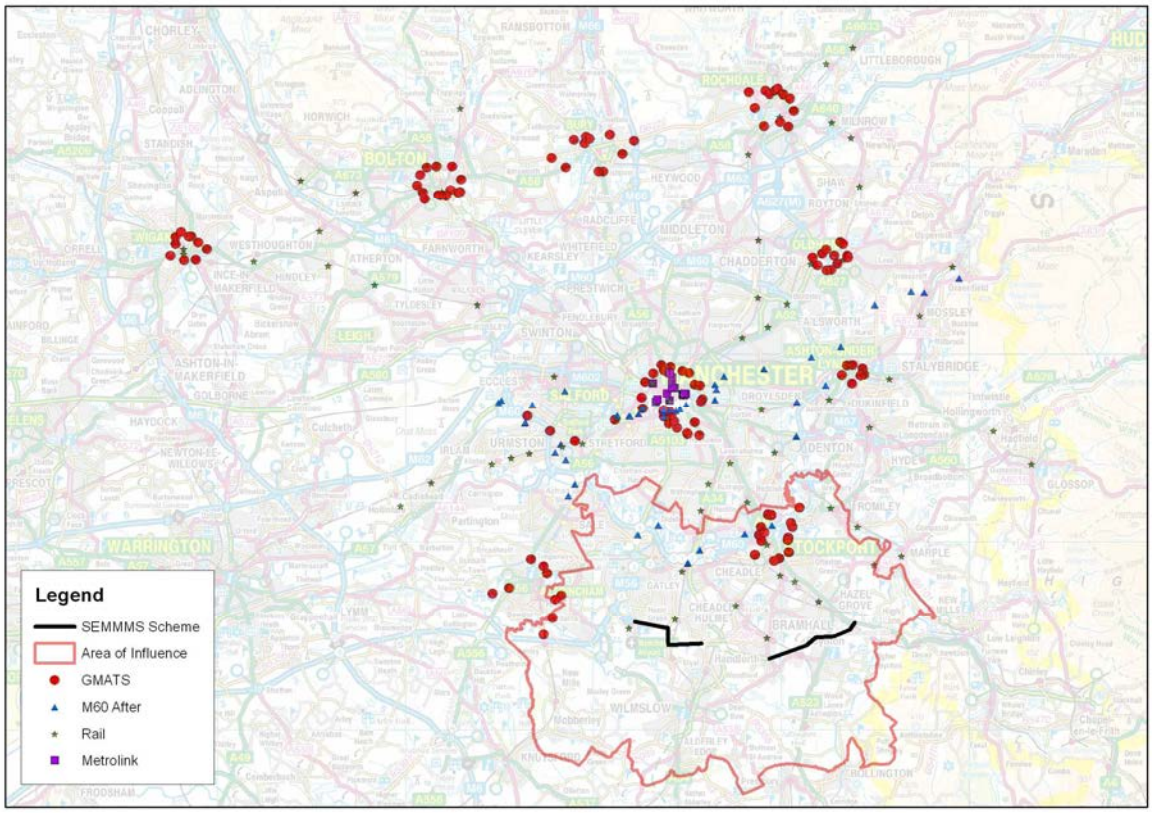

Figure 4.1 SEMMMS Scheme, AofI and Survey Points

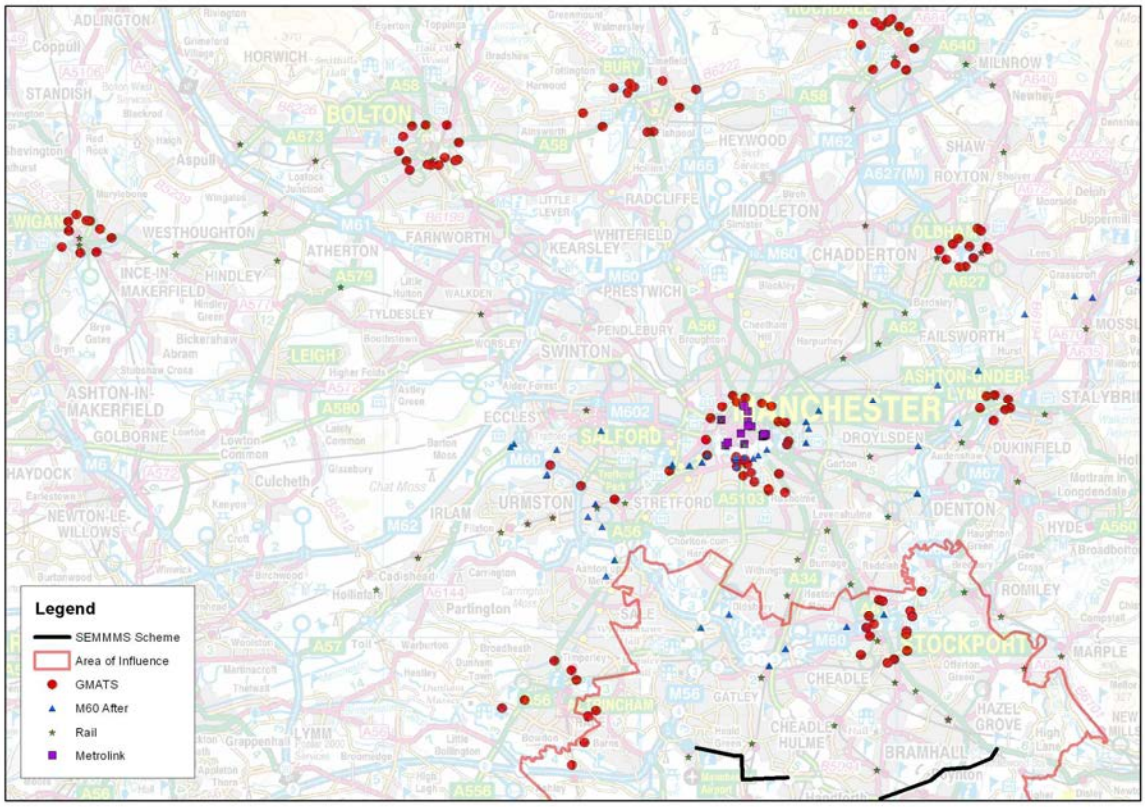

Figure 4.2 SEMMMS Scheme, AofI and Survey Points (enlarged view)

4.3.6 It can be seem from Figure 4.1 and Figure 4.2 that the survey locations are spread throughout the Greater Manchester area but there are relatively few survey points close to the SEMMMS scheme and none to the south of the scheme in the Cheshire area.

2001 Census Journey-to-Work Data

4.3.7 Census journey-to-work data record the home location (at output area level), usual workplace location (at output area level) and usual mode of travel. Information on the frequency of travel is not recorded. These data have been used in conjunction with information from the GMATS Household Interview Survey (see below) to estimate demand using bus which was not observed in the passenger interview surveys.

CAPRI Rail Ticket Sales Data

4.3.8 CAPRI data for 111 stations in Greater Manchester were obtained. These data are from 2003 and record annual revenue and journeys to and from each station from all stations on the national rail network. These data were used to estimate demand using rail which was not observed in the passenger interview surveys.

Metrolink Ticket Sales Data

4.3.9 Station-to-station journey and revenue data are collected by the Ticket Vending Machine (TVM) system. These data are available by time of day (before 9:30 am, 9:30 to 15:29 and 15:30 to 18:30) for June 2004. These data were used to estimate demand using Metrolink which was not observed in the passenger interview surveys.

GMATS Household Interview Surveys

4.3.10 Household interview survey data were collected in a sample of 53 wards. The average sample rate within these wards was 1.5%. The following data were used in the study:

- factors to derive home-to-work journeys by time period and model from the Census journey-to-work data; and
- factors to derive work-to-home journeys by time period and model from the transposed Census journey-to-work data.

Passenger Count Data

4.3.11 Various sets of counts have been provided by GMPTE which were used for both the calibration and validation of the model:

- passenger counts conducted as part of the GMATS and M60 origin / destination surveys;
- bus and Rail Boarding and Alighting counts from Bolton, July 2004, Count On Us – One day 12 hr count (0700-1900) at all stands, by service, in Bolton Bus Station and all platforms, in 15 minute intervals, at Bolton Train Station;
- 12 hour (0700-1900) roadside estimates of bus occupancy from Greater Manchester from various sites, by service type and bus type ie single or double-decker);
- 10 hour (0800-1800) bus boarding counts, by service, at Salford University at three sites, in both directions;
- bus occupancy and boarding and alighting counts undertaken by MVA for the Stockport Model in June 2004; and
- 12 hour (0700-1900) boarding and alighting counts by departure (destination recorded) at nearly all rail and metrolink stations in Greater Manchester in November 2004.

5 Network Validation

5.1 Introduction

5.1.1 This chapter documents the network validation which was undertaken with reference to DfT's Detailed Guidance. The guidance recommends:

- checking network coding;
- reviewing modelled journey times against timetables and surveys; and
- assessing the reasonableness of modelled route choice.

5.2 Network Checks

5.2.1 Checks of the public transport representation included:

- comparison of rail link times against timetables for services operating in the AofI;
- a review of centroid connectors and coded walk links, concentrating on the AofI;
- a review of the routing and headway of bus and rail services which pass through the AofI using the Cheshire East Council website.

5.2.2 Any network coding errors identified were corrected.

5.3 Journey Time Validation

5.3.1 The bus journey time definitions were taken from the highway speeds in the SATURN model, with the highway speed multiplied by a factor to calculate the bus speed. The factor used (0.8 for all time periods) was determined by trial-and-error to produce the validation result shown below and reflects the additional time buses take to stop to pick up passengers (See 3.4.3 to 3.4.4). Rail and Metrolink journey times were taken directly from published timetables.

5.3.2 CPS journey time data were available for a number of routes, described in Appendix D. Modelled bus journey times for each surveyed route have been compared against the CPS journey time data. Detailed bus journey time validation tables are included in Appendix D. These tables show the following information for the sections of each surveyed route that lie within the study area in each modelled time period:

- observed journey time (minutes);
- modelled journey time (minutes);
- percentage difference; and
- whether the modelled time is "slow" (ie more than 15% greater than observed), "fast" (ie more than 15% less than observed) or "OK".

5.3.3 The categorisation of modelled journey times is shown in Table 5.1.

Table 5.1 Bus Journey Time Categorisation – In Whole Study Area

Modelled	Morning Peak		Inter Peak		Evening Peak		Total	
Time is:	%	No.	%	No.	%	No.	%	No.
Slow	5%	2	24%	9	24%	9	18%	20
OK	79%	30	71%	27	66%	25	72%	82
Fast	16%	6	5%	2	11%	4	11%	12
TOTAL		**38**		**38**		**38**		**114**

Note: 114 routes in total – 38 in AM peak, 38 in inter peak and 38 in PM peak

5.3.4 Overall modelled journey times are within 15% of observed for 72% of routes. In the morning peak 16% and in the evening peak 11% of the routes are categorised as fast. We have compared the modelled times for these routes against timetables and found a close correlation. This implies that there is a discrepancy between timetabled and surveyed bus journey times in the peak periods.

5.3.5 There are no specific targets in the DfT guidance for journey time validation for public transport models. We are satisfied that bus journey times in the SEMMMS8-PT are well replicated for the intended use of the model as part of the SEMMMS8-VDM system for assessing the mode choice in connection with the proposed SEMMMS link road.

5.4 Route Choice

5.4.1 In order to assess the reasonableness of modelled routes, the routings between a number of locations were investigated for the morning peak. Paths were chosen to represent typical public transport journeys within the area of influence.

5.4.2 The zone pairs for the routings examined are listed in Table 5.2 .

Table 5.2 Zone Pairs for Routing Checks

Origin	Zone	Destination	Zone
Hazel Grove	638	Altrincham	728
Macclesfield	1075	Manchester Airport	294
Wilmslow	1078	Woodsmoor	564

5.4.3 In order to check the paths between zone pairs the functionality within the assignment software to load 100 trips between each zone pair was used. Separate plots were produced for each pair of zones. The resulting loadings were plotted to indicate the multiple routes chosen by TRIPS. Loading 100 trips between zones provides a visual indication of the spread

of demand across alternative routes between each zone pair, but it should be remembered that the absolute values depicted are not correct.

5.4.4 The plots from the morning peak were reviewed, and are included as Appendix E. The routings were judged to be realistic, based on our knowledge of the area and reviews of published timetables.

5.4.5 Mode shares for each of the investigated movements are shown in Table 5.3.

Table 5.3 Mode Shares for Selected Zone Pairs

		% O to D		
Origin	**Destination**	**Bus**	**Rail**	**Tram**
Hazel Grove	Altrincham	0	61	39
Macclesfield (Wilmslow)	(Wilmslow)	100	0	0
	Manchester Airport	20	80	0
Wilmslow	Woodsmoor	0	100	0

5.4.6 The data contained in Table 5.3 and illustrated in Appendix E show that the mode shares for the chosen zone pairs and the fact that two of the routes are multi-modal are reasonable based of personal knowledge of the routes chosen, as discussed below:

- for Hazel Grove to Altrincham travellers can choose between several indirect routes some multi-modal. The fastest route uses rail (29 mins), other options being via rail and metrolink (50 mins) or via bus (1hr 20mins) take longer so the modal split is reasonable;
- for the Macclesfield to Manchester Airport route, there is a choice between journeys using bus, rail or both, all which require at least 1 interchange. The peak period fare for rail is £12, bus fares using operator day tickets are less than £5. The model chooses routes with a 100% bus share from Macclesfield to Wilmslow and then a split between bus and train from Wilmslow to Manchester Airport. It seems reasonable that the model does not choose routes based solely on rail given the large difference in fares;
- for Wilmslow to Woodsmoor travellers can choose between an indirect rail service via Stockport (between 27 and 37 minute journey time), and a direct bus service (45 minute journey time). Trains between Stockport and Woodsmoor run every 30 minutes, and the plot in appendix E shows that people are choosing to walk from Stockport to Woodsmoor rather than to wait for a train. The split between bus and rail is reasonable.

5.5 Conclusion

5.5.1 This chapter has reported on network validation following DfT guidance. The majority of bus routes examined are close to observed journey times and modelled route choice for selected zone pairs has been checked and confirmed to be reasonable.

6 Matrix Validation

6.1 Introduction

6.1.1 The guidance in TAG unit 3.11.2 suggests that "Matrices should be validated by assignment to the network. Matrix level validation should involve comparisons of assigned to counted passengers across complete screenline and cordons. At this level of aggregation, the differences between assigned and counted flows should in 95% of the cases be less than 15%."

6.1.2 The guidance continues to suggest that "If the matrices do not validate satisfactorily, matrix estimation may be used to adjust the trip matrices to accord more closely with the validation counts. The changes brought about by the matrix estimation process should be examined to check for particular distortions."

6.1.3 As there was insufficient data available for the Area of Influence of the SEMMMS scheme to form complete screenlines and cordons, the TAG 3.11.2 matrix validation check has not been undertaken. Rather, a simple comparison of matrix size against other sources has been undertaken.

6.2 Comparison of Matrices with Other Sources

6.2.1 Table 6.1 contains the annualised matrix demand in SEMMMS8-PT for the full model area and the Area of Influence and Greater Manchester area.

Table 6.1 Annualised Demand in SEMMMS8-PT

	Full Model	AofI	AofI + GM
AM average hour	349,995	14,282	78,845
IP average hour	236,367	9,125	53,797
PM average hour	214,209	10,490	63,823
AM period (AM * 2.2)	769,989	31,420	173,459
IP period (IP * 5.5)	1,300,019	50,188	295,884
PM period (PM * 2.2)	471,260	23,078	140,411
12hr	2,541,267	104,685.90	609,753
24hr (12hr * 1.1)	2,795,394	115,154.49	670,728
Annual (24hr * 275)	768,733,358	31,667,485	184,450,313

6.2.2 The population in the full model is approximately 10 million people. Assuming an average of three trips per person per day, based on the trip rates from the GMATS household interview surveys, one would expect 30 million trips per day within the whole model. The SEMMMS8-PT matrix has 2.8 million trips per day in the full model, implying approximately a 9% mode share for public transport, which is highly comparable to the PT mode shares suggested by TEMPRO.

6.3 Conclusions

6.3.1 The comparison of matrix size provided above indicates that the public transport matrix size is of the correct order of magnitude according to the trip rates from the GMATS Household Interview Surveys.

7 Assignment Validation – Before Matrix Estimation

7.1 Introduction

7.1.1 In outline, the approach taken to assignment validation was to:

- tabulate comparisons of modelled and observed passenger flows;
- review assignment parameters to assess if the validation could be improved;
- apply matrix estimation; and
- repeat tabulations of comparisons of modelled and observed passenger flows.

7.1.2 Validation before the application of matrix estimation is described in this chapter. The following chapter d0escribes the matrix estimation process and tabulates the resulting assignment validation.

7.1.3 In general it is more difficult to establish patronage estimates by service or link for public transport than for road links, as for the latter continuous automated counts are often available. Therefore TAG Unit 3.11.2 suggests the following validation targets for comparison of modelled and observed passenger flows:

- modelled flows should be within 15% of the observed values on screenlines and cordons; and
- modelled flows should be within 25% of individual counts except where observed flows are less than 150 passengers.

7.1.4 The above targets are for public transport models that would be used in the assessment of public transport schemes. There are no such targets for public transport models used to facilitate a reasonable mode choice in the assessment of a highway scheme, such as the SEMMMS model.

7.1.5 GEH values have been calculated as they provide a useful comparison of the relative validation of links. Care should be taken in interpreting these GEH values. As public transport flows are typically lower than road traffic volumes the recommended values for highway assignment (ie GEH should be less than 5) are not directly relevant. GEH does however overcome the difficulty in comparing results for counts with low flows (where a relatively high percentage difference may be considered unimportant) and high flows (where a small percentage difference may be considered important). The equation for GEH is shown below:

$$GEH = \sqrt{\frac{(\text{observed flow} - \text{modelled flow})^2}{0.5 \times (\text{observed flow} + \text{modelled flow})}}$$

7.1.6 As described in Chapter 4 there was a wealth of data available for assignment validation. The following validation reports are included in Appendix F and summarised below:

- bus passenger flows across the M60 After and GMATS screenlines and cordons;
- rail boardings and alightings at surveyed stations; and

- Metrolink boardings at alightings at surveyed stations.

7.1.7 The validation within the area of influence was the main focus, with the wider model validation a secondary concern. The validation of the AofI is therefore summarised separately in the following sections.

7.2 Assignment Parameters

7.2.1 As SEMMMS8 PT was developed from a validated public transport model, the assignment parameters have remained unchanged from those described in section 3.8.

7.2.2 A summary of the assignment parameters used is shown in Table 7.1.

Table 7.1 Assignment Parameters

Parameter	Value
Value of Time – AM	£6.40 per hour
Value of Time – IP, PM	£5.39 per hour
Walk Time Factor	1.9
Wait Time Factor – All modes	1.9
Boarding Penalty - Bus	10 minutes
In Vehicle Time Factor – Bus	1
In Vehicle Time Factor – Rail	0.95
In Vehicle Time Factor – Metrolink	0.9
Transfer Penalty – within mode	2.5 minutes
Transfer Penalty – between differing modes	5 minutes

7.3 Area of Influence Validation

7.3.1 This section presents the validation against observed bus, rail and Metrolink patronage within the area of influence of the proposed SEMMMS link road, in relation to the TAG guidance summarised in paragraph 7.1.3.

7.3.2 A summary of the validation against the GMATS District Centre Cordon counts in the AofI (Altrincham and Stockport) is presented in Table 7.2 to Table 7.3. Stockport is the only District Centre to have observed data in both inbound and outbound directions. Overall 41% of links with flows in excess of 150 passengers per hour are replicated to within 25%. Modelled crossing flows are within 15% of observed total screenline crossing flows for the

inter-peak and evening peak average hours in the outbound direction. They are 66% too high for Altrincham in the morning peak average hour, in the outbound direction.

Table 7.2 – Bus District Centre Cordons Screenline Summaries (AofI) prior to Matrix Estimation

	AM			IP			PM		
	Obs	Model	% diff	Obs	Model	% diff	Obs	Model	% diff
Outbound Cordon									
Altrincham	171	283	66%	330	334	1%	559	519	-7%
Stockport	1757	1456	-17%	1942	1959	1%	2695	2987	11%
Inbound Cordon									
Stockport	2365	2489	5%	1960	1316	-33%	1624	1199	-26%

Table 7.3 - Bus Outbound Summary District Centre Cordons Individual Counts (AofI) prior to Matrix Estimation

	AM	IP	PM
Outbound Cordon			
No. links with > 150 pax / hr	6	6	10
No. links with > 150 pax / hr and difference< 25%	2	3	6
% links with > 150 pax / hr and difference <25%	33%	50%	60%
Inbound Cordon			
No. links with > 150 pax / hr	8	7	4
No. links with > 150 pax / hr and difference< 25%	3	1	2
% links with > 150 pax / hr and difference <25%	38%	14%	50%

7.3.3 The rail boarding and alighting validation in the area of influence is presented in Table 7.4. There is only observed data for the average morning and inter peak periods. The data indicate the model generally assigns lower boardings and alightings than in the observed data, apart from at Stockport, for which the modelled boardings and alightings are significantly higher than observed in the morning peak average hour. Stockport and Manchester Airport are the most significant stations within the area of influence. Most of the

stations are minor, with only small numbers of passengers using them, leading to large percentage differences for relatively small absolute differences between modelled and observed levels. The summary presented in Table 7.5 shows that only 20% of the stations with over 150 passengers per hour are within 25% of observed passengers.

Table 7.4 – Rail Boarding and Alighting Validation (AofI) prior to Matrix Estimation

	AM			IP		
	Obs	**Model**	**% diff**	**Obs**	**Model**	**% diff**
Boardings						
Airport	315	86	-73%	358	79	-78%
Heald Green	204	72	-65%	56	17	-69%
Bramhall	99	35	-65%	35	5	-86%
Cheadle Hulme	323	103	-68%	56	46	-19%
Davenport	117	47	-60%	22	6	-72%
Woodsmoor	71	6	-91%	18	1	-94%
Stockport	1009	1178	17%	349	310	-11%
Total	**2138**	**1526**	**-29%**	**894**	**463**	**-48%**
Alightings						
Airport	450	139	-69%	259	73	-72%
Heald Green	46	19	-58%	30	19	-38%
Bramhall	8	9	15%	11	6	-45%
Cheadle Hulme	85	100	17%	29	38	30%
Davenport	23	18	-23%	13	4	-69%
Woodsmoor	18	4	-77%	9	1	-87%
Stockport	671	1394	108%	257	366	42%
Total	**1301**	**1683**	**29%**	**608**	**506**	**-17%**

Table 7.5 – Rail Boarding and Alighting Summary (AofI) prior to Matrix Estimation

	AM	IP
Boardings		
No. Stations with boardings > 150 pax / hr	4	2
No. Stations with boardings > 150 pax / hr and difference< 25%	1	1
% Stations with boardings > 150 pax / hr and difference <25%	25%	50%
Alightings		
No. Stations with alighting > 150 pax / hr	2	2
No. Stations with alightings > 150 pax / hr and difference< 25%	0	0
% Stations with alightings > 150 pax / hr and difference <25%	0%	0%

7.3.4 Table 7.6 presents the Metrolink boarding and alighting validation within the area of influence. At a summary level, the modelled patronage is of the right order of magnitude, however, at a detailed level, some station's modelled patronages are significantly different from observed data. Sale and Dane Road have considerable variation from the observed data across most of the modelled time periods.

Table 7.6 – Metrolink Boarding and Alighting Validation (AofI) prior to Matrix Estimation

	AM			IP			PM		
	Obs	**Model**	**% diff**	**Obs**	**Model**	**% diff**	**Obs**	**Model**	**% diff**
Boardings									
Altrincham	361	275	-24%	208	206	-1%	369	277	-25%
Navigation Road	100	195	94%	31	57	84%	34	85	153%
Timperley	251	278	11%	135	70	-48%	131	75	-43%
Brooklands	418	215	-49%	84	43	-48%	91	55	-40%
Sale	104	445	328%	87	138	58%	148	184	24%
Dane Road	38	109	184%	35	26	-26%	77	17	-77%
Totals	**1273**	**1518**	**19%**	**580**	**540**	**-7%**	**850**	**693**	**-18%**
Alightings									
Altrincham	487	448	-8%	158	123	-22%	306	276	-10%
Navigation Road	33	58	74%	23	25	10%	79	81	2%
Timperley	105	43	-59%	115	84	-27%	287	71	-75%
Brooklands	64	30	-52%	60	44	-26%	265	156	-41%
Sale	165	121	-27%	73	155	112%	109	265	144%
Dane Road	95	34	-64%	50	22	-55%	97	60	-38%
Totals	**948**	**734**	**-23%**	**478**	**454**	**-5%**	**1142**	**908**	**-20%**

7.3.5 Table 7.7 presents the summary Metrolink validation and shows that only a small number of stations exceed 150 passengers per hour in each modelled time period. Of these 64% of modelled flows are within 25% of the observed values.

Table 7.7 - Metrolink Boarding and Alighting Summary (AofI) prior to Matrix Estimation

	AM	IP	PM
Boardings			
No. Stations with boardings > 150 pax / hr	3	1	1
No. Stations with boardings > 150 pax / hr and difference< 25%	2	1	1
% Stations with boardings > 150 pax / hr and difference <25%	67%	100%	100%
Alightings			
No. Stations with alighting > 150 pax / hr	2	1	3
No. Stations with alightings > 150 pax / hr and difference< 25%	1	1	1
% Stations with alightings > 150 pax / hr and difference <25%	50%	100%	33%

7.3.6 There is only a small amount of observed data within the area of influence that is available to validate the performance of the model. The comparisons presented in the tables above indicate that while the matrix is of the correct order of magnitude, the distribution and submode share could be improved. The differences between the modelled and observed data are most likely associated with the synthesis undertaken in this area of the matrix.

7.4 Wider Model Summary Validation

7.4.1 As explained previously, the validation of the public transport model within the area of influence is of the most significance to the SEMMMS modelling. However, to ensure that the wider model was performing satisfactorily, a wider model validation was also undertaken, a summary of which is presented in this section. Table 7.8 presents a summary of the bus patronage validation against the GMATS District Centre Cordon counts (at the sites shown in Figure 4.1. The M60 Inner cordon has the best validation, however it should be noted that only a small number of links on this cordon have greater than 150 passengers per hour. Across the other cordons, there are between 18% and 67% of the links with greater than 150 passengers per hour with the modelled flow within 25%. The summary validation presented in Table 7.9 shows that in the inter peak average hour, just over half of the links with greater than 150 passengers per hour have modelled flows within 25%. The peak periods have around 40% of links within this category.

Table 7.8 - Bus Cordon Summary prior to Matrix Estimation

		No. links with > 150 pax / hr	No. links with > 150 pax / hr and difference < 25%	% links with >150 pax / hr and difference <25%
M60 After Inner	AM	3	3	100%
	IP	5	4	80%
	PM	3	5	67%
M60 After Outer	AM	16	6	31%
	IP	12	9	60%
	PM	15	8	60%
District Centres	AM	28	11	39%
	IP	37	18	49%
	PM	44	25	57%
Manchester University	AM	11	4	36%
	IP	9	6	67%
	PM	14	3	21%
Manchester City Centre	AM	21	5	24%
	IP	19	8	42%
	PM	22	4	18%

Table 7.9 – Bus Overall Summary prior to Matrix Estimation

	AM	IP	PM
No. links with > 150 pax / hr	79	82	100
No. links > 150 pax / hr and difference< 25%	28	42	43
% links > 150 pax / hr and difference <25%	35%	51%	43%

7.4.2 The rail boarding and alighting validation for the wider model is presented for the average morning and interpeak hours in Table 7.10. At best, 43% of stations with greater than 150 passengers per hour have modelled boardings within 25% of the observed.

Table 7.10 – Rail Boarding and Alighting Summary (Wider Model) prior to Matrix Estimation

	AM	IP
Boardings		
No. Stations with boardings > 150 pax / hr	16	7
No. Stations with boardings > 150 pax / hr and difference< 25%	5	3
% Stations with boardings > 150 pax / hr and difference <25%	**31%**	**43%**
Alightings		
No. Stations with alighting > 150 pax / hr	9	4
No. Stations with alightings > 150 pax / hr and difference< 25%	2	0
% Stations with alightings > 150 pax / hr and difference <25%	**22%**	**0%**

7.4.3 The wider model Metrolink boarding and alighting validation is presented in Table 7.11. The best performing period is the inter-peak alightings, with 100% of the stations with greater than 150 passengers per hour modelled within 25% of the observation. Overall 62% of these high patronage stations meet this criteria.

Table 7.11 - Metrolink Boarding and Alighting Summary (Wider Model) prior to Matrix Estimation

	AM	IP	PM
Boardings			
No. Stations with boardings > 150 pax / hr	17	8	9
No. Stations with boardings > 150 pax / hr and difference< 25%	6	3	4
% Stations with boardings > 150 pax / hr and difference <25%	**35%**	**38%**	**44%**
Alightings			
No. Stations with alighting > 150 pax / hr	4	2	12
No. Stations with alightings > 150 pax / hr and difference< 25%	2	2	3
% Stations with alightings > 150 pax / hr and difference <25%	**50%**	**100%**	**25%**

7.5 Conclusions

7.5.1 The validation within the area of influence and in the wider model show that the model is not sufficiently close to TAG recommendations to be used within the SEMMMS modelling system. A further review of the coded networks, including network speeds, walk and access arrangements was undertaken, but no errors were found. In order to improve model validation, it was decided to make use of the matrix estimation techniques, with the estimation process and results are discussed in the following chapter.

8 Assignment Validation – After Matrix Estimation

8.1 Overview

8.1.1 Matrix adjustment was carried out using the matrix estimation capabilities of the TRIPS suite. The following data are required for matrix estimation:

- a "prior" demand matrix – in this case the demand matrices developed from the M60 After and GMATS bus and rail data, ticket sales data, Census Journey-to-Work and synthetic estimates (described in Chapter 4); and
- passenger count data – in this case:
  - bus passenger flows across the GMATS and M60 After survey screenlines and cordons, illustrated in Figure 4.1 and Figure 4.2;
  - Metrolink boardings and alightings for all stations (excluding city centre); and
  - rail boardings and alightings for most stations (excluding city centre).

8.1.2 There will inevitably be inconsistencies between sources of data (due to variability of demand on different days and errors in the survey data). Matrix estimation, as implemented by TRIPS, uses statistical procedures to establish the demand matrix which is most likely to explain the input data. Confidence levels were assigned to the input data which reflected the greater reliability of the passenger count data relative to individual cells of the prior matrices. Confidence levels were set based on professional judgement and adjusted to achieve the best level of fit to passenger count data without unduly distorting the matrix. The confidence settings were as follows:

- rail and metrolink boarding and alighting counts 50
- individual bus passenger flows 25
- screenline bus passenger flows 50
- individual matrix cells 3
- matrix trip ends 8

8.1.3 Checks were made to ensure that the input matrices were not unduly distorted by the matrix estimation process. These checks included:

- reviewing changes in matrices - in total and at a sector level;
- examining trip length distributions (i.e. proportion of demand by trip distance band) of the input and calibrated matrix; and
- reviewing changes to trip ends due to the estimation process.

8.1.4 Prior and estimated matrix totals are compared in Table 8.1, and show that the matrix estimation has resulted in only a small change in the absolute number of trips in the full model. In percentage terms, there is a slightly larger impact within the area of influence, however the absolute differences in number of trips is less than 500 in all time periods.

Table 8.1 - Matrix Totals Before and After Matrix Estimation

	Full Model			GM + AofI			AofI		
Time Period	Before ME	After ME	% Change	Before ME	After ME	% Change	Before ME	After ME	% Change
AM	349,995	349,777	-0.1%	78,845	79,261	0.5%	14,282	15,417	7.9%
IP	236,367	238,154	0.8%	53,797	56,003	4.1%	9,125	9,642	5.7%
PM	214,209	217,051	1.3%	63,823	66,951	4.9%	10,490	10,634	1.4%

8.1.5 Matrix estimation has only marginally changed matrix totals. Comparisons of the prior and estimated matrices at a sector to sector level are presented in Appendix G. The sector level is a 16 sector system. The largest changes in absolute terms, in each time period, were in sector 5, which is north of Manchester, and is one of the largest sectors in terms of demand. Generally, there is only a small impact of the matrix estimation by sector.

8.1.6 Trip length distributions for the prior and estimated matrices are presented in Figure 8.1 to Figure 8.3. They show that the trip length distribution before and after matrix estimation have not changed significantly. Over 50% of trips in each of the modelled time periods are less than 5km, which is due to the use of the Journey to Work data for the synthesis of demand within the Area of Influence. The change in average trip length in each modelled time period is tabulated in Table 8.2, showing that the matrix estimation led to a very small increase in average trip length in each time period.

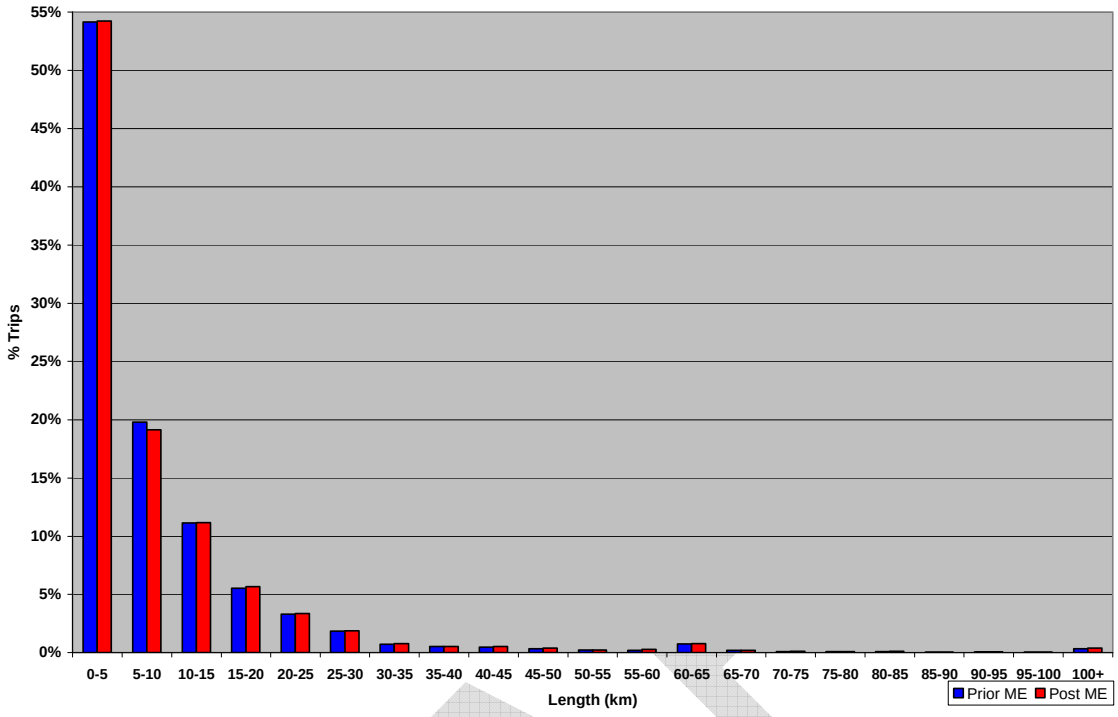

Figure 8.1 Morning Peak Trip Length Distribution Before and After Matrix Estimation

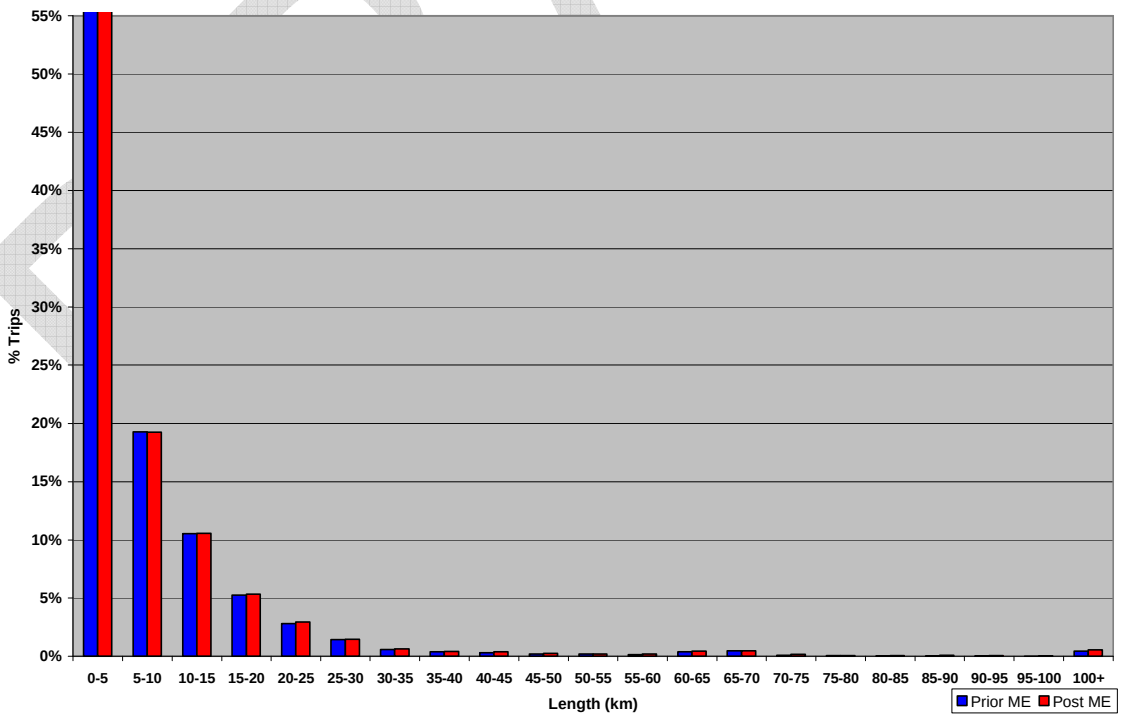

Figure 8.2 Inter peak Trip Length Distribution Before and After Matrix Estimation

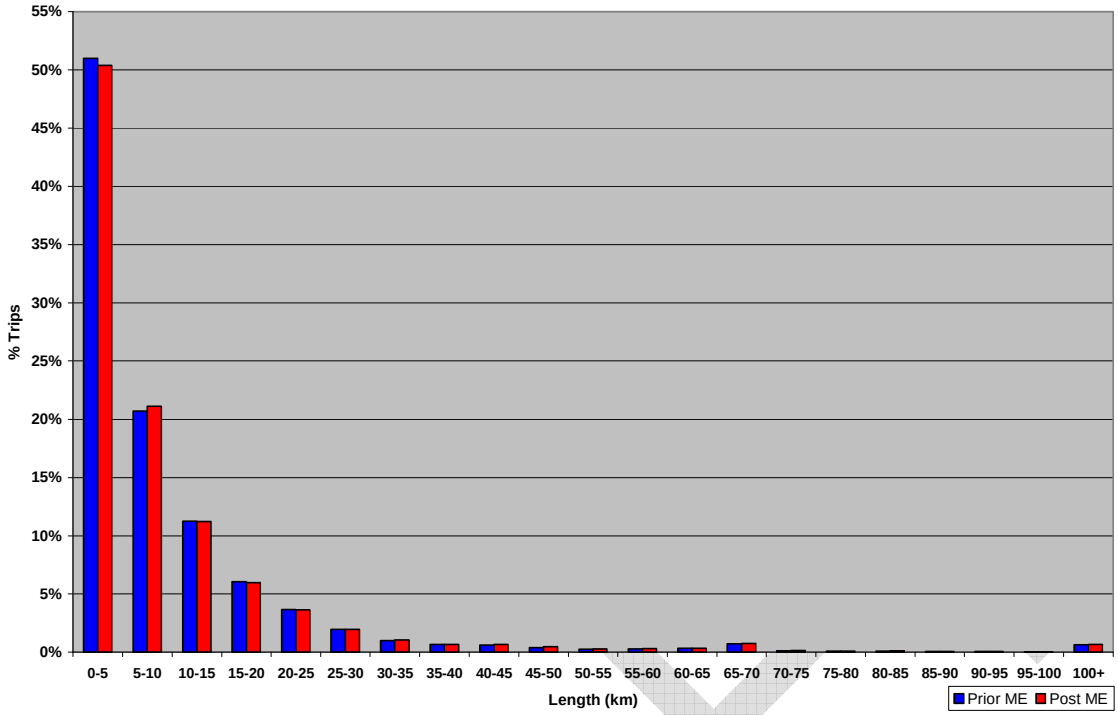

Figure 8.3 Evening Peak Trip Length Distribution Before and After Matrix Estimation

Table 8.2 - Mean Trip Lengths (km)

	Before Matrix Estimation	After Matrix Estimation
AM Peak	7.8	8.1
Inter Peak	7.4	8.0
PM Peak	9.2	9.5

8.1.7 Changes in trips ends as a result of matrix estimation were examined, to check for large changes in trips to or from any zones. The findings were as follows:

- the largest percentage changes in trip ends occur mostly in zones with relatively small number of trips ends;
- the largest absolute variations in origin / destination trip ends occur mostly for zones where the original number of origin / destination trips was high.

8.1.8 Trip ends were not substantially modified by the matrix estimation process. Plots of trip ends before and after estimation are included in Appendix H, annotated with trend lines illustrating the relationship between pre and post estimation trip ends. A close relationship is indicated by the proximity of the slope and R^2 value to 1.

8.1.9 All the plots contained in Appendix H exhibit a strong correlation between the prior and post estimation matrices. All the trend lines have slopes between 0.997 and 1.005 and R^2 values between 0.998 and 1.000.

8.1.10 Detailed validation tables of assignments undertaken after matrix estimation are included in Appendix I, with summary validation tables provided in this chapter.

8.2 Area of Influence Validation

8.2.1 This section presents the validation against observed bus, rail and Metrolink patronage within the area of influence of the proposed SEMMMS link road, in relation to the TAG guidance summarised in paragraph 7.1.3.

8.2.2 A summary of the validation against the GMATS District Centre Cordon counts in the AofI (Altrincham and Stockport) is presented in Table 8.3 to Table 8.4. Overall 73% (41% prior to ME) of links with flows in excess of 150 passengers per hour are replicated to within 25%. All modelled crossing flows are within 15% of observed total screenline crossing flows except for Altrincham Outbound AM and Stockport Inbound IP which are slightly under the target at 21% too low. This validation is greatly improved compared to the prior ME validation.

Table 8.3 – Bus District Centre Cordons Screenline Summaries (AofI) after Matrix Estimation

	AM			IP			PM		
	Obs	Model	% diff	Obs	Model	% diff	Obs	Model	% diff
Outbound Cordon									
Altrincham	171	136	-21%	330	335	1%	559	468	-16%
Stockport	1757	1490	-15%	1942	1785	-8%	2695	2527	-6%
Inbound Cordon									
Stockport	2365	2018	-15%	1960	1562	-20%	1624	1357	-16%

Table 8.4 - Bus Summary District Centre Cordons Individual Counts (AofI) after Matrix Estimation

	AM	IP	PM
Outbound Cordon			
No. links with > 150 pax / hr	6	6	10
No. links with > 150 pax / hr and difference< 25%	4	4	8
% links with > 150 pax / hr and difference <25%	67%	67%	80%
Inbound Cordon			
No. links with > 150 pax / hr	8	7	4
No. links with > 150 pax / hr and difference< 25%	6	5	3
% links with > 150 pax / hr and difference <25%	75%	71%	75%

8.2.3 The rail boarding and alighting validation in the area of influence is presented in Table 8.5. The post matrix estimation validation shows that in general all modelled flows have increased, this has resulted in modelled boardings or alightings being within 15% of observed counts in 61% of cases. However, this has also resulted in modelled flows for Stockport now being even higher than the prior ME validation. The summary presented in Table 8.6 shows that for the larger stations with over 150 passengers per hour 60% of modelled flows are within 25% of observed passengers which is an improvement from the prior to matrix estimation case (20%).

Table 8.5 – Rail Boarding and Alighting Validation (AofI) after Matrix Estimation

	AM			IP		
	Obs	Model	% diff	Obs	Model	% diff
Boardings						
Airport	315	285	-9%	358	307	-14%
Heald Green	204	193	-5%	56	45	-19%
Bramhall	99	95	-4%	35	30	-13%
Cheadle Hulme	323	323	0%	56	64	14%
Davenport	117	112	-4%	22	22	1%
Woodsmoor	71	61	-14%	18	8	-57%
Stockport	1009	1939	92%	349	681	95%
Total	**2138**	**3009**	**41%**	**894**	**1157**	**29%**
Alightings						
Airport	450	413	-8%	259	214	-17%
Heald Green	46	48	4%	30	29	-5%
Bramhall	8	9	7%	11	9	-19%
Cheadle Hulme	85	119	40%	29	45	57%
Davenport	23	22	-2%	13	13	3%
Woodsmoor	18	16	-11%	9	6	-35%
Stockport	671	1701	154%	257	573	123%
Total	**1301**	**2328**	**79%**	**608**	**889**	**46%**

8.2.4 The model has considerably more passengers modelled for Stockport than were observed in the surveys. However the counts used are from 2004, and were not uplifted to the model base year of 2009. Published data from the Office of the Rail Regulator indicate that passengers using Stockport increased by over 70% between 2004 and 2009, and therefore the observed data used in the validation may be too low. The ORR data could not be used directly in the validation because it is only available as total annual patronage.

Table 8.6 – Rail Boarding and Alighting Summary (AofI) after Matrix Estimation

	AM	IP
Boardings		
No. Stations with boardings > 150 pax / hr	4	2
No. Stations with boardings > 150 pax / hr and difference< 25%	3	1
% Stations with boardings > 150 pax / hr and difference <25%	75%	50%
Alightings		
No. Stations with alighting > 150 pax / hr	2	2
No. Stations with alightings > 150 pax / hr and difference< 25%	1	1
% Stations with alightings > 150 pax / hr and difference <25%	50%	50%

8.2.5 Table 8.7 presents the Metrolink boarding and alighting validation within the area of influence. As prior to ME, at a summary level, the modelled patronage is of the right order of magnitude, however, at a detailed level, some station's modelled patronage are significantly different from observed data. Table 8.8 presents the summary Metrolink validation for stations with larger passenger flows and shows that overall 73% of these have modelled flows within 25% of the observed values showing an improvement over the prior ME case (64%).

Table 8.7 – Metrolink Boarding and Alighting Validation (AofI) after Matrix Estimation

	AM			IP			PM		
	Obs	**Model**	**% diff**	**Obs**	**Model**	**% diff**	**Obs**	**Model**	**% diff**
Boardings									
Altrincham	361	348	-4%	208	216	4%	369	352	-5%
Navigation Road	100	188	87%	31	46	50%	34	69	106%
Timperley	251	271	8%	135	74	-45%	131	53	-60%
Brooklands	418	283	-32%	84	54	-36%	91	56	-39%
Sale	104	488	369%	87	199	128%	148	179	21%
Dane Road	38	111	189%	35	32	-9%	77	19	-76%
Totals	**1273**	**1689**	**33%**	**580**	**622**	**7%**	**850**	**727**	**-14%**
Alightings									
Altrincham	487	475	-3%	158	165	5%	306	323	6%
Navigation Road	33	50	49%	23	40	74%	79	144	82%
Timperley	105	40	-62%	115	72	-37%	287	120	-58%
Brooklands	64	26	-59%	60	51	-14%	265	242	-8%
Sale	165	114	-31%	73	144	97%	109	366	237%
Dane Road	95	33	-65%	50	40	-19%	97	68	-30%
Totals	**948**	**737**	**-22%**	**478**	**513**	**7%**	**1142**	**1264**	**11%**

Table 8.8 - Metrolink Boarding and Alighting Summary (AofI) after Matrix Estimation

	AM	IP	PM
Boardings			
No. Stations with boardings > 150 pax / hr	3	1	1
No. Stations with boardings > 150 pax / hr and difference< 25%	2	1	1
% Stations with boardings > 150 pax / hr and difference <25%	67%	100%	100%
Alightings			
No. Stations with alighting > 150 pax / hr	2	1	3
No. Stations with alightings > 150 pax / hr and difference< 25%	1	1	2
% Stations with alightings > 150 pax / hr and difference <25%	50%	100%	67%

8.3 Wider Model Summary Validation

8.3.1 As explained previously, the validation of the public transport model within the area of influence is of the most significance to the SEMMMS modelling. However, to ensure that the wider model was performing satisfactorily, a wider model validation was also undertaken, a summary of which is presented in this section. Table 8.9 presents a summary of the bus patronage validation against the GMATS District Centre Cordon counts (at the sites shown in Figure 4.1. The M60 Inner cordon has the best validation as in the prior ME case. Across the other cordons the validation is much improved over the prior ME case, there are now between 59% and 89% (previously 18% and 67%) of the links with greater than 150 passengers per hour and with the modelled flow within 25%. The summary validation presented in Table 8.10 shows that 79% to 80% of the links with greater than 150 passengers per hour have modelled flows within 25% which is much improved over the prior ME case where less than 40% of links met this criteria.

Table 8.9 - Bus Cordon Summary after Matrix Estimation

		No. links with > 150 pax / hr	No. links with > 150 pax / hr and difference < 25%	% links with >150 pax / hr and difference <25%
M60 After Inner	AM	3	3	100%
	IP	5	3	60%
	PM	5	5	100%
M60 After Outer	AM	16	11	69%
	IP	12	8	67%
	PM	15	12	80%
District Centres	AM	28	23	82%
	IP	37	33	89%
	PM	44	39	89%
Manchester University	AM	11	9	82%
	IP	9	8	89%
	PM	14	10	71%
Manchester City Centre	AM	21	17	81%
	IP	19	14	74%
	PM	22	13	59%

Table 8.10 – Bus Overall Summary after Matrix Estimation

	AM	IP	PM
No. links with > 150 pax / hr	79	82	100
No. links > 150 pax / hr and difference< 25%	63	66	79
% links > 150 pax / hr and difference <25%	80%	80%	79%

8.3.2 For the wider model rail boarding and alighting validation the average morning and interpeak hours is presented in Table 8.11. The validation is much improved over the prior ME case as 69% and 43% (previously 31% and 43%) of stations with greater than 150 passengers per hour have modelled boardings within 25% of observed, and 78% and 75% (previously 22% and 0%) of stations with greater than 150 passengers per hour have modelled alightings within 25% of observed.

Table 8.11 – Rail Boarding and Alighting Summary (Wider Model) after Matrix Estimation

	AM	IP
Boardings		
No. Stations with boardings > 150 pax / hr	16	7
No. Stations with boardings > 150 pax / hr and difference< 25%	11	3
% Stations with boardings > 150 pax / hr and difference <25%	**69%**	**43%**
Alightings		
No. Stations with alighting > 150 pax / hr	9	4
No. Stations with alightings > 150 pax / hr and difference< 25%	7	3
% Stations with alightings > 150 pax / hr and difference <25%	**78%**	**75%**

8.3.3 The wider model Metrolink boarding and alighting validation is presented in Table 8.12. The validation is improved over the prior ME case as overall 67% (previously 62%) of high patronage links are within 25% of the observed values.

Table 8.12 - Metrolink Boarding and Alighting Summary (Wider Model) after Matrix Estimation

	AM	IP	PM
Boardings			
No. Stations with boardings > 150 pax / hr	17	8	9
No. Stations with boardings > 150 pax / hr and difference< 25%	7	4	6
% Stations with boardings > 150 pax / hr and difference <25%	**41%**	**50%**	**67%**
Alightings			
No. Stations with alighting > 150 pax / hr	4	2	12
No. Stations with alightings > 150 pax / hr and difference< 25%	2	2	6
% Stations with alightings > 150 pax / hr and difference <25%	**50%**	**100%**	**50%**

8.4 Conclusions

8.4.1 Following matrix estimation the validation is much improved. The validation targets suggested in TAG Unit 3.11.2 have not been fully reached however, these targets are for public transport models that would be used for the assessment of public transport schemes. The validation of the model is reasonable given that it is intended for use in the assessment of a highway scheme which does not include any public transport interventions.

9 Conclusions

9.1 Overview

9.1.1 This report has described the work undertaken by MVA Consultancy to develop the public transport assignment model of Greater Manchester (SPM2-PT) to be used as a constituent element of SEMMMS8-VDM. The model has been updated in the area of influence for the proposed SEMMMS road scheme.

9.1.2 The validation of the model prior to undertaking matrix estimation is poor for each of the public transport sub-modes. However, having undertaken matrix estimation, the validation has improved significantly with the model comparing favourably to the criteria used for models used in the assessment of public transport schemes.

9.1.3 The model base year is 2009, with average hours within the following time periods represented:

- morning peak: 0700-0930.
- inter-peak: 0930-1600.
- evening peak: 1600-1900.

9.2 Demand Data

9.2.1 Demand matrices for the SPM2-PT were developed using the following sources:

- GMATS and M60 After survey rail and bus origin / destination surveys provided demand for trips which cross, start or finish in the study area; and
- Movements not captured by GMATS or M60 After origin / destination surveys were developed from available data (LENNON, TVM, Census JTW, local O/D surveys), and used to infill the GMATS/M60 matrices. The resulting matrices were then smoothed.

9.3 Supply Data

9.3.1 The supply representation was developed from the SEMMMS8 SATURN model, with rail, Metrolink and walk links added from SPM2-PT. Public transport services have been taken from SPM2-PT and supplemented by additional services within the Area of Influence from the SEMMMS8 SATURN model and published timetable information.

9.4 Model Parameters and Algorithms

9.4.1 TRIPS was used to implement the assignment algorithm making use of the Sub-Mode Choice and Enhanced Service Models. Assignment parameters (value of time, walk and wait time factors, boardings and interchange factors) were set with as used in the previously validated SPM2 PT model, which were in line with DfT guidance.

9.5 Validation

9.5.1 Chapters 5 to 8 report the validation of the revised model in accordance with DfT guidance. Model validation followed the advice given in TAG Unit 3.11.2.

9.5.2 The supply side validation, presented in Chapter 5 demonstrates that the model contains a satisfactory replication of the public transport provision in Greater Manchester and the Area of Influence. The following comparisons were made:

- comprehensive checking of network coding;
- modelled and observed journey times on bus corridors; and
- modelled routings checked for plausibility.

9.5.3 The validation of the demand matrices, in Chapter 6, was undertaken by comparing:

- the implied daily total public transport trips, from the matrices, with the number of trips implied by the HIS trip rates.

9.5.4 Detailed assignment validation of the matrices before and after matrix estimation within the Area of Influence and across the wider modelled area, was presented in Chapters 7 and 8 respectively. Validation was undertaken utilising:

- bus passenger flows across the M60 After and GMATS screenlines and cordons;
- rail boardings and alightings at surveyed stations; and
- Metrolink boardings at alightings at surveyed stations.

9.5.5 Matrix estimation was undertaken but was shown not to have a significant impact on the total size of the matrices or the trip distribution.

9.6 Conclusion

9.6.1 This report has demonstrated that the SEMMMS8 Public Transport Model is appropriate for the appraisal of a large highway scheme with no public transport intervention, allowing a reasonable mode choice to be modelled.

Appendix A
Summary of Bus, Rail and Metrolink Services

1.1 Summary

1.1.1 This appendix lists the routes coded in the TRIPS lines files, together with the GMPTE database number;

Table 1

Line No	TRIPS Line Name	Database Route Number	Headway (minutes) AM	IP	PM
1	Mancheste->Mancheste	1D		6	
3	Mancheste->Mancheste	2B	10	10	10
4	Mancheste->Mancheste	3A	8	10	10
5	Outside G->Outside G	3B		150	60
6	Outside G->Altrincha	5E	30	30	30
7	Altrincha->Outside G	5E	30	30	60
9	Rochdale ->Rochdale	6A	15	15	30
11	Stockport->Ashton TC	7A	20	20	20
12	Ashton TC->Stockport	7A	20	20	20
13	Rochdale ->Rochdale	7C	15	15	15
14	Bolton TC->Mancheste	8A		8	12
16	Mancheste->Bolton TC	8A	9	8	8
17	Winton->Mancheste	10A		20	20
19	Mancheste->Winton	10A	20	20	20
20	Altrincha->Stockport	11D	10	10	12
21	Stockport->Altrincha	11D	12	10	30
23	Mancheste->Leigh	12B	30	30	60
26	Leigh->Mancheste	12B	60	27	
29	Middleton->Middleton	12C	30	30	60
30	Altrincha->Altrincha	13D	30	30	30
32	Davyhulme->Mancheste	15B	10	12	15
34	Mancheste->Davyhulme	15B	15	12	10
35	Rochdale ->Mancheste	16A	60	33	30
36	Mancheste->Rochdale	16A	60	30	20
37	Altrincha->Mancheste	16B	30	30	30
38	Mancheste->Altrincha	16B	30	30	30
40	Rochdale ->Mancheste	17		7	8
41	Mancheste->Rochdale	17	9	43	
42	Mancheste->Rochdale	17		9	10
43	Trafford ->Altrincha	18B	30	30	30
44	Altrincha->Trafford	18B	30	30	30
45	Altrincha->Ringway	19D	12	15	15
46	Ringway->Altrincha	19D	12	15	15
47	Outside G->Leigh	19H	30	30	20
48	Leigh->Outside G	19H	20	30	30
49	Timperley->Bowdon	20	30	30	30
51	Bowdon->Timperley	20	30	30	30
56	Altrincha->Altrincha	21		60	
57	Stockport->Bolton TC	22	30	50	30
58	Stockport->Bolton TC	22		75	
59	Bolton TC->Stockport	22		43	60
60	Bolton TC->Stockport	22	30	100	60
63	Trafford ->Stockport	23C	30	30	30
64	Stockport->Trafford	23C	30	30	30
66	Rochdale ->Mancheste	24	15	15	30
68	Mancheste->Rochdale	24	15	15	15
69	Leigh->Mancheste	26	30	300	
70	Leigh->Mancheste	26		33	30
71	Mancheste->Leigh	26	30	30	30
72	Swinton->Mancheste	27		60	60
74	Mancheste->Swinton	27	60	60	60
75	Leigh->Outside G	28A	30	60	60
76	Outside G->Leigh	28A	60	60	
78	Stockport->Stockport	28C	20	20	20
79	Farnworth->Mancheste	31		60	
81	Mancheste->Farnworth	31	60	60	
83	Mancheste->Wigan TC	32	30	30	

85	Wigan TC->Mancheste	32	30	30	60
86	Worsley->Mancheste	33	15	15	20
88	Mancheste->Worsley	33	15	15	15
90	Outside G->Leigh	34C	20	20	20
92	Leigh->Outside G	34C	20	20	20
94	Bolton TC->Mancheste	36	10	10	15
95	Mancheste->Bolton TC	36	10	10	10
96	Altrincha->Outside G	37		60	60
97	Outside G->Altrincha	37	60	60	60
98	Bolton TC->Mancheste	37A	15	10	15
100	Mancheste->Bolton TC	37A	10	10	10
102	Altrincha->Outside G	38	60	60	60
103	Outside G->Altrincha	38	60	60	60
105	Ashton TC->Ashton TC	38C	30	30	30
107	Ashton TC->Ashton TC	39A	30	30	30
108	Outside G->Outside G	3A	60	100	
110	Sale->Mancheste	41	15	20	30
111	Altrincha->Mancheste	41	60	30	30
114	Mancheste->Sale	41	20	20	20
115	Mancheste->Altrincha	41	30	30	30
117	Ashton TC->Dukinfiel	41C	30	30	30
119	Dukinfiel->Ashton TC	41C	30	30	30
120	Stockport->Mancheste	42D	12	10	12
121	Mancheste->Stockport	42D	10	10	10
122	Didsbury->Mancheste	42J	5	5	10
123	Didsbury->Mancheste	42J	10	9	30
125	Mancheste->Didsbury	42J	10	5	9
127	Mancheste->Didsbury	42J	12	13	12
128	Mancheste->Didsbury	42J	30	300	20
129	Mancheste->Didsbury	42J	60	25	
130	Mancheste->Ringway	43	10	10	10
131	Ringway->Mancheste	43	15	10	10
132	Northende->Baguley	43C		300	
133	Gatley->Mancheste	44	60	60	60
134	Mancheste->Gatley	44	60	60	60
136	Mancheste->Mancheste	46	30	30	
138	Mancheste->Mancheste	47	60	30	
139	Mancheste->Northende	48		300	
140	Mancheste->Northende	48	30	20	20
141	Northende->Mancheste	48	20	20	15
142	Didsbury->Mancheste	50	5	10	9
143	Burnage->Levenshul	50		300	
144	Burnage->Ardwick	50		300	
145	Burnage->Mancheste	50		300	
148	Mancheste->Didsbury	50	8	9	8
149	Crumpsall->Mancheste	51B	60	60	60
150	Pendleton->Mancheste	51B	30	30	60
151	Pendleton->Crumpsall	51B	60	30	20
154	Mancheste->Crumpsall	51B	60	60	60
155	Mancheste->Pendleton	51B	30	30	60
157	Crumpsall->Pendleton	51B	60	30	30
159	Oldham TC->Pendleton	52	30	30	30
161	Pendleton->Oldham TC	52	30	30	
163	Cheetham ->Pendleton	53	20	20	20
165	Pendleton->Cheetham	53	20	20	20
167	Longsight->Hulme	54A		33	
169	Hulme->Longsight	54A		33	
171	Pendleton->Eccles	55	60	60	60
172	Eccles->Pendleton	55	60	60	
173	Rochdale ->Middleton	58	15	15	30
175	Middleton->Rochdale	58	20	15	15
176	Mancheste->Shaw	59	15	15	15
177	Shaw->Mancheste	59	15	15	30
179	Eccles->Eccles	61A		30	30
180	Eccles->Eccles	62A	60	60	
181	Outside G->Marple	62B	60	75	
182	Outside G->Outside G	62B		300	
183	Outside G->Marple	62B		300	
184	Outside G->Outside G	62B		150	
186	Marple->Outside G	62B	60	60	
187	Outside G->Outside G	62B		100	
192	Mancheste->Oldham TC	64A	30	30	30
194	Oldham TC->Mancheste	64A	30	30	
195	Eccles->Eccles	64B		150	

196	Eccles->Eccles	65B		100	
198	Mancheste->Cadishead	67	10	10	10
199	Cadishead->Mancheste	67		12	10
201	Cadishead->Mancheste	67	12	75	
202	Outside G->Mancheste	67A		300	
203	Mancheste->Outside G	67A		300	
204	Bolton TC->Mancheste	68		20	60
206	Mancheste->Bolton TC	68	20	20	20
208	Eccles->Salford Q	69		300	
209	Eccles->Stretford	69		75	60
211	Salford Q->Eccles	69		300	60
212	Stretford->Eccles	69		75	
214	Swinton->Seedley	70B		60	60
216	Seedley->Swinton	70B		60	
219	Pendleton->Swinton	72	60	60	
220	Swinton->Pendleton	72	60	60	
221	Oldham TC->Mancheste	72A	60	30	30
222	Oldham TC->Chadderto	72A		300	
224	Mancheste->Oldham TC	72A		60	60
226	Mancheste->Oldham TC	72A		60	60
227	Swinton->Mancheste	73B		60	
228	Mancheste->Swinton	73B	60	60	
229	Pendleton->Pendleton	74A	60	60	
233	Pendleton->Pendleton	75A		60	60
235	Mancheste->Oldham TC	76	15	15	30
239	Oldham TC->Mancheste	76	15	15	30
241	Mancheste->Mancheste	77A	60	20	
245	Mancheste->Mancheste	77A		20	20
249	Mancheste->Middleton	80A	20	20	20
250	Middleton->Mancheste	80A	20	20	20
251	Spring Hi->Mancheste	81	10	10	15
252	Mancheste->Spring Hi	81	10	10	10
254	Spring Hi->Mancheste	82	12	10	15
255	Mancheste->Spring Hi	82	10	10	15
258	Sholver->Mancheste	83A	10	10	20
259	Mancheste->Sholver	83A	10	10	12
261	Withingto->Mancheste	84	60	30	60
263	Mancheste->Withingto	84	60	30	60
264	Chorlton-->Mancheste	85	6	10	15
265	Mancheste->Chorlton-	85	10	10	8
266	Chorlton-->Mancheste	86	3	5	10
269	Mancheste->Chorlton-	86	5	5	5
270	Mancheste->Mancheste	88	10	10	10
272	Mancheste->Mancheste	89C	12	10	15
274	Bury TC->Mancheste	93		20	20
276	Mancheste->Bury TC	93	20	20	20
277	Pendleton->Bolton TC	95B	30	30	60
278	Bolton TC->Pendleton	95B	30	30	60
279	Simister->Mancheste	96	60	60	
280	Mancheste->Simister	96	60	60	60
282	Bury TC->Mancheste	98A	12	10	60
283	Mancheste->Bury TC	98A	10	10	10
285	Ashton-On->Mancheste	99A		60	
287	Mancheste->Ashton-On	99A		60	60
290	Outside G->Mancheste	TP		300	
292	Outside G->Unknown s	TP		75	
293	Mancheste->Outside G	TP		150	
296	Unknown s->Outside G	TP		100	
298	Heywood->Heywood	X1A		75	
299	Mancheste->Trafford	100C	30	30	30
301	Mancheste->Outside G	100C	60	60	60
306	Trafford ->Mancheste	100C		30	30
307	Outside G->Mancheste	100C		60	
309	Mancheste->Wythensha	101	12	10	10
310	Wythensha->Mancheste	101	12	10	15
312	Wythensha->Mancheste	104	60	30	30
313	Mancheste->Wythensha	104	30	30	30
315	Ringway->Mancheste	105	60	30	30
316	Mancheste->Ringway	105	30	30	30
318	Newall Gr->Mancheste	109	60	30	30
319	Mancheste->Newall Gr	109	30	30	30
320	Chorlton-->Mancheste	111A	6	8	10
321	Mancheste->Chorlton-	111A	10	8	8
322	Middleton->Mancheste	112A	20	20	20

323	Mancheste->Middleton	112A	30	20	10
325	Outside G->Wigan TC	113	60	60	60
327	Wigan TC->Outside G	113	60	60	60
332	Middleton->Middleton	115C		60	
333	Middleton->Middleton	116		60	
334	Mancheste->Crumpsall	118	20	20	20
337	Crumpsall->Mancheste	118	20	20	15
339	Mancheste->Middleton	123	10	10	12
341	Middleton->Mancheste	124A	12	10	30
343	Outside G->Bolton TC	125	15	15	60
347	Bolton TC->Outside G	125	12	15	30
349	Middleton->Middleton	125B		60	
350	Outside G->Bolton TC	126	30	30	60
352	Bolton TC->Outside G	126	60	30	60
353	Leigh->Trafford	126C		60	60
354	Trafford ->Leigh	126C		60	30
355	Middleton->Middleton	129B	30	30	30
356	Outside G->Mancheste	130	40	30	30
358	Mancheste->Outside G	130	60	30	30
360	Wigan TC->Trafford	132A		60	
362	Trafford ->Atherton	132A		300	
363	Trafford ->Wigan TC	132A		60	60
364	Bury TC->Mancheste	135	9	7	9
366	Mancheste->Bury TC	135	8	8	8
369	Bury TC->Mancheste	137		20	20
370	Mancheste->Bury TC	137	30	20	20
373	Withingto->Mancheste	140	30	30	
374	Mancheste->Withingto	140	60	30	
375	Withingto->Mancheste	141D	20	50	
376	Didsbury->Mancheste	142	5	5	5
378	Fallowfie->Mancheste	142	5	38	
379	Mancheste->Didsbury	142	9	5	5
380	Ardwick->Withingto	142		14	10
382	Withingto->Mancheste	143	4	4	4
384	Mancheste->Withingto	143	4	4	4
386	Mancheste->Mancheste	147B	10	10	10
387	Mancheste->Oldham TC	149A	30	30	30
389	Oldham TC->Mancheste	149A	30	30	30
391	Chadderto->Broughton	151	30	30	
393	Broughton->Chadderto	151	30	30	
396	Crumpsall->Bury TC	154		60	60
397	Bury TC->Crumpsall	154		60	60
398	Outside G->Outside G	156A		60	60
402	Langley->Mancheste	156B	30	30	60
403	Mancheste->Langley	156B	30	30	30
404	Cheadle H->Mancheste	157		300	
406	Bramhall->Mancheste	157	30	75	30
407	Bramhall->Mancheste	157		50	
408	Mancheste->Cheadle	157		300	
409	Mancheste->Bramhall	157	60	60	20
410	Mancheste->Bramhall	157		60	
411	Ashton-in->Outside G	157A		60	60
413	Outside G->Ashton-in	157A		60	60
415	Middleton->Oldham TC	159	60	60	
417	Oldham TC->Middleton	159	60	60	60
418	Mancheste->Bury TC	163	10	10	10
419	Bury TC->Mancheste	163	10	10	12
424	Mancheste->Norden	167	30	60	30
425	Norden->Mancheste	167	30	60	60
426	Chorlton-->Ashton TC	168	30	30	60
430	Ashton TC->Chorlton-	168	30	30	60
432	Ashton TC->Chorlton-	169	30	30	30
433	Chorlton-->Ashton TC	169	30	30	
436	Droylsden->Ashton-u-	169		300	
437	Withingto->Newton He	171	60	30	
440	Newton He->Withingto	171	30	30	
443	Mancheste->Reddish	173A		300	
444	Mancheste->Great Moo	173A		100	
445	Reddish->Great Moo	173A		300	
446	Reddish->Mancheste	173A		300	
447	Great Moo->Mancheste	173A	60	100	
448	Great Moo->Reddish	173A		300	
451	Reddish->Newall Gr	178B		60	
453	Newall Gr->Reddish	178B	60	60	60

455	Stockport->Newall Gr	179	60	60	
456	Newall Gr->Stockport	179		60	60
457	Hopwood->Middleton	17AA		300	
458	Charlesto->Hopwood	17AA		300	
459	Greenfiel->Mancheste	180	30	30	30
460	Mancheste->Greenfiel	180	30	30	30
463	Shaw->Mancheste	181	60	60	60
464	Rochdale ->Mancheste	181	60	60	60
465	Mancheste->Shaw	181	60	60	60
466	Mancheste->Rochdale	181	60	60	60
467	Shaw->Mancheste	182	60	60	60
468	Rochdale ->Mancheste	182		60	60
469	Mancheste->Shaw	182	60	60	60
470	Mancheste->Rochdale	182	60	60	60
471	Oldham TC->Hollinwoo	183A		300	
472	Oldham TC->Hollinwoo	183A		33	
473	Hollinwoo->Oldham TC	183A		30	
476	Outside G->Mancheste	184	60	60	60
477	Greenfiel->Mancheste	184	30	30	30
478	Greenfiel->Mancheste	184	60	60	60
480	Mancheste->Outside G	184	60	60	60
481	Mancheste->Greenfiel	184	30	30	30
482	Mancheste->Greenfiel	184	60	60	60
483	Clayton->Clayton	185A		75	
484	Gorton->Mancheste	188		75	60
485	Mancheste->Gorton	188	60	75	60
486	Charlesto->Mancheste	188A		30	
488	Mancheste->Charlesto	188A		30	60
492	Outside G->Stockport	191		60	60
496	Stockport->Outside G	191	60	60	
498	Stockport->Mancheste	192	8	8	8
499	Hazel Gro->Mancheste	192	8	8	7
501	Mancheste->Stockport	192	8	7	7
502	Mancheste->Hazel Gro	192	9	8	8
503	Great Moo->Mancheste	192M	8	8	8
504	Mancheste->Great Moo	192M	8	8	8
506	Withingto->Withingto	195A		100	
507	Withingto->Gatley	195A		300	
509	Gatley->Withingto	195A		300	
510	Withingto->Withingto	196A		100	
511	Withingto->Heald Gre	196A		300	
512	Gatley->Withingto	196A		300	
513	Stockport->Mancheste	197	20	20	20
514	Mancheste->Stockport	197	20	20	20
516	Outside G->Ringway	199A	50	30	30
518	Ringway->Outside G	199A	30	30	30
519	Outside G->Ringway	200A	80	60	90
520	Ringway->Outside G	200A	80	60	90
521	Mottram->Mancheste	201A	8	8	10
523	Mancheste->Mottram	201A	9	8	8
527	Stockport->Mancheste	203	8	8	8
529	Mancheste->Stockport	203	8	8	9
531	Hyde->Mancheste	204	20	30	20
532	Hyde->Denton	204		30	
533	Mancheste->Hyde	204	60	30	20
534	Denton->Hyde	204	30	30	
535	Denton->Mancheste	205	30	30	30
536	Mancheste->Denton	205	30	30	30
538	Wigan TC->Outside G	206A		150	
539	Outside G->Wigan TC	206A		100	
540	Ashton TC->Mancheste	216	5	5	6
541	Mancheste->Ashton TC	216	5	5	5
545	Mancheste->Mancheste	217A	60	60	
548	Mancheste->Mancheste	218B		60	
550	Ashton TC->Mancheste	219	6	7	8
552	Mancheste->Ashton TC	219	8	7	6
554	Ashton-u-->Mancheste	220		300	
559	Outside G->Bolton TC	225F	60	30	30
561	Bolton TC->Outside G	225F	30	30	30
564	Ashton TC->Mancheste	231	30	30	30
565	Droylsden->Mancheste	231	12	30	30
567	Mancheste->Ashton TC	231	30	30	15
568	Mancheste->Droylsden	231	30	30	15
569	Outside G->Ashton TC	236	60	60	60

570	Ashton TC->Outside G	236	60	60	
574	Outside G->Ashton TC	237		60	
577	Ashton TC->Outside G	237	60	60	60
579	Outside G->Ashton TC	239		60	60
580	Ashton TC->Outside G	239	60	60	60
581	Trafford ->Stockport	23A	60	30	30
582	Stockport->Trafford	23A	60	30	30
584	Altrincha->Davyhulme	245	30	30	
586	Davyhulme->Altrincha	245	20	30	30
588	Eccles->Altrincha	247		30	30
592	Altrincha->Eccles	247	30	30	60
595	Trafford ->Mancheste	250A	60	15	15
596	Mancheste->Trafford	250A	15	15	15
603	Partingto->Mancheste	255	30	30	30
606	Mancheste->Partingto	255	60	30	60
607	Davyhulme->Mancheste	256	12	10	20
608	Mancheste->Davyhulme	256	12	10	10
609	Outside G->Outside G	256B		30	30
611	Ashton-On->Partingto	260	60	60	
612	Partingto->Ashton-On	260		60	
613	Ashton-On->Ashton-On	261		60	
614	Ashton-On->Ashton-On	262		60	
615	Wigan TC->Outside G	262A	15	15	15
616	Outside G->Wigan TC	262A	15	15	
617	Altrincha->Mancheste	263	10	10	12
618	Mancheste->Altrincha	263	10	10	10
620	Altrincha->Ashton-On	266	60	60	
621	Ashton-On->Altrincha	266	60	60	
622	Altrincha->Ashton-On	267A		60	60
624	Ashton-On->Altrincha	267A	60	60	60
625	Wythensha->Urmston	268B	60	60	60
626	Urmston->Wythensha	268B		60	60
630	Outside G->Bolton TC	273	60	60	60
631	Bolton TC->Ramsbotto	273		300	
632	Bolton TC->Outside G	273	60	60	60
634	Stretford->Withingto	276		300	
635	Davyhulme->Withingto	276	60	100	
636	Davyhulme->Stretford	276		300	
637	Withingto->Stretford	276		300	
638	Withingto->Davyhulme	276	60	100	
639	Stretford->Davyhulme	276		300	
640	Davyhulme->Stretford	277		60	
641	Davyhulme->Stretford	277		300	
643	Stretford->Davyhulme	277		60	60
644	Davyhulme->Stretford	278		60	
645	Stretford->Davyhulme	278		60	
647	Outside G->Wigan TC	285A	30	30	60
650	Wigan TC->Outside G	285A	30	30	60
651	Altrincha->Hale	286		33	
654	Hale->Altrincha	286		33	
656	Outside G->Altrincha	288	60	60	60
657	Altrincha->Outside G	288	40	60	60
658	Outside G->Altrincha	289	150	200	90
659	Altrincha->Outside G	289	150	200	90
660	Outside G->Leigh	28A	60	60	60
661	Leigh->Outside G	28A	60	60	60
664	Trafford ->Mancheste	291		300	60
665	Trafford ->Mancheste	291		300	60
666	Mancheste->Trafford	291	60	300	
668	Outside G->Wigan TC	295A	30	30	30
669	Wigan TC->Outside G	295A	30	30	30
670	Bolton TC->Trafford	300A		60	
671	Trafford ->Bolton TC	300A		75	30
672	Marple->Marple	303		300	
673	Marple->Marple	303		300	
674	Marple->Hyde	304D		300	
675	Hyde->Marple	304D		150	
676	Marple->Marple	305B		300	
677	Marple->Marple	305B		300	
678	Marple->Marple	306		150	
679	Stockport->Stockport	307		60	60
680	Stockport->Stockport	308	60	50	60
681	Stockport->Stockport	309	30	30	20
685	Stockport->Stockport	310A	30	30	30

688	Outside G->Stockport	312		60	60
690	Stockport->Outside G	312	60	60	
692	Stockport->Cheadle H	313	15	14	12
693	Cheadle H->Stockport	313	12	15	12
694	Stockport->Stockport	314B	10	10	10
695	Ashton TC->Great Moo	317	60	60	
697	Denton->Great Moo	317	60	60	60
698	Great Moo->Ashton TC	317	60	60	60
699	Great Moo->Denton	317	60	60	60
700	Reddish->Stockport	319	30	30	30
701	Stockport->Reddish	319	30	30	30
702	Ashton-in->Outside G	320	20	20	30
704	Wigan TC->Outside G	320	60	30	30
705	Outside G->Ashton-in	320	60	300	
706	Outside G->Wigan TC	320	30	30	30
707	Outside G->Ashton-in	320	20	20	15
708	Outside G->Egerton	320A		300	
709	Egerton->Outside G	320A		300	
710	Outside G->Egerton	321A		300	
711	Egerton->Outside G	321A		150	
712	Stockport->Stockport	322	60	60	30
714	Stockport->Stockport	325	7	7	10
715	Denton->Stockport	327	30	60	30
716	Stockport->Denton	327	60	60	30
717	Outside G->Shevingto	327A		300	
718	Ashton TC->Stockport	330	9	8	8
719	Stockport->Ashton TC	330	9	8	8
720	Ashton TC->Ashton TC	331	20	20	20
723	Ashton TC->Ashton TC	333C	20	20	20
724	Ashton TC->Ashton TC	335		60	
726	Ashton TC->Ashton TC	337	30	30	30
729	Outside G->Hyde	341A	60	60	
730	Hyde->Outside G	341A	60	60	60
732	Hyde->Hyde	342D		60	
733	Oldham TC->Hyde	343	60	60	60
736	Mossley->Stalybrid	343		300	
737	Hyde->Oldham TC	343	60	60	60
739	Hyde->Hyde	344D		60	
742	Ashton TC->Ashton TC	345	60	60	
743	Ashton TC->Hyde	346	30	30	30
744	Ashton TC->Hyde	346	30	30	30
746	Hyde->Ashton TC	346	30	30	30
747	Hyde->Ashton TC	346	30	30	30
749	Ashton TC->Ashton TC	347	8	8	8
750	Mossley->Ashton TC	348	10	10	10
751	Ashton TC->Mossley	348	10	10	10
752	Ashton TC->Mossley	350	15	15	20
753	Ashton TC->Oldham TC	350	30	33	30
754	Ashton TC->Oldham TC	350		300	
756	Mossley->Ashton TC	350	15	15	15
757	Oldham TC->Ashton TC	350	60	30	30
760	Wigan TC->Outside G	352A	15	15	15
762	Outside G->Wigan TC	352A	15	15	20
763	Delph->Ashton TC	353		300	
765	Delph->Ashton TC	353		300	
766	Ashton TC->Delph	353		150	
768	Ashton TC->Delph	353	60	300	
770	Delph->Ashton TC	354		150	60
773	Ashton TC->Delph	354		150	
774	Stockport->Outside G	358	60	60	60
775	Outside G->Stockport	358	60	60	60
776	Wigan TC->Golborne	360A	30	30	30
777	Wigan TC->Outside G	360A	30	30	30
779	Golborne->Wigan TC	360A	30	30	60
780	Outside G->Wigan TC	360A	30	30	30
782	Outside G->Wigan TC	362	15	17	15
784	Outside G->Wigan TC	362		150	
785	Wigan TC->Outside G	362	15	17	15
786	Wigan TC->Outside G	362		150	
789	Marple->Stockport	362C		60	60
790	Stockport->Marple	362C		60	60
791	Stockport->Stockport	364	60	60	60
792	Stockport->Newall Gr	368	60	30	60
793	Newall Gr->Stockport	368	30	30	30

795	Stockport->Ringway	369	30	30	20
796	Ringway->Stockport	369	30	30	30
798	Altrincha->Stockport	370	30	30	30
800	Stockport->Altrincha	370	60	30	30
802	Altrincha->Stockport	371	30	30	30
804	Stockport->Altrincha	371	60	30	30
806	Stockport->Stockport	372		60	60
807	Stockport->Reddish	373A	15	15	20
808	Reddish->Stockport	373A	20	15	15
809	Stockport->Hazel Gro	374	30	30	30
810	Stockport->Bramhall	374		300	
813	Hazel Gro->Stockport	374	30	30	30
814	Outside G->Wigan TC	375B	60	60	60
815	Wigan TC->Unknown s	375B	60	60	
816	Marple->Outside G	375C		60	
818	Outside G->Marple	375C		60	
822	Stockport->Outside G	378	60	60	60
824	Stockport->Cheadle H	378	20	30	30
825	Outside G->Stockport	378	60	60	60
827	Cheadle H->Stockport	378	30	30	20
830	Stockport->Stockport	380B		60	60
832	Stockport->Stockport	381B	60	60	60
834	Stockport->Stockport	381B		300	
835	Stockport->Stockport	383	15	15	15
836	Stockport->Stockport	384	20	15	15
837	Outside G->Wigan TC	385	60	60	60
838	Wigan TC->Unknown s	385	60	60	60
839	Ashton TC->Hyde	387A	60	60	60
840	Hyde->Ashton TC	387A	60	60	60
842	Ashton TC->Hyde	389	30	30	30
843	Ashton TC->Stockport	389	60	60	60
845	Hyde->Ashton TC	389	30	30	30
846	Stockport->Ashton TC	389	60	60	
847	Stockport->Bramhall	390		200	
848	Bramhall->Stockport	390	60	200	
849	Outside G->Stockport	392	80	130	180
850	Stockport->Outside G	392		130	180
851	Ashton TC->Ashton TC	393B	30	30	30
852	Outside G->Stockport	393C	150	120	180
853	Stockport->Outside G	393C	150	120	90
854	Great Moo->Outside G	394		60	60
855	Outside G->Great Moo	394		60	60
856	Ashton-u-->Ashton TC	395B	60	60	60
857	Ashton TC->Ashton-u-	395B	60	60	
858	Outside G->Wigan TC	395C	30	30	30
859	Wigan TC->Outside G	395C	30	30	30
861	Newton He->Ashton TC	396B		60	
863	Ashton TC->Newton He	396B		60	60
864	Hyde->Outside G	397B		60	60
866	Outside G->Hyde	397B		60	60
867	Oldham TC->Oldham TC	402	30	30	30
869	Shaw->Shaw	403		30	60
870	Chadderto->Oldham TC	406A		60	
872	Oldham TC->Middleton	406A		60	
874	Delph->Oldham TC	407	60	60	60
875	Oldham TC->Delph	407	60	60	60
876	Stalybrid->Shaw	408	60	60	60
878	Shaw->Stalybrid	408	60	60	60
882	Ashton TC->Rochdale	409	7	7	10
883	Rochdale ->Ashton TC	409	7	7	12
885	Oldham TC->Oldham TC	410	30	30	60
886	Oldham TC->Oldham TC	411	30	30	60
887	Middleton->Lees	415	30	30	60
888	Middleton->Oldham TC	415	30	30	20
889	Lees->Middleton	415	30	30	20
890	Unknown s->Middleton	415	30	30	30
891	Oldham TC->Oldham TC	418A		60	
892	Middleton->Ashton TC	419	30	30	30
893	Ashton TC->Middleton	419	30	30	30
894	Lees->Hathersha	425	10	10	10
896	Hathersha->Lees	425	10	10	10
898	Unknown s->Oldham TC	428C		60	
900	Mancheste->Gorton	42A	60	30	30
903	Reddish->Mancheste	42A	30	30	60

905	Rochdale ->Rochdale	432		60	
908	Rochdale ->Castleton	434C	30	30	30
909	Castleton->Rochdale	434C	30	30	30
911	Rochdale ->Shaw	435	20	30	30
912	Shaw->Rochdale	435	30	30	30
913	Rochdale ->Rochdale	436A	20	30	30
914	Rochdale ->Norden	438	60	60	60
915	Rochdale ->Bamford	438	60	60	60
917	Norden->Rochdale	438	60	60	60
918	Bamford->Rochdale	438	60	60	60
920	Rochdale ->Rochdale	440	15	16	15
922	Rochdale ->Rochdale	441	60	50	
924	Rochdale ->Rochdale	442	30	30	
925	Norden->Rochdale	444A	60	30	30
926	Rochdale ->Norden	444A	30	30	30
927	Rochdale ->Rochdale	445A	60	30	30
928	Rochdale ->Outside G	446A	30	30	30
929	Outside G->Rochdale	446A	60	30	30
930	Rochdale ->Newhey	451	60	60	60
932	Newhey->Rochdale	451	60	60	60
934	Rochdale ->Littlebor	452	60	60	60
935	Littlebor->Rochdale	452	60	60	60
936	Rochdale ->Littlebor	454	30	30	30
937	Littlebor->Rochdale	454	30	30	30
938	Rochdale ->Littlebor	455	60	60	
941	Littlebor->Rochdale	455		60	60
944	Rochdale ->Littlebor	456	60	60	60
945	Littlebor->Rochdale	456	20	60	
947	Rochdale ->Littlebor	457	30	30	30
948	Rochdale ->Littlebor	457	60	60	60
949	Littlebor->Rochdale	457	30	30	30
950	Littlebor->Rochdale	457	60	60	60
951	Littlebor->Rochdale	458A		60	60
953	Rochdale ->Littlebor	458A	60	60	60
955	Rochdale ->Bury TC	461B	30	30	
957	Bury TC->Rochdale	461B	30	30	60
959	Rochdale ->Milnrow	462A		60	
960	Milnrow->Rochdale	462A		60	
961	Rochdale ->Outside G	464	10	10	20
964	Outside G->Rochdale	464	10	10	15
970	Rochdale ->Heywood	468		300	
973	Heywood->Tottingto	469	20	20	20
974	Rochdale ->Tottingto	469	20	20	20
976	Tottingto->Heywood	469	20	20	20
977	Tottingto->Rochdale	469	20	20	20
979	Rochdale ->Bolton TC	471	10	10	15
983	Bolton TC->Rochdale	471	10	10	15
985	Bury TC->Bury TC	472	10	10	10
988	Bury TC->Bury TC	474	10	10	10
990	Ramsbotto->Heywood	475A		60	
992	Heywood->Ramsbotto	475A	60	60	
993	Ramsbotto->Norden	476B	60	60	60
994	Norden->Ramsbotto	476B		60	
996	Ramsbotto->Walmersle	477A	60	60	
997	Walmersle->Ramsbotto	477A	60	60	60
1000	Bury TC->Bury TC	479	60	60	60
1001	Bolton TC->Bury TC	480B		60	60
1002	Bury TC->Bolton TC	480B		60	
1004	Bury TC->Ramsbotto	481	60	60	60
1006	Ramsbotto->Bury TC	481		60	60
1012	Outside G->Bury TC	482A		33	60
1014	Bury TC->Outside G	482A		30	
1020	Fairfield->Outside G	483		150	60
1021	Fairfield->Outside G	483	60	75	
1022	Fairfield->Outside G	483	60	60	
1028	Outside G->Fairfield	483	60	60	
1029	Outside G->Fairfield	483		60	
1030	Prestwich->Seedley	484	60	60	
1033	Seedley->Prestwich	484		60	
1035	Outside G->Bury TC	484A		75	
1036	Outside G->Ramsbotto	484A		300	
1038	Outside G->Ramsbotto	484A		150	
1039	Bury TC->Outside G	484A		60	
1040	Outside G->Outside G	484A		150	

1041	Ramsbotto->Bury TC	485A		75	
1042	Ramsbotto->Ramsbotto	485A		300	
1043	Bury TC->Ramsbotto	485A		60	
1044	Radcliffe->Bury TC	486B		60	60
1046	Bury TC->Radcliffe	486B		60	60
1047	Bury TC->Bury TC	494	30	30	30
1048	Simister->Prestwich	495A	60	60	60
1049	Simister->Prestwich	495A	60	60	
1050	Prestwich->Simister	495A		60	60
1051	Prestwich->Simister	495A	60	60	
1052	Farnworth->Smithills	501	8	8	9
1053	Smithills->Farnworth	501	9	8	10
1054	Horwich->Bolton TC	505		60	60
1055	Heaton->Bolton TC	505		60	60
1056	Bolton TC->Horwich	505		50	
1057	Bolton TC->Heaton	505		60	60
1059	Bolton TC->Bolton TC	506	10	10	10
1062	Bolton TC->Bolton TC	507	10	10	10
1063	Bolton TC->Bury TC	510	30	30	30
1064	Bury TC->Bolton TC	510	30	30	30
1065	Bury TC->Bolton TC	512	60	60	
1067	Bolton TC->Bury TC	512	60	60	60
1068	Bury TC->Bolton TC	513		60	60
1069	Bolton TC->Bury TC	513	60	60	
1071	Bolton TC->Bolton TC	515	30	30	30
1075	Atherton->Westhough	516		300	
1076	Bolton TC->Smithills	519	10	10	10
1077	Smithills->Bolton TC	519	10	10	10
1079	Little Le->Blackrod	521	60	60	
1080	Blackrod->Little Le	521		60	
1082	Bolton TC->Bury TC	524	9	8	9
1083	Bury TC->Bolton TC	524	12	8	12
1085	Bolton TC->Bolton TC	525		60	60
1087	Bolton TC->Smithills	526	30	60	60
1088	Smithills->Bolton TC	526	30	60	60
1089	Bolton TC->Bolton TC	527	60	60	60
1091	Outside G->Rochdale	528A		150	60
1092	Outside G->Rochdale	528A	60	100	
1093	Rochdale ->Outside G	528A		100	
1094	Rochdale ->Outside G	528A		150	60
1095	Egerton->Bolton TC	533	30	30	30
1097	Bolton TC->Egerton	533	30	30	30
1098	Astley Br->Bolton TC	534	10	10	10
1100	Bolton TC->Astley Br	534	10	10	10
1102	Bolton TC->Outside G	535	60	60	60
1103	Bolton TC->Outside G	535		300	
1105	Outside G->Bolton TC	535	60	60	
1106	Bolton TC->Astley Br	538A	20	20	20
1108	Astley Br->Bolton TC	538B	20	20	20
1110	Westhough->Bolton TC	540	30	30	30
1111	Wigan TC->Bolton TC	540	12	10	15
1112	Bolton TC->Wigan TC	540	10	10	12
1114	Bolton TC->Westhough	540	30	30	30
1115	Bolton TC->Egerton	541A	15	15	20
1116	Egerton->Bolton TC	541A	20	15	15
1117	Bolton TC->Bolton TC	544		60	
1118	Farnworth->Farnworth	550		60	
1120	Leigh->Worsley	551		300	
1122	Bolton TC->Worsley	553	60	60	60
1123	Worsley->Bolton TC	553	60	60	60
1125	Kearsley->Farnworth	557		60	60
1126	Kearsley->Farnworth	557		60	
1127	Farnworth->Kearsley	557		30	
1128	Farnworth->Farnworth	557		60	
1129	Hindley->Bolton TC	559	60	60	60
1130	Bolton TC->Hindley	559	60	60	60
1131	Bolton TC->Bolton TC	561	20	15	15
1132	Bolton TC->Bolton TC	562	20	15	20
1133	Outside G->Bolton TC	563	60	60	60
1135	Bolton TC->Outside G	563	60	60	30
1137	Deane->Bolton TC	570B	60	60	60
1138	Bolton TC->Deane	570B	60	60	60
1139	Bolton TC->Bolton TC	571	15	15	15
1140	Bolton TC->Bolton TC	572	15	15	20

1141	Wigan TC->Bolton TC	575	20	15	20
1144	Horwich->Bolton TC	575	12	10	12
1145	Bolton TC->Wigan TC	575	20	15	15
1148	Bolton TC->Horwich	575	12	10	10
1151	Bolton TC->Leigh	582	9	8	10
1152	Leigh->Bolton TC	582	9	8	8
1158	Leigh->Leigh	584A	60	30	60
1159	Leigh->Leigh	584A	60	60	60
1160	Leigh->Leigh	587B	60	60	
1161	Leigh->Leigh	587B	60	60	
1162	Leigh->Leigh	588C	60	60	
1163	Rochdale ->Outside G	589A	60	60	
1165	Outside G->Rochdale	589A	60	60	60
1166	Leigh->Leigh	589C		60	60
1167	Rochdale ->Outside G	590	60	60	60
1168	Outside G->Rochdale	590	60	60	60
1169	Leigh->Leigh	590A		60	
1172	Leigh->Bolton TC	592B	30	30	
1174	Bolton TC->Leigh	592B	30	30	
1176	Westleigh->Leigh	593	30	15	60
1179	Leigh->Westleigh	593	30	15	60
1181	Wigan TC->Wigan TC	593A		33	60
1182	Leigh->Leigh	594A	30	33	30
1184	Leigh->Leigh	594A		300	
1185	Leigh->Westleigh	595		30	60
1187	Westleigh->Leigh	595	30	30	
1189	Leigh->Leigh	596		60	60
1191	Leigh->Leigh	597		60	
1192	Wigan TC->Leigh	598	10	10	12
1193	Leigh->Wigan TC	598	12	10	10
1194	Wigan TC->Leigh	600	9	8	10
1196	Leigh->Wigan TC	600	9	8	9
1202	Ashton-in->Outside G	603	60	60	60
1203	Outside G->Ashton-in	603	60	60	
1205	Ashton-in->Wigan TC	607	60	60	60
1206	Wigan TC->Ashton-in	607	60	60	60
1207	Wigan TC->Wigan TC	610	20	15	15
1209	Wigan TC->Wigan TC	612		60	60
1215	Wigan TC->Wigan TC	614		20	
1216	Wigan TC->Leigh	615	60	60	
1219	Leigh->Wigan TC	615		60	60
1220	Hindley->Outside G	620B	60	60	60
1221	Outside G->Hindley	620B	60	60	
1222	Wigan TC->Wigan TC	621E	10	10	12
1225	Pemberton->Aspull	624		75	
1226	Wigan TC->Aspull	624		300	
1227	Aspull->Pemberton	624		60	
1228	Aspull->Wigan TC	624		300	
1229	Wigan TC->Wigan TC	625	20	20	20
1231	Wigan TC->Wigan TC	626	20	20	30
1233	Wigan TC->Wigan TC	628B	10	10	15
1235	Abram->Longshaw	630		60	
1239	Longshaw->Abram	630		60	60
1241	Longshaw->Wigan TC	630		300	
1242	Wigan TC->Wigan TC	631	20	20	20
1243	Wigan TC->Wigan TC	632	20	20	30
1244	Wigan TC->Shevingto	635	10	10	9
1246	Shevingto->Wigan TC	635	12	7	10
1247	Wigan TC->Wigan TC	638		60	60
1248	Wigan TC->Wigan TC	639A		75	
1251	Wigan TC->Wigan TC	639A		300	
1253	Wigan TC->Wigan TC	640A	60	60	60
1254	Wigan TC->Wigan TC	641A		60	60
1255	Leigh->Hindley	652B		30	60
1256	Leigh->Wigan TC	652B	20	30	30
1257	Hindley->Leigh	652B		30	60
1258	Wigan TC->Leigh	652B	60	30	30
1259	Leigh->Farnworth	654A		60	
1262	Farnworth->Leigh	654A		50	60
1265	Wigan TC->Leigh	658	10	10	12
1266	Leigh->Wigan TC	658	10	10	10
1268	Aspull->Ince	664	60	60	
1270	Leigh->Leigh	672E	30	30	30
1271	Leigh->Leigh	672E	30	30	60

1274	Ince->Aspull	674B		60	
1277	Ince->Aspull	674B		300	
1280	Irlam->Irlam	67L		30	
1281	Atherton->Atherton	681A	60	60	
1282	Atherton->Atherton	681A	60	60	60
1284	Atherton->Leigh	682	60	60	60
1285	Leigh->Atherton	682	60	60	60
1287	Leigh->Astley	685	60	60	60
1288	Astley->Leigh	685	30	60	
1290	Leigh->Leigh	686	60	30	60
1291	Leigh->Astley	686		300	
1293	Mancheste->Outside G	700A	60	60	60
1294	Outside G->Mancheste	700A	60	60	60
1295	Wigan TC->Bolton TC	715D	30	30	30
1297	Bolton TC->Wigan TC	715D	30	30	30
1299	Hopwood->Hopwood	719B		300	
1303	Mancheste->Outside G	A40	60	60	60
1304	Outside G->Mancheste	A40	60	60	60
1306	Altrincha->Outside G	HD1		300	
1307	Outside G->Altrincha	HD1		150	
1308	Mancheste->Winton	M10	12	12	12
1310	Winton->Mancheste	M10		12	15
1313	Stretford->Trafford	ML1	30	20	20
1314	Trafford ->Stretford	ML1	60	20	20
1315	Leigh->Mancheste	X34		60	60
1316	Mancheste->Leigh	X34	60	60	
1321	Mancheste->Outside G	X40		300	
1324	Outside G->Mancheste	X41		27	
1325	Mancheste->Outside G	X41		300	
1326	Mancheste->Outside G	X41	30	38	60
1327	Outside G->Mancheste	X43	30	30	20
1329	Mancheste->Outside G	X43	20	20	15
1331	Outside G->Mancheste	X44B		150	
1332	Mancheste->Outside G	X44B		100	30
1333	Outside G->Mancheste	X61		100	
1334	Unknown s->Mancheste	X61		150	
1335	Mancheste->Outside G	X61	60	75	
1336	Mancheste->Unknown s	X61		300	
1440	Poynton-Stockport	391	80	60	90
1441	Stockport-Poynton	391	150	60	90
1442	Macc-Disley	60		200	180
1443	Disley-Macc	60	150	390	
1444	Sandbach-Macc	38	60	60	60
1445	Macc-Sandbach	38	60	60	60
1446	Macc-Congleton	99	50	40	90
1447	Congleton-Macc	99	30	40	60
1448	Macc-Boll	0	30	30	30
1449	Boll-Macc	0	30	30	30
1450	Macc-Knutsford	27	80	60	60
1451	Knutsford-Macc	27	80	60	60
1452	Northwich_Sandbach	37	60	60	90
1453	Sandbach-Northwich	37	60	60	60
1454	Crewe-Congleton	42	150	60	60
1455	Cogleton-Crewe	42	150	60	60
1456	Macc-Whaley	60A	150	120	180
1457	Whaley-Macc	60A		120	60
1458	Macc-NewMills	60B		390	
1459	NewMills-Macc	60B		200	
1462	Macc-Glossop	64	150	390	
1463	Glossop-Macc	64		390	180
1464	Northwich-Crewe	37	80	60	90
1465	Crewe-Northwich	37	50	60	60
1467	Macc-Kerridge	11	150	60	60
1468	Kerrige-Macc	11		60	60
1469	Prestbury-Macc	19	80	60	90
1470	Macc-Prestbury	19	80	60	90
1471	Macc-Buxton	58	80	60	60
1472	Buxton-Macc	58	60	60	60
1473	Macc-Ashbourne	108	150	200	180
1474	Ashbourne-Macc	108	80	120	180
1476	Altrin-Warring	108	80	60	60
1477	Warrin-Altrin	108	80	60	60
1478	North-Warring	45	150	130	180
1479	Warrin-North	45	80	130	180

1480	North-Warring	46	80	130	60
1481	Warrin-North	46	150	100	180
6000	Cleethorp->Airport	6000R	30	60	60
6001	Hull->Piccad	6001R	60	60	60
6002	Airport->Cleeth	6002R	60	60	60
6003	Piccadilly->Hull	6003R	60	60	60
6004	Mid/Nwc/Yrk-Apt	6004R	60	30	60
6005	Scarbrgh->Liver LS	6005R	60	60	60
6006	Huddersfiel->Victo	6006R		60	60
6007	stalybdg->LvrplLS	6007R		60	30
6008	Apt->Mid/Nwc/Scr/Yk	6008R		30	60
6009	Victoria->Hudders	6009R	60	60	60
6011	LiverLS->Scarbrgh	6011R	30	60	60
6012	Leeds->Victoria	6012R		30	30
6013	Victora->Leeds	6013R	60	30	30
6014	Nrwch/Cmb->Liv	6014R	60	60	60
6015	Picc->XCountryS	6015R	60	40	60
6016	Edingbur->Piccad	6016R	60	180	60
6017	Picc->XCountrySCng	6017R	60	120	60
6018	XCountrySCng->Pic	6018R	60	120	60
6019	XCountryS->Pic	6019R	60	40	60
6020	Piccad->Edin/Glsg	6020R	60	120	60
6023	London->Piccad	6023R		60	30
6024	London->Piccad	6024R	60	360	60
6025	London->Piccad	6025R	60	60	60
6027	Piccad->London	6027R	60	360	60
6028	Pccdll->London	6028R		60	60
6029	Pccdll->London	6029R		60	
6032	Piccad->Marple	6032R	60	60	60
6033	Piccadil->Marple	6033R		60	60
6034	Piccad->RoseHill	6034R	60	60	60
6035	Piccad->Sheff	6035R	60	90	60
6036	Piccad->new mills	6036R		180	60
6037	Marple->Piccad	6037R	60	60	60
6038	RoseHIll->Picc	6038R	60	60	60
6039	Sheffield->Piccad	6039R	60	360	60
6040	Marple->Piccad	6040R		60	60
6041	newmills->Picc	6041R	30	180	
6042	Piccad->Hadfield	6042R	60	30	20
6043	Hadfield->Piccad	6043R	60	30	
6044	Piccad->Holyhead	6044R		300	60
6045	Piccad->LLandud	6045R	60	60	60
6046	Llandud->Piccad	6046R	60	60	60
6047	Victoria->WiganWG	6047R		60	60
6048	Apt->Brw/Wndm/Oxen	6048R		60	60
6049	Rochdale->Suthprt	6049R	20	60	60
6050	Aiport->Blkpl	6050R		60	60
6051	victoria-WiganWG	6051R	60	60	60
6052	airport->southprt	6052R	60	72	60
6053	Rochdale->Kirby	6053R		60	60
6054	Nrthwhch->BLckpl	6054R		360	60
6055	Buxton->Blackpool	6055R		120	60
6056	wiganWG->Victoria	6056R		60	60
6057	wndmr/barw->Aport	6057R		60	60
6058	S.port->rochdale	6058R	60	60	60
6059	Wigan WG->Vctra	6059R	60	60	60
6060	Blackpl->Buxton	6060R	60	120	60
6061	Sport->Aiport	6061R	60	60	60
6062	Blackpl->Airport	6062R	60	72	60
6063	kirkby->Rochdale	6063R	60	60	60
6064	Alderlyedge->Picc	6064R	60	60	60
6065	Crewe->Picc	6065R	60	60	60
6066	Crewe->Piccad	6066R	60	60	60
6067	Carm/MilfH->Pic	6067R	60	60	60
6068	Macc->Deansgate	6068R	60	60	60
6069	Piccad->Ald.edge	6069R	60	60	60
6070	Piccad->Crewe	6070R	60	60	60
6071	Deansgate->Macc	6071R	60	60	60
6072	Piccad->Crewe	6072R		60	60
6073	Pic->carm/milfdH	6073R		60	60
6085	Picad->HazelG	6085R		90	30
6087	H.Grove->Piccad	6087R	60	60	60
6088	Buxton->Piccad	6088R		360	60
6090	Chester->Piccad	6090R	60	72	60

6091	Piccad->Chester	6091R	60	60	30
6092	LiverLS->OxfordRD	6092R		60	60
6093	LiverLS->OxfordRD	6093R		120	60
6094	LiverLS->MIA	6094R		60	60
6095	LiverLS->Nrw/Notm	6095R	30	60	60
6096	OxfordRD->LvrLS	6096R		60	60
6097	OxfordRd->LiverLS	6097R	60	120	60
6098	OxfordRd->LiverLS	6098R	30	120	
6099	Apt->LiverpILS	6099R	30	60	
6105	Victoria->Clither	6105R	60	180	60
6106	Clither->Vctr	6106R	60	120	60
6107	Victoria->Clither	6107R	30	90	
6109	ManVic->Rchdle	6109R	60	30	30
6110	ManVic->Shw&Crmptn	6110R	60	30	30
6111	Rochdale->Victoria	6111R		30	30
6112	Shw&Crmptn->ManVic	6112R	30	30	30
6150	airport->southprt	6150R		72	
6151	Blackpl->Airport	6151R		360	
6152	Blackpl->Buxton	6152R		180	
6153	Blackpl->HazelG	6153R		360	
6154	Buxton->Blackpool	6154R		180	
6155	Clither->Vctr	6155R		120	
6156	LiverLS->OxfordRD	6156R		120	
6157	Picadilly->Buxton	6157R		180	
6158	Edingbur->Glasgow	6158R		360	
6159	Sheffield->Piccad	6159R		120	
6161	LiverLS->Stlybrd	6161R		60	
6162	Blackbn->Vctr	6162R		360	
6200	DONCASTER->SHEFFIELD	6200	30	30	30
6201	HULL -> SHEFFIELD	6201	90	90	90
6202	YORK->DERBY	6202	30	30	30
6203	SHEFFIELD->DONCASTER	6203	60	60	60
6204	SHEFFIELD->HULL	6204	60	60	60
6205	SHEFFIELD->YORK	6205	60	60	60
6206	DONCASTER->LEEDS	6206	60	60	60
6207	SHEFFIELD->LEEDS	6207	60	60	60
6208	SHEFFIELD->YORK	6208	60	60	60
6209	LEEDS->DONCASTER	6209	60	60	60
6210	LEEDS->SHEFFIELD	6210	60	60	60
6211	YORK->SHEFFIELD	6211	60	60	60
6212	LEEDS->PNTFRCT MONKH	6212	60	60	60
6213	WKEFLDWGT->PTFRCTMNK	6213	60	60	60
6214	PMTFRCT MONKH->LEEDS	6214	60	60	60
6215	PNTFRCTMKK->WKFLDWGT	6215	60	60	60
6216	SHEFFIELD->LEEDS	6216	60	60	60
6217	SHEFFIELD->WAKEFLD K	6217	60	60	60
6218	SHEFFIELD->HDDRSFLD	6218	60	60	60
6219	LEEDS->SHEFFIELD	6219	60	60	60
6220	HDDRSFLD->SHEFFIELD	6220	60	60	60
6221	BRADFORD FS->KEIGHLY	6221	30	30	30
6222	LEEDS->KEIGHLEY	6222	25	25	25
6223	KEIGHLEY->BRADFORDFS	6223	30	30	30
6224	KEIGHLEY->LEEDS	6224	25	25	25
6225	LEEDS->GUISELEY	6225	30	30	30
6226	BRADFORD FS->GUISELY	6226	30	30	30
6227	GUISELEY->LEEDS	6227	30	30	30
6228	GUISELEY->BRADFORD F	6228	30	30	30
6229	PRESTON->YORK	6229	60	60	60
6230	YORK->PRESTON	6230	60	60	60
6231	LEEDS->HUDDERSFIELD	6231	30	30	30
6232	HUDDERSFIELD->LEEDS	6232	60	60	60
6233	CREWE->CHESTER	6233	25	25	25
6234	L'POOLLS-> WAR.BKQ.	6234	60	60	60
6235	L'POOLLS-> WIGANNW.	6235	30	60	30
6236	L'POOLLS->PRESTON	6236	60	60	30
6237	CHESTER->CREWE	6237	25	25	25
6238	WIGN NW.->L'POOL LS	6238	60	30	30
6239	PRESTN->LIVERPOOL LS	6239	60	60	60
6240	CREWE->LIVERPOOL LS	6240	60	60	60
6241	CREWE->LIVERPOOL LS	6241	60	60	60
6242	CREWE->LANCASTER	6242	60	60	30
6243	LIVERPOOL LS->CREWE	6243	60	60	60
6244	LIVERPOOL LS->CREWE	6244	60	60	60
6245	LIVERPOOL LS->CREWE	6245	60	60	60

6246	LANCASTER->CREWE	6246	30	60	60
6247	MOORFIELDS->ORMSKIRK	6247	15	15	15
6248	ORMSKIRK->MOORFIELDS	6248	15	15	15
6249	ORMSKIRK->PRESTON	6249	60	60	60
6250	PRESTON->ORMSKIRK	6250	90	90	15
6251	HUNTS CROSS->STHPORT	6251	15	15	15
6252	STHPORT->HUNTS CROSS	6252	15	15	15
6253	MOORFIELDS->KIRKBY	6253	15	15	15
6254	KIRKBY->MOORFIELDS	6254	15	15	15
6255	MOORFIELDS->N.BRGHTN	6255	15	15	15
6256	N.BRGIHTN->L'POOL LS	6256	15	15	15
6257	MOORFIELDS->W.KIRBY	6257	15	15	15
6258	W.KIRBY->L'POOL LS	6258	15	15	30
6259	MOORFIELDS->CHESTER	6259	30	30	30
6260	CHESTER->LVRPL LS	6260	15	30	30
6261	MOORFIELDS->ELLEPRT	6261	30	30	30
6262	ELLEPRT->LIVERPOOL L	6262	15	30	60
6263	PRESTON->COLNE	6263	30	60	60
6264	COLNE->PRESTON	6264	60	60	
8000	ALTRINCHAM->BURY	8000M		12	12
8001	PICCADILLY->BURY	8001M	12	12	12
8002	PICCADILLY->ALTRNCHM	8002M	12	12	12
8004	ALTRINCHAM->BURY	8004M	12	12	12
8005	ALTRINCHAM->PICC	8005M	12	12	12
8006	PICCADILLY->BURY	8006M	12	12	12
8007	PICCADILLY->ECCLES	8007M	12	12	12
8008	ECCLES->PICCADILLY	8008M	12	12	12

Appendix B
Matrix Development

1 Introduction

1.1 A detailed specification for the development of public transport demand matrices for Greater Manchester was presented in Technical Note No 4. This was based on previous experience and informed by a meeting held between MVA and GMPTE on 18th April 2005. This note describes the actual methodology followed in preparation of the matrices, and is based on Technical Note No 4 in both structure and content. The methodology followed broadly mirrors the approach agreed at the meeting.

1.2 The demand matrices have been calculated in such a way to have the following characteristics:

- represent 2004 although data were collected at different times;
- time periods – AM (0800-0900), IP (1000-1500) and PM (1700-1800) – other time periods were retained throughout processing where possible;
- maximum demand segmentation (eg purpose, car availability) retained in processing where possible but no segmentation for assignment purposes

2 Available Data

2.1 A list of data which were available for matrix development is included in Appendix A. New data were not collected as part of this study. Recommendations will be made for future data collection which may be used in matrix updating or validation.

2.2 In summary the O/D data available for matrix development were as follows:

- GMATS (10 cordons) and M60 After (2 screenlines) O/D surveys – main source of O/D data for the matrices;
- GMATS HIS – 1.5% sample, sample of 53 wards;
- 2001 Census Journey-to-Work data;
- CAPRI station-to-station rail demand for 111 stations;
- Metrolink station-to-station demand from ticket machines;
- Airport Employee survey – home postcode, mode, full/part-time;
- Self-completion postcard O/D surveys in Golborne;
- O/D surveys at Salford University by FaberMaunsell in 2004; and
- matrices from the JETTS public transport model (AM and inter peak).

2.3 Numerous sources of volumetric data were available for calibration (including possible matrix estimation) and validation purposes. Bus passenger counts on GMATS cordons were only conducted in

the outbound direction in most cases. GMATS rail and Metrolink passenger counts were undertaken for both boarders and alighters. Counts on the M60 After screenlines were undertaken in both directions.

3 Overview of Matrix Development Methodology

3.1 In overview the approach to matrix development was:

- GMATS O/D surveys and M60 After surveys used for trips in the "forward" direction (outbound from district centres and northbound across M60 After survey cordons) with expansion factors derived by GMTU;
- GMATS O/D and M60 After surveys transposed;
- movements which were observed on more than one cordon or partially observed were identified using the network model;
- an initial matrix for movements not captured by GMATS O/D or M60 After surveys was developed from available data (eg local O/D surveys, CAPRI data, Metrolink Ticket data, Census, etc);
- matrices from GMATS / M60 were combined with the infill matrix; and
- matrix smoothing techniques were applied

3.2 The matrices represent "true" origin and destination. For example, in the case of a home-to-work trip consisting of a car access leg to a rail station and a public transport leg the origin is recorded as the home zone and the destination recorded as the workplace zone. A subsequent process in TRIPS will modify the matrices for assignment purposes such that the origin zone in the above example will be re-allocated to the rail station. This process is discussed in section 9 of this note.

3.3 All work is carried out in the *Matrices* sub-folder of the project folder.

4 Calculation of Forward Direction Matrices from GMATS and M60 After OD Surveys

Combining GMATS and M60 After Surveys

4.1 An initial task was to combine records from the GMATS and M60 After surveys. This task was carried out in the *Matrices\GMATSM60* folder. Before the combination of GMATS and M60 data could be achieved, the different GMATS and M60after datasets (bus, Metrolink, and rail for each) needed to be married up into one dataset. The preparation for combining was carried out largely manually, with the combining of GMATS data carried out in the Access database *combineGMATS.mdb* located in folder *GMATS* utilising queries 001-003. The details of the combination and resulting fields are outlined in Table 4.1, with an x in columns 2-4 indicating that the field was present in the original individual mode dataset, and a gap indicating no data present.

Table 4.1 Combining GMATS Data from Different Modes

Field	BUS	METROLINK	RAIL	Notes on combining

Field	BUS	METROLINK	RAIL	Notes on combining
Unique Number	x	x	x	
Phase	x	x	x	
UniqueNumberWithPhase	x		x	
IDNumber	x			
TrainID			x	
Date	x	x	x	
PreExpansionCordonTime	x			
IssueTime		x	x	
SiteNumber	x	x	x	recoded with prefixes B,M, and R
StartPurpose	x	x	x	
StartEasting	x	x	x	
StartNorthing	x	x	x	
StartDumpFlag	x	x	x	
StartStationCode		x	x	
EndStationCode		x	x	
StartTime		x	x	
StartMode	x	x	x	re-coded for consistency
EndPurpose	x	x	x	
EndEasting	x	x	x	
EndNorthing	x	x	x	
EndDumpFlag	x	x	x	
EndMode	x	x	x	re-coded for consistency
CarAvailable	x	x	x	
StartParkCost	x	x	x	
EndParkCost	x	x	x	
ReverseJourney	x	x	x	
ReverseTime	x	x	x	
ReverseDay			x	
TicketType	x	x	x	re-coded for consistency
Age	x	x	x	
Sex	x	x	x	
NumberCars	x	x	x	
TicketValidTime	x	x	x	
Service	x			
ConstrainedExpFactor	x	x	x	
RecordFlag		x	x	
PseudoInterviewTime	x	x		
ActualInterviewTime	x	x		
ExpansionHistory	x	x	x	
JourneyPurpose	x	x	x	
MatchingTrainID			x	
SRHMOriginZone	x	x	x	
SEMMMSOriginZone	x	x	x	
SRHMDestinationZone	x	x	x	
SEMMMSDestinationZone	x	x	x	
CrowFlyDistance(m)	x	x	x	
StartPurpSynthesised	x	x	x	
EndPurpSynthesised	x	x	x	
JourneyPurpSynthesised	x	x	x	
MVAstarttime				pseudointerview for bus&metro, issue time for rail
ModeSurvey				Bus, Met, or Rail

4.2 A similar procedure was followed with M60 after survey data for public transport modes and is outlined in Table 4.2. The preparation was carried out manually and the combining process is undertaken using queries 001-003 in the Access database *combinedM60.mdb* in the *M60after* folder.

Table 4.2 Combining M60 After Survey Data from Different Modes

Field	BUS	METROLINK	RAIL	Notes on combining
SiteNumber	x			
ServiceNumber	x			
PreExpansionScreenlineTime	x			
Date		x	x	
Batch		x		
Time			x	
SerialNumber	x	x	x	
OriginPurpose	x	x	x	
BoardStation		x	x	
OriginMode	x	x	x	re-coded for consistency
DestinationPurpose	x	x	x	
DestinationMode	x	x	x	re-coded for consistency
AlightStation		x	x	
CarAvailable	x	x	x	
OriginParkCost	x	x	x	
DestinationParkCost	x	x	x	
TicketType	x	x	x	re-coded for consistency
Age	x	x	x	
Sex	x	x	x	
NumberCarsAvailable	x	x	x	
OriginEasting	x	x	x	
OriginNorthing	x	x	x	
DestnEasting	x	x	x	
DestnNorthing	x	x	x	
Group		x		
NumberOver16		x		
NumberUnder16		x		
OriginDumpFlag	x	x	x	
DestnDumpFlag	x	x	x	
ConstrainedExpFactor	x	x	x	
UnconstrainedExpFactor	x	x		
PseudoInterviewTime	x	x		
ActualInterviewTime	x	x		
ExpansionHistory	x	x	x	
RouteNumber			x	
ExpansionStation			x	
TrainNumber			x	
TrainTime			x	
Operator			x	
Direction			x	
MVAStartTime				pseudointerview for bus&metro, time for rail
ModeSurvey				M60Bus, M60Met, or M60Rail

4.3 The GMATS and M60After Survey data were then combined together into one dataset utilising queries 001-002 in the Access database *gmatsm60combining.mdb* located in the *combined* folder. Again, the re-coding necessary was carried out prior to combination. Field names and notes on the combination are shown in Table 4.3

Table 4.3 GMATS and M60 After Survey Field Equivalence

GMATS Field	M60 Field	Notes on Combining
UniqueNumber	SerialNumber	
Phase	Batch	
UniqueNumberWithPhase		
IDNumber		
TrainID		
IssueDate	Date	
PreExpansionCordonTime	PreExpansionScreenlineTime	
IssueTime	Time	
SiteNumber	SiteNumber	
StartPurpose	OriginPurpose	re-coded for consistency
StartEasting	OriginEasting	
StartNorthing	OriginNorthing	
StartDumpFlag	OriginDumpFlag	
StartStationCode	BoardStation	re-coded for consistency
EndStationCode	AlightStation	re-coded for consistency
StartTime		
StartMode	OriginMode	re-coded for consistency
EndPurpose	DestinationPurpose	re-coded for consistency
EndEasting	DestnEasting	
EndNorthing	DestnNorthing	
EndDumpFlag	DestnDumpFlag	
EndMode	DestinationMode	re-coded for consistency
CarAvailable	CarAvailable	
StartParkCost	OriginParkCost	
EndParkCost	DestinationParkCost	
ReverseJourney		
ReverseTime		
ReverseDay		
TicketType	TicketType	re-coded for consistency
Age	Age	re-coded for consistency
Sex	Sex	
NumberCars	NumberCarsAvailable	
TicketValidTime		
Service		
ConstrainedExpFactor	ConstrainedExpFactor	
RecordFlag		
PseudoInterviewTime	PseudoInterviewTime	
ActualInterviewTime	ActualInterviewTime	
ExpansionHistory	ExpansionHistory	
JourneyPurpose		
MatchingTrainID		
SRHMOriginZone		
SEMMMSOriginZone		
SRHMDestinationZone		

GMATS Field	M60 Field	Notes on Combining
SEMMMSDestinationZone		
CrowFlyDistance(m)		
StartPurpSynthesised		
EndPurpSynthesised		
JourneyPurpSynthesised		
MVATime	MVAStartTime	
ModeSurvey	ModeSurvey	
	ServiceNumber	
	Group	
	NumberOver16	
	NumberUnder16	
	UnconstrainedExpFactor	
	RouteNumber	
	Direction	
	TrainNumber	
	TrainTime	
	Operator	
	ExpansionStation	

4.4 The M60 After data had the following omissions of particular note:

- reverse journey flag and time – it was assumed that all journeys are two-way and reverse journey times were synthesised (see below);
- SEMMMS and SRHM zones – records were allocated to the newly modified zone system developed for this study – SEMMMS and SRHM zones were not required;
- journey purpose information – was determined from origin and destination purpose.

4.5 With all combination of datasets, fields which are not present in both datasets were retained, with blanks if the data were not collected.

Zoning

4.6 Each record was allocated origin and destination zones (using the zone system that has been developed for this study). This was done by exporting the full set of origin and destination eastings and northings to MapInfo, allocating zones using a SQL query, and then re-importing an easting and northing to zone equivalence list into Access. Queries 001-003 in the Access database *combinedworking.mdb* in the *combined* folder are used to produce the initial eastings and northings list. Some data within the interview dataset had an origin or destination located just off-shore (according to MapInfo coordinates) and hence would not match to any zone. These surveys had their origin or destination eastings and northings re-coded so that they corresponded to the nearest shoreline zone. The re-coded data is in table *Data_GMATSM60_revforOSGR*. The eastings/northings to zone equivalence table output from MapInfo is in table *Data_Gridrefs-zones* with query 004 adding origin and destination zone to each interview record.

Multiple Observations in the Surveyed Direction

4.7 Expansion factors for trips which were captured in the survey direction on more than one cordon or screenline were reduced to eliminate double-counting. Trips which should have been multiply observed were identified using the network model. The model used was an early version of the TRIPS PT model being developed for the study.

4.8 The process was as follows:

- MVPUBM was used to build multi-route paths and load a matrix of 1s (a set of assignment parameters was used based on DfT guidance and experience);
- MVPUBM was used to build select link matrices for each cordon and screenline in the surveyed direction;
- MVGRAF was used to visually inspect the trip ends and desire lines relating to each select link matrix to check for reasonableness;
- MVMODL was used to calculate [ratio] = [select link mx] / [full mx] at a zonal level for each select link matrix (ie the ratio of the probability of a trip from i to j crossing the screenline);
- MVMODL was used to produce a matrix of number of survey cordon/screenline crosses per OD pair (a cordon/screenline was assumed to have been crossed if the ratio was greater than 0.5 for that cordon/screenline);
- this matrix of cordon/screenline crosses was output to csv for importing into Access; and
- the expansion factor for each interview record was factored by by 1 / [no. crossings in the surveyed direction] for that OD journey.

4.9 The above procedure is carried out in the CUBE application *Matrices\SLINKS\CUBE\assign00.app* utilising the TRIPS programs of execution order 1 and 3-6.

4.10 Forward matrices were calculated by query *005* in the *combinedworking.mdb* Access database by summing the adjusted expansion factor over:

- origin zone;
- destination zone;
- hour – allocated based on MVATime (PsuedoInterviewTime or issue time) ;
- start purpose;
- end purpose; and
- car availability.

5 Transposition of GMATS and M60 After OD Surveys

5.1 In outline the transposition process followed was as follows:

- origin / destination and start / end purpose transposed from forward direction records;
- records which were observed outbound on any screenline / cordon were excluded (these trips would have been included in the forward matrices);
- return times were synthesised where these were missing by reference to a profile calculated from survey records with both forward and reverse times (this is outlined below) ;
- reverse direction matrices were calculated on the basis of the modified forward expansion factor; and
- expansion factors were adjusted to match reverse direction counts where available.

Transposition of Records

5.2 A transposed dataset was created consisting of:

- site number;
- source and Mode of Survey;
- start purpose (end purpose from the forward direction);
- end purpose (start purpose from the forward direction);
- start mode (end mode from the forward journey);
- end mode (start mode from the forward journey)
- start station code (end station code from the forward journey);
- end station code (start station code from the forward journey);
- car availability;
- reverse journey time;
- origin (destination from the forward direction);
- destination (origin from the forward direction);
- expansion factor modified for multiple cordon crosses; and

- forward time (PseudoInterviewTime).

5.3 Records where the transposed trip would have been observed in the forward direction on any cordon were then removed from the transpose data. These were identified using the select link information. The transposition and filtering were carried out by queries *005b* and *009* in the *combinedworking.mdb* Access database. Records where the reverse journey flag indicates that no return journey was made were excluded from the transposition.

Synthesise Return Times

5.4 Return journey time is not recorded on around 40% of GMATS records. Return journey time was not collected in the M60 After surveys. Return times were therefore synthesised where missing.

5.5 Return time profiles were calculated from those forward direction records which include reverse journey time. Profiles were defined by period as preliminary examination of the database indicated that data by hour would be patchy. Queries *006-008* in Access database *combinedworking.mdb* in folder *combined* were used to create a tabulation of the following data:

- start purpose;
- end purpose;
- forward journey period;
- % of trips making the return trip in each period.

5.6 Periods were defined as follows:

- before 0700
- 0700-1000;
- 1000-1500;
- 1500-1600;
- 1600-1900; and
- after 1900.

5.7 An additional profile was calculated for all purposes, used for synthesising return times for those records without any purpose data or for those with purpose combinations not covered by the profiles previously calculated.

5.8 The period profile tabulation is shown in Appendix B. Some of the less common purposes were aggregated so that "Hotel/B&B", "Personal Business", and "Social/Leisure" were combined as "Other".

Note that each row sums to 100%. These tabulations were inspected for reasonableness. These return time period profiles were applied by queries *010-012*.

5.9 Ultimately matrices were required for selected hours. Factors were derived by purpose to split reverse time period into reverse hour. Where there was no purpose data, factors were calculated simply by reference to all trips regardless of purpose. These factors were calculated by queries *013-015* and applied by queries *016-018*.

5.10 As a result, records without a valid return time were replicated six times in the transpose matrix – one for each reverse period specified in Appendix B, and then factored again to reduce the factored expansion factors to the hourly figures.

Revising Expansion Factors to Reflect Reverse Counts

5.11 Bus counts are available in the reverse direction for the Regional Centre cordon and Stockport cordon. Rail and Metrolink counts are available in the reverse direction for all GMATS screenlines and cordons. Expansion factors were revised for all cordons and screenlines where counts were available in the reverse direction.

5.12 Records for which the reverse direction movement have been captured on any cordon or screenline in the forward direction were excluded from the transposition process. Therefore the reverse direction counts must be reduced accordingly prior to calculating expansion factors. The adjusted reverse count on a screenline can be calculated as follows:

$$C' = C - \Sigma_{ij} (F_{ij} \times S_{ij})$$

Where C' = adjusted reverse direction count
C = observed reverse direction count
i = origin zone
j = destination zone
F_{ij} = forward direction matrix
S_{ij} = select link matrix in the reverse direction for the screenline in question

5.13 These adjustments were calculated by time period. The assignment and select link of the cordons in the reverse direction to the survey were carried out in the *Assign00.app* TRIPS application by the MVPUBM programs with execution orders 8 and 9. The adjustments to the total cordon counts is then calculated with reference to the forward matrices (read in by MVMODL execution order 10) in MVMODL with execution order 11. Data concerning the counts and the processing of the adjustments can be found in the *Matrices\GMATSM60\counts* folder.

5.14 Expansion factors were then revised to match the adjusted reverse direction counts where available. The factors and the application of the factors are carried out by queries *019-022*.

5.15 Finally queries *023-028* construct the overall matrices from the previously calculated forward and reverse matrices, while the *OUTPUT* queries produce data suitable to be exported as csv file ready for input to TRIPS.

6 In-Filling Demand

6.1 Movements not captured by the GMATS and M60 After surveys were "in-filled" using the best available data. Considering the origin / destination data listed in Appendix A the data were used in the following order:

- Salford University surveys;
- Golborne – Golborne to/from Salford University will be taken from the datasets listed above;
- Metrolink ticket machines – data is station-to-station (rather than true-OD) so GMATS, M60 After and datasets listed above would be used in preference;
- CAPRI – data is station-to-station and represents a full year; and
- Census Journey to Work - data relate only to home-to-work trips, are not segmented by time of day or day of week, frequency of trip making is not recorded.

6.2 The following data were not used:

- JETTS Matrices;
- Airport Passenger Surveys – coarse geographic segmentation, no time of day or day of week segmentation; and
- Airport Employee Surveys – no time of day or day of week segmentation, no indication of numbers of journeys per week (only if employee is full or part time).

6.3 The degree of segmentation in each dataset varies. Where required, factors were applied to each dataset to segment the matrices by time period as required for assignment.

6.4 The processing of each of the datasets is considered below.

Salford University

6.5 Expansion factors had been calculated within the databases provided to MVA. Matrices are also transposed within the databases. These calculations were reviewed with some minor corrections applied. Origin and destination zones were allocated to each record on the basis of co-ordinate data stored in the databases and the zone system devised for this study. Matrices were formed by summing expansion factors over:

- origin;
- destination;
- purpose; and

- hour.

6.6 The Salford University survey is somewhat limited in data coverage. The survey consists of 505 surveys over six sites in the period 0800-1800. The surveys were carried out on passengers waiting at bus stops near the university with no survey of either alighting passengers or reverse journeys of surveyed passengers.

6.7 The survey data were processed in the *Salford_Uni_Surveys.mdb* Access database in the *Matrices\SalfordUni* folder. Queries *001-007* produce expansion factors, while queries *008* and *009* attach a period code and expansion factors to each record respectively. Queries *010-012* are used to export OS Grid References for assignment of zone numbers using MapInfo, while *013* attaches zones to survey data and *014-016* produce the final output matrices from the survey data.

Golborne

6.8 The data provided to MVA was split into bus and rail survey data. The bus data were from self-completion postcard surveys handed out on bus in both directions at a number of locations in the Golborne study area, while the rail data were from self-completion postcard surveys handed out to rail passengers waiting at four stations in the study area (Newton-le-Wilows, Earlestown, Bryn, and Garswood). The data provided was partially processed interview data and included origin and destination grid references and expansion factors for each record.

6.9 Bus data consisted of 276 records and was for the period 1300-1800 and included some data on times of reverse journeys but these data were patchy. Rail data consisted of 158 records for the period 0700-1200 and also included data on times of reverse journeys.

6.10 Zones were allocated to each record in a similar manner to previous surveys using queries 001-005 in the *Golborne.mdb* database in the *Matrices\Golborne* folder and externally using MapInfo. The zones were appended to the survey records by queries *006* and *007.*

6.11 Because the survey data were sparse, it was decided to include all 0700-1000 movements in the am peak, and similarly 1600-1900 in the pm peak, and then factor down by reference to totals of expansion factors in the peak hour compared to the peak period. These totals were calculated by queries *008-011*.

6.12 With a limited number of survey records available, patchy data, and with bus surveys carried out in the afternoon and rail surveys carried out in the morning, it was decided that using reverse journey time data may not be successful. For this reason the pm rail matrix was calculated by simply transposing the am rail matrix. Similarly the am bus matrix was calculated by transposing the pm bus matrix. Interpeak matrices were calculated from the sections of interpeak covered by each of the bus and rail surveys.

Metrolink Ticket Machines

6.13 Matrices of station-to-station journeys were provided to MVA for weekday morning period (before 9:30), inter peak (9:30 to 15:29) and evening period (15:30 to 18:30). These were converted to a zone-to-zone matrix. This was carried out in the Metrolink subfolder, and the process was as follows:

- a catchment radius of 1km for Metrolink stops was determined by analysing walk distances to/from stops from the GMATS data;
- zones within the catchment radius of each stop were identified using MapInfo; and
- expanded GMATS and M60 After trip ends were used to calculate the distribution of demand within zones in the catchment area.

6.14 Zones within the catchment of each Metrolink station were originally identified in MapInfo as above, however there were a large number of zones present in the catchment of two or more stations. This was likely to cause some trips to be allocated to the wrong zones. To overcome this problem, where a zone was in the catchment of more than one station it was allocated to the nearest station (distances calculated from OS grid references). These steps are carried out by queries *002-006* in the *Metrolink.mdb* database in *Matrices\Metrolink* folder.

6.15 Queries *007-009* calculate the sum of trips in the GMATSM60 combined matrices (the parts derived from Metrolink-based surveys) by zone and hence factors to split the station totals into zones within the station catchments.

6.16 Period to hour factors were calculated on a whole matrix basis from boarding and alighting counts across the network, and are applied by queries *010-012*. The *OUTPUT* queries produce the final matrices.

CAPRI

6.17 The first step in processing the CAPRI data was to create a symmetrical station-to-station matrix of annual demand. Previous work by GMPTE had concentrated on intra-Greater Manchester trips and did not include any trips originating or destined for stations outside of Greater Manchester. The combination of data from all stations was carried out separately, while all further manipulations were carried out within the Access database *Capri.mdb* located in the *Matrices\Rail\CAPRI* folder.

6.18 The process is carried out by a number of queries in the *Capri.mdb* database. Queries 001-005 re-code some origins and destinations to more appropriate locations (eg excursion tickets (Alton Towers), and tickets with multiple stations (Manchester BR)). There were also some rover type tickets that needed to be dealt with, by far the most common being those valid within Greater Manchester. These are separated out by query 007 and calculation of factors and distribution of these trips are performed in queries 008-013. The distribution of these trips is based on the distribution of other trips wholly within Greater Manchester. Queries 014 and 015 add these distributed trips to the original station-station matrix and then subtotal any duplicate entries.

6.19 The annual CAPRI data were converted to modelled hours. An annual to weekday factor of 1/320 was used, in line with previous studies of this type. A weekday to 12 hour factor of 1/1.1 was then used to produce 12 hour weekday flows. For the final factoring, from 12 hour to peak hours and inter peak flows, it was necessary to introduce tidality to the flows as it would be expected that am and pm peak hour flows will have dominant flows in opposite directions on a number of routes.

6.20 For this purpose, the stations were split into four groups: Manchester City Centre, other Greater Manchester urban centres, Greater Manchester suburban, and external. Boarding and alighting counts were available for many stations in Greater Manchester and these were used to calculate factors for

each station group. Trips between station pairs were therefore factored by the board factor of the origin station group and the alight factor of the destination station group. This has the effect of introducing tidality into the station to station matrix. The application of factors is carried out by queries *016-018*.

6.21 Converting the station-to-station matrix to zone-to-zone was undertaken in a similar manner to that used for Metrolink.

7 Census Data

7.1 Census data were used directly to calculate bus journey to work matrices and indirectly to calculate trips by bus for all other purposes. The method for journey to work matrices is straightforward, while the method for other purposes relies on the same distribution as for journey to work, and trip rates derived from surveys.

7.2 The work was carried out in Access database *GMjourneytowork.mdb* in the *Matrices\Census Journey to Work* folder.

7.3 Data were extracted for those census records with either origin or destination output area (OA) or both within Greater Manchester and bus trips>0, by query 004. Home-to-work period matrices at OA level were then calculated by applying GMTU supplied factors (table *Fwdpdfactors*) for time of day and distance utilising *query 006A*. The factors applied are included in Appendix B. Distances were calculated from OA population centroid coordinates in *query 005*. The proportion of each OA within each zone by area was calculated using the outputs from *queries 001-003* and MapInfo to produce the table *OAZones*. Zonal matrices were then calculated from OA-based matrices by reference to table *OAZones* with *query 006c*.

7.4 Work-to-home period matrices were calculated by transposing the origin and destination OAs of the extracted bus records and applying a second set of factors supplied by GMTU (*TPosePdFactors*) for time of day and distance (*query 007A)*. These factors are also included in Appendix B. This was converted from an OA matrix to a zonal matrix in the same manner as the home-to-work matrices using *query 007B*.

7.5 To produce matrices for the other purposes it was necessary to apply the trip rates provided by GMTU held in table *TripRates*. These differ by household category (14 types based on occupants and car ownership), journey purpose (10 types), and location (inside/outside M60). These trip rates are shown in Appendix B. Each OA identified by *query 006B* as producing trips in the home-to-work matrices and stored in table *ResOAs* is treated as a trip-generating OA for all purposes.

7.6 Work was carried out on census data in Excel to give average proportion of each GMTU household category by ward (the lowest level at which data correlated between household occupants and car ownership is available). This gives table *HHTypesbyWard*. The *HHsbyOACode* table contains total households by OA, again calculated from census data. The *M60Ind* table was produced using MapInfo and contains a flag to indicate whether an OA is inside or outside the M60. Queries *008* and *009* match this data to the residential OAs identified above and calculate the number of households in each category for each OA based on the average proportions for that ward.

7.7 The trips rates described in paragraph 7.5 are then applied to produce number of trips by purpose and household category per day by *query 010*. The home-to-work and work-to-home purposes can be

discarded as they have already been accounted for directly from census data. Home-to-any-other, and any-other-to-home, are produced with a known origin for home to other and destination for other to home. There are two purposes (any employers business and non-home to non-home) for which we cannot be sure of either origin or destination location.

7.8 The home-to-any-other trips are extracted using *query 014A* and any-other-to-home by *query 014B*. The total number of trips (excluding home-to-work and work-to-home) is calculated by *query 015A*, while *query 015B* calculates the total number of trips for which we know neither origin nor destination.

7.9 The home-to-any-other trips (and the any-other-to-home trips) are then factored to period totals using table *12hrtoPdfactorsforNonHWtrips* and *queries 016A-016B*. These factors are based on the GMATS bus survey data and differ by time period and to/from home directions. These queries also convert between OAs and zones in the same manner as for the home-to-work and work-to-home process above.

7.10 The home-to-work Trip matrices produced by query 006C are then factored at an origin zone level to produce the correct number of trips per origin (output from query 016A) in each time period for the home-to-any-other matrix. This is carried out by queries *017A, 018A,* and *019A*. any-other-to-home calculations are carried out by factoring by destination zones using queries *017B, 018B,* and *019B*.

7.11 The final step is to factor up the home-to-any-other and any-other-to-home matrices to account for the two purposes for which we know neither origin nor destination. The home-to-any-other and any-other-to-home matrices are combined (*queries 020C and 020D*). The total number of trips to be added to account for the unknown trips for each period was calculated by *query 015C*, and together with the total number of trips in each time period for the combined matrix (*query 021A*) allows a whole matrix factor for each period to be calculated (*query 021B*). These factors are then applied by *query 022B*.

7.12 *Queries 020A* and *020B* combine the home-work and work-home matrices, which is subtotalled by *query 022A*. The work based and non-work based matrices are then combined using *queries 023A* and *023B*. Output matrices are produced for each time period by the *OUTPUT* queries.

8 Matrix Compilation

8.1 Forward and reverse matrices from the GMATS / M60 After data were added and output from Access in csv format and built into TRIPS format. The matrices output from Access are not segmented by car availability of journey purpose, and show simply origin zone, destination zone, and trips.

8.2 The Salford University and Golborne matrices were combined. Double counting between these datasets was eliminated by determining matrices of flags for movements which could have been observed in each survey. The flags for Salford University surveys were determined manually, while the Golborne flags were determined by a select link procedure carried out in *Matrices\SLINKS\CUBE\assign00.app*.

8.3 A select link matrix was produced by MVPUBM to identify all movements which should have been observed on any GMATS or M60 After cordon or screenline in either direction , and this was used as the flag to indicate if that movement was represented in the matrix. A movement was considered to be present if the select links indicated more than 50% of demand was observed on any cordon or screenline.

8.4 The compilation of matrices was carried out with in a hierarchical manner with the datasets starting with the most reliable being :

- GMATS and M60 Derived Matrices;
- Salford University survey matrices;
- Golborne survey matrices; and
- Metrolink Ticket, Rail Ticket, and Census-based bus matrices.

8.5 The compilation of the matrices is carried out in the TRIPS application *COMBIN00.app* (located in the Matrices\CUBE COMBINING folder) by the MVMODL programs with execution orders 1-8.

8.6 The number of trips contributed from each component of the matrices are shown in Table 8.1.

Table 8.1 Number of Trips Contributed by Each Dataset

	am	ip	pm
GMATS M60	46091	34880	50939
Salford Uni	15	13	36
Golborne	98	85	48
CAPRI data	636	216	698
Metrolink ticket data	6580	3409	4057
Census-based bus	29885	24237	19096
TOTAL	83305	62840	74875

9 Matrix Smoothing

9.1 As the matrices reflect the sample errors in the underlying data a process of "matrix smoothing" was adopted to reduce lumpiness. Districts were defined consisting of neighbouring zones with similar land uses. The smoothed matrix matches the original matrix at a district level. Within districts the distribution is altered to match the matrix wide trips ends. This can be expressed algebraically in the following way:

$$T_{ij}^{*} = T_{IJ} \times \frac{T_i}{T_I} \times \frac{T_j}{T_J}$$

where:

T_{ij}* smoothed matrix (zonal level)

T_{IJ} original matrix (district level)

T_i , T_j original trip ends (zonal level)

T_I , T_J original trip ends (district level)

9.2 Implementing the smoothing process in TRIPS consists of the following steps:

- MVSQEX – compress matrix (T_{ij}) to district level (T_{IJ})
- MVSQEX – expand (replicate) district level matrix
- MVMODL – calculate district level trip ends (T_I and T_J) and save as matrices (so "origin" matrix has the same data in each column, and the "destination" has the same data in each row)
- MVSQEX - expand (replicate) district level trip end matrices
- MVMODL – do smoothing calculation

9.3 This procedure is followed through in the SMOOTH sub-application in the *COMBIN00.app* TRIPS application.

Appendix A – Data for Matrix Building

This appendix summarises the data that are available for developing public transport demand matrices for the Greater Manchester Public Transport Model.

Data Sources – O/D

GMATS Passenger Surveys:

- surveys undertaken in 2002/3
- time period 7am to 7pm
- self completion
- conducted in outbound direction
- data on true OD, purpose, access & egress mode, car availability, reverse journey time
- bus passenger surveys on 9 cordons and one screenline:

Bolton	Stockport
Bury	Ashton-u-Lyne
Manchester	Altrincham
Oldham	Wigan
Rochdale	Trafford Park (screenline)

- Rail passenger surveys at 14 stations in the 10 cordon areas:

Altrincham	Oxford Road
Navigation Road	Piccadilly
Stockport	Salford Manchr
Wigan North Western	Manchester Vic
Wigan Wallgate	Rochdale
Bolton	Oldham Mumps
Deansgate	Ashton

- Metrolink surveys at 10 stations:

Bury	Navigation Road
Victoria Station	Altrincham
Market Street	Piccadilly Gardens
St Peter's Square	Mosley Street
GMEX	Piccadilly Station

GMATS HIS:

- 15,000 households – 1.5% sample
- date 2001-3

- trip data for 7am to 7pm avg weekday and weekend
- sample of 53 wards (see figure)

M60 After

- surveys undertaken in Spring 2004
- time period 0630-2030
- self completion
- two cordons (see figure)
- surveys in northbound direction
- counts in both directions
- on-bus surveys
- Metrolink surveys at 9 stops

Altrincham	Dane Road
Navigation Road	Stretford
Timperley	Old Trafford
Brooklands	Trafford Bar
Sale	

- Rail surveys on 6 routes

Guide Bridge (Rose Hill line)	Warrington
Bredbury (New Mills line)	Manchester Airport
Stalybridge/Huddersfield	Stockport

- data on true OD, purpose, access & egress mode, car availability, reverse journey time

2001 Census Journey to Work:

- we have ward level data for all UK
- GMPTE have provided OA data for north west

CAPRI:

- 2002
- To/from 111 stations
- GMPTE(?) produced station-to-station tables of journeys, issues and revenue

Metrolink Data:

- station-to-station demand
- year 2000
- Mon-Fri by time period
- Sat by time period
- Sun by time period

ETM:

- Not provided by GMPTE
- Only available for subsidised services
- Operators very sensitive about data for commercial services

Airport Employee Surveys:

- 2003/4 Q4 to 2004/5 Q3
- data on home postcode, main mode, second mode, no. stops, full/part-time, sex, age, employer
- also air-passenger access mode by postcode sector and district

Golborne

- face-to-face OD surveys
- bus and rail user data available with O/D postcodes and expansion factor
- no time of day or segmentation on available data

Salford Uni and City Centre

- June 2004 (FaberMaunsell?)
- Bus pax
- O/D, mode, purpose, access/egress mode
- Boarding counts for Uni (not city centre?)
- Small sample – 500 for Uni, 200 for city centre,

JETTS Matrices

- no segmentation
- AM and IP

- GMPTE analysis indicates that validation is very poor

Data Sources – Volumetric

Bolton:

- July 04
- 7am to 7pm
- Boarding / alighting at bus station
- To / from platforms at rail station

FaberMaunsell Regional Centre Counts

- June 2004
- 7am to 7pm
- Visual bus occupancy counts on cordon around city centre (time, service, bus type, estimated pax)

CPS Derived bus counts

- Work for Stockport suggested that these we unreliable
- @@ check occupancies for individual routes

Astley Bridge:

- Estimated bus pax flows for one link near Bolton
- Date not recorded in spreadsheet

On-bus boarding counts

- Metroshuttle – April 2003
- Hyde – Nov 2002

A56 Prestwich

- For JETTS
- June 2001
- Visual occupancy bus pax

Stockport

- MVA

- June 2004
- Bus b/a counts at bus station and stops on A6 and A560 in town centre
- Visual pax counts on GMATS cordon, with on-bus sample for bias correction

GMTU Annual Reports

- AM and IP b/a counts at 65 rail stations and 29 Metrolink stations

Rail B/A Counts

- November 2004
- AM and IP
- By direction
- 92 stations

Appendix B – GMTU Household Interview Survey - Factors and Trip Rates

Table B1.1 24-hour to Period Factors for Home to Work by Bus

	Crow fly < 2km	2-4.99km	5-9.99km	>= 10km
0800-0900	36.54%	22.86%	25.08%	26.42%
1000-1500	9.07%	9.33%	8.89%	6.89%
1700-1800	0.00%	0.00%	0.00%	1.26%

Table B1.2 24-hour to Period Factors for Work to Home by Bus

	Crow fly < 2km	2-4.99km	5-9.99km	>= 10km
0800-0900	0.78%	0.45%	0.31%	0.00%
1000-1500	11.92%	9.18%	5.61%	2.15%
1700-1800	24.29%	20.85%	25.50%	22.40%

Table B.3 GMTU Household Categories

	Cars per Household			
Census Household Category	0	1	2	3+
HS1	1	2	2	2
HS2	3	4	4	4
HS3	5	6	6	6
HS4	7	8	8	8
HS5	9	10	11	11
HS6	12	13	14	14

Household Categories

HS1: One adult only aged 65+ and retired (not working)
HS2: One adult only aged 16 to 64 or aged 65+ and working
HS3: One adult only aged 16+ and one or more children aged 0-15
HS4: Two or more adults only, aged 65+ and not working
HS5: Two or more adults only, aged 16 to 64, or aged 65+ and working
HS6: Two or more adults aged 16+ and one or more children aged 0-15

Table B.4 Bus Trip Rates by Household Category and Purpose (inside M60)

	Journey Purpose									
GMTU Household Category	1	2	3	4	5	6	7	8	9	10
1					0.110	0.114	0.141	0.109		0.032
2										
3	0.055	0.033	0.017	0.017	0.186	0.189	0.193	0.123	0.030	0.071
4	0.041	0.041			0.011	0.011	0.038			
5			0.250	0.195	0.197	0.195	0.446	0.458		0.123
6			0.167	0.195			0.028			0.071
7					0.299	0.352	0.291	0.246		0.062
8					0.038	0.038	0.093	0.093		
9	0.319	0.302	0.199	0.187	0.204	0.202	0.316	0.307	0.018	0.219
10	0.166	0.147	0.046	0.038	0.044	0.039	0.077	0.066	0.036	0.063
11	0.229	0.227	0.078	0.078	0.028	0.036	0.046	0.020	0.042	0.031
12	0.214	0.189	0.287	0.238	0.216	0.194	0.385	0.159	0.069	0.273
13	0.142	0.130	0.310	0.304	0.067	0.066	0.046	0.037		0.075
14	0.137	0.119	0.226	0.184		0.020	0.013	0.098	0.009	0.043

Purposes

1 Home to work
2 Work to home
3 Home to education
4 Education to home
5 Home to shop
6 Shop to home
7 Home to other
8 Other to home
9 Any to employer's busines and employer's busines to Any
10 Any non-home to any non-home (excluding employer's business)

Table B.5 Bus Trip Rates by Household Category and Purpose (outside M60)

	Journey Purpose

GMTU Household Category	1	2	3	4	5	6	7	8	9	10
1			0.002	0.002	0.117	0.129	0.114	0.102		0.032
2					0.016	0.022	0.027	0.021		0.014
3	0.059	0.035	0.003	0.003	0.158	0.193	0.084	0.100		0.114
4	0.019	0.015			0.004	0.008	0.014	0.028		
5	0.012	0.028	0.218	0.213	0.133	0.141	0.282	0.246	0.011	0.256
6			0.191	0.199			0.012	0.028		0.131
7					0.293	0.342	0.270	0.152		0.064
8					0.055	0.076	0.064	0.078		0.038
9	0.256	0.218	0.040	0.040	0.289	0.309	0.296	0.290	0.010	0.090
10	0.126	0.126	0.021	0.023	0.069	0.089	0.077	0.074	0.001	0.045
11	0.049	0.048	0.035	0.035	0.010	0.017	0.003	0.013		0.023
12	0.178	0.153	0.330	0.337	0.164	0.198	0.375	0.142	0.020	0.115
13	0.114	0.101	0.235	0.220	0.055	0.032	0.075	0.067	0.020	0.082
14	0.051	0.031	0.219	0.245	0.005	0.010	0.024	0.036	0.009	0.056

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Appendix C – Derivation of Values of Time

1 Introduction

1.1 This appendix sets out the methodology used to calculate value of time used in the GMSPM2 public transport model.

2 Methodology

2.1 A "perceived" value of time for assignment purposes has been derived from TAG Unit 3.5.6. TAG gives values of time for fourteen categories of occupant (by mode), and also and an average value across mode. "Standard appraisal values" for commuting and other non-working time purposes are not segmented by mode. Relevant values are presented in Table B1.

Table B1 Perceived Values of Time for Public Transport Users

	Perceived Value of Time
Working Time	
PSV passenger	£16.72
Rail passenger	£30.57
Average of all workers	£22.11
Non – Working Time	
Commuting	£5.04
Other	£4.46

Units: £/hr, 2002 values and price

Source: TAG Unit 3.5.6 (February 2007), Tables 1 and 2

2.2 These values of time at 2002 prices and values is factored to 2008 values (2002 prices). Working time is factored by the projected growth in GDP per person, while non work time is factored by 0.8*working value of time growth. Annual growth rates for GDP per person are available from TAG unit 3.5.6 Table 3 and the relevant growth rates are presented in Table B2.

Table B2 Value of Time Growth Rates (2002 to 2009)

Years	Work VOT Growth	Non Work VOT Growth
2002-2003	2.44%	1.95%
2003-2004	2.55%	2.07%
2004-2005	1.67%	1.34%
2005-2006	2.18%	1.74%
2006-2007	1.97%	1.57%
2007-2008	-0.09%	-0.07%
2008-2009	-5.38%	-4.31%

2.3 These are applied to 2002 values of time, using the average of all modes for work time, to give 2009 values of time shown in Table B3.

Table B3 2009 Values of Time (£/hour 2002 Prices)

Purpose	2009 Value of Time £/hr (2002 prices)
Employer's Business	23.26
Commute	5.26
Other	4.65

2.4 The PT matrices have been derived by purpose and the weighted average purpose splits are shown in Table B4.

Table B4 PT Matrix Purpose Splits

Purpose	ALL (wtd avg)
Employer's Business	3.5%
Commute	51.0%
Other	45.4%

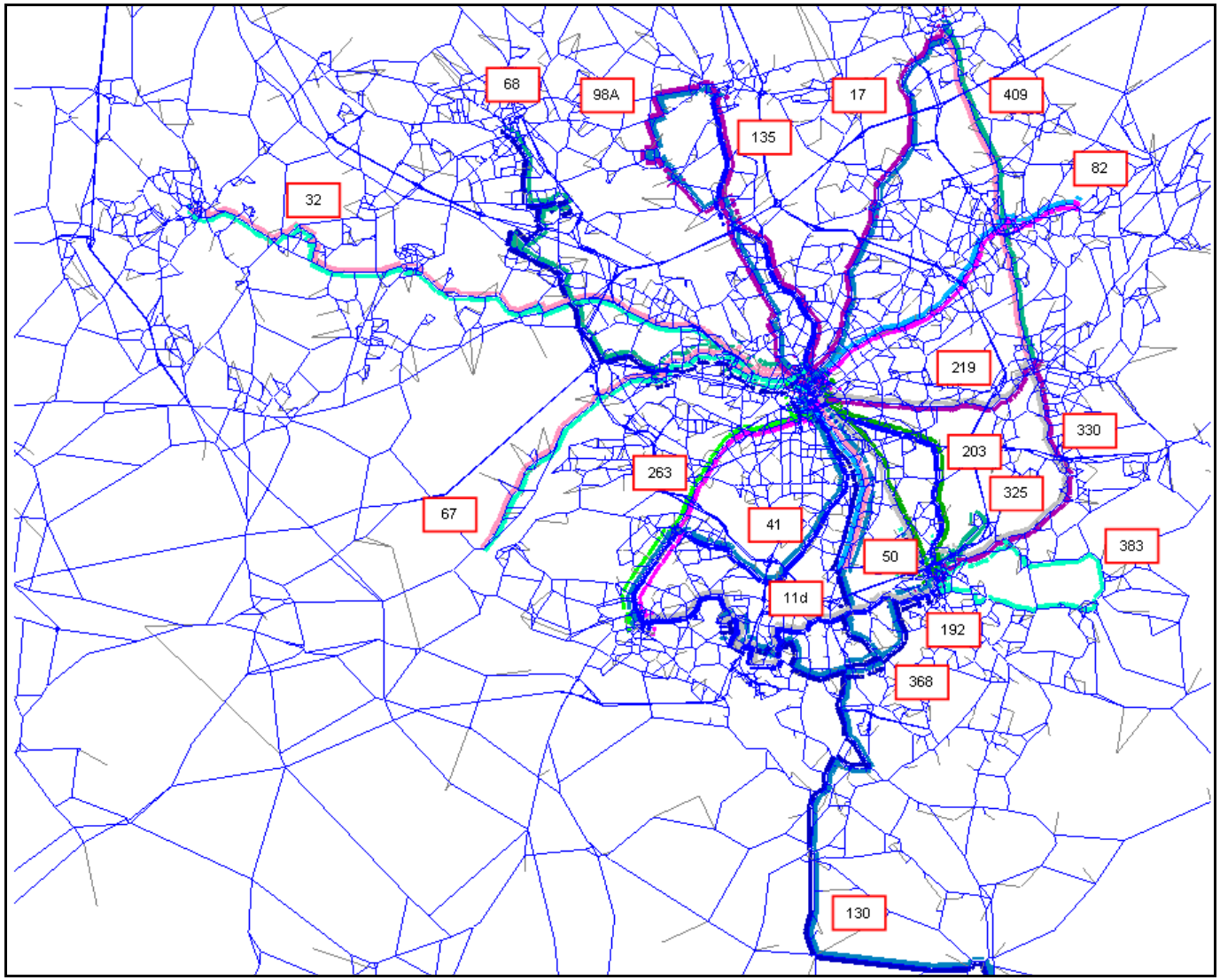
2.5 Applying the all periods weighted average purpose splits (Table B4) to the 2009 values of time (Table B3) gives an average 2009 value of time of £5.61 per hour (2002 prices).

2.6 So far national average values have been considered. The Annual Survey of Hours and Earnings 2009 indicates that average gross hourly earnings for Greater Manchester are some 94% of the UK national average. Adjusting for this difference in income yields a value of time of 525 pence per hour (2002 prices).

Appendix D
Bus Journey Time Routes

Bus Journey Time Routes

Figure 1 below shows the journey time routes which have been used in the model validation.



The descriptions of the routes are as follows:

Table 1 Bus Journey Time Routes

Route No	Description	Type
11d	Stockport – Cheadle Green – Gatley – Wythenshawe - Altrincham	Two-Way
17	Manchester – Blackley – Middleton – Castleton - Rochdale	Two-Way
32	Wigan - Manchester	Two-Way
41	Manchester – Rusholme – Northenden – Sale - Altrincham	Two-Way
50	Manchester – Victoria Park – Burnage – East Didsbury	Two-Way
67	Manchester – Hope Hospital – Eccles – Irlam - Cadishead	Two-Way
68	Manchester – Eccles – Walkden – Farnworth - Bolton	Two-Way
82	Manchester - Oldham	Two-Way
98A	Manchester - Whitefield	Two-Way
135	Manchester – Whitefield - Bury	Two-Way
192	Manchester - Levenshulme - Stockport - Hazel Grove	Two-Way
203	Manchester - Belle Vue - Reddish - Stockport	Two-Way
219	Manchester – Openshaw – Ashton - Stalybridge	Two-Way
263	Manchester - Altrincham	Two-Way
330	Stockport - Bredbury - Hyde - Dukinfield – Ashton	Two-Way
409	Rochdale – Royton - Ashton	Two-Way

325	Stockport – Portwood – Brinnington Estate Circular	Circular
383	Stockport - Dialstone Lane - Marple - Romiley - Bredbury - Stockport (Circular)	Circular
368	Stockport – Newall Green	Two-Way
130	Macclesfield – Manchester City Centre	Two-Way

Table 2 Comparison of Modelled and Observed Bus Journey Times

			AM Peak				Inter-peak				PM Peak			
Service	**Direction**	**TRIPS**	**Obs**	**Mod**	**% diff**		**Obs**	**Mod**	**% diff**		**Obs**	**Mod**	**% diff**	
11d	Inbound	20	72.2	62.1	-14%	OK	68.9	64.0	-7%	OK	67.8	67.4	-1%	OK
	Outbound	21	65.6	64.7	-1%	OK	69.9	63.6	-9%	OK	58.4	63.6	9%	OK
17	Inbound	39	54.5	62.5	15%	OK	49.4	54.2	10%	OK	45.5	54.2	19%	SLOW
	Outbound	41	53.4	55.7	4%	OK	52.3	62.0	19%	SLOW	53.8	55.6	3%	OK
32	Inbound	85	85.0	88.4	4%	OK	74.4	87.1	17%	SLOW	77.0	87.1	13%	OK
	Outbound	83	85.4	88.3	3%	OK	77.3	89.4	16%	SLOW	69.8	93.8	34%	SLOW
41	Inbound	111	66.7	67.9	2%	OK	60.2	68.4	14%	OK	60.2	70.9	18%	SLOW
	Outbound	115	62.5	68.9	10%	OK	59.4	64.2	8%	OK	65.2	64.2	-2%	OK
50	Inbound	142	32.9	28.5	-13%	OK	30.3	29.3	-3%	OK	41.2	29.3	-29%	FAST
	Outbound	148	38.9	27.9	-28%	FAST	33.3	30.3	-9%	OK	33.3	30.3	-9%	OK
67	Inbound	201	73.2	60.5	-17%	FAST	67.7	62.9	-7%	OK	60.2	65.7	9%	OK
	Outbound	198	63.2	61.4	-3%	OK	66.1	61.8	-7%	OK	70.2	61.8	-12%	OK
68	Inbound	205	97.8	99.7	2%	OK	94.6	98.6	4%	OK	89.0	98.3	10%	OK
	Outbound	206	84.0	92.8	10%	OK	87.6	94.4	8%	OK	83.4	94.4	13%	OK
82	Inbound	254	43.3	55.4	28%	SLOW	40.0	53.0	33%	SLOW	37.8	53.0	40%	SLOW
	Outbound	255	43.5	52.0	19%	SLOW	48.5	50.4	4%	OK	54.0	52.7	-2%	OK
98A	Inbound	282	72.4	70.4	-3%	OK	67.9	74.9	10%	OK	69.8	74.9	7%	OK
	Outbound	283	66.9	69.1	3%	OK	66.4	74.3	12%	OK	60.0	74.3	24%	SLOW
135	Inbound	364	56.3	49.7	-12%	OK	48.3	52.2	8%	OK	45.1	54.5	21%	SLOW
	Outbound	366	54.2	44.5	-18%	FAST	51.9	45.8	-12%	OK	58.4	45.8	-22%	FAST
192	Inbound	498												
			64.7	41.4	-36%	FAST	53.3	34.0	-36%	FAST	48.7	34.0	-30%	FAST

			AM Peak				Inter-peak				PM Peak			
Service	**Direction**	**TRIPS**	**Obs**	**Mod**	**% diff**		**Obs**	**Mod**	**% diff**		**Obs**	**Mod**	**% diff**	
	Outbound	501	51.5	35.6	-31%	FAST	50.4	36.2	-28%	FAST	52.2	36.2	-31%	FAST
203	Inbound	527	44.4	46.0	4%	OK	39.1	40.3	3%	OK	39.6	40.3	2%	OK
	Outbound	529	39.5	43.4	10%	OK	35.9	41.7	16%	SLOW	35.6	41.7	17%	SLOW
219	Inbound	550	34.7	35.2	2%	OK	34.0	33.5	-2%	OK	31.7	33.5	6%	OK
	Outbound	552	35.8	40.2	12%	OK	34.4	42.6	24%	SLOW	38.5	42.6	11%	OK
263	Inbound	617	52.0	56.6	9%	OK	47.9	57.1	19%	SLOW	52.5	61.0	16%	SLOW
	Outbound	618	54.4	54.6	0%	OK	45.3	52.3	16%	SLOW	53.9	52.3	-3%	OK
330	Inbound	718	44.7	47.3	6%	OK	42.3	48.9	15%	OK	39.9	48.9	22%	SLOW
	Outbound	719	42.3	47.5	12%	OK	43.0	44.9	4%	OK	44.4	44.9	1%	OK
409	Inbound	883	51.5	49.3	-4%	OK	47.8	47.4	-1%	OK	48.3	47.4	-2%	OK
	Outbound	882	53.5	46.3	-13%	OK	49.6	47.7	-4%	OK	48.7	47.7	-2%	OK
325	Circular	714	30.7	33.1	8%	OK	31.0	31.0	0%	OK	30.6	31.0	1%	OK
383	Circular	835	61.2	64.9	6%	OK	55.7	64.5	16%	SLOW	57.0	64.5	13%	OK
368	Inbound	793	54.0	55.4	3%	OK	48.0	54.6	14%	OK	54.0	54.6	1%	OK
	Outbound	792	51.0	50.1	-2%	OK	46.0	50.1	9%	OK	46.0	50.1	9%	OK
130	Inbound	356	127.0	98.7	-22%	FAST	103.0	98.1	-5%	OK	113.0	98.1	-13%	OK
	Outbound	358	117.0	100.5	-14%	OK	103.0	101.7	-1%	OK	115.0	101.7	-12%	OK

Note: "OK" is where the modelled journey time is within 15% of the observed journey time

Table 3 Bus Journey Time Categorisation – In Study Area

Modelled	**Morning Peak**		**Inter Peak**		**Evening Peak**		**Total**	
Time is:	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**
Slow	5%	2	24%	9	24%	9	18%	20
OK	79%	30	71%	27	66%	25	72%	82
Fast	16%	6	5%	2	11%	4	11%	12
TOTAL		38		38		38		114

Note: 114 routes in total – 38 in AM peak, 38 in inter peak and 38 in PM peak

Appendix E
Path Analysis

Path Analysis

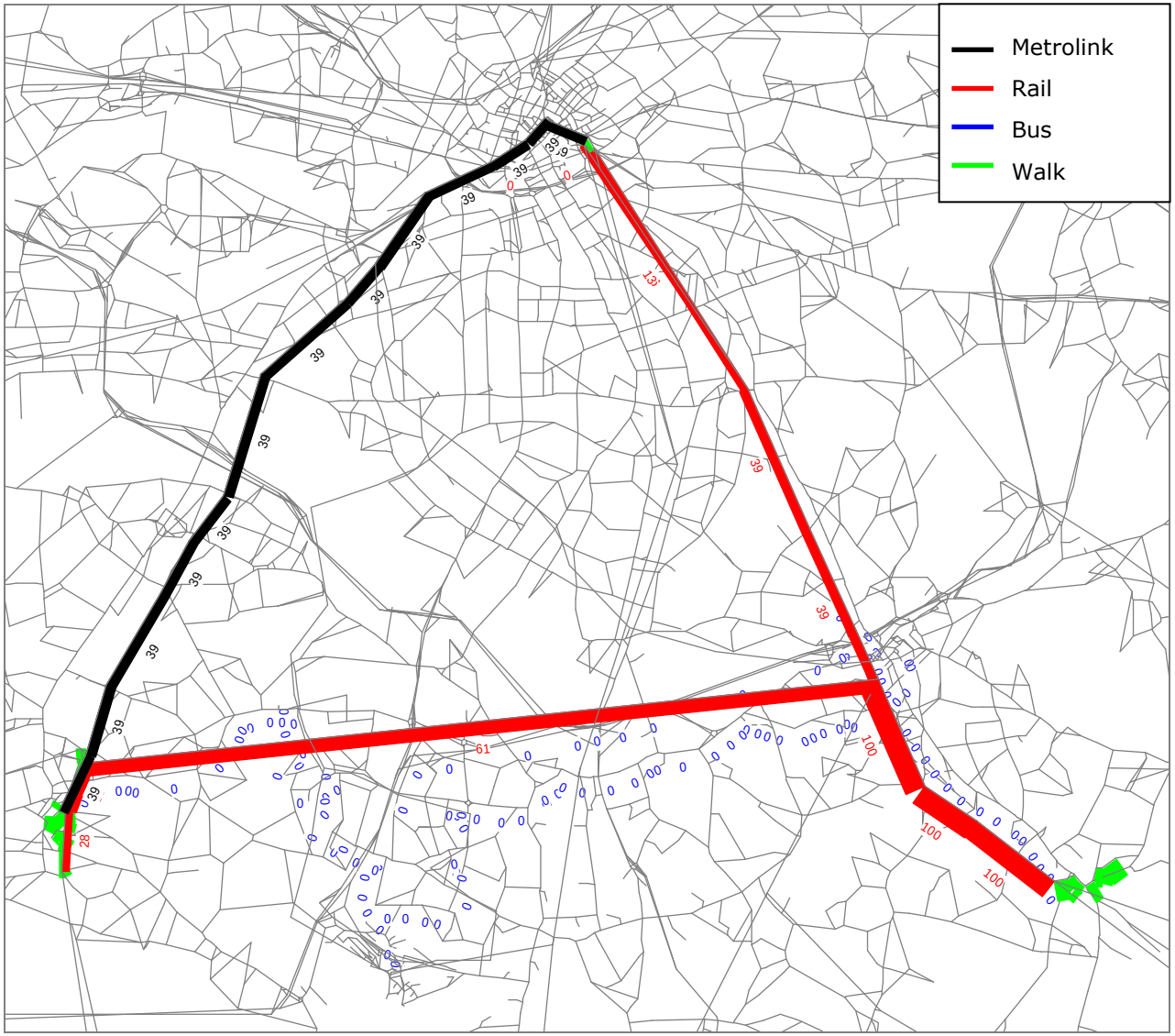


Figure 1 – Hazel Grove (zone 638) to Altrincham (zone 728) (AM)

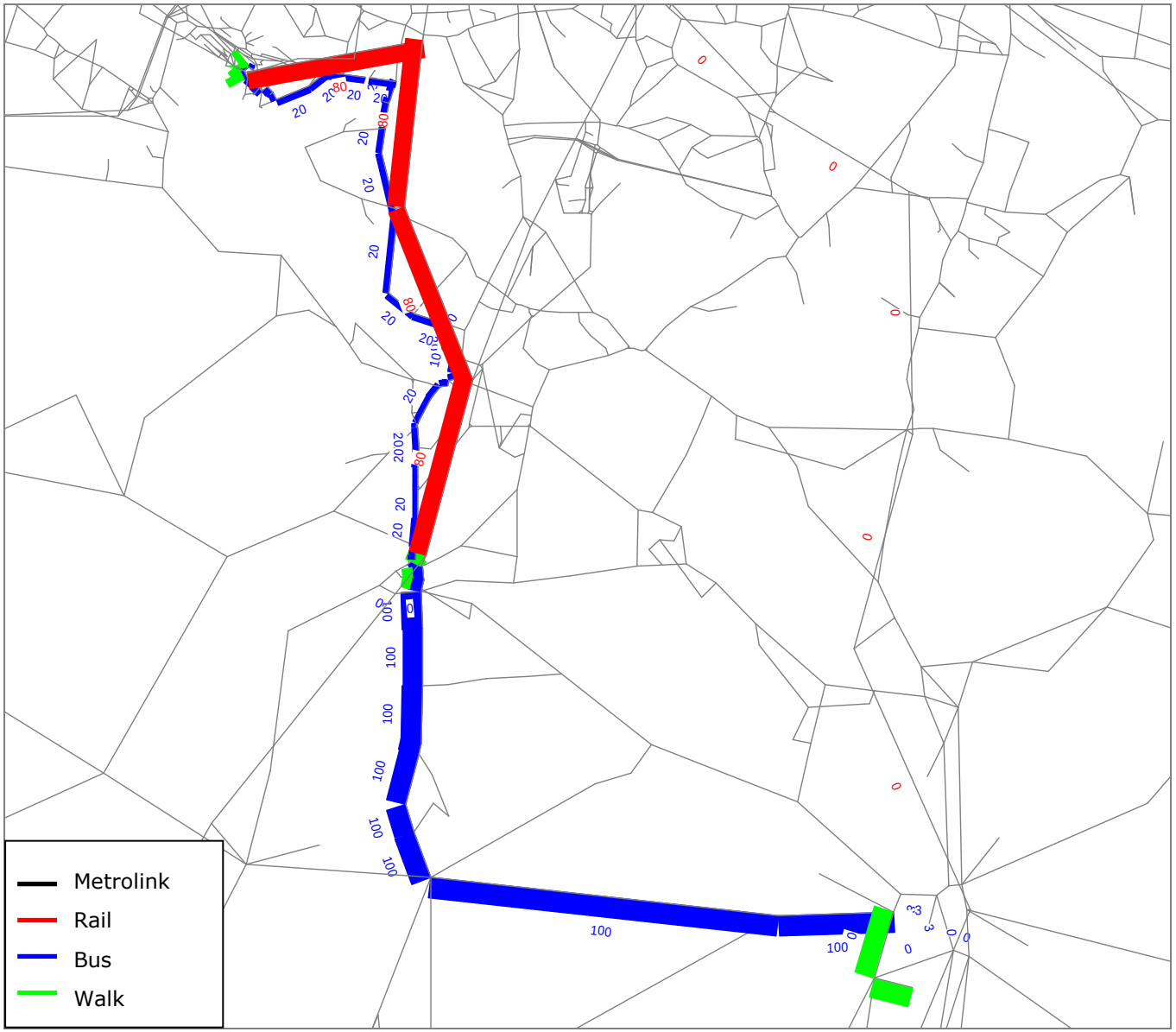


Figure 2 – Macclesfield (Zone 1075) to Manchester Airport (Zone 294) (AM)

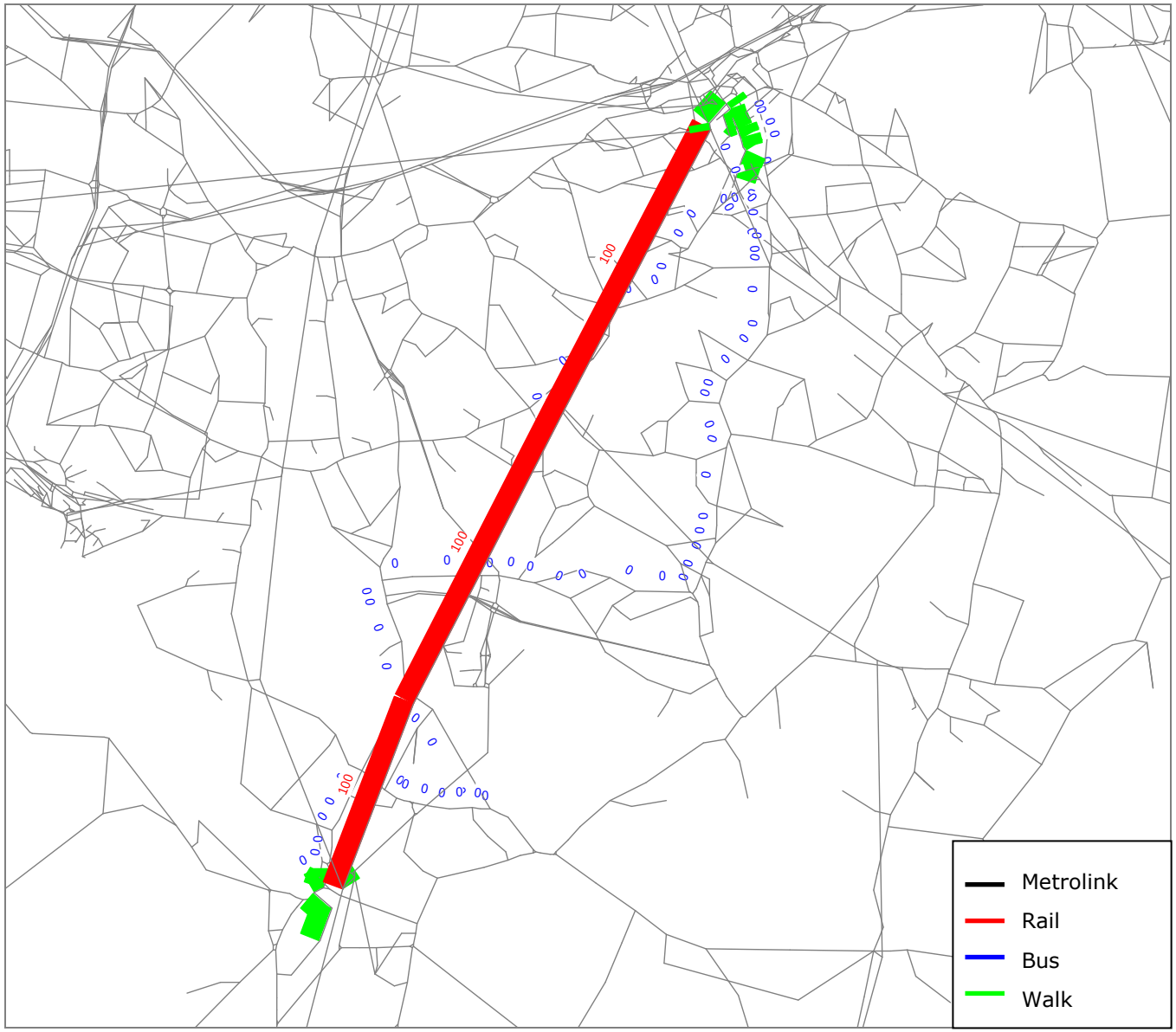


Figure 3 - Wilmslow (Zone1078) to Woodsmoor (Zone 564) (AM)

Appendix F
Pre Matrix Estimation Validation Assignment

Table 1 M60 After Inner Screenline Northbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A57 Liverpool Rd	100	158	58%	5.1	83	113	37%	3.1	52	36	-30%	2.4
B5211 Redclyffe Rd	53	63	20%	1.4	88	78	-11%	1.1	165	114	-31%	4.3
A576 Centenary Way	0	0	-	0.3	0	0	-	-	5	2	-56%	1.5
A5603 Trafford Rd	12	30	142%	3.8	9	28	211%	4.4	13	20	60%	1.9
A56 Bridgewater Way	36	0	-100%	8.5	0	0	-	-	0	0	-	-
A5014 Chester Road	116	112	-3%	0.4	52	120	129%	7.3	68	45	-34%	3.1
A635 Ashton Old Rd	360	421	17%	3.1	180	189	5%	0.7	121	160	33%	3.3
Palmerston St	11	0	-100%	4.7	8	14	82%	1.9	6	12	101%	2.0
A662 Ashton New Rd	794	758	-5%	1.3	260	231	-11%	1.9	185	193	5%	0.6
A6010 Alan Turing Way	67	43	-36%	3.3	50	42	-17%	1.2	31	40	30%	1.6
Edge Ln, Droylsden	11	2	-82%	3.6	13	18	34%	1.1	6	0	-100%	3.4
A627 Oldham Rd	113	117	3%	0.4	176	144	-18%	2.5	110	95	-14%	1.5
B6194 Lees Rd	10	8	-21%	0.7	8	13	56%	1.4	6	3	-46%	1.3
Lees Rd	12	13	7%	0.2	8	16	95%	2.2	8	2	-73%	2.6
A670 Stockport Rd	0	16	3943%	5.5	2	3	41%	0.5	2	0	-100%	2.0
A635 Manchester Rd	8	30	256%	4.9	7	26	287%	4.7	8	5	-42%	1.4
Total	**1706**	**1772**	**4%**	**1.6**	**944**	**1034**	**10%**	**2.9**	**785**	**728**	**-7%**	**2.1**
GEH	No.	%			No.	%			No.	%		
< 5.0	13	81%			13	93%			15	100%		
< 7.5	15	94%			14	100%			15	100%		
< 10.0	16	100%			14	100%			15	100%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	2				3				2			
No. Links with Flow > 150 and diff < 25%	2	100%			3	100%			1	50%		

Table 2 M60 After Outer Screenline Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
B5214 Barton Rd	46	70	54%	3.2	58	68	17%	1.2	66	60	-9%	0.7
B5158 Lostock Rd	164	212	29%	3.5	90	133	48%	4.1	82	132	61%	4.8
Winchester Rd	1	3	180%	1.4	8	8	-11%	0.3	5	0	-100%	3.2
Bradfield Rd	0	0	-100%	0.9	3	1	-64%	1.4	1	0	-100%	1.2
B5213 Stretford Rd	201	411	104%	12.0	125	160	28%	2.9	102	148	45%	4.1
A56 Cross St	236	227	-4%	0.6	175	150	-14%	2.0	177	167	-6%	0.8
A5103 Princess Parkway	236	293	24%	3.4	136	186	37%	3.9	136	181	32%	3.5
B5167 Palatine Rd	394	441	12%	2.3	151	127	-16%	2.1	192	172	-11%	1.5
A34 Kingsway	6	2	-70%	2.1	5	3	-45%	1.2	1	0	-100%	1.4
B5095 Manchester Rd, Cheadle	85	181	114%	8.4	72	99	38%	2.9	68	135	98%	6.6
A5145 Didsbury Road	130	119	-8%	0.9	164	138	-16%	2.1	206	210	2%	0.3
A6 Wellington Rd North	196	285	45%	5.7	261	276	6%	0.9	304	290	-4%	0.8
B6167 Lancashire Hill	80	84	4%	0.4	204	196	-4%	0.6	332	287	-14%	2.6
A 57 Manchester Rd, Denton	272	375	38%	5.7	130	180	38%	4.0	111	125	13%	1.4
Lumb Ln	80	131	64%	5.0	61	126	107%	6.7	53	117	122%	7.0
B6390 Audenshaw Rd	189	318	68%	8.1	94	128	37%	3.3	59	90	52%	3.6
A635 Manchester Rd	230	142	-38%	6.5	236	107	-55%	9.8	179	126	-29%	4.2
Total	**2547**	**3295**	**29%**	**13.8**	**1974**	**2086**	**6%**	**2.5**	**2073**	**2241**	**8%**	**3.6**
GEH	No.	%			No.	%			No.	%		
< 5.0	11	65%			15	88%			15	88%		
< 7.5	14	82%			16	94%			17	100%		
< 10.0	16	94%			17	100%			17	100%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	9				6				6			
No. Links with Flow > 150 and diff <	3	33%			5	83%			5	83%		

Table 3 M60 After Inner Screenline Southbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A57 Liverpool Road	52	107	107%	6.2	64	102	60%	4.2	119	220	86%	7.8
B5211 Redclyffe Road	65	309	378%	17.9	101	114	13%	1.2	150	76	-49%	7.0
A576 Centenary Way	16	9	-46%	2.1	0	0	-	-	1	2	37%	0.4
A5063 Trafford Road	43	44	3%	0.2	19	20	4%	0.2	9	57	567%	8.5
A56 Bridgewater Way	0	0	-	-	0	0	-	-	135	44	-67%	9.6
A5014 Chester Road	78	21	-73%	8.1	31	74	138%	5.9	89	91	2%	0.2
A635 Ashton Old Road	192	184	-4%	0.6	150	159	6%	0.7	235	520	122%	14.7
Palmerston Street	3	2	-44%	0.9	5	13	174%	2.8	3	2	-38%	0.7
A662 Ashton New Road	127	68	-47%	6.0	201	163	-19%	2.8	663	680	3%	0.7
A601 Alan Turing Way	51	58	14%	1.0	53	79	47%	3.1	65	47	-28%	2.5
Edge Lane	22	10	-53%	2.9	12	8	-29%	1.0	7	20	190%	3.5
A627 Oldham Road	103	223	117%	9.4	179	132	-26%	3.8	110	109	-1%	0.1
B6194 Lees Road	88	23	-74%	8.8	14	26	94%	2.9	14	10	-28%	1.1
Lees Road	39	1	-97%	8.4	7	8	11%	0.3	14	19	35%	1.2
A670 Stockport Road	0	0	-	-	3	0	-97%	2.5	0	0	-	-
A635 Manchester Road	4	14	266%	3.4	8	28	248%	4.7	7	35	404%	6.2
Total	**881**	**1071**	**22%**	**6.1**	**846**	**925**	**9%**	**2.7**	**1620**	**1933**	**19%**	**7.4**
GEH	No.	%			No.	%			No.	%		
< 5.0	7	50%			13	93%			9	60%		
< 7.5	9	64%			14	100%			11	73%		
< 10.0	13	93%			14	100%			14	93%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	1				2				3			
No. Links with Flow > 150 and diff <	1	100%			1	50%			1	33%		

Table 4 M60 After Outer Screenline Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
B5214 Barton Road	24	37	57%	2.4	42	31	-25%	1.8	83	65	-22%	2.1
B5158 Lostock Road	99	197	99%	8.1	96	86	-10%	1.0	155	171	10%	1.2
Winchester Road	8	7	-9%	0.3	8	11	38%	1.0	15	0	-100%	5.5
Bradfield Road	4	0	-100%	2.8	4	1	-80%	2.1	2	1	-58%	1.0
B5213 Stretford Road	130	156	20%	2.2	100	153	52%	4.7	195	217	11%	1.5
A56 Cross Street	309	222	-28%	5.3	172	99	-42%	6.2	316	185	-42%	8.3
A5103 Princess Parkway	158	210	32%	3.8	136	149	9%	1.0	202	263	30%	4.0
B5167 Palatine Road	171	193	13%	1.6	152	106	-30%	4.0	217	326	50%	6.6
A34 Kingsway	2	4	140%	1.4	4	6	40%	0.8	3	0	-100%	2.2
B5095 Manchester Road	58	76	30%	2.2	76	86	12%	1.0	176	272	55%	6.4
A5145 Didsbury Road	140	266	90%	8.9	170	42	-76%	12.5	144	46	-68%	10.1
A6 Wellington Road North	476	325	-32%	7.5	184	224	22%	2.8	333	400	20%	3.5
B6167 Lancashire Hill	265	262	-1%	0.1	190	130	-32%	4.8	85	66	-23%	2.2
A57 Manchester Road	132	110	-16%	2.0	115	186	61%	5.7	249	282	13%	2.0
Lumb Lane	56	158	179%	9.8	57	99	74%	4.8	48	149	211%	10.2
B6390 Audenshaw Road	194	56	-71%	12.3	98	122	24%	2.2	134	267	99%	9.4
A635 Manchester Road	201	143	-29%	4.5	222	71	-68%	12.5	190	118	-38%	5.8
Total	**2427**	**2423**	**0%**	**0.1**	**1828**	**1601**	**-12%**	**5.5**	**2546**	**2826**	**11%**	**5.4**
GEH	No.	%			No.	%			No.	%		
< 5.0	11	65%			13	76%			9	53%		
< 7.5	12	71%			15	88%			13	76%		
< 10.0	16	94%			15	88%			15	88%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	7				6				9			
No. Links with Flow > 150 and diff <	2	29%			1	17%			4	44%		

Table 5 Manchester City Centre Cordon Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
B5117 Oxford Rd	2533	3318	31%	14.5	1697	1262	-26%	11.3	2021	1364	-33%	16.0
Cambridge St	189	519	174%	17.5	120	154	28%	2.8	98	328	233%	15.7
A5103 Princess Rd (Main)	106	59	-44%	5.1	107	186	74%	6.5	162	37	-77%	12.5
A5103 Princess Rd (Slip)	185	132	-29%	4.2	117	40	-66%	8.7	83	35	-58%	6.3
A56 Chester Rd	214	107	-50%	8.4	61	118	93%	6.0	80	44	-45%	4.6
A57 Regent Rd	101	324	220%	15.3	43	58	33%	2.0	33	100	203%	8.2
A6 Chapel St	1125	1438	28%	8.7	499	461	-8%	1.7	394	651	65%	11.2
A6041 Blackfriars Rd	491	827	68%	13.1	245	71	-71%	13.9	118	91	-23%	2.6
A56 Great Ducie St	372	592	59%	10.0	168	174	4%	0.5	58	130	122%	7.4
A665 Cheetham Hill Rd	677	557	-18%	4.8	419	119	-72%	18.3	301	130	-57%	11.6
A664 Rochdale Rd	897	1322	47%	12.8	430	331	-23%	5.1	221	265	20%	2.8
A62 Oldham Rd	1144	1514	32%	10.2	527	426	-19%	4.6	286	283	-1%	0.2
Old Mill St	843	23	-97%	39.4	600	21	-97%	32.9	325	11	-96%	24.2
A662 Pollard St	856	740	-14%	4.1	390	199	-49%	11.1	256	176	-31%	5.5
A635 Ashton Old Rd	325	420	29%	4.9	211	201	-5%	0.7	126	170	35%	3.7
A665 Chancellor La	2	6	217%	2.1	0	16	4260%	5.5	3	0	-100%	2.3
A6 Downing St	1760	1100	-38%	17.5	966	413	-57%	21.0	737	420	-43%	13.2
A34 Upper Brook St	368	633	72%	11.8	131	221	68%	6.8	67	255	279%	14.8
Total	**12188**	**13630**	**12%**	**12.7**	**6732**	**4471**	**-34%**	**30.2**	**5368**	**4489**	**-16%**	**12.5**
GEH	No.	%			No.	%			No.	%		
< 5.0	5	28%			6	33%			6	33%		
< 7.5	6	33%			11	61%			9	50%		
< 10.0	8	44%			12	67%			10	56%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	15				11				9			
No. Links with Flow > 150 and diff <	2	13%			5	45%			2	22%		

Table 6 Manchester City Centre Cordon Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
B5117 Oxford Rd	1066	1061	0%	0.1	1639	893	-45%	21.0	5486	3152	-43%	35.5
Cambridge St	61	236	285%	14.3	114	253	123%	10.3	181	565	213%	19.9
A5103 Princess Rd	264	101	-62%	12.1	60	80	34%	2.4	110	235	113%	9.5
A56 Chester Rd	101	22	-78%	10.0	31	74	138%	5.9	141	140	-1%	0.1
A57 Regent Rd	38	85	122%	6.0	32	61	93%	4.3	118	70	-41%	5.0
A6 Chapel St	452	321	-29%	6.6	460	537	17%	3.4	1145	1521	33%	10.3
A6041 Blackfriars Rd	57	79	40%	2.7	140	108	-22%	2.8	600	367	-39%	10.6
A56 Great Ducie St	26	208	687%	16.8	73	200	175%	10.9	475	643	35%	7.1
A665 Cheetham Hill Rd	151	183	21%	2.5	249	174	-30%	5.2	697	521	-25%	7.1
A664 Rochdale Rd	103	172	68%	5.9	291	305	5%	0.8	1073	769	-28%	10.0
A62 Oldham Rd	147	206	41%	4.5	372	410	10%	1.9	1111	1273	15%	4.7
Old Mill St	0	4	-	2.8	154	65	-58%	8.5	319	26	-92%	22.3
A662 Pollard St	146	59	-60%	8.6	265	151	-43%	7.9	756	674	-11%	3.1
A635 Ashton Old Rd	184	204	11%	1.4	125	176	41%	4.2	374	530	42%	7.3
A665 Chancellor La	0	0	-	-	0	9	4324%	4.1	0	0	-	-
A6 Downing St	586	173	-71%	21.2	851	283	-67%	23.9	2535	753	-70%	44.0
A34 Upper Brook St	22	419	1800%	26.7	64	211	231%	12.6	328	985	201%	25.7
Total	**3403**	**3534**	**4%**	**2.2**	**4919**	**3988**	**-19%**	**13.9**	**15450**	**12223**	**-21%**	**27.4**
GEH	No.	%			No.	%			No.	%		
< 5.0	6	38%			8	47%			3	19%		
< 7.5	9	56%			10	59%			7	44%		
< 10.0	10	63%			12	71%			8	50%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	21				19				22			
No. Links with Flow > 150 and diff <	5	24%			8	42%			4	18%		

Table 7 Manchester University Cordon Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A34 Anson Rd	614	1024	67%	14.3	235	326	39%	5.5	161	204	27%	3.2
B5117 Oxford Rd (S)	2564	3025	18%	8.7	1539	1181	-23%	9.7	1057	844	-20%	6.9
Lloyd St North	1	14	1663%	4.9	7	109	1373%	13.3	2	0	-100%	2.0
Burlington St	302	1185	292%	32.4	192	224	16%	2.2	188	367	95%	10.7
Booth St West	949	1324	40%	11.1	651	521	-20%	5.4	564	649	15%	3.4
Cavendish St	145	202	39%	4.3	156	131	-16%	2.1	254	388	53%	7.5
Cambridge St	61	236	285%	14.3	114	253	123%	10.3	181	565	213%	19.9
B5117 Oxford Rd (N)	1066	1061	0%	0.1	1639	893	-45%	21.0	5486	3152	-43%	35.5
A34 Upper Brook St	22	419	1800%	26.7	64	211	231%	12.6	328	985	201%	25.7
A5184 Plymouth Gr	368	422	15%	2.7	131	105	-20%	2.4	67	34	-50%	4.7
Total	**6091**	**8911**	**46%**	**32.6**	**4728**	**3954**	**-16%**	**11.8**	**8288**	**7187**	**-13%**	**12.5**
GEH	No.	%			No.	%			No.	%		
< 5.0	4	40%			3	30%			4	40%		
< 7.5	4	40%			5	50%			5	50%		
< 10.0	5	50%			6	60%			6	60%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	6				6				8			
No. Links with Flow > 150 and diff <	3	50%			4	67%			2	25%		

Table 8 Manchester University Cordon Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A34 Anson Rd	76	159	109%	7.7	127	311	145%	12.4	976	1405	44%	12.4
B5117 Oxford Rd (S)	403	365	-9%	1.9	1337	1071	-20%	7.7	5078	3573	-30%	22.9
Lloyd St North	0	0	-	-	0	74	-	12.2	0	75	-	12.2
Burlington St	53	171	225%	11.2	106	137	30%	2.9	220	670	204%	21.3
Booth St West	275	614	123%	16.1	372	398	7%	1.3	1343	1175	-13%	4.7
Cavendish St	0	0	-	-	0	0	-	-	0	0	-	-
Cambridge St	189	519	174%	17.5	120	154	28%	2.8	98	328	233%	15.7
B5117 Oxford Rd (N)	2533	3318	31%	14.5	1697	1262	-26%	11.3	2021	1364	-33%	16.0
A34 Upper Brook St	368	633	72%	11.8	131	221	68%	6.8	67	255	279%	14.8
A5184 Plymouth Gr	22	17	-22%	1.1	64	145	127%	7.9	328	468	43%	7.0
Total	**3919**	**5796**	**48%**	**26.9**	**3954**	**3773**	**-5%**	**2.9**	**10133**	**9313**	**-8%**	**8.3**
GEH	No.	%			No.	%			No.	%		
< 5.0	2	25%			3	33%			1	11%		
< 7.5	2	25%			4	44%			2	22%		
< 10.0	3	38%			6	67%			2	22%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	11				9				6			
No. Links with Flow > 150 and diff <	4	36%			6	67%			1	17%		

Table 9 GMATS Cordon Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A34 Anson Rd	614	1024	67%	14.3	235	326	39%	5.5	161	204	27%	3.2
B5117 Oxford Rd	2564	3025	18%	8.7	1539	1181	-23%	9.7	1057	844	-20%	6.9
Lloyd St North	1	14	1663%	4.9	7	109	1373%	13.3	2	0	-100%	2.0
Burlington St	302	1185	292%	32.4	192	224	16%	2.2	188	367	95%	10.7
Booth St West	949	1324	40%	11.1	651	521	-20%	5.4	564	649	15%	3.4
Cavendish St	145	202	39%	4.3	156	131	-16%	2.1	254	388	53%	7.5
A5103 Princess Rd (Main)	106	59	-44%	5.1	107	186	74%	6.5	162	37	-77%	12.5
A5103 Princess Rd (Slip)	185	132	-29%	4.2	117	40	-66%	8.7	83	35	-58%	6.3
A56 Chester Rd	214	107	-50%	8.4	61	118	93%	6.0	80	44	-45%	4.6
A57 Regent Rd	101	324	220%	15.3	43	58	33%	2.0	33	100	203%	8.2
A6 Chapel St	1125	1438	28%	8.7	499	461	-8%	1.7	394	651	65%	11.2
A6041 Blackfriars Rd	491	827	68%	13.1	245	71	-71%	13.9	118	91	-23%	2.6
A56 Great Ducie St	372	592	59%	10.0	168	174	4%	0.5	58	130	122%	7.4
A665 Cheetham Hill Rd	677	557	-18%	4.8	419	119	-72%	18.3	301	130	-57%	11.6
A664 Rochdale Rd	897	1322	47%	12.8	430	331	-23%	5.1	221	265	20%	2.8
A62 Oldham Rd	1144	1514	32%	10.2	527	426	-19%	4.6	286	283	-1%	0.2
Old Mill St	843	23	-97%	39.4	600	21	-97%	32.9	325	11	-96%	24.2
A662 Pollard St	856	740	-14%	4.1	390	199	-49%	11.1	256	176	-31%	5.5
A635 Ashton Old Rd	325	420	29%	4.9	211	201	-5%	0.7	126	170	35%	3.7
A665 Chancellor La	2	6	217%	2.1	0	16	4260%	5.5	3	0	-100%	2.3
A6 Downing St	1760	1100	-38%	17.5	966	413	-57%	21.0	737	420	-43%	13.2
A5184 Plymouth Gr	368	422	15%	2.7	131	105	-20%	2.4	67	34	-50%	4.7
Total	**14040**	**16355**	**16%**	**18.8**	**7696**	**5431**	**-29%**	**28.0**	**5474**	**5026**	**-8%**	**6.2**
GEH	No.	%			No.	%			No.	%		
< 5.0	8	36%			8	36%			10	45%		
< 7.5	9	41%			14	64%			14	64%		
< 10.0	12	55%			16	73%			16	73%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	17				15				13			
No. Links with Flow > 150 and diff <	4	24%			9	60%			4	31%		

Table 10 GMATS Cordon Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A34 Anson Rd	76	159	109%	7.7	127	311	145%	12.4	976	1405	44%	12.4
B5117 Oxford Rd	403	365	-9%	1.9	1337	1071	-20%	7.7	5078	3573	-30%	22.9
Lloyd St North	0	0	-	-	0	74	-	12.2	0	75	-	12.2
Burlington St	53	171	225%	11.2	106	137	30%	2.9	220	670	204%	21.3
Booth St West	275	614	123%	16.1	372	398	7%	1.3	1343	1175	-13%	4.7
Cavendish St	0	0	-	-	0	0	-	-	0	0	-	-
A5103 Princess Rd	264	101	-62%	12.1	60	80	34%	2.4	110	235	113%	9.5
A56 Chester Rd	101	22	-78%	10.0	31	74	138%	5.9	141	140	-1%	0.1
A57 Regent Rd	38	85	122%	6.0	32	61	93%	4.3	118	70	-41%	5.0
A6 Chapel St	452	321	-29%	6.6	460	537	17%	3.4	1145	1521	33%	10.3
A6041 Blackfriars Rd	57	79	40%	2.7	140	108	-22%	2.8	600	367	-39%	10.6
A56 Great Ducie St	26	208	687%	16.8	73	200	175%	10.9	475	643	35%	7.1
A665 Cheetham Hill Rd	151	183	21%	2.5	249	174	-30%	5.2	697	521	-25%	7.1
A664 Rochdale Rd	103	172	68%	5.9	291	305	5%	0.8	1073	769	-28%	10.0
A62 Oldham Rd	147	206	41%	4.5	372	410	10%	1.9	1111	1273	15%	4.7
Old Mill St	0	4	-	2.8	154	65	-58%	8.5	319	26	-92%	22.3
A662 Pollard St	146	59	-60%	8.6	265	151	-43%	7.9	756	674	-11%	3.1
A635 Ashton Old Rd	184	204	11%	1.4	125	176	41%	4.2	374	530	42%	7.3
A665 Chancellor La	0	0	-	-	0	9	4324%	4.1	0	0	-	-
A6 Downing St	586	173	-71%	21.2	851	283	-67%	23.9	2535	753	-70%	44.0
A5184 Plymouth Gr	22	17	-22%	1.1	64	145	127%	7.9	328	468	43%	7.0
Total	**3083**	**3144**	**2%**	**1.1**	**5109**	**4767**	**-7%**	**4.9**	**17401**	**14886**	**-14%**	**19.8**
GEH	No.	%			No.	%			No.	%		
< 5.0	7	39%			10	50%			4	21%		
< 7.5	10	56%			12	60%			9	47%		
< 10.0	12	67%			16	80%			10	53%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	24				24				28			
No. Links with Flow > 150 and diff <	7	29%			14	58%			7	25%		

Table 11 District Centre Cordons Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
STOCKPORT												
Travis Brow, A6145	330	232	-29%	5.8	180	54	-70%	11.6	223	72	-68%	12.4
Wellington Rd North, A6	248	233	-6%	1.0	287	280	-3%	0.4	199	273	37%	4.8
Manchester Rd, A625	68	17	-76%	7.9	35	8	-78%	5.9	11	2	-78%	3.3
Sandy Lane, B6167	226	304	34%	4.8	244	150	-39%	6.7	147	71	-51%	7.2
Brinnington Rd	440	229	-48%	11.5	198	74	-63%	10.7	102	60	-41%	4.6
Carrington Rd, B6104	176	179	2%	0.3	164	55	-66%	10.3	119	76	-36%	4.3
New Bridge Lane	52	120	129%	7.3	75	57	-24%	2.2	124	32	-74%	10.3
Turncroft Lane	15	18	19%	0.7	8	6	-24%	0.7	2	3	45%	0.5
Hall Street, A626	113	121	7%	0.8	107	53	-50%	6.0	72	15	-79%	8.6
Hempshaw Rd	37	162	340%	12.6	86	69	-19%	1.9	45	56	26%	1.6
Wellington RD South, A6	272	549	101%	13.6	273	343	26%	4.0	289	325	12%	2.0
Shaw Heath, B5465	152	106	-30%	4.0	139	56	-60%	8.4	125	59	-52%	6.8
Mercian Way, B4565	236	218	-8%	1.2	166	111	-33%	4.6	167	152	-9%	1.2
Stockport Total	**2365**	**2489**	**5%**	**2.5**	**1960**	**1316**	**-33%**	**15.9**	**1624**	**1199**	**-26%**	**11.3**
GEH	No.	%			No.	%			No.	%		
< 5.0	7	54%			6	46%			8	62%		
< 7.5	9	69%			9	69%			10	77%		
< 10.0	10	77%			10	77%			11	85%		
Flow	No.	%	13		No.	%			No.	%		
No. Links with Flow > 150	8				7				4			
No. Links with Flow > 150 and diff <	3	38%			1	14%			2	50%		

Table 12 District Centre Cordons Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
ALTRINCHAM												
Charcoal Road	1	35	4159%	8.1	8	8	2%	0.1	16	15	-5%	0.2
Manchester Road	74	77	4%	0.3	135	114	-16%	1.9	218	220	1%	0.1
Navigation Road	4	8	87%	1.5	5	11	97%	1.8	9	21	130%	3.1
Stockport Road	40	48	19%	1.2	118	119	1%	0.1	239	203	-15%	2.5
Moss Lane	15	5	-68%	3.2	18	0	-100%	6.0	7	0	-100%	3.8
Hale Road	33	65	97%	4.6	26	59	132%	5.2	31	37	20%	1.1
Arthog Road	0	45	-	9.5	4	23	465%	5.1	17	23	38%	1.4
Ashley Road	0	0	-	-	0	0	-	-	0	0	-	-
Dunham Road	3	0	-100%	2.6	16	0	-100%	5.6	22	0	-100%	6.6
Altrincham Total	**171**	**283**	**66%**	**7.5**	**330**	**334**	**1%**	**0.2**	**559**	**519**	**-7%**	**1.7**
ASHTON	102	102	0%	0.0	223	124	-45%	7.5	273	132	-52%	9.9
Oldham Road	23	14	-41%	2.2	54	74	36%	2.5	77	25	-67%	7.2
Turner Lane	198	151	-23%	3.5	284	183	-36%	6.6	319	236	-26%	5.0
Penny Meadow	16	54	243%	6.5	41	28	-32%	2.2	57	90	59%	3.9
Stamford Street	37	22	-41%	2.8	60	30	-50%	4.5	87	16	-82%	9.9
Whitelands	121	114	-6%	0.7	163	111	-32%	4.4	166	126	-24%	3.3
Cavendish Street	305	180	-41%	8.1	434	271	-37%	8.6	450	277	-38%	9.1
Katherine Street	**802**	**636**	**-21%**	**6.2**	**1259**	**821**	**-35%**	**13.6**	**1429**	**902**	**-37%**	**15.4**
Ashton Total	102	102	0%	0.0	223	124	-45%	7.5	273	132	-52%	9.9
BOLTON												
Tudor Avenue	0	0	-	0.9	6	9	44%	1.0	0	1	-	1.1
St Georges Road	169	142	-16%	2.1	303	109	-64%	13.5	518	178	-66%	18.2
Merehall Drive	27	65	139%	5.6	119	114	-4%	0.5	143	85	-41%	5.4
Blackburn Road	186	222	19%	2.5	184	231	26%	3.3	305	236	-23%	4.2
Folds Road	176	243	38%	4.6	190	194	2%	0.3	491	342	-30%	7.3
Bury Road	168	199	18%	2.2	278	215	-23%	4.0	406	397	-2%	0.4
Radcliffe Road	0	0	-	-	4	1	-65%	1.6	0	0	-	-
Bromwich St	0	13	-	5.0	23	29	26%	1.2	16	24	55%	1.9
St Peters Way SB on slip	0	0	-	-	0	0	-	-	0	0	-	-
Manchester Road	213	182	-15%	2.2	215	185	-14%	2.1	369	320	-13%	2.6
Thynne Street												

Bridgeman Street	38	24	-36%	2.5	86	41	-52%	5.7	135	54	-60%	8.2
Derby Street	114	95	-17%	1.9	306	241	-21%	3.9	383	317	-17%	3.5
Deane Street	87	162	85%	6.6	222	129	-42%	7.0	309	303	-2%	0.3
Bolton Total	**1377**	**1615**	**17%**	**6.2**	**2192**	**1753**	**-20%**	**9.9**	**3395**	**2565**	**-24%**	**15.2**
BURY												
Walshaw Road	66	18	-73%	7.4	37	44	20%	1.2	100	88	-12%	1.3
Tottington Road	40	73	85%	4.5	42	48	15%	0.9	114	92	-19%	2.1
Brandlesholme Road	38	55	44%	2.5	87	122	41%	3.4	173	265	53%	6.2
Woodhill Road	4	7	68%	1.2	39	7	-81%	6.6	50	19	-63%	5.3
Walmersley Road	41	50	22%	1.3	100	111	10%	1.0	175	121	-31%	4.5
Rochdale Old Road	59	73	25%	1.8	105	104	-1%	0.1	123	125	1%	0.1
Rochdale Road	49	110	123%	6.8	164	192	16%	2.0	222	215	-3%	0.4
Parkhills Road	8	10	20%	0.5	23	39	70%	2.9	39	29	-26%	1.8
Manchester Road	141	129	-9%	1.1	426	267	-37%	8.5	420	290	-31%	6.9
Bolton Road	64	98	53%	3.8	64	101	57%	4.0	144	178	23%	2.7
Ainsworth Road	20	39	95%	3.5	62	53	-15%	1.2	180	119	-34%	5.0
Bury Total	**530**	**661**	**25%**	**5.4**	**1150**	**1087**	**-5%**	**1.9**	**1741**	**1540**	**-12%**	**5.0**
OLDHAM												
Middleton Road	115	103	-10%	1.1	188	232	23%	3.0	269	213	-21%	3.6
Rochdale Road	230	166	-28%	4.6	204	165	-19%	2.9	309	305	-1%	0.2
Henshaw Street	0	3	-	2.4	12	16	27%	0.9	0	1	-	1.6
Horsedge Street	2	1	-74%	1.5	10	0	-100%	4.4	18	0	-99%	5.9
Higginshaw Road	0	1	-	1.1	0	0	-	-	0	0	-	0.6
Shaw Road	73	85	15%	1.3	103	94	-8%	0.9	196	153	-22%	3.2
Huddersfield Road	119	203	71%	6.6	275	475	73%	10.3	492	837	70%	13.4
Lees Road	34	0	-100%	8.2	140	0	-100%	16.7	325	44	-87%	20.7
Huddersfield Road + Lees Road	153	203	33%	3.8	415	475	15%	2.9	817	881	8%	2.2
Waterloo Street	5	1	-79%	2.3	19	10	-48%	2.4	13	2	-84%	4.0
Park Road	12	4	-68%	2.9	6	30	413%	5.7	9	15	60%	1.6
King Street	241	308	28%	4.0	422	343	-19%	4.0	484	349	-28%	6.6
Manchester Street	239	188	-22%	3.5	297	130	-56%	11.5	322	184	-43%	8.7
Oldham Total	**1069**	**1060**	**-1%**	**0.3**	**1677**	**1495**	**-11%**	**4.6**	**2436**	**2104**	**-14%**	**7.0**
ROCHDALE												

Edenfield Road	18	33	81%	2.9	63	46	-27%	2.3	143	66	-54%	7.5
Falinge Road	1	1	61%	0.5	17	30	78%	2.7	23	12	-46%	2.5
Heights	0	6	-	3.3	0	3	-	2.6	0	15	-	5.4
Whitehall Rd	0	4	-	2.7	32	3	-90%	6.9	27	14	-47%	2.8
Whitworth Road	21	66	209%	6.8	78	162	107%	7.7	157	218	38%	4.4
Yorkshire Street	63	97	53%	3.8	177	130	-27%	3.8	197	157	-20%	3.0
Entwisle Road	24	21	-14%	0.7	41	75	83%	4.5	68	36	-47%	4.4
Milnrow Road	59	77	29%	2.1	99	88	-11%	1.1	168	130	-22%	3.1
Oldham Road	102	152	49%	4.4	189	165	-12%	1.8	275	199	-28%	5.0
Milkstone Rd	0	0	-	-	3	0	-100%	2.5	0	0	-	-
Manchester Road	273	374	37%	5.6	267	236	-11%	1.9	264	279	6%	0.9
Bury Road	30	39	32%	1.6	36	46	25%	1.4	50	101	104%	5.9
Rochdale Total	**592**	**870**	**47%**	**10.3**	**1003**	**984**	**-2%**	**0.6**	**1372**	**1228**	**-10%**	**4.0**
WIGAN												
Pottery Road	172	321	87%	9.5	725	630	-13%	3.7	802	830	3%	1.0
Frog lane	12	4	-61%	2.5	36	33	-7%	0.4	39	30	-25%	1.7
Parsons Walk	19	25	33%	1.3	53	66	23%	1.6	97	115	18%	1.7
Bridgeman Terrace	21	23	10%	0.4	38	52	39%	2.2	35	54	53%	2.8
Standishgate	0	0	-	-	0	14	-	5.2	0	28	-	7.5
Central Park Way	54	77	43%	2.9	124	53	-57%	7.5	96	99	2%	0.2
Scholes	14	49	250%	6.2	133	133	0%	0.0	114	84	-27%	3.0
Darlington St	85	74	-13%	1.2	194	147	-24%	3.6	180	171	-5%	0.7
Warrington Road	7	57	673%	8.8	81	137	69%	5.4	90	88	-2%	0.2
B5238 Chapel Lane	19	0	-100%	6.2	19	0	-100%	6.2	14	0	-100%	5.4
Wigan Total	**402**	**631**	**57%**	**10.1**	**1403**	**1265**	**-10%**	**3.8**	**1469**	**1497**	**2%**	**0.7**
STOCKPORT												
Wood Street	10	12	20%	0.6	29	30	4%	0.2	15	10	-35%	1.5
Travis Brow, A6146	163	134	-18%	2.4	195	149	-24%	3.5	377	208	-45%	9.9
Wellington Rd North, A6	196	285	45%	5.7	261	276	6%	0.9	304	290	-4%	0.8
Manchester Rd, A626	53	7	-86%	8.4	47	44	-7%	0.5	56	14	-75%	7.0
Sandy Lane, B6168	121	94	-23%	2.7	206	201	-2%	0.3	184	399	117%	12.6
Brinnington Rd	129	54	-58%	7.8	246	159	-36%	6.1	313	273	-13%	2.4
Carrington Rd, B6105	95	78	-18%	1.8	148	137	-7%	0.9	268	197	-26%	4.6
New Bridge Lane	27	30	13%	0.7	48	81	67%	4.0	64	124	95%	6.2

Turncroft Lane	17	8	-55%	2.6	13	12	-7%	0.2	6	9	56%	1.2
Hall Street, A627	175	55	-69%	11.3	96	48	-51%	5.7	105	98	-7%	0.7
Hempshaw Rd	130	73	-44%	5.6	95	128	34%	3.1	138	180	30%	3.3
Wellington RD South, A6	240	345	44%	6.1	236	468	99%	12.4	375	721	92%	14.8
Shaw Heath, B5466	204	125	-39%	6.1	124	104	-16%	1.9	160	185	16%	1.9
Mercian Way, B4566	197	156	-21%	3.1	199	124	-37%	5.8	330	280	-15%	2.9
Stockport Total	**1757**	**1456**	**-17%**	**7.5**	**1942**	**1959**	**1%**	**0.4**	**2695**	**2987**	**11%**	**5.5**
TRAFFORD PARK												
Park Road	7	3	-57%	1.7	20	25	24%	1.0	61	54	-11%	0.9
Trafford Boulevard	12	67	477%	8.8	58	83	45%	3.1	124	59	-52%	6.8
Parkway	20	33	67%	2.6	17	16	-4%	0.2	72	54	-25%	2.3
White City Circle	25	4	-82%	5.3	20	0	-99%	6.2	94	102	8%	0.8
Trafford Park Total	**63**	**107**	**71%**	**4.8**	**114**	**125**	**9%**	**1.0**	**352**	**269**	**-23%**	**4.7**

GEH	No.	%		No.	%		No.	%	
< 5.0	63	71%		64	70%		60	67%	
< 7.5	79	88%		78	85%		79	87%	
< 10.0	86	96%		83	90%		85	93%	

Flow	No.	%		No.	%		No.	%	
No. Links with Flow > 150	20			30			40		
No. Links with Flow > 150 and diff <	8	40%		17	57%		23	58%	

Table 13 Rail Boardings

	AM Peak				IP Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Wigan North Western	233	148	-37%	6.2	106	66	-38%	4.3
Wigan Wallgate	257	274	7%	1.0	154	156	1%	0.2
Hindley	63	53	-15%	1.3	14	3	-75%	3.5
Daisy Hill	82	113	37%	3.1	9	6	-39%	1.3
Atherton	116	115	-1%	0.1	26	9	-63%	3.8
Walkden	63	6	-90%	9.7	13	5	-63%	2.7
Westhoughton	48	40	-16%	1.1	11	4	-59%	2.3
Horwich Parkway	86	13	-85%	10.4	12	11	-4%	0.2
Lostock Junction	120	77	-36%	4.3	4	4	13%	0.2
Bromley Cross	96	77	-19%	2.0	16	9	-46%	2.1
Bolton	513	843	64%	12.7	348	158	-55%	12.0
Salford Crescent	153	233	52%	5.8	147	106	-28%	3.7
Total Wigan / Bolton Line	**1831**	**1993**	**9%**	**3.7**	**858**	**537**	**-37%**	**12.2**
Glazebrook	8	0	-100%	3.9	2	0	-100%	2.2
Irlam	62	51	-18%	1.5	9	9	-5%	0.2
Flixton	30	29	-5%	0.3	4	5	11%	0.2
Chassen Road	17	8	-55%	2.7	1	0	-100%	1.5
Urmston	70	33	-53%	5.2	15	9	-39%	1.6
Humphrey Park	13	13	0%	0.0	0	0	-87%	0.8
Trafford Park	11	4	-63%	2.5	2	0	-100%	2.1
Total Liverpool Line	**211**	**138**	**-35%**	**5.6**	**35**	**23**	**-34%**	**2.2**
Airport	315	86	-73%	16.1	358	79	-78%	18.9
Heald Green	204	72	-65%	11.3	56	17	-69%	6.4
Gatley	74	55	-25%	2.3	14	10	-29%	1.2
Burnage	52	11	-79%	7.4	8	2	-77%	2.7
Mauldeth Road	57	28	-50%	4.3	20	14	-31%	1.5
Total Airport Line	**702**	**252**	**-64%**	**20.6**	**455**	**121**	**-73%**	**19.7**
Bramhall	99	35	-65%	26.8	35	5	-86%	6.8
Cheadle Hulme	323	103	-68%	10.6	56	46	-19%	1.5
Davenport								

Hazel Grove	187	105	-44%	8.1	32	3	-89%	6.8
Woodsmoor	71	6	-91%	4.5	18	1	-94%	5.5
Stockport	1009	1178	17%	**30.6**	349	310	-11%	2.2
Heaton Chapel	176	41	-76%	12.9	29	17	-42%	2.5
Levenshulme	73	193	166%	10.5	26	39	51%	2.3
Total Stockport Line	**2054**	**1708**	**-17%**	**35.7**	**567**	**426**	**-25%**	**6.3**
Glossop	226	228	1%	0.1	58	40	-31%	2.6
Hadfield	111	0	-100%	14.9	32	0	-100%	8.0
Flowery Field	47	21	-55%	4.4	13	6	-54%	2.3
Marple	184	104	-44%	6.7	34	22	-37%	2.4
Rose Hill	34	24	-29%	1.8	8	1	-87%	3.3
Romiley	114	87	-24%	2.7	24	7	-70%	4.2
Bredbury	54	47	-13%	1.0	13	7	-48%	2.0
Reddish North	34	74	121%	5.5	8	7	-11%	0.3
Guide Bridge	47	65	37%	2.3	14	15	7%	0.2
Gorton	18	3	-85%	4.7	6	1	-89%	2.8
Total Marple/Glossop Line	**869**	**652**	**-25%**	**7.9**	**212**	**106**	**-50%**	**8.3**
Greenfield	89	52	-41%	4.3	16	12	-22%	0.9
Mossley	110	16	-85%	11.8	16	4	-72%	3.5
Stalybridge	331	118	-64%	14.2	67	29	-56%	5.4
Ashton	116	67	-42%	5.2	44	14	-68%	5.5
Total Ashton	**646**	**254**	**-61%**	**18.5**	**142**	**60**	**-58%**	**8.1**
Littleborough	9	856	9630%	40.7	23	28	22%	1.0
Smithy Bridge	59	122	106%	6.6	11	7	-35%	1.3
Castleton	40	50	27%	1.6	8	6	-31%	1.0
Mills Hill	84	93	11%	0.9	16	8	-49%	2.3
Moston	17	23	32%	1.2	5	6	23%	0.5
Rochdale	222	195	-12%	1.8	106	86	-19%	2.0
Milnrow	40	126	217%	9.5	17	20	17%	0.7
New Hey	20	46	134%	4.6	4	2	-42%	0.9
Shaw	123	156	27%	2.8	29	26	-9%	0.5
Derker	10	1	-89%	3.7	2	1	-53%	0.8
Oldham Mumps	72	52	-27%	2.5	32	24	-23%	1.4

Oldham Werneth	20	1	-94%	5.8	6	1	-79%	2.6
Hollinwood	15	1	-91%	4.8	4	0	-91%	2.5
Failsworth	20	1	-96%	5.9	7	0	-95%	3.4
Dean Lane	12	0	-98%	4.7	3	1	-77%	1.8
Total Oldham/R'dale Line	**761**	**1723**	**126%**	**27.3**	**273**	**218**	**-20%**	**3.5**
GEH	No.	%			No.	%		
< 5.0	33	56%			52	85%		
< 7.5	45	74%			58	95%		
< 10.0	49	80%			59	97%		
Flow	No.	%			No.	%		
No. Links with Flow > 150	14				4			
No. Links with Flow > 150 and diff <	4	29%			2	50%		

Table 14 Rail Alightings

	AM Peak				IP Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Wigan North Western	118	112	-5%	0.6	82	81	-2%	0.2
Wigan Wallgate	125	199	59%	5.8	74	91	22%	1.8
Hindley	3	14	324%	3.6	8	5	-34%	1.0
Daisy Hill	3	9	229%	2.6	2	5	158%	1.6
Atherton	8	13	71%	1.7	10	13	31%	0.9
Walkden	13	9	-33%	1.3	11	8	-24%	0.9
Westhoughton	9	9	6%	0.2	8	6	-16%	0.5
Horwich Parkway	32	77	143%	6.1	16	8	-54%	2.6
Lostock Junction	2	2	0%	0.0	6	3	-44%	1.2
Bromley Cross	42	30	-30%	2.1	8	11	33%	0.9
Bolton	259	404	56%	8.0	283	147	-48%	9.2
Salford Crescent	399	500	25%	4.8	240	111	-54%	9.7
Total Wigan / Bolton Line	**1012**	**1379**	**36%**	**10.6**	**746**	**488**	**-35%**	**10.4**
Glazebrook	0	0	-100%	0.9	0	0	-	-
Irlam	16	22	43%	1.5	8	13	68%	1.6
Flixton	3	4	35%	0.5	2	2	0%	0.0
Chassen Road	7	1	-80%	2.7	0	0	1%	0.0
Urmston	23	12	-50%	2.8	12	8	-33%	1.2
Humphrey Park	1	1	-48%	0.6	0	1	436%	1.2
Trafford Park	7	5	-30%	0.9	2	0	-100%	1.9
Total Liverpool Line	**57**	**45**	**-22%**	**1.8**	**24**	**24**	**3%**	**0.1**
Airport	450	139	-69%	18.1	259	73	-72%	14.4
Heald Green	46	19	-58%	4.7	30	19	-38%	2.3
Gatley	11	14	30%	0.9	5	10	103%	1.9
Burnage	2	2	21%	0.3	3	1	-61%	1.2
Mauldeth Road	3	3	-10%	0.2	6	9	55%	1.2
Total Airport Line	**511**	**177**	**-65%**	**18.0**	**302**	**112**	**-63%**	**13.3**
Bramhall	8	9	15%	0.4	11	6	-45%	1.7
Cheadle Hulme	85	100	17%	1.5	29	38	30%	1.5
Davenport								

Hazel Grove	13	34	161%	4.4	12	3	-74%	3.2
Woodsmoor	18	4	-77%	4.2	9	1	-87%	3.5
Stockport	671	1394	108%	22.5	257	366	42%	6.2
Heaton Chapel	9	52	465%	7.7	8	7	-9%	0.2
Levenshulme	8	37	340%	6.0	6	18	219%	3.6
Total Stockport Line	**836**	**1648**	**97%**	**23.1**	**344**	**443**	**29%**	**5.0**
Glossop	58	40	-32%	2.6	38	57	49%	2.7
Hadfield	8	0	-100%	3.9	14	0	-100%	5.2
Flowery Field	27	28	4%	0.2	7	7	10%	0.3
Marple	15	36	142%	4.2	10	16	68%	1.8
Rose Hill	8	4	-49%	1.6	4	3	-24%	0.5
Romiley	9	19	105%	2.6	12	9	-20%	0.7
Bredbury	8	10	19%	0.5	4	5	14%	0.3
Reddish North	8	14	69%	1.7	6	10	86%	1.7
Guide Bridge	27	46	68%	3.0	6	12	114%	2.1
Gorton	5	6	19%	0.4	3	1	-59%	1.3
Total Marple/Glossop Line	**173**	**201**	**16%**	**2.1**	**102**	**121**	**18%**	**1.8**
Greenfield	6	26	367%	5.2	4	15	285%	3.7
Mossley	6	4	-25%	0.7	7	4	-41%	1.2
Stalybridge	19	51	164%	5.3	16	24	43%	1.6
Ashton	26	23	-13%	0.7	25	18	-29%	1.6
Total Ashton	**57**	**104**	**82%**	**5.2**	**53**	**61**	**16%**	**1.1**
Littleborough	9	24	171%	3.7	8	55	571%	8.3
Smithy Bridge	4	6	63%	1.0	4	5	3%	0.1
Castleton	8	38	404%	6.4	5	7	57%	1.1
Mills Hill	8	24	215%	4.1	9	8	-3%	0.1
Moston	4	11	158%	2.5	4	4	7%	0.1
Rochdale	58	104	77%	5.0	69	73	6%	0.5
Milnrow	3	10	249%	2.8	6	15	153%	2.8
New Hey	2	1	-59%	0.9	1	6	760%	2.8
Shaw	14	21	51%	1.7	15	21	35%	1.3
Derker	1	0	-81%	0.9	0	0	-	0.8
Oldham Mumps	37	22	-42%	2.9	19	15	-17%	0.8

Oldham Werneth	5	1	-78%	2.3	2	1	-36%	0.6
Hollinwood	6	3	-41%	1.1	4	1	-75%	1.9
Failsworth	1	0	-69%	0.9	3	0	-84%	1.9
Dean Lane	2	5	160%	1.7	4	1	-66%	1.6
Total Oldham/R'dale Line	**161**	**270**	**68%**	**7.5**	**152**	**214**	**41%**	**4.6**
GEH	No.	%			No.	%		
< 5.0	50	82%			54	90%		
< 7.5	57	93%			56	93%		
< 10.0	59	97%			59	98%		
Flow	No.	%			No.	%		
No. Links with Flow > 150	4				4			
No. Links with Flow > 150 and diff < 25%	0	0%			0	0%		

Table 15 City Centre Rail Boadings and Alightings

	AM Peak				IP Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Rail City Centre Boardings								
Piccadilly 1	---	823	---	---	---	670	---	---
Piccadilly 2	---	494	---	---	---	145	---	---
Piccadilly Total	828	1318	59%	15.0	1046	815	-22%	7.6
Oxford Road	302	319	6%	0.9	229	332	45%	6.2
Victoria	132	238	79%	7.7	288	207	-28%	5.2
Salford Central	12	18	54%	1.7	12	51	328%	7.0
Deansgate	23	30	28%	1.3	26	17	-34%	1.9
Total Boardings	**1297**	**1922**	**48%**	**15.6**	**1601**	**1422**	**-11%**	**4.6**
Rail City Centre Alightings								
Piccadilly 1	---	1847	---	---	---	---	---	---
Piccadilly 2	---	604	---	---	---	---	---	---
Piccadilly Total	3919	2451	-37%	26.0	---	---	---	---
Oxford Road	1634	1313	-20%	8.4	---	---	---	---
Victoria	1588	1678	6%	2.2	---	---	---	---
Salford Central	596	1021	71%	14.9	---	---	---	---
Deansgate	371	119	-68%	16.1	---	---	---	---
Total Alightings	**8108**	**6582**	**-19%**	**17.8**	---	---	---	---

Table 16 Metrolink Boardings

	AM Peak				IP Peak				PM Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Altrincham Line												
Altrincham	361	275	-24%	4.8	208	206	-1%	0.2	369	277	-25%	5.1
Navigation Road	100	195	94%	7.8	31	57	84%	3.9	34	85	153%	6.7
Timperley	251	278	11%	1.7	135	70	-48%	6.4	131	75	-43%	5.6
Brooklands	418	215	-49%	11.4	84	43	-48%	5.1	91	55	-40%	4.2
Sale	104	445	328%	20.6	87	138	58%	4.8	148	184	24%	2.8
Dane Road	38	109	184%	8.2	35	26	-26%	1.7	77	17	-77%	8.7
Stretford	446	188	-58%	14.5	154	66	-57%	8.3	157	60	-62%	9.3
Old Trafford	195	63	-68%	11.7	63	56	-10%	0.9	88	138	57%	4.7
Trafford Bar	258	21	-92%	20.0	75	9	-88%	10.2	98	8	-92%	12.5
Total Altrincham Line	**2172**	**1790**	**-18%**	**8.6**	**872**	**671**	**-23%**	**7.2**	**1193**	**898**	**-25%**	**9.1**
Bury Line												
Bury Interchange	359	196	-45%	9.7	268	214	-20%	3.5	288	216	-25%	4.6
Radcliffe	386	290	-25%	5.2	110	102	-7%	0.8	65	147	128%	8.0
Whitefield	238	102	-57%	10.5	88	83	-5%	0.5	53	70	32%	2.2
Besses'O'Th'Barn	180	168	-6%	0.9	47	50	7%	0.5	29	33	14%	0.7
Prestwich	190	127	-33%	5.0	122	85	-30%	3.6	86	163	89%	6.9
Heaton Park	145	421	190%	16.4	78	147	88%	6.5	42	140	235%	10.3
Bowker Vale	206	439	113%	13.0	55	128	133%	7.6	21	51	142%	5.0
Crumpsall	187	381	103%	11.5	93	93	0%	0.0	71	219	208%	12.3
Woodlands Road	53	47	-12%	0.9	36	14	-62%	4.5	31	28	-8%	0.5
Total Bury Line	**1945**	**2170**	**12%**	**5.0**	**897**	**916**	**2%**	**0.6**	**685**	**1066**	**56%**	**12.9**
Eccles Line												
Eccles ML	148	160	9%	1.0	67	57	-14%	1.2	74	28	-62%	6.4
Ladywell	54	37	-31%	2.5	25	19	-26%	1.4	28	41	49%	2.3
Weaste	41	49	20%	1.2	33	28	-15%	0.9	39	38	-3%	0.2
Langworthy	64	25	-61%	5.9	30	3	-88%	6.4	47	14	-70%	6.0
Broadway	2	40	2399%	8.4	15	35	133%	4.0	32	74	131%	5.8
Harbour City	10	4	-57%	2.1	19	0	-100%	6.2	89	17	-81%	9.9
Anchorage	22	31	41%	1.8	27	58	113%	4.7	84	130	54%	4.4
Salford quays	35	20	-42%	2.8	24	21	-12%	0.6	85	108	27%	2.4
Exchange quay												

Pomona	2	2	4%	0.1	4	8	113%	1.7	4	23	539%	5.4
Total Eccles Line	**409**	**369**	**-10%**	**2.1**	**272**	**229**	**-16%**	**2.7**	**619**	**473**	**-24%**	**6.2**
City Centre												
G-Mex	74	66	-11%	1.0	47	71	51%	3.1	85	338	300%	17.4
St Peters Square	157	135	-14%	1.8	296	149	-49%	9.8	885	630	-29%	9.3
Piccadilly Gardens	171	179	5%	0.6	158	6	-96%	16.8	395	129	-67%	16.4
Piccadilly	274	411	50%	7.4	193	82	-58%	9.5	240	192	-20%	3.2
Market St	100	81	-18%	1.9	214	192	-11%	1.6	448	412	-8%	1.7
Mosley St	138	199	45%	4.7	98	126	28%	2.6	384	300	-22%	4.5
Victoria	237	25	-89%	18.5	190	25	-87%	15.9	357	66	-82%	20.0
Total City Centre	**1151**	**1097**	**-5%**	**1.6**	**1196**	**651**	**-46%**	**18.0**	**2794**	**2068**	**-26%**	**14.7**
GEH	No.	%			No.	%			No.	%		
< 5.0	16	46%			22	63%			15	43%		
< 7.5	20	57%			27	77%			23	66%		
< 10.0	25	71%			32	91%			28	80%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	17				8				9			
No. Links with Flow > 150 and diff <	6	35%			3	38%			4	44%		

Table 17 Metrolink Alightings

	AM Peak				IP Peak				PM Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Altrincham Line												
Altrincham	487	448	-8%	1.8	158	123	-22%	2.9	306	276	-10%	1.7
Navigation Road	33	58	74%	3.7	23	25	10%	0.5	79	81	2%	0.2
Timperley	105	43	-59%	7.2	115	84	-27%	3.1	287	71	-75%	16.2
Brooklands	64	30	-52%	4.8	60	44	-26%	2.1	265	156	-41%	7.5
Sale	165	121	-27%	3.7	73	155	112%	7.6	109	265	144%	11.4
Dane Road	95	34	-64%	7.6	50	22	-55%	4.6	97	60	-38%	4.1
Stretford	118	83	-30%	3.5	130	66	-49%	6.5	322	174	-46%	9.4
Old Trafford	73	96	31%	2.4	50	38	-25%	1.9	169	63	-63%	9.8
Trafford Bar	51	20	-60%	5.2	75	11	-85%	9.8	233	31	-87%	17.6
Total Altrincham Line	**1191**	**933**	**-22%**	**7.9**	**733**	**568**	**-23%**	**6.5**	**1866**	**1177**	**-37%**	**17.7**
Bury Line												
Bury Interchange	370	311	-16%	3.2	241	217	-10%	1.5	335	393	17%	3.0
Radcliffe	76	167	120%	8.3	91	106	17%	1.6	289	247	-15%	2.6
Whitefield	42	63	51%	2.9	73	76	4%	0.3	195	79	-60%	10.0
Besses'O'Th'Barn	12	333	2583%	24.4	43	60	40%	2.4	124	176	42%	4.2
Prestwich	103	176	71%	6.2	104	100	-4%	0.4	169	85	-50%	7.5
Heaton Park	108	174	61%	5.6	46	110	140%	7.3	108	190	75%	6.7
Bowker Vale	13	65	392%	8.3	60	126	111%	6.9	131	172	31%	3.3
Crumpsall	67	157	134%	8.5	88	133	52%	4.4	181	330	82%	9.3
Woodlands Road	29	29	-1%	0.0	36	14	-61%	4.4	64	52	-19%	1.6
Total Bury Line	**819**	**1473**	**80%**	**19.3**	**780**	**942**	**21%**	**5.5**	**1598**	**1725**	**8%**	**3.1**
Eccles Line												
Eccles ML	41	41	0%	0.0	68	56	-17%	1.5	172	110	-36%	5.2
Ladywell	22	28	25%	1.1	25	33	29%	1.4	59	41	-31%	2.6
Weaste	32	18	-42%	2.7	16	34	111%	3.6	40	60	49%	2.8
Langworthy	48	11	-77%	6.8	21	6	-71%	4.0	52	28	-46%	3.8
Broadway	38	41	7%	0.5	17	38	121%	3.9	8	15	84%	2.0
Harbour City	80	72	-10%	0.9	33	0	-100%	8.1	19	21	7%	0.3
Anchorage	83	115	39%	3.2	26	68	162%	6.1	27	34	24%	1.2
Salford quays												

Exchange quay	168	0	-100%	18.3	37	0	-100%	8.6	32	0	-100%	7.9
Pomona	5	20	288%	4.2	5	5	5%	0.1	2	4	53%	0.7
Total Eccles Line	**602**	**460**	**-24%**	**6.2**	**275**	**258**	**-6%**	**1.0**	**454**	**341**	**-25%**	**5.6**
GEH	No.	%			No.	%			No.	%		
< 5.0	17	61%			20	71%			16	57%		
< 7.5	22	79%			24	86%			20	71%		
< 10.0	26	93%			28	100%			25	89%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	4				2				12			
No. Links with Flow > 150 and diff <	2	50%			2	100%			3	25%		

Appendix G
Matrix Estimation - Analysis of Matrices by Sector

Table 1 Morning Peak Prior ME Matrix

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	499	110	41	345	475	1	2	1	5	2	2	19	4	1	10	5	1521
2	120	635	292	65	355	10	245	1	6	1	6	1	1	5	21	7	1771
3	88	291	1925	32	1503	4	94	6	5	0	463	19	93	13	16	35	4588
4	367	58	59	2329	2068	32	4	14	15	0	11	5	0	11	32	33	5039
5	213	235	1150	908	23833	10	43	168	1844	89	972	102	50	14	132	159	29924
6	7	58	11	105	89	1576	34	2	0	0	0	9	0	169	161	0	2220
7	5	219	223	6	215	84	2403	2	3	0	0	7	239	94	43	0	3543
8	6	0	4	20	1354	4	0	4277	1116	4	14	90	7	8	906	19	7829
9	8	13	9	42	2005	0	6	379	5776	123	31	143	0	4	34	43	8617
10	0	0	3	1	823	0	0	0	294	2197	349	102	0	0	2	5	3776
11	8	8	382	19	2290	0	1	7	51	309	4877	51	25	1	1	21	8051
12	12	3	29	2	1303	5	14	109	389	356	55	120464	396	23	336	0	123496
13	18	10	161	2	281	0	135	15	15	0	78	1279	51756	64	96	0	53912
14	8	32	77	4	120	383	442	13	0	0	0	115	35	21036	465	0	22730
15	2	3	11	44	687	69	24	924	15	0	0	521	29	158	70065	0	72553
16	17	2	53	8	276	0	0	10	27	7	24	0	0	0	0	0	424
Total	1379	1678	4431	3933	37678	2178	3447	5929	9560	3088	6883	122927	52636	21602	72321	327	349995

Table 2 Morning Peak Post ME Matrix

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	458	110	32	335	614	3	9	1	4	46	5	46	8	3	17	7	1699
2	129	566	308	78	497	10	268	1	12	0	31	1	4	16	35	25	1980
3	75	358	1757	38	1798	24	123	11	4	0	853	34	205	89	33	90	5491
4	336	58	60	2285	2103	23	4	9	9	0	7	9	0	38	39	46	5024
5	324	320	1087	983	22294	13	60	183	1529	74	1174	127	54	45	163	148	28578
6	4	54	18	66	157	1568	34	3	0	0	0	11	0	170	137	0	2221
7	13	193	259	4	278	81	2366	2	1	0	0	7	231	95	36	0	3568
8	14	0	6	15	1333	4	0	4314	1062	1	17	115	7	11	867	13	7778
9	14	14	17	103	2133	0	6	298	5840	85	26	147	0	2	43	21	8749
10	0	0	1	2	616	0	0	0	251	2268	307	75	0	0	4	5	3528
11	22	6	232	7	2411	0	1	5	94	321	4750	85	22	3	2	32	7993
12	44	4	45	2	1373	4	10	98	373	320	57	120247	389	69	305	0	123338
13	47	11	141	0	461	0	139	14	6	0	84	1274	51614	66	88	0	53946
14	21	28	147	3	248	375	422	18	0	1	0	104	33	20909	439	0	22750
15	9	2	21	59	793	64	18	921	11	0	0	547	25	154	70025	0	72648
16	40	1	54	3	353	0	0	8	18	2	7	0	0	0	0	0	485
Total	1549	1723	4186	3986	37460	2170	3457	5884	9214	3119	7318	122830	52593	21670	72231	387	349777

Table 3 Absolute Difference between Morning Peak Prior and Post ME Matrices

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	-40	0	-9	-10	139	2	8	0	-1	45	3	27	4	2	7	2	177
2	9	-70	16	12	141	0	23	-1	7	0	25	0	3	11	14	18	208
3	-14	67	-168	7	295	20	29	5	-1	0	390	15	112	76	16	55	904
4	-31	0	1	-44	34	-8	0	-5	-7	0	-4	3	0	27	7	13	-15
5	111	85	-64	75	-1540	3	16	15	-315	-14	202	25	4	31	30	-10	-1346
6	-3	-4	7	-38	69	-9	0	0	0	0	0	2	0	1	-24	0	1
7	8	-26	36	-2	63	-3	-37	0	-1	0	0	0	-8	1	-7	0	24
8	8	0	2	-5	-22	0	0	37	-54	-3	3	25	0	3	-39	-6	-51
9	7	1	8	61	128	0	-1	-81	64	-38	-5	4	0	-2	9	-22	132
10	0	0	-2	2	-208	0	0	0	-44	71	-42	-27	0	0	2	0	-248
11	14	-2	-150	-11	121	0	0	-2	44	11	-127	34	-3	2	0	12	-58
12	31	0	16	0	70	0	-5	-12	-15	-36	2	-217	-7	46	-31	0	-157
13	28	1	-19	-2	180	0	3	-1	-9	0	6	-5	-142	1	-7	0	34
14	14	-4	70	-1	128	-8	-20	5	0	1	0	-11	-1	-126	-26	0	20
15	6	-1	10	15	106	-5	-6	-4	-3	0	0	27	-5	-4	-40	0	95
16	22	-1	1	-5	77	0	0	-2	-10	-4	-17	0	0	0	0	0	62
Total	169	46	-245	53	-218	-8	11	-46	-346	31	436	-97	-43	69	-89	60	-218

Table 4 Inter-peak Prior Matrix

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	457	108	34	314	180	3	4	3	5	1	2	15	7	1	6	28	1167
2	111	518	179	34	140	25	160	0	2	0	4	2	4	7	4	11	1201
3	59	218	1908	29	895	1	92	2	7	1	369	9	114	7	6	28	3745
4	328	41	25	1669	844	14	2	15	30	2	8	3	1	3	30	27	3042
5	147	129	686	627	14818	13	33	275	743	143	870	209	100	41	167	381	19383
6	4	22	1	13	14	986	40	2	0	0	0	3	0	181	64	0	1330
7	1	156	83	2	31	37	1561	1	0	0	1	6	118	176	20	0	2192
8	1	1	2	14	334	2	0	4414	542	3	6	85	4	4	672	24	6108
9	4	3	4	17	872	0	2	710	4653	219	40	208	1	2	14	35	6783
10	2	1	3	3	165	1	0	2	110	1631	302	224	0	2	1	16	2462
11	1	3	411	7	1259	1	1	8	31	292	4610	29	52	1	8	23	6737
12	9	1	7	1	128	4	6	54	134	160	23	79333	522	41	272	0	80692
13	6	4	87	2	65	0	127	4	2	2	37	491	35811	30	32	0	36699
14	2	6	1	1	18	159	142	3	1	1	1	33	30	14292	160	0	14849
15	4	6	8	28	139	73	21	603	18	6	2	251	32	186	48324	0	49702
16	24	2	14	12	159	0	0	11	22	11	18	0	0	0	0	0	274
Total	1160	1218	3453	2773	20059	1318	2191	6104	6301	2472	6291	80902	36797	14976	49780	572	236367

Table 5 Inter-peak Post ME Matrix

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	414	110	33	291	261	3	7	7	16	1	5	67	25	10	20	50	1319
2	120	489	190	36	129	26	174	0	6	0	3	8	21	13	5	13	1235
3	83	247	1811	40	902	4	121	4	20	1	360	17	106	28	17	53	3812
4	291	42	46	1647	796	15	2	17	8	2	9	16	4	29	52	81	3058
5	206	141	709	620	14949	15	29	338	783	183	938	559	108	144	436	463	20622
6	3	21	2	10	13	978	39	2	0	0	0	8	0	178	63	0	1318
7	3	149	106	2	25	37	1537	0	0	0	1	6	124	179	33	0	2200
8	5	0	3	13	361	2	0	4388	521	4	5	102	4	4	700	18	6130
9	16	9	17	15	1044	0	5	765	4629	195	36	226	2	12	19	56	7046
10	9	2	4	13	216	0	0	1	122	1614	320	179	0	4	4	9	2495
11	3	3	466	10	1606	10	0	11	39	282	4498	38	59	1	17	9	7052
12	25	0	11	5	140	16	5	51	132	144	17	79114	535	38	299	0	80534
13	16	3	94	2	84	0	123	3	3	1	37	495	35763	38	32	0	36695
14	6	5	3	3	22	158	138	2	1	1	1	41	28	14220	156	0	14783
15	10	6	11	27	133	73	21	585	21	2	1	296	30	186	48156	0	49557
16	56	4	24	22	155	0	0	8	18	6	5	0	0	0	0	0	298
Total	1263	1231	3529	2755	20836	1336	2203	6183	6319	2436	6235	81172	36810	15085	50011	751	238154

Table 6 Absolute Difference between Inter-peak Prior and Post ME Matrices

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	-43	1	-2	-23	81	0	3	5	11	0	3	51	17	8	15	23	151
2	9	-29	11	2	-11	1	14	0	4	0	-1	7	17	6	1	2	33
3	24	29	-97	11	7	2	29	2	13	0	-9	9	-9	21	11	24	67
4	-37	1	21	-22	-48	2	1	2	-22	0	1	13	3	26	22	55	16
5	59	12	23	-7	131	2	-4	64	40	40	69	350	8	102	269	82	1239
6	-1	-1	1	-2	0	-8	-1	0	0	0	0	5	0	-3	-1	0	-12
7	2	-7	23	0	-6	0	-24	0	0	0	0	0	5	3	13	0	8
8	3	0	1	-1	28	0	0	-26	-21	1	-1	17	0	0	28	-7	22
9	12	7	13	-2	172	0	3	55	-23	-24	-4	18	2	10	5	21	263
10	6	1	1	10	51	0	0	-1	12	-17	17	-46	0	2	3	-7	33
11	2	0	55	3	347	9	-1	3	8	-10	-112	9	7	-1	9	-14	315
12	16	0	4	4	12	12	0	-2	-2	-16	-6	-219	14	-2	27	0	-158
13	10	-1	6	0	19	0	-4	0	1	-1	0	4	-47	8	0	0	-4
14	4	-1	2	1	4	-2	-3	0	0	0	0	8	-1	-72	-4	0	-65
15	5	0	3	0	-6	-1	0	-19	3	-4	-1	45	-2	0	-167	0	-145
16	32	2	10	9	-3	0	0	-3	-5	-5	-13	0	0	0	0	0	24
Total	103	13	75	-18	777	18	12	79	18	-36	-56	270	13	109	231	179	1787

Table 7 Evening Peak Prior Matrix

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	314	91	53	230	178	3	4	4	6	2	7	16	7	4	2	20	941
2	73	358	195	65	180	27	144	1	2	1	8	4	22	25	3	5	1113
3	85	245	1479	33	1005	2	139	5	21	1	271	3	109	24	8	32	3464
4	237	43	29	1494	812	27	11	25	39	0	8	9	20	4	28	12	2798
5	367	572	1357	1426	21193	68	224	1106	2010	502	1858	966	380	217	456	438	33139
6	2	10	5	34	26	839	42	2	0	0	0	4	0	190	45	0	1197
7	2	131	92	3	45	23	1310	1	1	0	2	9	85	233	15	0	1953
8	1	0	1	23	247	2	1	3159	219	1	8	52	10	13	681	17	4434
9	2	2	6	19	797	0	1	759	4117	289	26	275	1	1	9	24	6328
10	0	0	14	0	109	0	0	1	154	1440	298	203	0	0	0	4	2223
11	2	7	362	5	1141	1	1	14	55	346	3571	75	32	1	5	21	5638
12	1	2	20	6	333	5	5	67	107	141	70	66581	718	65	280	0	68401
13	7	34	118	2	55	0	121	6	3	1	21	317	28954	21	23	0	29683
14	0	7	31	7	28	101	74	5	3	0	2	23	41	11579	118	0	12018
15	0	15	17	35	176	85	23	663	9	0	3	226	64	267	38774	0	40357
16	18	7	78	28	254	0	0	52	50	14	19	0	0	0	0	0	521
Total	1111	1523	3857	3410	26579	1184	2100	5871	6795	2737	6171	68765	30443	12643	40447	573	214209

Table 8 Evening Peak Post ME Matrix

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	304	94	63	218	267	3	5	6	6	6	6	19	10	4	2	16	1027
2	75	372	237	63	139	25	137	1	1	1	8	3	25	27	3	4	1122
3	159	261	1429	34	975	5	116	5	22	1	291	3	84	32	9	30	3455
4	269	47	37	1441	777	28	12	23	41	0	12	12	27	6	40	13	2785
5	294	528	1171	1686	22637	123	314	1164	1972	563	1802	1184	505	349	628	515	35436
6	1	10	3	17	33	827	43	2	0	0	0	5	0	190	45	0	1176
7	2	135	102	1	42	20	1283	2	1	0	2	10	81	237	16	0	1933
8	1	0	1	35	275	2	1	3098	235	1	5	49	10	13	670	16	4411
9	1	2	8	5	767	0	1	808	4572	284	26	289	1	1	8	19	6789
10	0	0	8	0	121	0	0	1	153	1458	336	156	0	0	0	3	2236
11	1	6	405	3	1261	0	0	13	43	347	3677	65	32	1	8	19	5885
12	1	2	16	8	382	6	5	61	92	117	78	66514	714	64	265	0	68327
13	12	28	109	3	68	0	123	7	2	1	22	320	28918	21	24	0	29658
14	0	6	31	7	30	99	71	4	3	0	2	25	40	11524	120	0	11963
15	0	16	16	44	217	81	25	662	8	0	4	219	63	264	38690	0	40308
16	16	7	79	25	285	0	0	52	36	17	21	0	0	0	0	0	538
Total	1137	1513	3714	3591	28278	1218	2138	5909	7185	2795	6292	68873	30510	12733	40529	635	217051

Table 9 Absolute Difference between Evening Peak Prior and Post-ME Matrices

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	-10	3	10	-12	89	-1	2	2	0	4	-1	2	3	0	0	-4	86
2	2	14	42	-2	-41	-2	-7	0	-1	0	1	-1	4	2	0	-1	9
3	74	16	-51	1	-30	2	-24	0	1	0	19	0	-26	8	1	-3	-9
4	32	4	8	-53	-35	1	1	-2	2	0	5	3	7	2	12	1	-13
5	-73	-44	-185	260	1444	54	90	58	-38	62	-55	218	124	131	173	77	2297
6	-1	0	-2	-17	7	-12	1	0	0	0	0	1	0	1	0	0	-21
7	0	4	10	-2	-3	-3	-27	1	0	0	0	1	-4	3	1	0	-20
8	0	0	0	12	28	0	0	-61	16	0	-2	-4	0	1	-11	-1	-22
9	-1	0	1	-14	-30	0	0	49	455	-5	-1	14	0	0	-1	-5	461
10	0	0	-6	0	12	0	0	0	-2	18	38	-47	0	0	0	-1	13
11	0	0	44	-2	120	-1	0	-1	-12	1	106	-10	0	1	3	-2	247
12	0	0	-5	2	50	1	0	-5	-15	-23	7	-67	-4	-1	-15	0	-74
13	4	-6	-9	2	13	0	2	1	-1	0	1	3	-36	0	1	0	-25
14	0	-1	1	-1	2	-2	-3	0	0	0	0	2	0	-55	2	0	-55
15	0	1	-1	9	41	-4	2	-1	-2	0	1	-8	-1	-3	-84	0	-49
16	-2	0	1	-3	32	0	0	-1	-14	2	2	0	0	0	0	0	17
Total	26	-10	-142	181	1699	34	37	38	390	58	121	107	67	91	82	62	2842

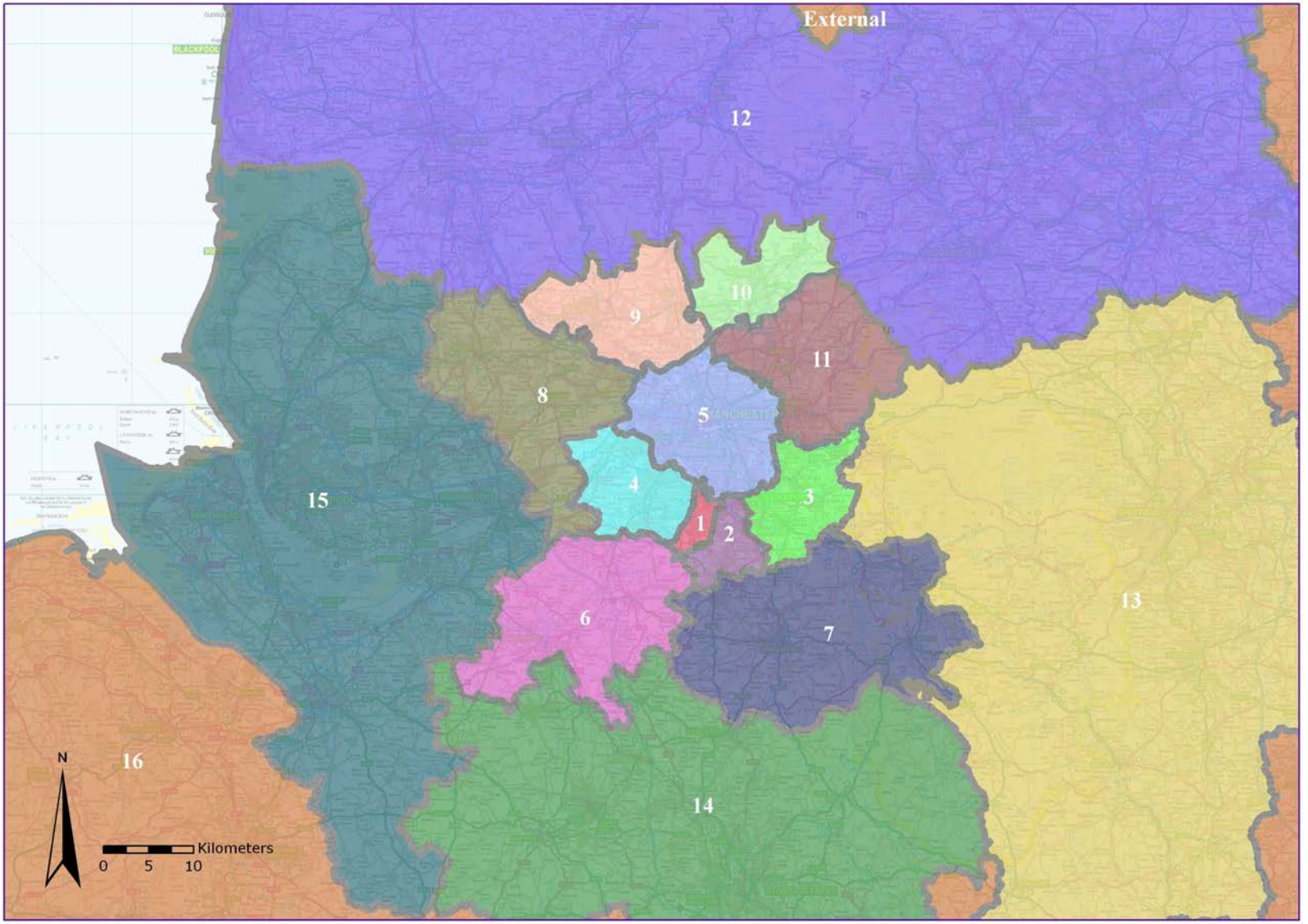


Figure 1 SEMMMS 16 Sector Zone System

Appendix H
Matrix Estimation – Trip End Summaries

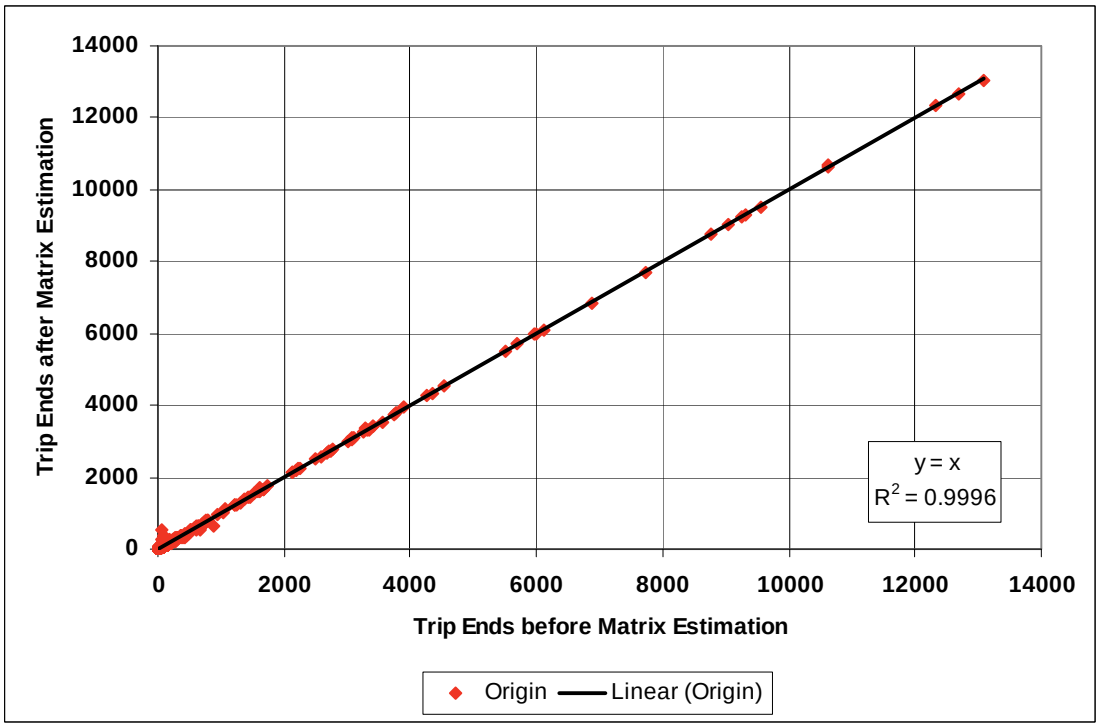


Fig 1 Morning Peak Origin Trip Ends

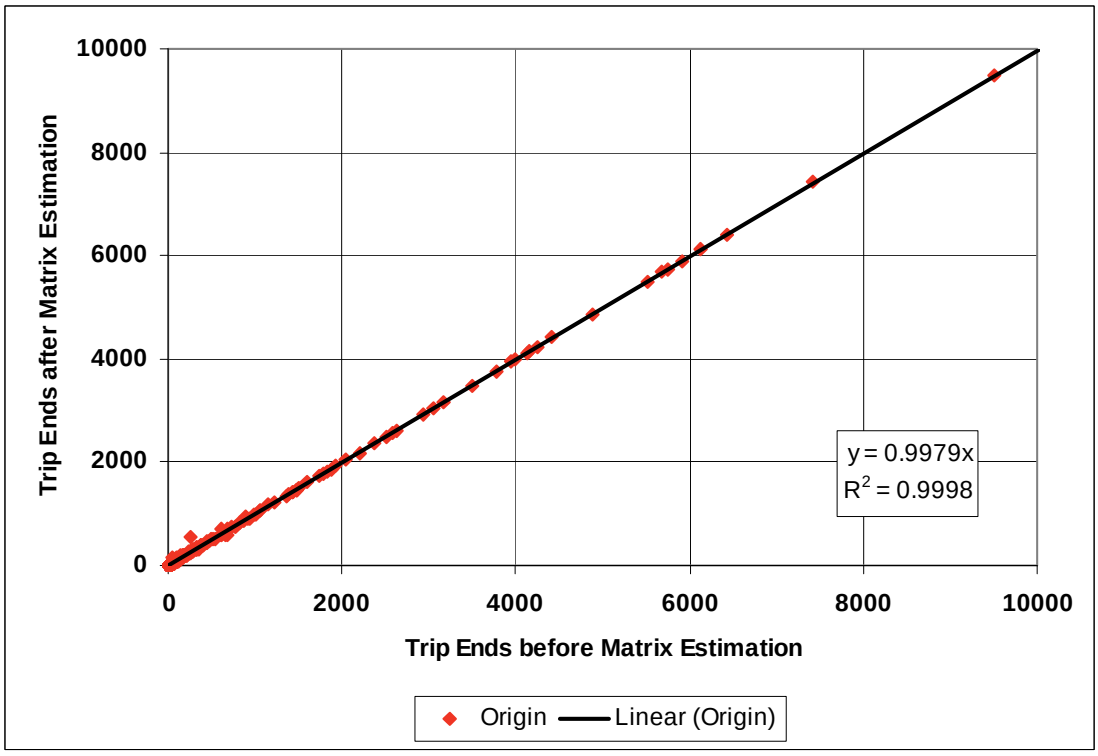


Fig 2 Inter-peak Origin Trip Ends

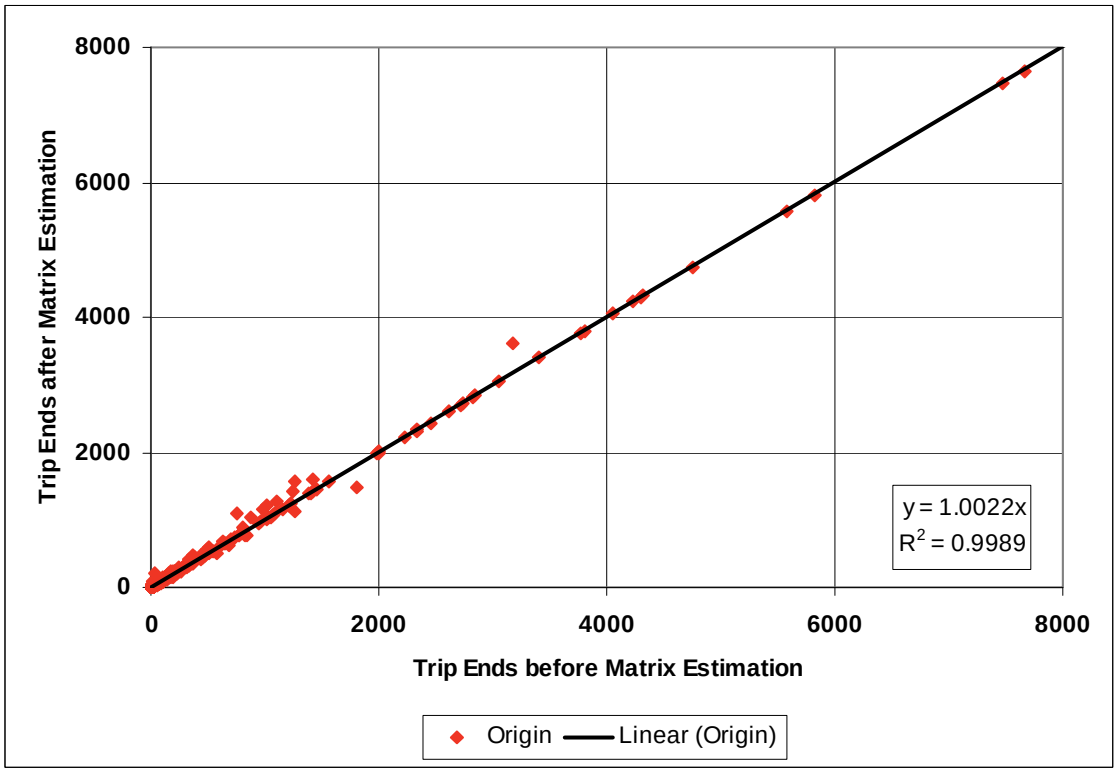


Fig 3 Evening Peak Origin Trip Ends

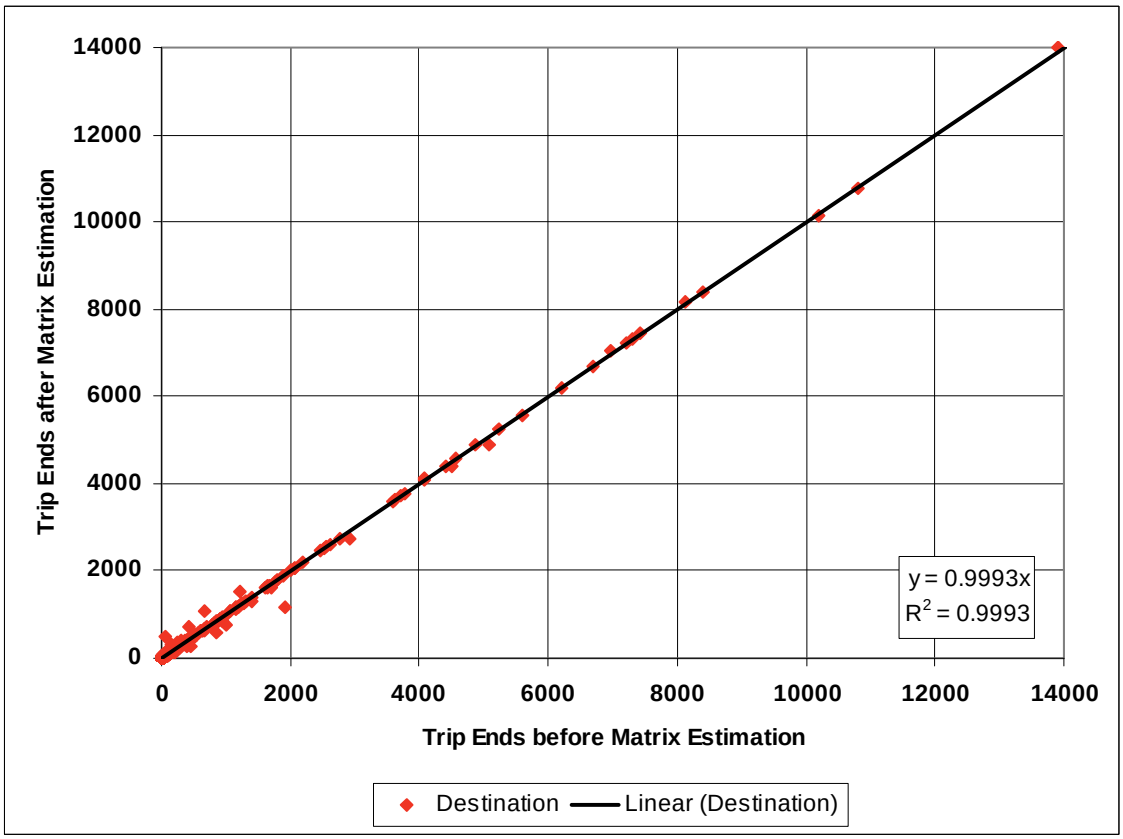


Fig 4 Morning Destination Trip Ends

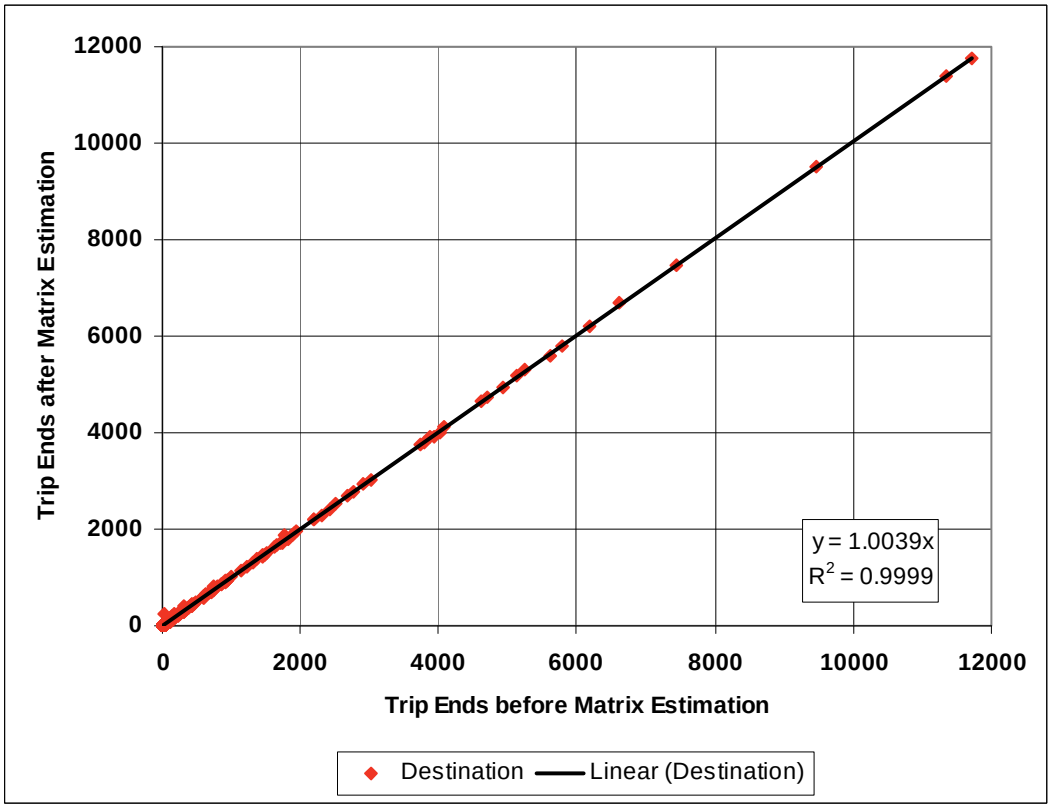


Fig 5 Inter-peak Destination Trip Ends

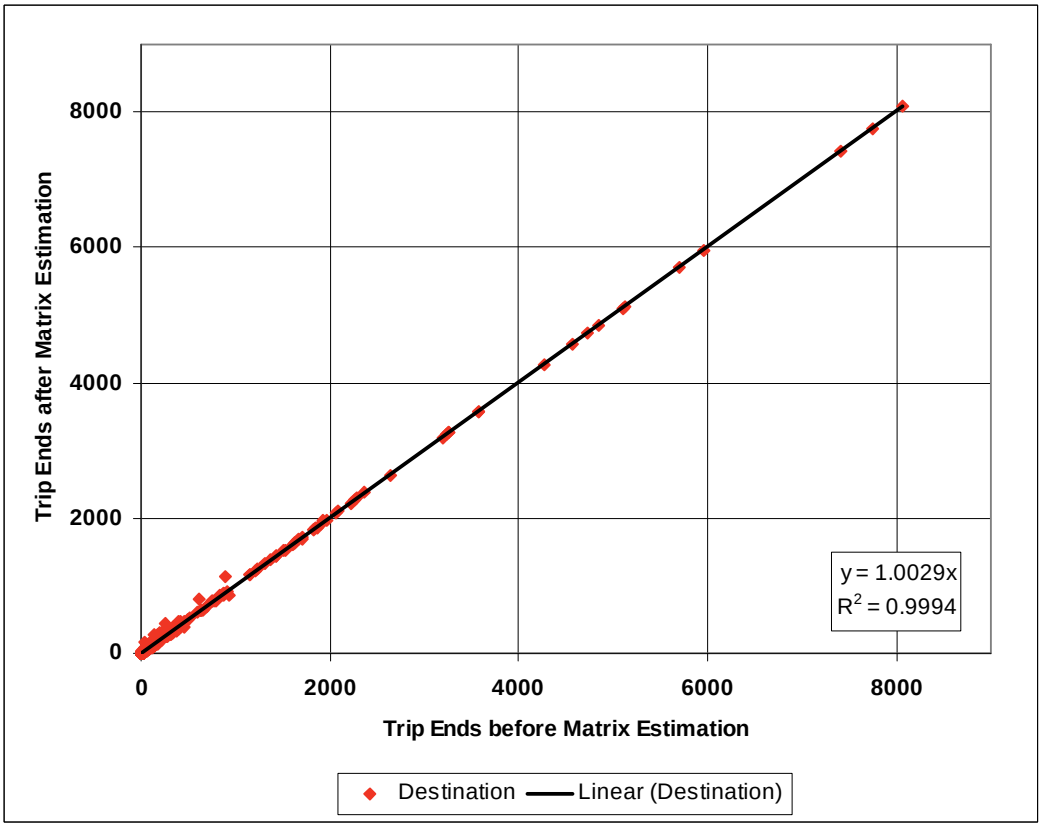


Fig 6 Evening Peak Destination Trip Ends

Appendix I
Post Matrix Estimation Validation Assignment

Table 1 M60 After Inner Screenline Northbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A57 Liverpool Rd	100	94	-6%	0.7	83	87	5%	0.5	52	42	-19%	1.5
B5211 Redclyffe Rd	53	45	-15%	1.1	88	72	-18%	1.8	165	139	-16%	2.1
A576 Centenary Way	0	0	---	---	0	0	---	---	5	1	-72%	2.1
A5603 Trafford Rd	12	8	-35%	1.4	9	5	-46%	1.6	13	7	-42%	1.7
A56 Bridgewater Way	36	0	-100%	8.5	0	0	---	---	0	0	---	---
A5014 Chester Road	116	107	-8%	0.9	52	23	-57%	4.9	68	41	-40%	3.7
A635 Ashton Old Rd	360	313	-13%	2.5	180	233	30%	3.7	121	107	-12%	1.3
Palmerston St	11	0	-100%	4.7	8	7	-14%	0.4	6	105	1648%	13.3
A662 Ashton New Rd	794	819	3%	0.9	260	319	23%	3.5	185	193	5%	0.6
A6010 Alan Turing Way	67	203	202%	11.7	50	29	-42%	3.3	31	24	-22%	1.3
Edge Ln, Droylsden	11	2	-86%	3.8	13	6	-56%	2.4	6	0	-100%	3.4
A627 Oldham Rd	113	99	-13%	1.4	176	145	-17%	2.4	110	86	-22%	2.4
B6194 Lees Rd	10	9	-12%	0.4	8	3	-68%	2.4	6	2	-65%	1.9
Lees Rd	12	10	-20%	0.7	8	3	-62%	2.1	8	4	-52%	1.7
A670 Stockport Rd	0	7	1540%	3.3	2	2	0%	0.0	2	0	-100%	2.0
A635 Manchester Rd	8	12	38%	1.0	7	7	6%	0.1	8	6	-27%	0.8
Total	1706	1727	1%	0.5	944	941	0%	0.1	785	757	-4%	1.0
GEH	No.	%			No.	%			No.	%		
< 5.0	13	87%			14	100%			14	93%		
< 7.5	13	87%			14	100%			14	93%		
< 10.0	14	93%			14	100%			14	93%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	2				3				2			
No. Links with Flow > 150 and diff < 25%	2	100%			2	67%			2	100%		

Table 2 M60 After Outer Screenline Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
B5214 Barton Rd	46	30	-33%	2.4	58	54	-8%	0.6	66	72	10%	0.8
B5158 Lostock Rd	164	173	5%	0.7	90	109	21%	1.9	82	93	14%	1.2
Winchester Rd	1	2	47%	0.5	8	7	-23%	0.7	5	0	---	3.2
Bradfield Rd	0	0	---	0.9	3	2	-54%	1.2	1	0	---	1.2
B5213 Stretford Rd	201	227	13%	1.8	125	142	14%	1.5	102	109	8%	0.8
A56 Cross St	236	204	-14%	2.2	175	146	-17%	2.3	177	151	-15%	2.0
A5103 Princess Parkway	236	244	3%	0.5	136	124	-9%	1.0	136	176	29%	3.2
B5167 Palatine Rd	394	367	-7%	1.4	151	154	2%	0.2	192	183	-5%	0.7
A34 Kingsway	6	4	-34%	0.9	5	2	-69%	2.0	1	0	---	1.4
B5095 Manchester Rd, Cheadle	85	90	6%	0.5	72	67	-7%	0.6	68	73	7%	0.6
A5145 Didsbury Road	130	111	-14%	1.7	164	141	-14%	1.8	206	221	7%	1.0
A6 Wellington Rd North	196	106	-46%	7.3	261	193	-26%	4.5	304	213	-30%	5.6
B6167 Lancashire Hill	80	59	-27%	2.6	204	182	-11%	1.6	332	205	-38%	7.7
A 57 Manchester Rd, Denton	272	290	7%	1.1	130	136	4%	0.5	111	109	-2%	0.2
Lumb Ln	80	84	5%	0.4	61	85	40%	2.9	53	74	40%	2.6
B6390 Audenshaw Rd	189	298	57%	7.0	94	141	51%	4.4	59	61	2%	0.2
A635 Manchester Rd	230	193	-16%	2.5	236	252	7%	1.1	179	169	-5%	0.7
Total	2547	2480	-3%	1.3	1974	1936	-2%	0.8	2073	1909	-8%	3.7
GEH	No.	%			No.	%			No.	%		
< 5.0	15	88%			17	100%			15	88%		
< 7.5	17	100%			17	100%			16	94%		
< 10.0	17	100%			17	100%			17	100%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	9				6				6			
No. Links with Flow > 150 and diff <	7	78%			5	83%			4	67%		

Table 3 M60 After Inner Screenline Southbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A57 Liverpool Road	52	53	3%	0.2	64	71	11%	0.9	119	144	21%	2.2
B5211 Redclyffe Road	65	97	50%	3.6	101	91	-10%	1.0	150	121	-19%	2.5
A576 Centenary Way	16	4	-75%	3.8	0	0	---	---	1	2	65%	0.6
A5063 Trafford Road	43	24	-45%	3.3	19	12	-39%	1.9	9	14	67%	1.7
A56 Bridgewater Way	0	0	---	---	0	0	---	---	135	84	-38%	4.9
A5014 Chester Road	78	19	-75%	8.4	31	20	-37%	2.3	89	69	-23%	2.3
A635 Ashton Old Road	192	186	-3%	0.4	150	170	14%	1.6	235	288	23%	3.3
Palmerston Street	3	3	-18%	0.3	5	1	-78%	2.2	3	4	17%	0.3
A662 Ashton New Road	127	131	3%	0.3	201	255	27%	3.6	663	716	8%	2.0
A601 Alan Turing Way	51	50	-1%	0.1	53	18	-66%	5.9	65	83	28%	2.1
Edge Lane	22	11	-49%	2.6	12	9	-21%	0.8	7	7	-4%	0.1
A627 Oldham Road	103	92	-11%	1.1	179	163	-9%	1.2	110	98	-11%	1.2
B6194 Lees Road	88	71	-19%	1.9	14	11	-19%	0.7	14	11	-25%	1.0
Lees Road	39	13	-66%	5.0	7	4	-37%	1.1	14	10	-28%	1.1
A670 Stockport Road	0	0	---	---	3	1	-73%	1.7	0	0	---	---
A635 Manchester Road	4	6	70%	1.2	8	16	95%	2.2	7	11	54%	1.3
Total	881	761	-14%	4.2	846	842	-1%	0.2	1620	1660	2%	1.0
GEH	No.	%			No.	%			No.	%		
< 5.0	12	86%			13	93%			15	100%		
< 7.5	13	93%			14	100%			15	100%		
< 10.0	14	100%			14	100%			15	100%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	1				2				3			
No. Links with Flow > 150 and diff <	1	100%			1	50%			3	100%		

Table 4 M60 After Outer Screenline Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
B5214 Barton Road	24	15	-37%	2.0	42	38	-9%	0.6	83	77	-8%	0.7
B5158 Lostock Road	99	127	29%	2.7	96	106	10%	1.0	155	192	24%	2.8
Winchester Road	8	8	-4%	0.1	8	4	-51%	1.6	15	0	---	5.5
Bradfield Road	4	0	-100%	2.8	4	0	-90%	2.4	2	1	-74%	1.3
B5213 Stretford Road	130	122	-6%	0.7	100	116	15%	1.5	195	180	-8%	1.1
A56 Cross Street	309	245	-21%	3.9	172	127	-26%	3.6	316	238	-25%	4.7
A5103 Princess Parkway	158	166	4%	0.6	136	133	-2%	0.2	202	180	-11%	1.6
B5167 Palatine Road	171	172	0%	0.0	152	157	3%	0.4	217	239	10%	1.5
A34 Kingsway	2	2	37%	0.5	4	1	-76%	2.0	3	0	---	2.2
B5095 Manchester Road	58	54	-7%	0.6	76	72	-5%	0.5	176	189	8%	1.0
A5145 Didsbury Road	140	220	58%	6.0	170	120	-30%	4.2	144	109	-24%	3.1
A6 Wellington Road North	476	350	-26%	6.2	184	122	-34%	5.0	333	183	-45%	9.4
B6167 Lancashire Hill	265	185	-30%	5.3	190	156	-18%	2.6	85	71	-17%	1.6
A57 Manchester Road	132	129	-2%	0.2	115	130	12%	1.3	249	300	20%	3.1
Lumb Lane	56	68	21%	1.5	57	60	5%	0.4	48	62	29%	1.9
B6390 Audenshaw Road	194	141	-27%	4.1	98	99	1%	0.1	134	145	8%	1.0
A635 Manchester Road	201	179	-11%	1.6	222	211	-5%	0.7	190	181	-5%	0.7
Total	2427	2184	-10%	5.0	1828	1652	-10%	4.2	2546	2346	-8%	4.0

GEH	No.	%	No.	%	No.	%
< 5.0	14	82%	17	100%	15	88%
< 7.5	17	100%	17	100%	16	94%
< 10.0	17	100%	17	100%	17	100%

Flow	No.	%	No.	%	No.	%
No. Links with Flow > 150	7		6		9	
No. Links with Flow > 150 and diff <	4	57%	3	50%	8	89%

Table 5 Manchester City Centre Cordon Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
B5117 Oxford Rd	2533	2488	-2%	0.9	1697	1551	-9%	3.6	2021	1502	-26%	12.4
Cambridge St	189	189	0%	0.0	120	233	94%	8.5	98	139	41%	3.7
A5103 Princess Rd (Main)	106	72	-32%	3.6	107	30	-72%	9.4	162	113	-30%	4.2
A5103 Princess Rd (Slip)	185	179	-3%	0.4	117	97	-17%	2.0	83	72	-13%	1.2
A56 Chester Rd	214	103	-52%	8.8	61	20	-67%	6.4	80	40	-49%	5.1
A57 Regent Rd	101	159	58%	5.1	43	65	49%	2.9	33	36	8%	0.4
A6 Chapel St	1125	1236	10%	3.2	499	481	-4%	0.8	394	477	21%	4.0
A6041 Blackfriars Rd	491	580	18%	3.8	245	170	-31%	5.3	118	111	-6%	0.6
A56 Great Ducie St	372	428	15%	2.8	168	196	17%	2.1	58	71	21%	1.5
A665 Cheetham Hill Rd	677	668	-1%	0.3	419	203	-52%	12.3	301	155	-49%	9.7
A664 Rochdale Rd	897	935	4%	1.3	430	365	-15%	3.3	221	229	4%	0.5
A62 Oldham Rd	1144	1318	15%	5.0	527	625	19%	4.1	286	316	11%	1.8
Old Mill St	843	218	-74%	27.1	600	30	-95%	32.1	325	104	-68%	15.1
A662 Pollard St	856	792	-7%	2.2	390	311	-20%	4.3	256	189	-26%	4.5
A635 Ashton Old Rd	325	315	-3%	0.5	211	249	18%	2.5	126	125	-1%	0.1
A665 Chancellor La	2	6	200%	2.0	0	3	650%	1.9	3	0	-100%	2.3
A6 Downing St	1760	1586	-10%	4.3	966	845	-12%	4.0	737	633	-14%	4.0
A34 Upper Brook St	368	358	-3%	0.5	131	160	22%	2.4	67	102	52%	3.8
Total	12188	11631	-5%	5.1	6732	5633	-16%	14.0	5368	4414	-18%	13.6
GEH	No.	%			No.	%			No.	%		
< 5.0	15	83%			12	67%			14	78%		
< 7.5	16	89%			14	78%			15	83%		
< 10.0	17	94%			16	89%			16	89%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	15				11				9			
No. Links with Flow > 150 and diff <	13	87%			8	73%			4	44%		

Table 6 Manchester City Centre Cordon Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
B5117 Oxford Rd	1066	707	-34%	12.0	1639	1290	-21%	9.1	5486	5050	-8%	6.0
Cambridge St	61	65	6%	0.5	114	162	43%	4.2	181	245	36%	4.4
A5103 Princess Rd	264	226	-14%	2.4	60	65	8%	0.6	110	136	23%	2.3
A56 Chester Rd	101	21	-79%	10.2	31	29	-7%	0.4	141	151	7%	0.8
A57 Regent Rd	38	32	-17%	1.1	32	53	69%	3.3	118	104	-12%	1.4
A6 Chapel St	452	391	-14%	3.0	460	515	12%	2.5	1145	1253	9%	3.1
A6041 Blackfriars Rd	57	56	-2%	0.1	140	120	-14%	1.7	600	554	-8%	1.9
A56 Great Ducie St	26	65	147%	5.7	73	132	81%	5.8	475	529	11%	2.4
A665 Cheetham Hill Rd	151	121	-20%	2.6	249	182	-27%	4.6	697	631	-10%	2.6
A664 Rochdale Rd	103	180	75%	6.5	291	295	1%	0.2	1073	675	-37%	13.5
A62 Oldham Rd	147	161	10%	1.1	372	442	19%	3.5	1111	1192	7%	2.4
Old Mill St	0	6	---	3.4	154	16	-90%	15.0	319	70	-78%	17.8
A662 Pollard St	146	121	-17%	2.2	265	258	-3%	0.4	756	737	-3%	0.7
A635 Ashton Old Rd	184	183	-1%	0.1	125	161	29%	3.0	374	316	-16%	3.1
A665 Chancellor La	0	0	---	---	0	3	1424%	2.2	0	0	---	---
A6 Downing St	586	434	-26%	6.7	851	661	-22%	6.9	2535	2286	-10%	5.1
A34 Upper Brook St	22	72	227%	7.3	64	139	117%	7.4	328	414	26%	4.5
Total	3403	2841	-17%	10.1	4919	4523	-8%	5.8	15450	14343	-7%	9.1
GEH	No.	%			No.	%			No.	%		
< 5.0	10	63%			12	71%			12	75%		
< 7.5	14	88%			15	88%			14	88%		
< 10.0	14	88%			16	94%			14	88%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	21				19				22			
No. Links with Flow > 150 and diff <	17	81%			14	74%			13	59%		

Table 7 Manchester University Cordon Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A34 Anson Rd	614	639	4%	1.0	235	237	1%	0.2	161	134	-16%	2.2
B5117 Oxford Rd (S)	2564	2573	0%	0.2	1539	1491	-3%	1.2	1057	1050	-1%	0.2
Lloyd St North	1	6	596%	2.7	7	10	36%	0.9	2	0	---	2.0
Burlington St	302	464	54%	8.3	192	348	81%	9.5	188	214	14%	1.8
Booth St West	949	831	-12%	4.0	651	554	-15%	4.0	564	518	-8%	2.0
Cavendish St	145	136	-6%	0.8	156	151	-3%	0.4	254	285	12%	1.9
Cambridge St	61	65	6%	0.5	114	162	43%	4.2	181	245	36%	4.4
B5117 Oxford Rd (N)	1066	707	-34%	12.0	1639	1290	-21%	9.1	5486	5050	-8%	6.0
A34 Upper Brook St	22	72	227%	7.3	64	139	117%	7.4	328	414	26%	4.5
A5184 Plymouth Gr	368	370	0%	0.1	131	56	-57%	7.7	67	38	-44%	4.1
Total	6091	5863	-4%	3.0	4728	4439	-6%	4.3	8288	7949	-4%	3.8
GEH	No.	%			No.	%			No.	%		
< 5.0	7	70%			6	60%			9	90%		
< 7.5	8	80%			7	70%			10	100%		
< 10.0	9	90%			10	100%			10	100%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	6				6				8			
No. Links with Flow > 150 and diff <	4	67%			5	83%			6	75%		

Table 8 Manchester University Cordon Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A34 Anson Rd	76	63	-17%	1.5	127	202	59%	5.9	976	957	-2%	0.6
B5117 Oxford Rd (S)	403	410	2%	0.4	1337	1288	-4%	1.4	5078	4981	-2%	1.4
Lloyd St North	0	0	---	---	0	20	---	6.3	0	49	---	9.9
Burlington St	53	44	-17%	1.3	106	169	60%	5.4	220	287	30%	4.2
Booth St West	275	305	11%	1.7	372	439	18%	3.3	1343	1397	4%	1.5
Cavendish St	0	0	---	---	0	0	---	---	0	0	---	---
Cambridge St	189	189	0%	0.0	120	233	94%	8.5	98	139	41%	3.7
B5117 Oxford Rd (N)	2533	2488	-2%	0.9	1697	1551	-9%	3.6	2021	1502	-26%	12.4
A34 Upper Brook St	368	358	-3%	0.5	131	160	22%	2.4	67	102	52%	3.8
A5184 Plymouth Gr	22	9	-58%	3.2	64	42	-34%	3.0	328	333	2%	0.3
Total	3919	3866	-1%	0.9	3954	4104	4%	2.4	10133	9746	-4%	3.9
GEH	No.	%			No.	%			No.	%		
< 5.0	8	100%			5	56%			7	78%		
< 7.5	8	100%			8	89%			8	89%		
< 10.0	8	100%			9	100%			8	89%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	11				9				14			
No. Links with Flow > 150 and diff <	9	82%			8	89%			10	71%		

Table 9 GMATS Cordon Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A34 Anson Rd	614	639	4%	1.0	235	237	1%	0.2	161	134	-16%	2.2
B5117 Oxford Rd	2564	2573	0%	0.2	1539	1491	-3%	1.2	1057	1050	-1%	0.2
Lloyd St North	1	6	596%	2.7	7	10	36%	0.9	2	0	-100%	2.0
Burlington St	302	464	54%	8.3	192	348	81%	9.5	188	214	14%	1.8
Booth St West	949	831	-12%	4.0	651	554	-15%	4.0	564	518	-8%	2.0
Cavendish St	145	136	-6%	0.8	156	151	-3%	0.4	254	285	12%	1.9
A5103 Princess Rd (Main)	106	72	-32%	3.6	107	30	-72%	9.4	162	113	-30%	4.2
A5103 Princess Rd (Slip)	185	179	-3%	0.4	117	97	-17%	2.0	83	72	-13%	1.2
A56 Chester Rd	214	103	-52%	8.8	61	20	-67%	6.4	80	40	-49%	5.1
A57 Regent Rd	101	159	58%	5.1	43	65	49%	2.9	33	36	8%	0.4
A6 Chapel St	1125	1236	10%	3.2	499	481	-4%	0.8	394	477	21%	4.0
A6041 Blackfriars Rd	491	580	18%	3.8	245	170	-31%	5.3	118	111	-6%	0.6
A56 Great Ducie St	372	428	15%	2.8	168	196	17%	2.1	58	71	21%	1.5
A665 Cheetham Hill Rd	677	668	-1%	0.3	419	203	-52%	12.3	301	155	-49%	9.7
A664 Rochdale Rd	897	935	4%	1.3	430	365	-15%	3.3	221	229	4%	0.5
A62 Oldham Rd	1144	1318	15%	5.0	527	625	19%	4.1	286	316	11%	1.8
Old Mill St	843	218	-74%	27.1	600	30	-95%	32.1	325	104	-68%	15.1
A662 Pollard St	856	792	-7%	2.2	390	311	-20%	4.3	256	189	-26%	4.5
A635 Ashton Old Rd	325	315	-3%	0.5	211	249	18%	2.5	126	125	-1%	0.1
A665 Chancellor La	2	6	200%	2.0	0	3	650%	1.9	3	0	-100%	2.3
A6 Downing St	1760	1586	-10%	4.3	966	845	-12%	4.0	737	633	-14%	4.0
A5184 Plymouth Gr	368	370	0%	0.1	131	56	-57%	7.7	67	38	-44%	4.1
Total	14040	13615	-3%	3.6	7696	6538	-15%	13.7	5474	4910	-10%	7.8
GEH	No.	%			No.	%			No.	%		
< 5.0	18	82%			15	68%			19	86%		
< 7.5	19	86%			17	77%			20	91%		
< 10.0	21	95%			20	91%			21	95%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	17				15				13			
No. Links with Flow > 150 and diff <	14	82%			11	73%			9	69%		

Table 10 GMATS Cordon Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
A34 Anson Rd	76	63	-17%	1.5	127	202	59%	5.9	976	957	-2%	0.6
B5117 Oxford Rd	403	410	2%	0.4	1337	1288	-4%	1.4	5078	4981	-2%	1.4
Lloyd St North	0	0	---	---	0	20	---	6.3	0	49	---	9.9
Burlington St	53	44	-17%	1.3	106	169	60%	5.4	220	287	30%	4.2
Booth St West	275	305	11%	1.7	372	439	18%	3.3	1343	1397	4%	1.5
Cavendish St	0	0	---	---	0	0	---	---	0	0	---	---
A5103 Princess Rd	264	226	-14%	2.4	60	65	8%	0.6	110	136	23%	2.3
A56 Chester Rd	101	21	-79%	10.2	31	29	-7%	0.4	141	151	7%	0.8
A57 Regent Rd	38	32	-17%	1.1	32	53	69%	3.3	118	104	-12%	1.4
A6 Chapel St	452	391	-14%	3.0	460	515	12%	2.5	1145	1253	9%	3.1
A6041 Blackfriars Rd	57	56	-2%	0.1	140	120	-14%	1.7	600	554	-8%	1.9
A56 Great Ducie St	26	65	147%	5.7	73	132	81%	5.8	475	529	11%	2.4
A665 Cheetham Hill Rd	151	121	-20%	2.6	249	182	-27%	4.6	697	631	-10%	2.6
A664 Rochdale Rd	103	180	75%	6.5	291	295	1%	0.2	1073	675	-37%	13.5
A62 Oldham Rd	147	161	10%	1.1	372	442	19%	3.5	1111	1192	7%	2.4
Old Mill St	0	6	---	3.4	154	16	-90%	15.0	319	70	-78%	17.8
A662 Pollard St	146	121	-17%	2.2	265	258	-3%	0.4	756	737	-3%	0.7
A635 Ashton Old Rd	184	183	-1%	0.1	125	161	29%	3.0	374	316	-16%	3.1
A665 Chancellor La	0	0	---	---	0	3	1424%	2.2	0	0	---	---
A6 Downing St	586	434	-26%	6.7	851	661	-22%	6.9	2535	2286	-10%	5.1
A5184 Plymouth Gr	22	9	-58%	3.2	64	42	-34%	3.0	328	333	2%	0.3
Total	3083	2827	-8%	4.7	5109	5092	0%	0.2	17401	16638	-4%	5.8
GEH	No.	%			No.	%			No.	%		
< 5.0	14	78%			14	70%			15	79%		
< 7.5	17	94%			19	95%			16	84%		
< 10.0	17	94%			19	95%			17	89%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	24				24				28			
No. Links with Flow > 150 and diff <	20	83%			18	75%			21	75%		

Table 11 District Centre Cordons Inbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
STOCKPORT												
Travis Brow, A6145	330	224	-32%	6.4	180	123	-32%	4.6	223	160	-28%	4.6
Wellington Rd North, A6	248	86	-65%	12.5	287	170	-41%	7.7	199	192	-3%	0.5
Manchester Rd, A625	68	36	-47%	4.5	35	16	-55%	3.8	11	5	-54%	2.0
Sandy Lane, B6167	226	222	-2%	0.3	244	190	-22%	3.7	147	93	-37%	4.9
Brinnington Rd	440	413	-6%	1.3	198	163	-18%	2.6	102	97	-5%	0.5
Carrington Rd, B6104	176	151	-14%	1.9	164	139	-15%	2.0	119	99	-17%	1.9
New Bridge Lane	52	60	14%	1.0	75	65	-13%	1.2	124	91	-27%	3.2
Turncroft Lane	15	9	-39%	1.7	8	6	-21%	0.6	2	2	11%	0.1
Hall Street, A626	113	90	-20%	2.2	107	43	-60%	7.4	72	24	-67%	7.0
Hempshaw Rd	37	61	65%	3.4	86	75	-13%	1.3	45	55	24%	1.5
Wellington RD South, A6	272	306	12%	2.0	273	320	17%	2.8	289	276	-5%	0.8
Shaw Heath, B5465	152	133	-13%	1.6	139	97	-30%	3.9	125	101	-19%	2.2
Mercian Way, B4565	236	227	-4%	0.6	166	155	-6%	0.8	167	162	-3%	0.4
Stockport Total	**2365**	**2018**	**-15%**	**7.4**	**1960**	**1562**	**-20%**	**9.5**	**1624**	**1357**	**-16%**	**6.9**
GEH	No.	%			No.	%			No.	%		
< 5.0	11	85%			11	85%			12	92%		
< 7.5	12	92%			12	92%			13	100%		
< 10.0	12	92%			13	100%			13	100%		
Flow	No.	%	13		No.	%			No.	%		
No. Links with Flow > 150	8				7				4			
No. Links with Flow > 150 and diff <	6	75%			5	71%			3	75%		

Table 12 District Centre Cordons Outbound

	AM Peak				IP Peak				PM Peak			
Road	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
ALTRINCHAM												
Charcoal Road	1	7	778%	3.2	8	33	294%	5.4	16	19	23%	0.9
Manchester Road	74	40	-46%	4.5	135	126	-7%	0.8	218	192	-12%	1.9
Navigation Road	4	3	-36%	0.8	5	10	84%	1.6	9	14	46%	1.3
Stockport Road	40	29	-29%	2.0	118	114	-4%	0.4	239	201	-16%	2.6
Moss Lane	15	4	-73%	3.5	18	5	-75%	4.0	7	0	---	3.8
Hale Road	33	32	-2%	0.1	26	33	27%	1.3	31	25	-19%	1.1
Arthog Road	0	21	---	6.4	4	16	287%	3.7	17	17	3%	0.1
Ashley Road	0	0	---	---	0	0	---	---	0	0	---	---
Dunham Road	3	0	-100%	2.6	16	0	-100%	5.6	22	0	---	6.6
Altrincham Total	**171**	**136**	**-21%**	**2.8**	**330**	**335**	**1%**	**0.3**	**559**	**468**	---	**4.0**
ASHTON												
Oldham Road	102	79	-22%	2.4	223	176	-21%	3.3	273	148	-46%	8.7
Turner Lane	23	16	-31%	1.6	54	28	-48%	4.1	77	33	-57%	5.9
Penny Meadow	198	118	-40%	6.3	284	237	-16%	2.9	319	321	1%	0.1
Stamford Street	16	25	62%	2.1	41	67	63%	3.5	57	60	6%	0.4
Whitelands	37	27	-27%	1.8	60	44	-27%	2.2	87	42	-52%	5.6
Cavendish Street	121	108	-11%	1.3	163	178	9%	1.1	166	158	-5%	0.6
Katherine Street	305	342	12%	2.1	434	503	16%	3.2	450	428	-5%	1.0
Ashton Total	**802**	**716**	**-11%**	**3.1**	**1259**	**1233**	**-2%**	**0.7**	**1429**	**1190**	**-17%**	**6.6**
BOLTON												
Tudor Avenue	0	0	---	0.9	6	2	-62%	1.9	0	1	---	1.1
St Georges Road	169	148	-12%	1.6	303	262	-13%	2.4	518	436	-16%	3.8
Merehall Drive	27	31	13%	0.7	119	79	-33%	4.0	143	121	-15%	1.9
Blackburn Road	186	173	-7%	1.0	184	190	4%	0.5	305	286	-6%	1.1
Folds Road	176	176	0%	0.1	190	191	0%	0.0	491	464	-6%	1.2
Bury Road	168	157	-7%	0.9	278	253	-9%	1.5	406	397	-2%	0.4
Radcliffe Road	0	0	---	---	4	3	-24%	0.5	0	0	---	---
Bromwich St	0	10	---	4.5	23	28	25%	1.1	16	21	34%	1.3
St Peters Way SB on slip	0	0	---	---	0	0	---	---	0	0	---	---
Manchester Road	213	194	-9%	1.3	215	220	2%	0.3	369	358	-3%	0.5
Thynne Street												

Bridgeman Street	38	5	-86%	7.0	86	37	-57%	6.3	135	98	-27%	3.4
Derby Street	114	65	-43%	5.1	306	236	-23%	4.3	383	322	-16%	3.3
Deane Street	87	55	-37%	3.8	222	207	-7%	1.0	309	275	-11%	2.0
Bolton Total	**1377**	**1210**	**-12%**	**4.6**	**2192**	**1970**	**-10%**	**4.9**	**3395**	**3083**	**-9%**	**5.5**
BURY												
Walshaw Road	66	27	-58%	5.6	37	37	0%	0.0	100	103	3%	0.3
Tottington Road	40	44	11%	0.7	42	37	-11%	0.7	114	88	-23%	2.6
Brandlesholme Road	38	37	-2%	0.1	87	79	-9%	0.9	173	189	10%	1.2
Woodhill Road	4	4	8%	0.2	39	41	5%	0.3	50	30	-40%	3.2
Walmersley Road	41	28	-31%	2.2	100	94	-7%	0.7	175	129	-26%	3.8
Rochdale Old Road	59	58	-1%	0.1	105	99	-6%	0.6	123	119	-4%	0.4
Rochdale Road	49	55	12%	0.8	164	170	3%	0.4	222	221	0%	0.0
Parkhills Road	8	9	5%	0.1	23	25	10%	0.5	39	32	-19%	1.3
Manchester Road	141	124	-12%	1.4	426	364	-15%	3.1	420	371	-12%	2.5
Bolton Road	64	63	-3%	0.2	64	64	0%	0.0	144	142	-2%	0.2
Ainsworth Road	20	22	10%	0.4	62	63	1%	0.1	180	160	-11%	1.6
Bury Total	**530**	**471**	**-11%**	**2.6**	**1150**	**1073**	**-7%**	**2.3**	**1741**	**1583**	**-9%**	**3.9**
OLDHAM												
Middleton Road	115	100	-13%	1.4	188	162	-14%	2.0	269	251	-7%	1.1
Rochdale Road	230	200	-13%	2.1	204	177	-13%	2.0	309	294	-5%	0.8
Henshaw Street	0	3	---	2.3	12	3	-72%	3.2	0	1	---	1.6
Horsedge Street	2	0	-87%	1.8	10	0	-99%	4.4	18	0	-99%	5.9
Higginshaw Road	0	0	---	0.8	0	0	---	0.4	0	0	---	0.6
Shaw Road	73	70	-5%	0.4	103	101	-2%	0.2	196	185	-6%	0.8
Huddersfield Road	119	158	33%	3.3	275	452	64%	9.3	492	788	60%	11.7
Lees Road	34	0	-100%	8.2	140	0	-100%	16.7	325	42	-87%	20.9
Huddersfield Road + Lees Road	153	158	3%	0.4	415	452	9%	1.8	817	830	2%	0.4
Waterloo Street	5	1	-82%	2.4	19	2	-87%	5.1	13	2	-86%	4.2
Park Road	12	10	-9%	0.3	6	7	22%	0.5	9	10	4%	0.1
King Street	241	230	-4%	0.7	422	410	-3%	0.6	484	442	-9%	1.9
Manchester Street	239	226	-6%	0.9	297	288	-3%	0.6	322	298	-7%	1.4
Oldham Total	**1069**	**998**	**-7%**	**2.2**	**1677**	**1603**	**-4%**	**1.8**	**2436**	**2312**	**-5%**	**2.5**
ROCHDALE												

Edenfield Road	18	19	7%	0.3	63	57	-10%	0.8	143	122	-15%	1.9
Falinge Road	1	1	-32%	0.3	17	11	-38%	1.7	23	14	-37%	2.0
Heights	0	4	---	2.9	0	18	---	6.0	0	21	---	6.5
Whitehall Rd	0	2	---	2.1	32	17	-48%	3.2	27	21	-24%	1.3
Whitworth Road	21	23	8%	0.4	78	90	15%	1.3	157	143	-9%	1.2
Yorkshire Street	63	61	-4%	0.3	177	161	-9%	1.2	197	163	-17%	2.5
Entwisle Road	24	15	-36%	1.9	41	28	-32%	2.2	68	40	-42%	3.9
Milnrow Road	59	51	-15%	1.2	99	99	0%	0.0	168	149	-11%	1.5
Oldham Road	102	100	-2%	0.2	189	193	2%	0.3	275	250	-9%	1.6
Milkstone Rd	0	0	---	---	3	0	-100%	2.5	0	0	---	---
Manchester Road	273	266	-3%	0.4	267	270	1%	0.2	264	260	-2%	0.3
Bury Road	30	25	-16%	0.9	36	37	2%	0.1	50	49	-2%	0.1
Rochdale Total	**592**	**567**	**-4%**	**1.0**	**1003**	**980**	**-2%**	**0.7**	**1372**	**1231**	**-10%**	**3.9**
WIGAN												
Pottery Road	172	192	12%	1.5	725	790	9%	2.3	802	802	0%	0.0
Frog lane	12	4	-69%	2.9	36	19	-47%	3.2	39	23	-43%	3.0
Parsons Walk	19	17	-9%	0.4	53	55	3%	0.2	97	94	-4%	0.4
Bridgeman Terrace	21	18	-14%	0.7	38	36	-4%	0.3	35	33	-7%	0.4
Standishgate	0	0	---	---	0	11	---	4.7	0	22	---	6.7
Central Park Way	54	51	-5%	0.4	124	111	-10%	1.2	96	94	-3%	0.3
Scholes	14	17	23%	0.8	133	127	-5%	0.5	114	88	-23%	2.6
Darlington St	85	76	-11%	1.0	194	196	1%	0.2	180	175	-3%	0.4
Warrington Road	7	16	119%	2.6	81	108	33%	2.7	90	83	-8%	0.8
B5238 Chapel Lane	19	0	-100%	6.2	19	0	-100%	6.2	14	0	---	5.4
Wigan Total	**402**	**390**	**-3%**	**0.6**	**1403**	**1453**	**4%**	**1.3**	**1469**	**1414**	**-4%**	**1.5**
STOCKPORT												
Wood Street	10	11	4%	0.1	29	11	-63%	4.1	15	11	-30%	1.3
Travis Brow, A6146	163	135	-17%	2.3	195	154	-21%	3.1	377	296	-22%	4.4
Wellington Rd North, A6	196	106	-46%	7.3	261	193	-26%	4.5	304	213	-30%	5.6
Manchester Rd, A626	53	24	-54%	4.6	47	12	-74%	6.4	56	23	-60%	5.3
Sandy Lane, B6168	121	107	-12%	1.3	206	217	6%	0.8	184	238	29%	3.7
Brinnington Rd	129	112	-13%	1.6	246	230	-7%	1.0	313	303	-3%	0.6
Carrington Rd, B6105	95	76	-20%	2.0	148	134	-9%	1.1	268	242	-10%	1.6
New Bridge Lane	27	28	6%	0.3	48	55	13%	0.9	64	79	24%	1.8

Turncroft Lane	17	15	-10%	0.4	13	6	-57%	2.4	6	6	15%	0.3
Hall Street, A627	175	108	-38%	5.7	96	59	-38%	4.2	105	73	-31%	3.4
Hempshaw Rd	130	125	-4%	0.5	95	84	-12%	1.2	138	143	3%	0.4
Wellington RD South, A6	240	275	14%	2.2	236	314	33%	4.7	375	437	16%	3.0
Shaw Heath, B5466	204	184	-10%	1.4	124	100	-19%	2.2	160	164	2%	0.3
Mercian Way, B4566	197	184	-6%	0.9	199	215	8%	1.1	330	302	-9%	1.6
Stockport Total	**1757**	**1490**	**-15%**	**6.6**	**1942**	**1785**	**-8%**	**3.6**	**2695**	**2527**	**-6%**	**3.3**
TRAFFORD PARK												
Park Road	7	2	-64%	2.0	20	13	-34%	1.6	61	60	-3%	0.2
Trafford Boulevard	12	28	147%	3.8	58	61	7%	0.5	124	97	-22%	2.6
Parkway	20	18	-11%	0.5	17	14	-18%	0.8	72	78	7%	0.6
White City Circle	25	6	-75%	4.7	20	4	-82%	4.7	94	80	-15%	1.5
Trafford Park Total	**63**	**55**	**-13%**	**1.0**	**114**	**92**	**-19%**	**2.1**	**352**	**315**	**-11%**	**2.1**

GEH	No.	%		No.	%		No.	%	
< 5.0	80	90%		83	90%		78	87%	
< 7.5	88	98%		89	96%		87	96%	
< 10.0	89	99%		90	97%		88	97%	

Flow	No.	%		No.	%		No.	%	
No. Links with Flow > 150	20			30			40		
No. Links with Flow > 150 and diff <	17	85%		28	93%		36	90%	

Table 13 Rail Boardings

	AM Peak				IP Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Wigan North Western	233	244	5%	0.7	106	116	10%	1.0
Wigan Wallgate	257	262	2%	0.3	154	184	19%	2.3
Hindley	63	64	1%	0.1	14	11	-19%	0.8
Daisy Hill	82	86	4%	0.4	9	9	-1%	0.0
Atherton	116	113	-3%	0.3	26	24	-7%	0.4
Walkden	63	57	-10%	0.8	13	12	-7%	0.3
Westhoughton	48	48	0%	0.0	11	10	-2%	0.1
Horwich Parkway	86	77	-11%	1.0	12	13	13%	0.4
Lostock Junction	120	111	-8%	0.9	4	4	15%	0.3
Bromley Cross	96	91	-5%	0.5	16	13	-21%	0.9
Bolton	513	670	31%	6.4	348	354	2%	0.3
Salford Crescent	153	214	40%	4.5	147	190	29%	3.3
Total Wigan / Bolton Line	**1831**	**2036**	**11%**	**4.7**	**858**	**941**	**10%**	**2.7**
Glazebrook	8	0	-100%	3.9	2	0	-100%	2.2
Irlam	62	70	13%	1.0	9	11	15%	0.4
Flixton	30	30	0%	0.0	4	5	2%	0.0
Chassen Road	17	16	-8%	0.4	1	0	-100%	1.5
Urmston	70	69	-2%	0.1	15	17	14%	0.5
Humphrey Park	13	15	13%	0.5	0	0	-93%	0.9
Trafford Park	11	10	-4%	0.1	2	0	-96%	2.0
Total Liverpool Line	**211**	**211**	**0%**	**0.0**	**35**	**32**	**-7%**	**0.4**
Airport	315	285	-9%	1.7	358	307	-14%	2.8
Heald Green	204	193	-5%	0.8	56	45	-19%	1.5
Gatley	74	74	0%	0.0	14	15	14%	0.5
Burnage	52	49	-6%	0.5	8	7	-11%	0.3
Mauldeth Road	57	54	-5%	0.4	20	25	25%	1.0
Total Airport Line	**702**	**655**	**-7%**	**1.8**	**455**	**399**	**-12%**	**2.7**
Bramhall	99	95	-4%	0.4	35	30	-13%	0.8
Cheadle Hulme	323	323	0%	0.0	56	64	14%	1.0
Davenport								

Hazel Grove	187	197	5%	0.7	32	21	-34%	2.1
Woodsmoor	71	61	-14%	1.2	18	8	-57%	2.9
Stockport	1009	1939	92%	24.2	349	681	95%	14.6
Heaton Chapel	176	158	-10%	1.4	29	26	-8%	0.4
Levenshulme	73	95	31%	2.4	26	60	132%	5.2
Total Stockport Line	**2054**	**2980**	**45%**	**18.5**	**567**	**912**	**61%**	**12.7**
Glossop	226	238	5%	0.8	58	60	2%	0.1
Hadfield	111	0	-100%	14.9	32	0	-100%	8.0
Flowery Field	47	44	-7%	0.5	13	14	6%	0.2
Marple	184	180	-3%	0.4	34	34	-1%	0.0
Rose Hill	34	34	3%	0.2	8	8	-8%	0.3
Romiley	114	190	66%	6.1	24	26	9%	0.4
Bredbury	54	56	3%	0.2	13	15	16%	0.5
Reddish North	34	44	31%	1.7	8	10	18%	0.5
Guide Bridge	47	52	9%	0.6	14	16	8%	0.3
Gorton	18	17	-6%	0.3	6	4	-20%	0.5
Total Marple/Glossop Line	**869**	**854**	**-2%**	**0.5**	**212**	**186**	**-12%**	**1.8**
Greenfield	89	83	-6%	0.6	16	25	59%	2.0
Mossley	110	97	-12%	1.3	16	27	76%	2.6
Stalybridge	331	351	6%	1.1	67	76	13%	1.0
Ashton	116	113	-3%	0.3	44	66	50%	3.0
Total Ashton	**646**	**645**	**0%**	**0.1**	**142**	**193**	**36%**	**4.0**
Littleborough	9	144	1539%	15.5	23	53	128%	4.8
Smithy Bridge	59	62	5%	0.4	11	10	-8%	0.3
Castleton	40	39	-1%	0.1	8	12	37%	1.0
Mills Hill	84	83	-2%	0.1	16	16	-1%	0.0
Moston	17	17	2%	0.1	5	7	49%	1.0
Rochdale	222	234	5%	0.8	106	142	34%	3.2
Milnrow	40	46	15%	0.9	17	17	-1%	0.1
New Hey	20	23	15%	0.6	4	4	2%	0.0
Shaw	123	126	2%	0.3	29	30	5%	0.3
Derker	10	8	-15%	0.5	2	3	74%	0.8
Oldham Mumps	72	69	-4%	0.3	32	45	43%	2.2

Oldham Werneth	20	17	-13%	0.6	6	4	-32%	0.9
Hollinwood	15	12	-23%	0.9	4	4	1%	0.0
Failsworth	20	15	-25%	1.2	7	4	-44%	1.3
Dean Lane	12	9	-22%	0.8	3	2	-27%	0.5
Total Oldham/R'dale Line	**761**	**904**	**19%**	**4.9**	**273**	**354**	**30%**	**4.6**
GEH	No.	%			No.	%		
< 5.0	56	92%			58	95%		
< 7.5	58	95%			59	97%		
< 10.0	58	95%			60	98%		
Flow	No.	%			No.	%		
No. Links with Flow > 150	14				4			
No. Links with Flow > 150 and diff <	11	79%			3	75%		

Table 14 Rail Alightings

	AM Peak				IP Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Wigan North Western	118	138	17%	1.8	82	80	-3%	0.2
Wigan Wallgate	125	146	16%	1.8	74	141	91%	6.5
Hindley	3	5	71%	1.1	8	12	56%	1.4
Daisy Hill	3	5	87%	1.2	2	5	192%	1.8
Atherton	8	10	30%	0.8	10	29	199%	4.4
Walkden	13	13	-2%	0.1	11	9	-23%	0.8
Westhoughton	9	9	1%	0.0	8	9	22%	0.6
Horwich Parkway	32	37	17%	0.9	16	19	15%	0.6
Lostock Junction	2	2	-7%	0.1	6	5	-10%	0.3
Bromley Cross	42	42	-2%	0.1	8	13	64%	1.6
Bolton	259	393	52%	7.4	283	303	7%	1.2
Salford Crescent	399	491	23%	4.4	240	271	13%	1.9
Total Wigan / Bolton Line	**1012**	**1290**	**27%**	**8.2**	**746**	**896**	**20%**	**5.2**
Glazebrook	0	0	-100%	0.9	0	0	-	-
Irlam	16	23	49%	1.7	8	10	34%	0.9
Flixton	3	3	24%	0.4	2	2	-2%	0.0
Chassen Road	7	6	-13%	0.3	0	0	-71%	0.6
Urmston	23	23	0%	0.0	12	11	-6%	0.2
Humphrey Park	1	1	-23%	0.3	0	0	-1%	0.0
Trafford Park	7	7	-9%	0.2	2	0	-99%	1.9
Total Liverpool Line	**57**	**63**	**11%**	**0.8**	**24**	**23**	**-1%**	**0.0**
Airport	450	413	-8%	1.8	259	214	-17%	2.9
Heald Green	46	48	4%	0.2	30	29	-5%	0.3
Gatley	11	12	8%	0.3	5	6	16%	0.3
Burnage	2	2	29%	0.3	3	5	82%	1.1
Mauldeth Road	3	3	6%	0.1	6	7	14%	0.3
Total Airport Line	**511**	**477**	**-7%**	**1.5**	**302**	**260**	**-14%**	**2.5**
Bramhall	8	9	7%	0.2	11	9	-19%	0.6
Cheadle Hulme	85	119	40%	3.4	29	45	57%	2.7
Davenport								

Hazel Grove	13	30	126%	3.6	12	17	46%	1.4
Woodsmoor	18	16	-11%	0.5	9	6	-35%	1.2
Stockport	671	1701	154%	29.9	257	573	123%	15.5
Heaton Chapel	9	15	61%	1.6	8	10	35%	0.9
Levenshulme	8	11	37%	1.0	6	35	527%	6.5
Total Stockport Line	**836**	**1924**	**130%**	**29.3**	**344**	**709**	**106%**	**15.9**
Glossop	58	59	1%	0.1	38	51	32%	1.8
Hadfield	8	0	-100%	3.9	14	0	-100%	5.2
Flowery Field	27	28	6%	0.3	7	18	165%	3.1
Marple	15	17	16%	0.6	10	17	80%	2.1
Rose Hill	8	7	-8%	0.2	4	4	-3%	0.1
Romiley	9	25	175%	3.9	12	40	250%	5.7
Bredbury	8	9	8%	0.2	4	8	91%	1.6
Reddish North	8	11	41%	1.1	6	16	183%	3.1
Guide Bridge	27	47	72%	3.2	6	12	121%	2.2
Gorton	5	5	-12%	0.3	3	3	-4%	0.1
Total Marple/Glossop Line	**173**	**209**	**20%**	**2.6**	**102**	**169**	**65%**	**5.7**
Greenfield	6	7	33%	0.7	4	4	-11%	0.2
Mossley	6	6	-3%	0.1	7	4	-37%	1.1
Stalybridge	19	70	264%	7.6	16	34	108%	3.5
Ashton	26	24	-8%	0.4	25	33	29%	1.4
Total Ashton	**57**	**108**	**88%**	**5.6**	**53**	**75**	**42%**	**2.8**
Littleborough	9	11	24%	0.7	8	33	307%	5.5
Smithy Bridge	4	5	39%	0.7	4	4	-9%	0.2
Castleton	8	13	71%	1.7	5	7	41%	0.8
Mills Hill	8	11	39%	1.0	9	11	21%	0.6
Moston	4	6	27%	0.5	4	7	96%	1.5
Rochdale	58	77	33%	2.3	69	95	38%	2.9
Milnrow	3	4	46%	0.7	6	11	83%	1.7
New Hey	2	2	26%	0.3	1	3	332%	1.7
Shaw	14	16	14%	0.5	15	20	28%	1.0
Derker	1	1	13%	0.1	0	5	-	3.1
Oldham Mumps	37	37	-1%	0.1	19	24	30%	1.2

Oldham Werneth	5	5	3%	0.1	2	1	-50%	0.8
Hollinwood	6	7	18%	0.4	4	4	-12%	0.2
Failsworth	1	1	-30%	0.4	3	5	58%	0.9
Dean Lane	2	2	15%	0.2	4	3	-17%	0.3
Total Oldham/R'dale Line	**161**	**197**	**23%**	**2.7**	**152**	**231**	**52%**	**5.7**
GEH	No.	%			No.	%		
< 5.0	58	95%			54	90%		
< 7.5	59	97%			59	98%		
< 10.0	60	98%			59	98%		
Flow	No.	%			No.	%		
No. Links with Flow > 150	4				4			
No. Links with Flow > 150 and diff < 25%	2	50%			3	75%		

Table 15 City Centre Rail Boadings and Alightings

	AM Peak				IP Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Rail City Centre Boardings								
Piccadilly 1	---	848	---	---	---	1290	---	---
Piccadilly 2	---	605	---	---	---	332	---	---
Piccadilly Total	828	1453	75%	18.5	1046	1623	55%	15.8
Oxford Road	302	427	41%	6.6	229	592	159%	17.9
Victoria	132	285	115%	10.6	288	818	184%	22.5
Salford Central	12	13	8%	0.3	12	126	960%	13.7
Deansgate	23	35	51%	2.2	26	91	253%	8.6
Total Boardings	1297	2213	71%	21.8	1601	3250	103%	33.5
Rail City Centre Alightings								
Piccadilly 1	---	3126	---	---	---	---	---	---
Piccadilly 2	---	1069	---	---	---	---	---	---
Piccadilly Total	3919	4195	7%	4.3	---	---	---	---
Oxford Road	1634	1742	7%	2.6	---	---	---	---
Victoria	1588	1785	12%	4.8	---	---	---	---
Salford Central	596	665	12%	2.7	---	---	---	---
Deansgate	371	319	-14%	2.8	---	---	---	---
Total Alightings	8108	8707	7%	6.5	---	---	---	---

Table 16 Metrolink Boardings

	AM Peak				IP Peak				PM Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Altrincham Line												
Altrincham	361	348	-4%	0.7	208	216	4%	0.5	369	352	-5%	0.9
Navigation Road	100	188	87%	7.3	31	46	50%	2.5	34	69	106%	5.0
Timperley	251	271	8%	1.3	135	74	-45%	5.9	131	53	-60%	8.1
Brooklands	418	283	-32%	7.2	84	54	-36%	3.6	91	56	-39%	4.1
Sale	104	488	369%	22.3	87	199	128%	9.3	148	179	21%	2.4
Dane Road	38	111	189%	8.4	35	32	-9%	0.5	77	19	-76%	8.5
Stretford	446	203	-55%	13.5	154	88	-43%	6.0	157	74	-53%	7.7
Old Trafford	195	58	-70%	12.2	63	61	-4%	0.3	88	176	100%	7.7
Trafford Bar	258	15	-94%	20.8	75	9	-88%	10.3	98	12	-87%	11.6
Total Altrincham Line	**2172**	**1965**	**-10%**	**4.6**	**872**	**779**	**-11%**	**3.2**	**1193**	**990**	**-17%**	**6.1**
Bury Line												
Bury Interchange	359	356	-1%	0.1	268	284	6%	1.0	288	257	-11%	1.9
Radcliffe	386	395	2%	0.5	110	103	-7%	0.7	65	73	13%	1.0
Whitefield	238	160	-33%	5.6	88	79	-10%	0.9	53	35	-34%	2.8
Besses'O'Th'Barn	180	248	38%	4.7	47	63	34%	2.2	29	25	-12%	0.7
Prestwich	190	136	-29%	4.3	122	89	-27%	3.2	86	86	0%	0.0
Heaton Park	145	291	100%	9.9	78	143	83%	6.2	42	103	146%	7.2
Bowker Vale	206	265	29%	3.8	55	99	81%	5.1	21	42	102%	3.8
Crumpsall	187	224	20%	2.6	93	104	11%	1.1	71	216	205%	12.1
Woodlands Road	53	20	-62%	5.5	36	31	-13%	0.8	31	96	211%	8.2
Total Bury Line	**1945**	**2095**	**8%**	**3.3**	**897**	**995**	**11%**	**3.2**	**685**	**934**	**36%**	**8.7**
Eccles Line												
Eccles ML	148	152	3%	0.4	67	73	9%	0.7	74	66	-11%	1.0
Ladywell	54	41	-24%	1.8	25	22	-14%	0.7	28	24	-13%	0.7
Weaste	41	51	24%	1.5	33	48	44%	2.3	39	36	-7%	0.4
Langworthy	64	38	-40%	3.6	30	12	-58%	3.8	47	12	-74%	6.4
Broadway	2	32	1874%	7.4	15	38	151%	4.4	32	76	139%	6.0
Harbour City	10	6	-36%	1.2	19	10	-50%	2.5	89	18	-79%	9.6
Anchorage	22	51	131%	4.8	27	72	165%	6.4	84	141	68%	5.4
Salford quays	35	42	21%	1.2	24	22	-8%	0.4	85	147	74%	5.8
Exchange quay												

Pomona	2	10	398%	3.3	4	7	112%	1.7	4	38	945%	7.6
Total Eccles Line	**409**	**424**	**4%**	**0.7**	**272**	**304**	**12%**	**1.8**	**619**	**560**	**-10%**	**2.4**
City Centre												
G-Mex	74	125	69%	5.1	47	89	89%	5.1	85	400	372%	20.3
St Peters Square	157	140	-11%	1.4	296	383	30%	4.8	885	796	-10%	3.1
Piccadilly Gardens	171	297	73%	8.2	158	116	-26%	3.5	395	158	-60%	14.2
Piccadilly	274	266	-3%	0.5	193	270	40%	5.1	240	214	-11%	1.7
Market St	100	61	-38%	4.3	214	230	7%	1.0	448	409	-9%	1.9
Mosley St	138	195	42%	4.4	98	267	171%	12.5	384	379	-1%	0.3
Victoria	237	133	-44%	7.7	190	153	-19%	2.8	357	70	-80%	19.6
Total City Centre	**1151**	**1217**	**6%**	**1.9**	**1196**	**1509**	**26%**	**8.5**	**2794**	**2426**	**-13%**	**7.2**
GEH	No.	%			No.	%			No.	%		
< 5.0	20	57%			24	69%			17	49%		
< 7.5	26	74%			31	89%			22	63%		
< 10.0	31	89%			33	94%			29	83%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	17				8				9			
No. Links with Flow > 150 and diff <	7	41%			4	50%			6	67%		

Table 17 Metrolink Alightings

	AM Peak				IP Peak				PM Peak			
Station	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH	Observed	Modelled	% Diff	GEH
Altrincham Line												
Altrincham	487	475	-3%	0.6	158	165	5%	0.6	306	323	6%	1.0
Navigation Road	33	50	49%	2.6	23	40	74%	3.0	79	144	82%	6.1
Timperley	105	40	-62%	7.6	115	72	-37%	4.4	287	120	-58%	11.7
Brooklands	64	26	-59%	5.7	60	51	-14%	1.2	265	242	-8%	1.4
Sale	165	114	-31%	4.3	73	144	97%	6.8	109	366	237%	16.7
Dane Road	95	33	-65%	7.7	50	40	-19%	1.4	97	68	-30%	3.2
Stretford	118	92	-23%	2.6	130	73	-44%	5.6	322	169	-48%	9.8
Old Trafford	73	140	91%	6.4	50	71	42%	2.7	169	53	-69%	11.0
Trafford Bar	51	39	-25%	1.9	75	27	-64%	6.8	233	19	-92%	19.1
Total Altrincham Line	**1191**	**1007**	**-15%**	**5.5**	**733**	**684**	**-7%**	**1.8**	**1866**	**1504**	**-19%**	**8.8**
Bury Line												
Bury Interchange	370	321	-13%	2.6	241	219	-9%	1.4	335	343	2%	0.4
Radcliffe	76	93	23%	1.9	91	100	10%	0.9	289	280	-3%	0.6
Whitefield	42	25	-40%	2.9	73	51	-29%	2.7	195	108	-45%	7.1
Besses'O'Th'Barn	12	135	987%	14.3	43	72	69%	3.9	124	183	47%	4.7
Prestwich	103	82	-20%	2.2	104	90	-13%	1.4	169	132	-22%	3.0
Heaton Park	108	134	24%	2.3	46	87	91%	5.1	108	188	74%	6.6
Bowker Vale	13	80	503%	9.7	60	96	60%	4.1	131	120	-8%	1.0
Crumpsall	67	190	184%	10.8	88	168	92%	7.1	181	234	29%	3.7
Woodlands Road	29	37	29%	1.4	36	107	195%	8.4	64	18	-72%	7.2
Total Bury Line	**819**	**1095**	**34%**	**8.9**	**780**	**991**	**27%**	**7.1**	**1598**	**1606**	**0%**	**0.2**
Eccles Line												
Eccles ML	41	40	-3%	0.2	68	70	3%	0.2	172	164	-4%	0.6
Ladywell	22	23	5%	0.2	25	24	-4%	0.2	59	49	-17%	1.3
Weaste	32	32	0%	0.0	16	19	17%	0.7	40	40	-1%	0.1
Langworthy	48	24	-51%	4.0	21	13	-38%	1.9	52	22	-58%	4.9
Broadway	38	52	35%	2.0	17	21	23%	0.9	8	17	104%	2.4
Harbour City	80	92	15%	1.3	33	33	1%	0.1	19	21	7%	0.3
Anchorage	83	149	80%	6.2	26	56	118%	4.8	27	34	25%	1.2
Salford quays												

Exchange quay	168	0	-100%	18.3	37	0	-100%	8.5	32	0	-100%	7.9
Pomona	5	20	283%	4.2	5	15	211%	3.2	2	3	11%	0.2
Total Eccles Line	**602**	**591**	**-2%**	**0.4**	**275**	**314**	**14%**	**2.3**	**454**	**377**	**-17%**	**3.8**
GEH	No.	%			No.	%			No.	%		
< 5.0	18	64%			20	71%			18	64%		
< 7.5	22	79%			26	93%			22	79%		
< 10.0	25	89%			28	100%			24	86%		
Flow	No.	%			No.	%			No.	%		
No. Links with Flow > 150	4				2				12			
No. Links with Flow > 150 and diff <	2	50%			2	100%			6	50%		

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