Client **SEMMMS Client Board**

Project **8SEMMMS (A6 to Manchester Airport) Relief Road**

Subject **HFAS Report 1678: SEMMMS8 Local Model Validation Report**

This Report describes the production and validation of the 2009 SEMMMS (A6 to Manchester Airport) Relief Road SATURN Model. The model validation follows guidelines in the Design Manual for Roads and Bridges (DMRB) issued by the Department for Transport (DfT).
The Report describes the development of the highway networks and trip matrices, and presents the results of the link flow and journey time validation.

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Note

On the 1st April 2011, the Greater Manchester Transportation Unit (GMTU) became part of the newly created Transport for Greater Manchester (TfGM) within which it is now known as Highways Forecasting and Analytical Services (HFAS). A number of the actions referred to in this report were undertaken under the auspices of GMTU. However, for ease of reading they now appear under the name of HFAS.

Executive Summary

Overview

1. In Autumn 2008, the Government announced it would contribute up to £165m towards the cost of the A6 to Manchester Airport phase of the SEMMMS Relief Road, if that sum were matched with local contributions, and subject to a satisfactory business case submission.

2. In 2009, the then Greater Manchester Transportation Unit (GMTU) was commissioned to build a SATURN model (SEMMMs 7B) to provide traffic forecasts to inform the development of the business case for the scheme. The SATURN model represents traffic movements by road, and it forms part of a modelling system that also includes a travel demand model (SEMMMS VDM) that is being developed by the consultant MVA.

3. In Spring 2011, TfGM HFAS was asked by the SEMMMS Project Board to undertake additional data collection (origin-destination surveys and counts) in the east of the SEMMMS Area of Influence (AOI) and revalidate/calibrate the highway and variable demand models (the updated highway model becoming SEMMMS8).

4. The SATURN model will have two main roles:

   - It will provide traffic forecasts for studies focusing on the road network ; and
   - It will provide the road network that the VDM needs to model travel demand. In turn the VDM model will generate inputs, in particular forecast year trip matrices, for the SATURN model.

5. In line with standard practice, the extent to which the model reproduces conditions in the base year (the validation) was assessed against guidelines in the Design Manual for Roads and Bridges (DMRB) issued by the Department for Transport (DfT). This involved comparing modelled and observed link flows on cordons and screenlines within the study area, and journey times on a selection of routes.

Zoning

6. The zoning system for the SEMMMS8 SATURN Model was derived from that established for the GM-SATURN model. It is based on local authority wards in order to facilitate the compilation of input data, such as population and employment totals, and provide a well-understood framework for summarising and reporting model outputs (local authorities and local authority wards, as at 2001, were used as the basic area building blocks). The model incorporates 1080 zones allowing a realistic and detailed representation of the actual origins and destinations of trips and traffic within the area likely to be affected by the proposed scheme i.e. the SEMMMS Area of Influence.

7. The zoning is most detailed within the SEMMMS AOI and within the rest of Greater Manchester. Zones just outside these areas are somewhat larger than those within, and the zones further away from Greater Manchester are larger still.

Network Build

8. An Area of Influence of the proposed scheme has been defined which encompasses an area bounded (approximately) by the M60 to the north of Stockport, the A6/A523 to the east, the A537 to the south and the A34 to the west. Within this area the SATURN network is coded in full simulation format that means that delays occurring at junctions are explicitly modelled. This level of coding also applies to the remainder of Greater Manchester. Beyond the AOI and Greater Manchester the network is coded in SATURN buffer format that uses link based flow-delay curves to estimate link speeds and consequently junction delays are not explicitly modelled in this part of the network.

9. The information required for simulation coding is detailed including, for example, link length and cruising speed, permitted movements, saturation flows, lane usage, signals staging, timings and offsets. Initial coding was taken from GM-SATURN and a local SATURN model developed earlier for SEMMMS (by Mott MacDonald). This was updated and enhanced as required within the SEMMMS AOI. Details of traffic signals (layouts and timings) were obtained from the Greater Manchester Urban Traffic Control Unit (GMUTC) and Cheshire East Council. Bus routes and frequencies were obtained from the then TfGM Northwest Journey Planner and timetables. All other information was obtained from aerial photography (undertaken in 2009), site visits and Ordnance Survey mapping.

10. The buffer network outside Greater Manchester was built using the Ordnance Survey Meridian network as a basis.

11. As part of the update from SEMMMS 7B to SEMMMS8 a comprehensive network audit was undertaken focussing particularly on the key areas along the A6 corridor and Manchester Airport. The audit was informed by site visits and detailed inspection of recent aerial photography.

Matrix Build

12. The initial ('prior') trip matrices for the SEMMMS7C SATURN Model were built using information from the 2001 National Census for journeys to and from work. For other purposes data was taken from roadside interview surveys undertaken for SEMMMS in October 2009, supplemented by other RIS undertaken since the completion of the final section of the M60 Manchester Outer Ring Road in October 2000. Other elements of the matrices were taken either from synthetic matrices developed by MVA.

13. The SEMMMS RSI data was collected at 46 sites on screenlines or cordons near the proposed scheme in October 2009. The other roadside interview data was collected in phases over the period June 2001 to April 2004, with interviews being conducted with drivers of private vehicles crossing a series of cordons and screenlines within the Greater Manchester.

14. In June 2011, additional roadside interview data was collected at 5 sites, forming a cordon in the study area, to intercept movements to and from Stockport (south of M60), Hazel Grove, High Lane and Poynton. To complete the cordon SEMMMS RSI data was supplemented with information from 11 sites that were surveyed previously.

15. Trip matrices were built for car, Light Goods Vehicle (LGV) and Other Goods Vehicle (OGV) trips for three time periods for a 2009 October average weekday, which is assumed to represent a neutral month, avoiding holidays and unusual traffic periods. In scheme appraisal it is intended

that 3 car user classes will be assigned, namely employer's business and journeys to work (i.e., commute) plus other car trips. LGVs and OGVs will each have a separate user class, to give five user classes.

16. Separate matrices were built for the AM peak hour (08:00-09:00), an average inter-peak hour ((09:30-16:00)/6.5) and the PM peak hour (17:00-18:00).

Matrix Estimation

17. Initial assignment validation statistics for a prior matrix assignment indicated that the validation fell short of the DMRB guidelines. Matrix estimation was therefore used to enhance the prior trip matrices and improve the match between observed and modelled flows.

18. Traffic counts for both assignment validation and matrix estimation were drawn from HFAS's count database and from data held by Cheshire East Council and Manchester Airport. The counts considered were mainly post-January 2008, excluding those affected by known 'special' events (e.g., accidents, road works and holidays). To provide reassurance of the validation outside the SEMMMS Area of Influence counts on screenlines and cordons throughout Greater Manchester were included. Overall, some 916 counts were selected for matrix estimation and validation purposes of which 834 were used in the matrix estimation runs across Greater Manchester. In the SEMMMS Area of Influence a total of 215 counts were used in matrix estimation and 82 were used to provide an "independent" (of ME) check on the calibrated model. The counts were factored to 2009 average October weekday values using locally developed factors.

19. A number of matrix estimation strategies were explored, using different combinations of counts and parameter values. The final matrix estimation strategy changed the size of the individual vehicle (pcu) matrices by between –2.9% and -0.6%. Changes of this magnitude were considered acceptable.

Convergence

20. The DMRB criteria for an acceptable level of convergence are that:

- Delta should be less than 1% on the final assignment
- More than 90% of links should have a flow that changes by less than 5% on the final 4 iterations.

21. The SEMMMS8 model was well converged in all time periods, with Delta values well below 1% and the percentage of links with flows changing by less than 2% approximately 99% or greater in all periods.

Assignment Validation

22. To provide reassurance that the validation of the base year model was acceptable over a wider area counts on cordons and screenlines across Greater Manchester were included in the validation process. For the purposes of this report only cordons and screenlines within the SEMMMS Area of Influence have been reported but results for other cordons and screenlines within Greater Manchester are available on request from HFAS.

23. The SATURN model has been built to evaluate the SEMMMS Relief Road. The model has therefore been validated by comparing modelled link flows and journey times with observed data across the SEMMMS Area of Influence, for the 2009 base year.

24. In total, 11 cordons and screenlines were formed for the link flow validation within the AOI, whilst journey times were compared on 15 (two-way) routes covering key radials and orbitals crossing or parallel to the proposed scheme.

25. Of the 11 cordons and screenlines, 10 were made up of counts used in matrix estimation, while 1 was kept aside to act as an independent validation check along the A34 corridor.

26. In the AM peak, PM peak and inter-peak hours the percentages of all motorway and local road sites across Greater Manchester used in ME which met DMRB validation criteria were 91%, 94% and 93% respectively.

27. In the SEMMMS Area of Influence, the AM peak, PM peak and inter-peak hours the percentages of all motorway and local road sites used in ME which met DMRB validation criteria were 91%, 95% and 93% respectively.

28. For Independent counts as a whole (the A34 screenline counts plus ad hoc counts), the percentage with GEH > 5.0 was 81%, 81% and 82% in AM peak, PM peak and the inter-peak hours respectively.

Assignment Validation On Cordons and Screenlines

29. DMRB suggests that for screenlines and cordons 85% should have a GEH value of 4 or less.

30. Considering the 10 ME cordon and screenlines within the SEMMMS Area of Influence together, the percentage with GEH values less than 4 is 85% in the AM peak, 80% in the inter-peak and 85% in the PM peak.

31. On the independent A34 screenline, GEH values ranged from 0.5 to 4.8 depending on direction and time period.

32. The above figures confirm that the model meets DMRB criteria with regard to cordon and screenline validation with the exception of the inter-peak during which two screenlines/cordons that are marginally greater than 4.0

Regression Analysis

33. The slopes of the regression lines and the R-squared values are within the guideline ranges specified in the DMRB for all time periods.

Journey Time Validation

34. The primary source of journey time data for this validation was the TrafficMaster database.

35. The DMRB guideline for journey time validation is that modelled times should be within 15% (or 1 minute if this is higher) of the observed time on more than 85% of routes.

36. The percentages of routes within 15% of the observed time ranges are 90%, 97% and 93% in the AM peak hour, inter-peak hour and PM peak hour respectively. The AM Peak, inter-peak and PM peak hours therefore comfortably meet DMRB criteria.

Conclusions

37. The model is well converged in all three modelled time periods and the modelled traffic volumes are therefore very stable.

38. The results presented in this report indicate that there is a good match between modelled and observed flows, in the critical area in all time periods.

39. The validation of modelled against observed journey times meets DMRB criteria in all of the periods.

40. Overall we consider that the model provides a sound basis for forecasting the effects of the proposed SEMMMS (A6 to Manchester Airport Relief Road).

1. Introduction

The Report

1.1 This report describes the development of the 2009 SEMMMS8 SATURN model and presents the results of the link flow and journey time validation using the criteria set out in the Design Manual for Roads and Bridges (DMRB, Reference 1).

1.2 The report has nine main sections:

Section 1 - Introduction and scheme background

Section 2 - Model background

Section 3 - Model zoning

Section 4 - Development of the 2009 (model) highway networks

Section 5 - Production of the prior trip matrices

Section 6 - Matrix estimation to enhance prior matrices and improve the fit between modelled and observed flows

Section 7 - Traffic flow validation results

Section 8 - Journey time validation results

Section 9 - Conclusions.

1.3 Further details of the validation are contained in the Appendices, including prior and estimated matrix comparisons by sector, and link flow validation results by vehicle type.

SEMMMS Scheme Background

1.4 The Government Transport Policy review in the late 1990s included consideration of the trunk road building programme; culminating in the "*New Deal for Trunk Roads in England"* report. The report recommended that the trunk road network, which is the responsibility of the Highways Agency (HA), should be greatly reduced. In the south east Greater Manchester, the A6 and A523 were recommended for de-trunking.

1.5 The "*New Deal"* also recommended that future road schemes associated with detrunked routes be withdrawn from the road building programme, as they were no longer a HA responsibility. In south east Greater Manchester (GM) such schemes were:

- A6 (M) Stockport North-South Bypass (including the Stepping Hill Link)
- A523 / A555 Poynton Bypass
- A555 Manchester Airport Eastern Link Road (MAELR)
- A555 Manchester Airport Link Road West (MALRW).

1.6 The schemes have been identified in plans dating to the 1930's and various residential and employment developments in the area have been predicated on their delivery. All three corridors are protected in respective local authority strategic plans. Progress included agreed preferred routes and, following a Public Inquiry in 1988, appropriate procedures for the A6 (M).

1.7 The central section of the A555 MAELR was constructed as part of a local authority A34 bypass scheme, with HA and developer contributions, and assuming that the remaining route would be built shortly afterwards; the HA having presented strong supporting evidence.

1.8 The final relevant recommendation of the *New Deal* was that a multi modal study should be conducted across south east Manchester to consider existing transport problems and develop a long-term (20-year) strategy for addressing them; the South East Manchester Multi Modal Study (SEMMMS) was commissioned and managed by the Government Office for the North West (GONW), which created a Steering Group (including relevant local authorities and transport organisations) and a wider reference group (to reflect local interests). Consultants were appointed to undertake the study, which began in January 2000 and completed in September 2001 when a final report, including a recommended strategy, was published.

1.9 Within multimodal study process, the package of recommendations was assessed using the GOMMMS methodology and the potential options were assessed against the Strategy objectives before recommendations were made. The local authorities, AGMA, the North West Regional Bodies and the Government, supported the strategy. A number of public consultations were also held during the process, to identify issues. A final consultation on the proposed strategy showed it had strong public support

The Original SEMMMS Relief Road Scheme

1.10 The wider SEMMMS strategy included the concept for a Relief Road, comprising 21.5 kilometres of new road from M60 Junction 25 to M56 Junction 5, of dual carriageway standard and with two single carriageway link roads – the Stepping Hill Link and Poynton Bypass. The central 3.9 kilometres of the SEMMMS relief road has already been constructed as part of the A555 and A34 bypass scheme.

1.11 Three local authorities, Stockport, Manchester City Council and Cheshire (now Cheshire East) jointly produced a Major Scheme Business Case bid for funding the SEMMMS New Relief Road, which was formally submitted to the DfT in July 2004. Over the next few years, further information was submitted to the DfT, including an investigation into the possibility of Private Finance Initiative (PFI) funding.

1.12 In July 2007 the DfT's considered response stated that the Relief Road scheme provided value for money, but limited funding capabilities meant it could not funded as a single scheme, so consideration should be given to phased delivery. Three potential phases of the scheme were identified by the local authorities, and were submitted to the DfT for consideration in 2007/ 08:

- M60 to the A6, including the Stepping Hill Link
- A6 to Manchester Airport with Poynton Bypass
- A6 to Manchester Airport without Poynton Bypass (SEMMMS A6 to Manchester Airport Relief Road).

1.13 Local Authority officers examined the key policy drivers and transport problems in the area and decided that the A6 to Manchester Airport section was the priority scheme due to the potential economic impact on Manchester Airport (and therefore the City Region) of delaying access improvements, which in turn could constrain future growth.

1.14 Following the Eddington (Access to International Gateways) study, which highlighted transport's pivotal role in supporting the future economic success of the UK, reforms of the planning, funding and delivery of transport interventions were recommended. The study recognised the need to maximise sustainable returns from investment, whilst improving the environmental performance of transport.

1.15 Eddington also recognised the importance of connecting inter-regional routes as part of the network. This role is played by the A6, A523 and A34, linking Greater Manchester with Cheshire, Derbyshire and Staffordshire. Eddington considered a number of road schemes including the SEMMMS Relief Road and recognised that it provided good value for money. Application of the Eddington criterion for Benefit Cost Ratios (BCR) raised the SEMMMS Relief Road BCR slightly to 5.6.

The A6 to Manchester Airport Relief Road Scheme

1.16 In Autumn 2008, the Government announced it would contribute up to £165m towards the cost of the A6 to Manchester Airport phase of the scheme (without the Poynton Bypass), if that were matched with local contributions, and subject to a satisfactory business case submission. The scheme cost was estimated at £330m. This phase of the original SEMMMS Relief Road is the scheme proposed in this document, known as the SEMMMS A6 to Manchester Airport Relief Road.

1.17 In May 2009 the Leaders of the Association of Greater Manchester Authorities (AGMA) agreed to create a Greater Manchester transport fund of over £1.5 billion to fund key projects, including a contribution of £125m towards the SEMMMS A6 to Manchester Airport Relief Road. Local Authority officers had indicated that, following a review, £290m would be sufficient to build this scheme. The Region accepted the AGMA approach and incorporated this within its response to the Regional Funding Allocation 2 (RFA2) process.

1.18 In July 2009 the Government responded to the RFA2 consultation saying "*We welcome AGMA's allocation of £125m from the Transport Fund for a new road link between Manchester Airport and the A6 to the east. This represents a very positive response to the Department's offer to provide up to £165m for this scheme if a local contribution was forthcoming to meet the balance of costs and will now allow preparation work to move ahead"*.

1.19 In March 2011 the Government named Manchester Airport as one of the new 'enterprise zones', the development known as Airport City will benefit from business rate discounts, simplified planning and access to superfast broadband. As a result of this the airport section (west of Shadowmoss Road) will be implemented prior to SEMMMS and is therefore included as a committed scheme.

SEMMMS Strategy Objectives

1.20 The SEMMMS strategy was developed and accepted in 2000/01. The original strategy was developed on a 20-year timescale to deal with the existing and predicted transport problems in the area.

1.21 Five core objectives were adopted in the strategy:

- The promotion of environmentally sustainable economic growth;
- The promotion of urban regeneration;
- The improvement of amenity, safety, and health;
- The enhancement of the regional centre, town centres and local and village centres and the Airport; and
- The encouragement of the community and cultural life of the neighbourhood and of social inclusion.

1.22 The five core objectives have clear linkages to transport issues that were identified within a series of defined sub-objectives. These were broken down into five priority themes:

- **Improvements to public transport** to promote sustainable economic growth, the improvement of neighbourhood community and cultural life, and the encouragement of social inclusion;
- **Making better use of existing road space** through the reallocation among transport users, to form part of the broader promotion of urban regeneration and improved amenity, safety and health;
- The encouragement and facilitation of **behavioural change** to enable people to reassess their transport needs and promote sustainable modes of transport. This element of the strategy had a wide-ranging focus, looking beyond immediate transport issues to examine the needs of schools and businesses and helping them to understand how they could benefit from a change in travel mind-set.
- The **promotion of urban regeneration**, to improve the streetscape and public realm, and address the impacts
- The development of the package of **complementary highway works**, in particular the major highway schemes identified in the SEMMMS strategy, was addressed fully in direct discussions between the DfT and the three authorities (Cheshire County Council, Manchester City Council, and Stockport Metropolitan Borough Council) charged by the Secretary of State with the development of the schemes. Other highway works included the longer-term objective of reducing the impacts of freight traffic on the SEMMMS area, through appropriate freight route designation and the promotion of alternative modes (e.g. rail).

Specific objectives for the A6 to Manchester Airport Relief Road scheme

1.23 Whilst transport policy has moved on since the SEMMMS strategy was developed, the underlying objectives and principles remain equally valid today as in 2001. The findings from Eddington and Stern strengthen the case as presented in the SEMMMS strategy, with its emphasis on sustainable economic growth, regeneration of deprived areas, reduced environmental degradation, and general improved quality of life – all of which are captured within the current 'DaSTS' way of thinking. Sustainable transport and behavioural change – both of which were

integral to the SEMMMS strategy – are seen as key tools in addressing current transport challenges.

1.24 Nevertheless, there are changes required to ensure that the objectives remain directly relevant to the current policy goals; most notably, the need to take explicit account of carbon emissions, and emphasise the importance of Manchester Airport as an international gateway and potential hub of economic development and regeneration in its own right.

1.25 Whilst the objectives for SEMMMS A6 to Manchester Airport Relief Road have been primarily developed around the existing problems, it is important to note that this scheme is considered an integral part of the overall SEMMMS strategy. Just as important is the demonstration that the objectives of the current scheme closely mirror those of the original SEMMMS Relief Road scheme. With these issues in mind, the A6 to Manchester Airport Relief Road Scheme objectives are set out below:

- Promote sustainable economic development through the provision of efficient surface access to, from and between Manchester Airport, the Airport Enterprise Zone and the local, town and district centres and employment sites
- Reduce the productivity losses to business, and provide an improved route for freight, by limiting the conflict between local and strategic traffic
- Reduce the impact of traffic congestion on local air and noise pollution
- Regenerate the local communities and encourage community, cultural and social inclusion through reduced severance and improved accessibility to, from and between key centres of economic and social activity

Description of New Relief Road

1.26 The improved SEMMMS A6 to Manchester Airport Relief Road scheme includes a new 2-lane dual carriageway connecting the A6 to Manchester Airport. The scheme bypasses Bramhall, Cheadle Hulme, Hazel Grove, Handforth, Poynton and Wythenshawe District Centres and Gatley and Heald Green Local Centres.

1.27 The scheme improves access to / from Manchester Airport and its employment areas as well as Hazel Grove, Newby Road, Bramhall Moor Lane, Poynton and Stanley Green employment areas. Access to a number of regeneration areas is also improved by the scheme, including Stockport Town Centre M60 Gateway, and Wythenshawe.

1.28 The scheme will provide a high quality route for freight vehicles to access the trunk road network (i.e. M56) and Manchester Airport from the southeast Manchester and Cheshire/Derbyshire area, and as an alternative route to using existing residential streets.

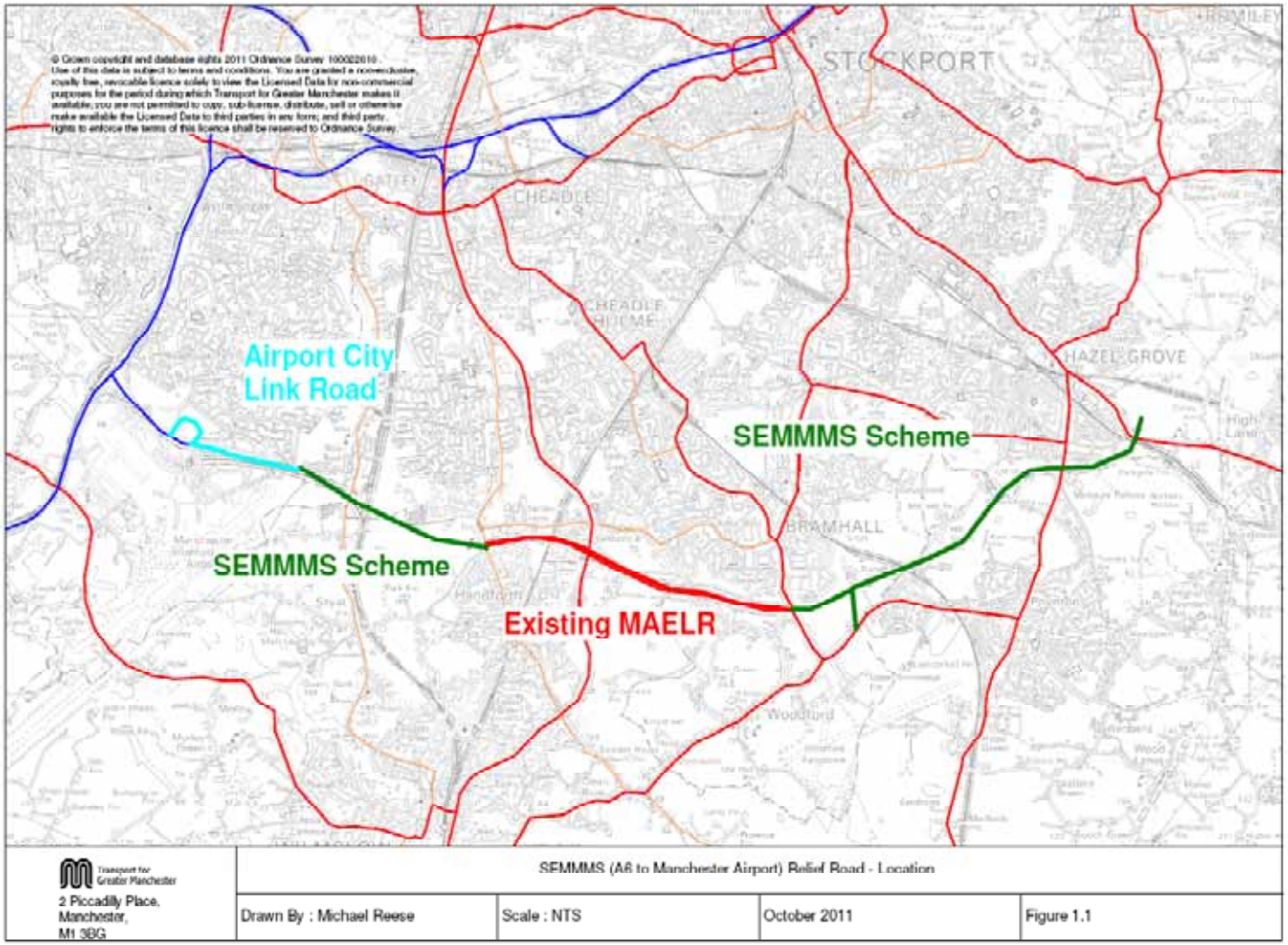
1.29 The proposed scheme consists of approximately 10km of new dual 2-lane and will include seven new junctions. It also incorporates approximately a further 4km of existing A555 dual carriageway to the south of Bramhall.

1.30 The location and extent of the scheme is shown in Figure 1.1.

1.31 The scheme includes three railway crossings including the West Coast Main Line. The scheme also includes provision of a cycle/pedestrian route adjacent to the carriageway, providing a new orbital link for the Strategic Cycle /Pedestrian Network.

1.32 The scheme has been designed to Department for Transport standards and adheres to the Design Manual for Roads and Bridges (DMRB). Any departures from approved standards will be authorised by the Director of the Overseeing Organisation.

1.33 A package of complementary and mitigation measures will ensure that the benefits of the scheme are locked into the surrounding transport corridor by reallocating road space to more sustainable forms of transport, traffic management and improvements to the public realm.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STOCKPORT
CHEADLE
HEADLE HULME
HAZEL GROVE
BRAMHALL
Woodford
Airport City Link Road
SEMMMS Scheme
SEMMMS Scheme
Existing MAELR
Transport for Greater Manchester
2 Piccadilly Place, Manchester, M1 3BG
SEMMMS (A6 to Manchester Airport) Relief Road - Location
Drawn By : Michael Reese
Scale : NTS
October 2011
Figure 1.1

2. Modelling Background

Overview

2.1 SEMMMS8 SATURN model has been developed from the Greater Manchester SATURN Model (GM-SATURN). GM-SATURN was originally built in Summer 2006 as part of a suite of inter-connected models to support the Greater Manchester Transport Innovation Fund (TIF) bid. These models comprised:

- The Greater Manchester Strategy Planning Model, (GMSPM2), which was developed by MVA and the David Symonds Consultancy, and which provides forecast year travel demand matrices for the GMPT and SATURN models
- The Greater Manchester Public Transport model, (SPM2-PT), which was developed by MVA and TfGM, and which provides PT travel cost data for input to the GMSPM
- The Greater Manchester SATURN Model, (GM-SATURN), which was developed by HFAS and MVA, and which provides highway travel costs for input to the GMSPM and link speeds for input to the SPM2-PT model.

2.2 The GM-SATURN model was validated for TIF to a base year of 2005.

2.3 In addition to its role as a detailed traffic assignment model for the GMSPM2, GM-SATURN has also provided a starting point for the development of local traffic models for use in major scheme appraisals within Greater Manchester, and a source of traffic speed and flow data for input to the Atmospheric Emissions Inventory for Greater Manchester (EMIGMA).

2.4 Geographically, the SEMMMS7C model is focussed on the area surrounding the proposed scheme – namely Stockport, South Manchester (including Manchester Airport) and Cheshire East, (principally Wilmslow, Alderley Edge and Poynton). It uses the GM-SATURN model area in full, but with the addition of a significant area of additional simulation network covering the northern part of Cheshire East. The model also incorporates a representation of the rest of Great Britain, albeit in less detail with increasing distance from the SEMMMS area.

2.5 Separate versions of the SEMMMS7C SATURN model have been built for the morning peak hour 0800-0900, the evening peak hour 1700-1800 and an average inter-peak hour for the time 09:30-16:00.

SEMMMS8 SATURN Model

2.6 The SEMMMS8 SATURN model has two main components comprising:

- The highway networks, which represent the roads and junctions used by traffic and bus services
- The trip matrices, which represent the demand for travel and the flow of vehicles between the zones in the model.

2.7 There are, however, a number of subsidiary files associated with the model, including:

- A ‘KNOBS’ data file, which contains additional data items for network links, such as the road class and number and the locations of zebra crossings

- A node-zone file, which is used for count-based validation, and gives details of the traffic zone in which each node lies
- A GIS file, used by SATURN to display links as curves rather than straight lines
- Inter-peak and PM peak 'X-files', to store supplementary link and turn data for the inter-peak and PM peak networks
- MapInfo node and link tables, to allow the network to be viewed in MapInfo.

2.8 Details of the highway networks and trip matrices are given below.

Highway Networks

2.9 The highway networks that are used with the model represent all roads of traffic carrying significance within the area through which the proposed scheme will run - Stockport, South Manchester and the north of Cheshire East - and the remainder of Greater Manchester, including all motorways, A-roads and B-roads. The networks also include all of the yellow coloured roads on the Ordnance Survey's Landranger maps of the area, and all roads carrying known bus services. The network outside the county is represented in much less detail, and becomes increasingly less dense with increasing distance from the county boundary.

2.10 The entire network within Greater Manchester and the northern part of Cheshire East is coded in full SATURN simulation format, allowing the interaction of traffic at junctions and the resulting delays and queues to be accurately modelled. Outside of this area, the network is coded in SATURN buffer format, so that junction delays and queues are not explicitly modelled in this part of the network.

2.11 The information required for the simulation coding is much more detailed than buffer coding and includes, for example, the link length and cruise speed, the permitted movements at junctions, saturation flows and lane usage (including locations of bus lanes), details of traffic signals and settings, including stages, cycle times, green splits, inter-greens and off-sets. Details of traffic signal settings are obtained from information supplied by the Greater Manchester Urban Traffic Control Unit (GMUTC).

2.12 Buses are represented in the model as fixed loads, with routes defined as chains of nodes in the simulation and buffer networks.

Trip Matrices

2.13 The SEMMMS trip matrices contain representations of all vehicle trips with an origin or destination inside the SEMMMS area and the remainder of Greater Manchester, and all external-to-external trips that cross the county boundary. The matrices do not, however, represent intra-zonal trips that take place entirely within the same zone.

2.14 Separate matrices are maintained for car, Light Goods Vehicle (LGV) and Other Goods Vehicle (OGV) trips, for the morning peak hour (0800-0900), the evening peak hour (1700-1800) and an average inter-peak hour for the period 1000-1530.

2.15 For cars, matrices are available for 12 journey purposes comprising (see Chapter 5 for details). For assignment purposes, however, the matrices are aggregated to form 5 'user classes', comprising:

- Commuting cars (home-to-work plus work-to-home car trips)
- Employer's business cars (home-based plus non-home-based employer's business car trips)
- Other cars (all other car trips)
- LGVS (all purpose LGV trips)
- OGVS (all purpose OGV trips).

3. The SEMMMS8 SATURN Model Zoning

Background to Model Zoning

3.1 The zoning system for the new SEMMMS8 SATURN Model had to fulfil several requirements.

3.2 Firstly, the zoning system for the whole modelling system was based on local authority areas and, within these, wards (as of 2001).

3.3 This was done to:

- Facilitate the compilation of input data, such as population and employment totals
- Provide a well-understood framework for summarising and reporting model outputs.

3.4 Secondly, there was a need to represent the actual origins and destinations of trips and traffic within the area surrounding the proposed scheme realistically and in detail. This was facilitated by developments in the demand modelling incorporated within the SEMMMS VDM that allowed more zones to be represented than in the "parent" GM-SATURN model. However, some caution was applied in defining zones to ensure that the usefulness of the model was not compromised by having so many zones that processing times became excessively long.

3.5 Finally, the focus of interest was the SEMMMS area, and the zoning is therefore most detailed within this. The zones in that area are therefore smaller than or of a similar size to those in the remainder of Greater Manchester. Elsewhere, zone sizes increase with distance from the Greater Manchester boundary.

Derivation of SEMMMS SATURN Model Zoning

3.6 The original GM-SATURN model contained 993 analysis zones of which 864 are within Greater Manchester. The original GM-SATURN model zoning is shown in Figure 3.1.

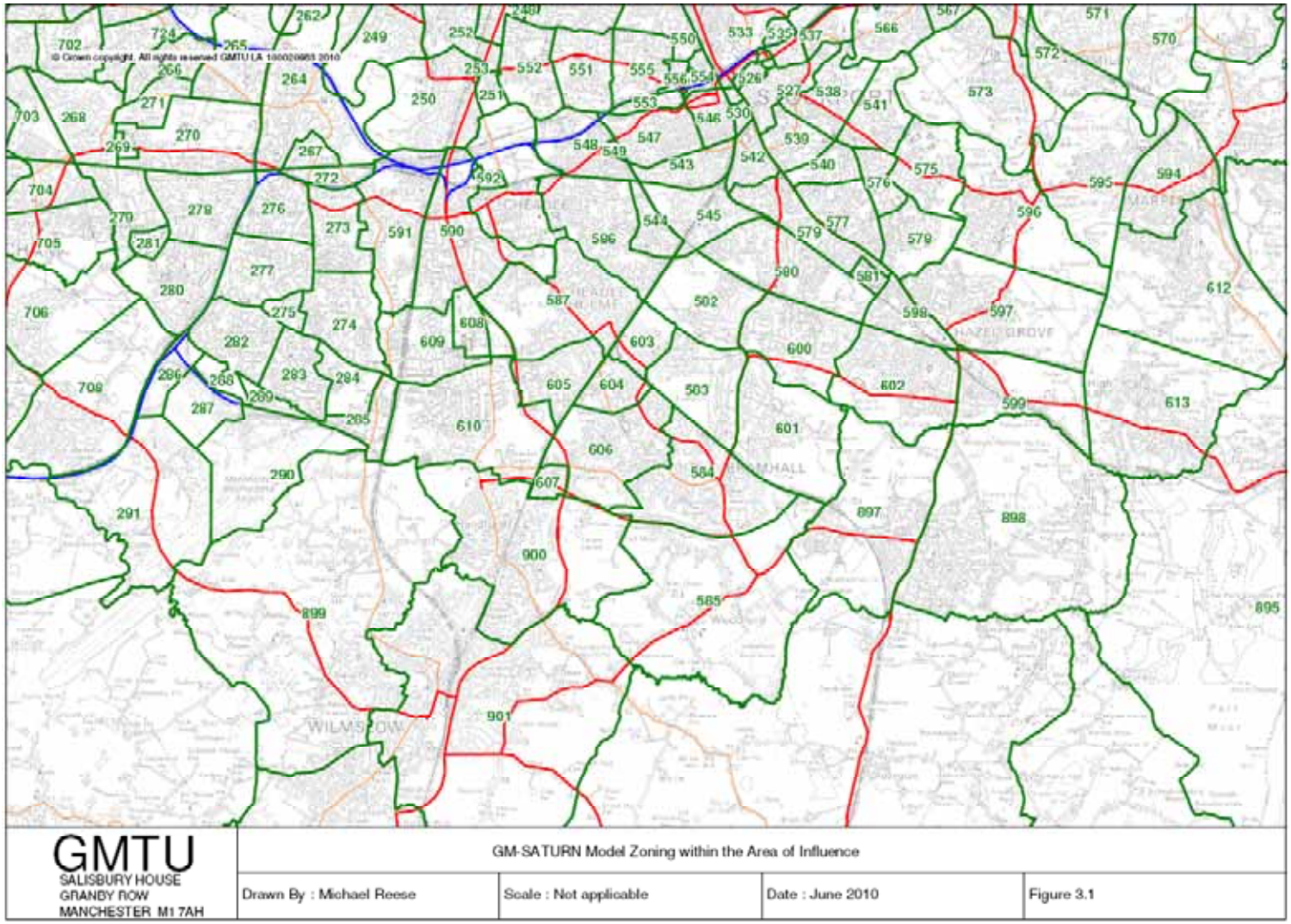
3.7 For the SEMMMS8 SATURN model, zoning both within and outside the county was reviewed. Within Greater Manchester, GM-SATURN zones within Stockport, South Manchester and East Trafford were checked and existing zones were disaggregated to better represent key generators and future development sites.

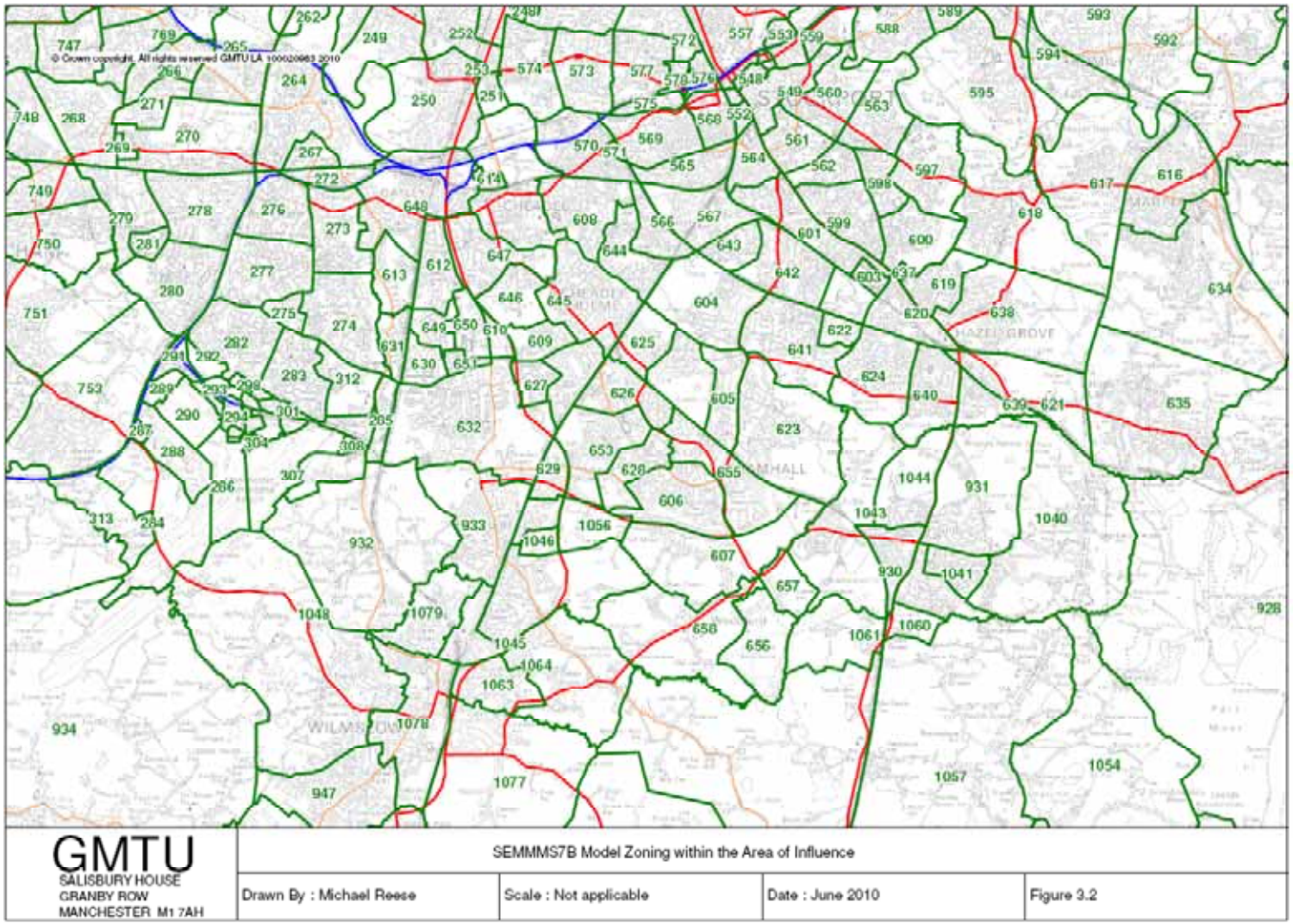
3.8 The area surrounding Manchester Airport was looked at in detail and the zoning in that area was reworked based on local knowledge and with reference to several documents. The latter included 'Manchester Airport Masterplan' (reference 2), 'Manchester Airport Ground Transport Plan' (reference 3) and Manchester Airport: The Need for Land' (reference 4). Together, these outline Manchester Airport's future development proposals and parking requirements in some detail.

3.9 Outside Greater Manchester, in the original GM-SATURN model the zones in Cheshire East were significantly larger than those within GM. As a certain proportion of Cheshire East is now coded in simulation detail and is in close proximity to the proposed SEMMMS scheme the zoning was reviewed and disaggregated.

3.10 In particular, the more built up areas around Wilmslow, Alderley Edge and Poynton required a more extensive rezoning to better reflect loading points on the network. As in Greater Manchester all zones in Cheshire East nest within ward boundaries.

3.11 The additional zoning within the Area of Influence and Cheshire has resulted in an increase in the number of zones in the SEMMMS8 SATURN model to 1080 analysis zones. The revised zoning for the SEMMMS7C SATURN model is shown in Figure 3.2.


GMTU
SALISBURY HOUSE
GRANBY ROW
MANCHESTER M1 7AH
GM-SATURN Model Zoning within the Area of Influence
Drawn By : Michael Reese
Scale : Not applicable
Date : June 2010
Figure 3.1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SEMMMS7B Model Zoning within the Area of Influence
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Scale : Not applicable
Date : June 2010
Figure 3.2

4. SEMMMS8 SATURN Network Development

Overview

4.1 Within the SEMMMS8 SATURN model, the SEMMMS Area of Influence (see paragraph 4.11 on) is represented at detailed node-based 'simulation' level; roads represented include motorways, A/B-roads, and other roads of traffic significance.

4.2 The information required for simulation coding is detailed; it includes the following items for each link / turn:

- Link length and cruising speed, usually taken as the speed limit
- Permitted movements, and the saturation flows and priorities for each movement
- Lane usage and lane sharing
- Flare lengths and stacking capacity
- Gap acceptance for opposed movements
- For traffic signals, the staging, timings and offsets

4.3 The starting point for the SEMMMS8 networks were 2009 GM-SATURN networks. These networks, in which the whole of Greater Manchester is in simulation detail, were developed from networks built in connection with the Regional Centre Transport Study (RCTS) in 2008 and which incorporated a number of enhancements from those originally created for the TIF work in 2005.

4.4 The GM-SATURN networks for 2009 were further enhanced to include all local traffic management schemes that HFAS were aware of that might affect network capacity (and consequently the routing and travel times of vehicles). These schemes were identified using information from a variety of sources including:

- Changes reported by Districts and HFAS staff
- Local knowledge
- Aerial photographs
- Discrepancies between the modelled and actual road system highlighted by the counts and accident validation procedures.

4.5 The 2009 networks also included major road schemes completed in recent years including:

- M60 Widening, Junctions 5-8
- A6193 Sir Isaac Newton Way, Phase 1.

4.6 The coding for that part of Cheshire East within the SEMMMS AOI was initially taken from work undertaken for SEMMMS by Mott MacDonald (Motts) and was added into the 2009 network in place of the previous buffer network. This extra simulation network broadly covers the area bounded by the GM Boundary to the north, the A523 to the east, the A537 to the south and the A34 to the west. HFAS reviewed the coding supplied for this area using recent aerial photographs undertaken in 2009 and site visits, and amended the coding as required.

4.7 Those roads outside the SEMMMS area (and the remainder of Greater Manchester) are represented by an extensive link-based 'buffer' network that represents surrounding motorways, A-and B-class roads, but with density diminishing with distance. The buffer network is represented by links, rather than as a series of junctions, with capacity restraint being modelled using flow-delay curves.

Spigot and Zone Centroid Coding

4.8 In accordance with best practice (to aid transparency of loading points), all zone centroids are connected to the model network via spigots. Spigots are links that join the centroid or centre of gravity of the zone to a node on the model network. In the case of point zones such as superstores accessed via a single junction, the spigot representation of a zone is realistic because the junction to which it connects exists and can therefore be coded as a simulation junction. However, in most cases, traffic for a zone joins / leaves the real network at many different points within the zone, and the centroid and spigot representation in the model is a simplification. In particular, the node to which it connects does not exist as a real junction.

4.9 Centroids for each zone were generated in HFAS's network information system (GMNIS) using MapInfo; the software can identify the centre of gravity of a bounded area, e.g., a SATURN zone. Then, for zones where in practice the traffic joins / leaves the coded network at a number of different locations but where the model had to use a single access point, spigot nodes were created on the model network to attach the link (i.e., the spigot) to / from the centroid. This was done where needed, i.e., for all zones except point zones across the network.

4.10 Note that the spigot nodes are junctions in the model, but most of them are not junctions on the real network. To avoid modelling delays at such nodes, they were coded using a template that included additional lanes and maximum saturation flows for the turns into and out of the spigot with no priority markers. For point zones, however, where the spigot represents the site access road, the spigot node represents a real junction, and is coded appropriately.

Area of Influence

4.11 The SEMMMS8 model covers all of Greater Manchester and the northern part of Cheshire East and, in progressively decreasing level of network and zone detail, the remainder of the mainland UK. The SEMMMS scheme in its current form on the section between M56 (at the airport) and A6 (at Hazel Grove) is intended to have relatively local influence, and is being designed as such.

4.12 In light of the above, the SEMMMS modelling team set out to identify an 'Area of Influence' (AOI) for the scheme, within which to focus attention on aspects such as network coding and density, inclusion of significant developments as individual zones, and compliance to DfT criteria (including base assignment validation).

4.13 The SEMMMS AOI was initially identified using a base year network with the scheme added. The defined AOI was later confirmed using interim forecasts for 2030.

4.14 Two sets of criteria were examined to identify the AOI:

- GEH criteria based on the traffic flow changes between the without- and with- scheme situations; the purpose of this approach was to apply quantification that related to DfT criteria for validation, where a key threshold is a GEH value of 5.0; and

- Absolute flow differences between without- and with scheme scenarios; changes were analysed in steps of 50 pcus from 100 to 250 pcus).

4.15 The results of the analyses undertaken were presented to the Department for Transport (reference 5) and following discussion, the SEMMMS modelling team decided to adopt an AOI based on changes of +/- 250 pcus. The area in which flow changes of this level were identified was converted into a boundary relating to SATURN zone boundaries.

4.16 The AOI is shown in Figure 4.1.

Traffic Signal Data

Overview

4.17 The traffic signal data in the SEMMMS8 SATURN model is obtained using information supplied by the Greater Manchester Urban Traffic Control Unit (GMUTC) and Cheshire East Council.

4.18 The majority of the signal data in the Greater Manchester area was originally obtained in 2006 as part of the TIF project. The signal data in the Regional Centre was updated in Summer 2007, however, as part of the modelling work undertaken for the RCTS, and has subsequently been further updated to include information for all new signalised junctions that have been installed since the completion of the RCTS model.

4.19 The signal times at all junctions within the SEMMMS AOI were reviewed in Spring 2010 and updated where required from the latest information available.

Pedestrian Crossing Data

4.20 Due to the number of individual crossings in the model and the time therefore required to monitor/source individual call data, model timings at pedestrian crossings were derived via a programme which identified the location of each pedestrian crossing in the simulation area and allocated green and inter-green (i.e. red to traffic) times which reflected the probable use of the crossing.

4.21 The crossings were split into groups using MapInfo. The locational criteria used varied by time period. In the AM peak crossings meeting one of three locational criteria were assumed to be called once every five minutes, namely:

- Those within 500m of a secondary school and 300m of a primary school
- Those within 500m of a hospital; and
- Those within 500m of a Census Special Output Area (SOA) zone centroid with greater than 500 employees.

4.22 In the inter-peak, crossings called once every five minutes were assumed to be those:

- Within 500m of a hospital
- Within 200m of a supermarket
- Within 200m of a health centre

- Within 500m of a university or college of further education.

4.23 In the PM peak, crossings meeting the following criteria were called once every five minutes:

- Within 500m of a hospital
- Within 200m of a supermarket
- Within 500m of a SOA zone centroid with greater than 500 employees
- Within 500m of a university or college of further education.

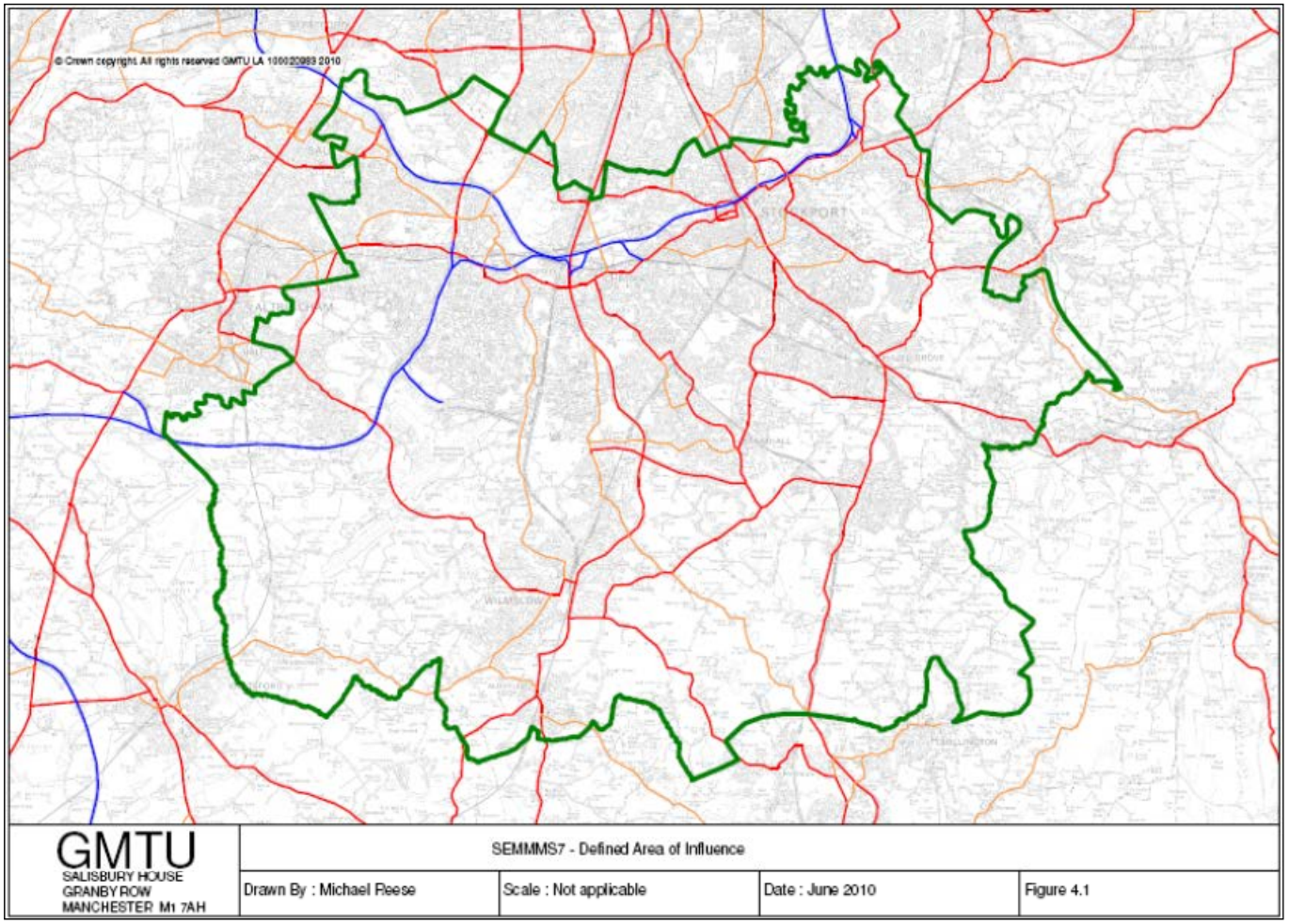
4.24 Crossings not meeting the five minute call criteria in the three time periods were assumed to be called once every 10 minutes.

4.25 The signal timings used were:

- For a five minute call interval, cycle time 300 seconds, green to traffic 277 seconds, inter-green time (green to pedestrians) 23 seconds
- For a 10 minute call interval, cycle time 600 seconds, green to traffic 577 seconds, inter-green time (green to pedestrians) 23 seconds.

4.26 These times are based on best-practice times for a Pelican crossing located on a 10-metre wide carriageway. They also assume that no vehicles proceed through the crossing during the flashing amber period.

4.27 During further calibration of the model, additional adjustments were made to various pedestrian crossings as required to reflect observed journey times.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GRANBY ROW
MANCHESTER M1 7AH
SEMMMS7 - Defined Area of Influence
Drawn By : Michael Reese
Scale : Not applicable
Date : June 2010
Figure 4.1

SCOOT/MOVA Controlled Junctions

4.28 Within the Greater Manchester part of the AOI there are a significant number of signals and pedestrian crossings under SCOOT (Split Cycle Offset Optimisation Technique) operation.

4.29 SCOOT is a fully adaptive traffic control system that uses data from vehicle detectors and optimises traffic signal settings to reduce vehicle delays and stops. SCOOT provides a fast response to changes in traffic conditions and enables a response to variations in traffic demand on a cycle-by-cycle basis.

4.30 As the operation of SCOOT sites changes with traffic demand, signal timings at these junctions were obtained from GMUTC for an entire day in October 2009. The timings in each of the peaks were then averaged to give as accurate a representation as possible in the SATURN Network.

4.31 In addition to the SCOOT sites there are a number of signal-controlled junctions that are under MOVA operation. MOVA (Microprocessor Optimised Vehicle Actuation) is a well-established strategy for the control of traffic light signals at isolated junctions - i.e. junctions that are uncoordinated with any neighbouring signals.

4.32 MOVA is designed to cater for the full range of traffic conditions, from very low flows through to a junction that is overloaded. MOVA operates in a delay minimising mode; if any approach becomes overloaded, the system switches to a capacity maximising procedure.

4.33 Again signal timings at MOVA sites are changeable and therefore timings were derived by entering the flows as derived from counts into the SATURN model and optimising the signal times to best represent the most likely green times at each of the junctions.

Checks and Adjustments to Networks

4.34 A series of network checks were done after the network had been built and preliminary trip matrices had been assigned. For example, cases were investigated where the coded capacity was less than the traffic count and/or where modelled delays were above a threshold.

4.35 In addition, coding on journey time routes within the Area of Influence was checked to better simulate observed travel times and delays on the network. Further to this selected trees (routes from a zone (origin) within the SEMMMS AOI to other zones (destinations) within the AOI) were followed and checked.

4.36 As part of the update from SEMMMS 7B to SEMMMS8 a comprehensive network audit was undertaken focussing particularly on the key areas along the A6 corridor and Manchester Airport. The audit was informed by site visits and detailed inspection of recent aerial photography.

Link Length Crow Fly Checks

4.37 As part of the network build process a sample of crow-fly warning messages (1 in 10) was examined to check that there was no systematic error in link length measurement and to ensure that those errors that were 'flagged' were not significant. No systematic errors were identified and any significant errors were corrected.

4.38 Within the SEMMMS Area of Influence the lengths of all simulation links in the final 'built' network were examined by comparison against OS mapping. Those with link length discrepancies in excess of 30m were checked in detail and the reasons identified. Of the 3,178

links in the AOI that were checked, 2,961 (93%) were within 10m of the mapped link length and only 59 (1.8%) were found to have a discrepancy in excess of 30m. 31 of these links were found to have the correct link length coded, the discrepancy being due to, for example, node coordinates being slightly incorrect. Of the remaining 28 links only 2 were found with an error in excess of 100m, while 8 had an error of 50m or less.

4.39 Details of those links with a coded-measured difference of greater than +/-30m are contained in Appendix 1.

Route Choice

4.40 Route choice tree plots have been analysed for six routes, providing a mix of east-west and north-south routes along/through the SEMMMS corridor, namely:

- Bredbury to Manchester Airport
- Chapel-en-le-Frith to Manchester Airport
- Hazel Grove to Manchester Airport
- Stockport town centre to Manchester Airport
- West Altrincham, to Macclesfield; and
- Alderley Edge to Manchester City Centre

4.41 SATURN plots showing the route trees for the three modelled time periods can be found in Appendix 2 of this report. These are summarised briefly below.

4.42 **Bredbury to Manchester Airport (Northeast to West) -** In all time periods the model suggests that all trips would route primarily via the M60 and M56, with route choice limited to where trips join the motorway at Bredbury (either M60 J27 and J25). This seems logical given the directness of the motorway route compared to the "cross country" (via local roads) alternative.

4.43 **Chapel-en-le-Frith to Manchester Airport (Southeast to West) -** In all periods the model suggests that the majority of trips would route via the B5470 through Chapel and then across country, crossing the A523 London Road at Adlington and then via the B5358 Wilmslow Rd, Dean Row Road and Stanneyland Road to join the B5166 Styal Road, adjacent to the Airport. This is the most direct route between the origin and destination (in both directions) although parts of it are of a relatively low standard. However, the alternative routes would be very heavily trafficked, especially during peak periods. It is likely therefore that with a good knowledge of the network, drivers would chose to use the route indicated by the model.

4.44 **Hazel Grove to Manchester Airport (East to West) -** The model suggests that the main east-west route between Hazel Grove and Manchester Airport is via Bramhall Moor Rd, A5143 Bridge Lane and Manor Road to Cheadle Hulme and thence via A5149, Turves Road, Etchells Road, Finney Lane, Styal Rd and Ringway Road to the Airport. This is the dominant route westbound in the morning peak and evening peak and in both directions in the interpeak. Eastbound in the AM and PM peaks the model suggests that a proportion of traffic will route via Finney Lane to join Wilmslow Road and the A555, before then routing via A5102 through Bramhall to pick up Bramhall Moor Road or via the A5149 and Chester Road to join the A6 at Hazel Grove.

4.45 In reality the density and congested nature of the (urban) network between Hazel Grove and Manchester Airport is such that drivers making this journey and who have a good knowledge of the network will chose their route as they proceed on their journey. It is unlikely that one particular route would be dominant. However, the 'primary' route indicated by the model is the most direct and is likely to be used by the greater number of trips.

4.46 **Stockport Town Centre to Manchester Airport (Central to West) -** The model suggests that in all time periods and in both directions all traffic between Stockport Town Centre and Manchester Airport would route primarily via the motorway network (M60 and M56), route choice being limited to the start/finish of the trip within the town centre.

4.47 **West Altrincham to Macclesfield (West to South-East) -** The model indicates that the dominant route in both directions in the AM peak is via the A56, A556, A50 and A537 through North Cheshire (i.e. via Knutsford). This is also the main route for northbound traffic in the PM peak hour. In the interpeak (both directions) and in the PM Peak southbound the main route indicated is via the A56, M56 and A538 through Wilmslow.

4.48 Both of the primary routes indicated by the model are logical. The route via the A538 is more direct but in the AM peak congestion around M56 junction 6 and in Wilmslow may act as a deterrent to its use.

4.49 **Alderley Edge to Manchester City Centre (South to North) -** In the morning peak hour the model indicates that the prime route for northbound traffic between Alderley Edge and Manchester City Centre is via the A34, A538, M56 and A5103 route. A similar route is indicated southbound but with a diversion via Ringway Road and Styal Rd to join the A34 in Wilmslow. In the interpeak, the prime route is forecast to be the A34, M60 and A5103 in both directions. In the evening peak hour, the model suggests that most southbound traffic will use the A34, albeit with some local multi-routing in the initial stages of the journey near the town centre. Northbound traffic in the evening peak is mainly routed via the A538, M56 and A5103.

4.50 In practice there is likely to be little to choose between the A34 and M56/A5103 routes throughout the day. Both are radial routes which very similar in nature (built up dual or multi-lane single carriageway with frequent traffic signals once off the motorway). It's likely that the proportion using the A34 in preference to A5103 would be higher than is indicated by the model as in reality drivers are unlikely to perceive the two routes as having significantly different journey times. However, routing will be very dependent on which part of the City Centre a driver is accessing or the location of their parking

Bus Data

4.51 Buses are represented in the model as fixed link loads, with routes defined as chains of links in the simulation or buffer networks.

4.52 For the most part, information about bus services and frequencies in the SEMMMS8 model is based on data from the TfGM bus service database, the Northwest Journey Planner website and bus timetables for North Cheshire.

Adjustments to Link Cruise Speeds

4.53 In the SATURN networks as originally coded, the link cruise speeds coded were set to the posted speed limit for the link in question. However, during development of GM-SATURN, the model was found to be running too fast during the early stages of calibration/validation.

4.54 To slow the network down, tests were carried out to assess the impact on speeds of calling all pedestrian crossings (as described above) and reducing link speeds. The rationale behind reducing link speeds was that in the peak periods in particular, there are considerable 'friction' effects acting on the network, such as vehicles loading and unloading, drivers making short stops at local shops, buses stopping more frequently than at other times of the day etc. These activities have an impact on the cruise speed and will tend to reduce it below the speed limit.

4.55 For SEMMMS8, a number of sensitivity tests were undertaken to determine the appropriate adjustments to link cruise speeds to match observed travel times on the network in the Area of Influence.

4.56 For the morning and evening peak hours, it was found that factoring Regional and District centre speeds by 0.75 and all other simulation links (except those with limits of 60mph or more) regardless of location by 0.80 gave the closest approximation to observed travel times.

4.57 For the inter-peak, it was found that factoring Regional and District centre speeds by 0.85 and all other simulation links (except those with limits of 60mph or more) regardless of location by 0.90 gave the closest approximation to observed travel times.

4.58 No speed adjustments were applied to motorway links.

4.59 It was noted that travel times in the rural network within Cheshire were generally too fast in initial model runs. These roads are generally outside both regional and district centres and built up areas and therefore were not factored via the process described earlier.

4.60 The fast travel times on these roads was attributed to the nature of the network where many roads have sharp bends and where visibility is poor or where friction effects occur. As a result the speeds were reduced using local knowledge of the network and aerial photos to better match observed times on those routes.

Motorway Flow Delay Curves

4.61 In the development of GM-SATURN, it was noticed that speeds on the motorways appeared to be too fast in relation to observed journey times.

4.62 It was decided that flow delay curves would be added to motorway links in order to accurately model delays resulting from a reduction in motorway speeds when the link is reaching capacity

4.63 Motorway flow delay curves were derived from work undertaken by MVA with the Sheffield SATURN Model, using COBA flow delay curves for motorways and suburban roads.

4.64 The standard flow-delay curves are most commonly applied to an 'average' stretch of motorway, with a standard carriageway width, no sharp bends and a distance of greater than 2 miles between junctions.

4.65 The motorway network in Greater Manchester, and in particular the M60 and M56 that pass through the SEMMMS AOI, have several 'non-typical' sections of motorway. These sections have one (or more) of the following features;

- A 50mph restriction due to a sharp bend;
- 2 or 3 narrow lanes;
- Several merges / diverges within close proximity; and
- Junctions within approximately 1 mile of each other.

4.66 These characteristics require some sections of motorway to have different flow delay curves from normal, to reflect slower free flow speeds.

4.67 Even following the application of these flow-delay relationships, in the SEMMMS8 SATURN model it was found that particular sections of the motorway network were running too fast. Notably these were in areas with a 50mph restriction for design reasons and/or where junctions are very closely spaced. To better represent the delays on these sections of motorway the free flow speed and speeds at capacity were reduced as part of calibration.

Times in the External Network

4.68 In the SATURN model, travel times on links in the buffer network outside the SEMMMS AOI and Greater Manchester are estimated using capacity restraint.

4.69 To determine the capacities the following processes were undertaken:

- All buffer links were coded with link capacities with 99,999 in all three time periods
- The network was converged
- Capacities were reset to be 1.2 times the demand flow using the maximum link flow in any time period which results in a single capacity used for each link across all time periods

4.70 The process of estimating capacities and calculating demand flows was iterative, and was repeated until there was no significant change in the calculated capacities from one assignment to the next. The overall change in link capacities was found to be less than 2% in five iterations.

Generalised Cost Parameters

4.71 The generalised cost parameters used in the assignment process are derived using an Excel spreadsheet prepared by MVA for the TIF study. They are consistent with data taken from TAG Unit 3.5.6 (April 2011).

4.72 User inputs to the spreadsheet consist of:

- Average network speed, used in the calculation of vehicle operating costs

- Proportions of distance travelled by each of three car-based user classes (i.e. commute, employers business and other) as output from a five user class assignment; these are used in the calculation of the cost parameters for the all-car user class (i.e. as a weight).

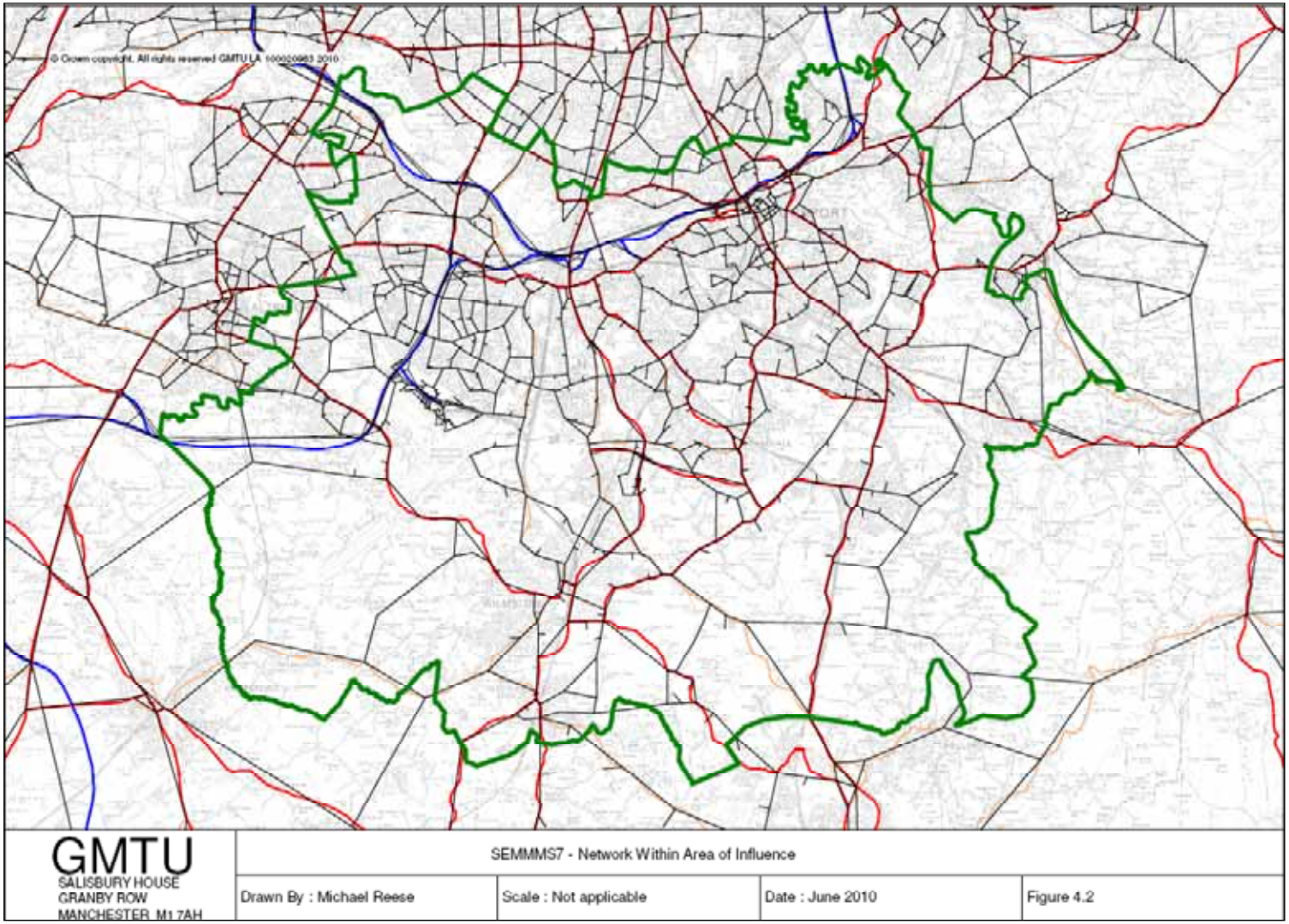
4.73 All other inputs (e.g. values of time, fuel consumption parameters and fuel costs, fuel price growth rates etc) were taken directly from the appropriate section of WebTAG.

4.74 The 2009 values of time (pence per minute – PPM) and distance (pence per kilometre – PPK) as output from the spreadsheet and used in the assignments are shown in Table 4.1 below.

4.75 A worked example showing a generalised cost calculation for PPM & PPK 2009 Employer's Business Car AM Peak Hour has been provided in Appendix 3.

Table 4.1 2009 Generalised Cost Parameters Used in the Assignments

Period	User Class	PPM	PPK
AM Peak Hour	Commuting Car	9.89	8.63
	Employer's Business Car	43.52	11.78
	Other Car	13.92	8.63
	LGV	17.03	12.74
	OGV	14.74	38.15
Inter-Peak Hour	Commuting Car	9.89	8.29
	Employer's Business Car	43.52	10.91
	Other Car	13.92	8.29
	LGV	17.03	12.33
	OGV	14.74	34.59
PM Peak Hour	Commuting Car	9.89	8.63
	Employer's Business Car	43.52	11.78
	Other Car	13.92	8.63
	LGV	17.03	12.74
	OGV	14.74	38.15


GMTU
SALISBURY HOUSE
GRANBY ROW
MANCHESTER M1 7AH
SEMMMS7 - Network Within Area of Influence
Drawn By : Michael Reese
Scale : Not applicable
Date : June 2010
Figure 4.2

Network Statistics

4.76 The SEMMMS8 network for the Area of Influence is shown in Figure 4.2. Table 4.2 shows the overall network statistics.

Table 4.2 SEMMMS SATURN Model Network Statistics (Version 21)

Nodes	
Type	**Number**
Simulation Nodes	9,471
Of which:	
External Nodes	1,712
Priority Nodes	5,131
Roundabouts	352
Traffic Signals	2,276
Buffer Nodes	1,831

Links		
Type	**Number**	**Total Length (Kms)**
Real Simulation Links	18,485	6,020
Spigot Connector Simulation Links	3,289	313
Buffer Network Links	5,308	11,639
Total Network Length	28,474	17,972

Notes
The figure for priority nodes includes a number of "exploded" roundabouts i.e. large roundabouts broken down into a series of priority junctions.

5. Development of the Prior Matrices

Overview

5.1 The assignment matrices for the SATURN model were built for a base year of 2009, for three time periods:

- The morning peak hour 0800-0900
- The evening peak hour 1700-1800
- An average inter-peak hour for the time period 0930-1600.

5.2 The matrices were formed in two stages:

- First, 'prior' matrices were built using information from the 2001 National Census of Population for commuting car trips, and from the SEMMMS roadside interview surveys and other roadside interview surveys that HFAS has undertaken since the completion of the final section of the M60 Manchester Outer Ring Road for other purposes. Other elements of the matrices were 'in filled', using data from the synthetic matrices being developed by MVA for the Variable Demand Model (VDM).

- Next, matrix estimation was used to update the prior matrices and improve the fit between modelled and observed flows.

5.3 Separate matrices were formed for car, Light Goods Vehicle (LGV) and Other Goods Vehicle (OGV) trips. For cars, individual matrices were built for the following 12 journey purposes:

- Home-to-work
- Work-to-home
- Home-to-education
- Education-to-home
- Home-to-shopping
- Shopping-to-home
- Home-to-employer's business
- Employer's business-to-home
- Home-to-other
- Other-to-home
- Non-home-based employer's business
- Non-home-based other.

5.4 For assignment, however, the separate purpose matrices were aggregated to form 5 'user classes' comprising:

- Commuting cars (home-to-work plus work-to-home car trips)

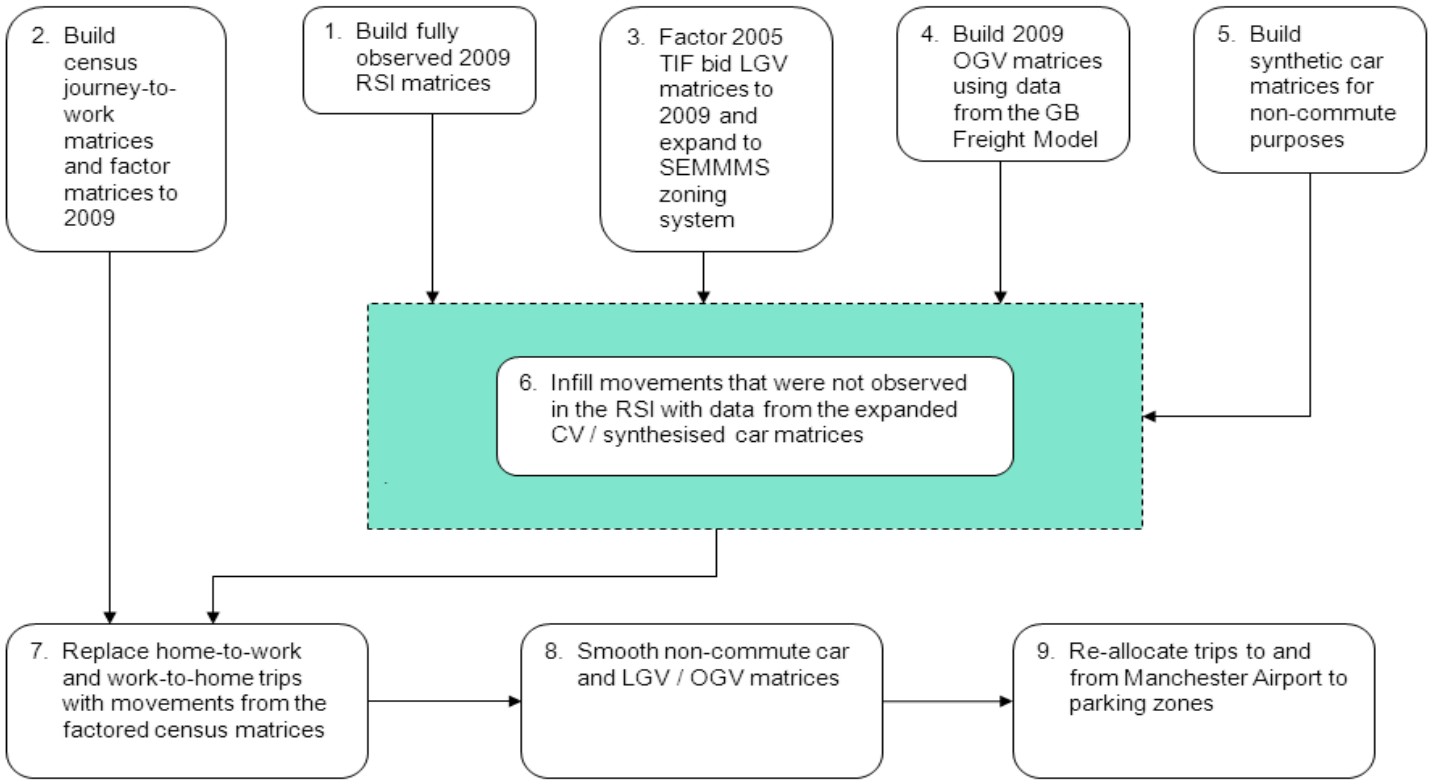
- Employer's business cars (home-based plus non-home-based employer's business car trips)
- Other cars (all other car trips)
- LGVS (all purpose LGV trips)
- OGVS (all purpose OGV trips).

5.5 The prior matrix building procedure is illustrated diagrammatically in Figure 5.1 and in greater detail in Appendix 4. The process involved 9 main steps, comprising:

- Building fully observed trip matrices from the SEMMMS, JETTS, GMATS and M60 After Study Roadside Interview (RSI) data
- Building car journey-to-work matrices from the 2001 National Census data and factoring the census matrices to 2009
- Building prior LGV matrices
- Building prior OGV matrices
- Building Synthetic car matrices for non-commute purposes
- 'Infilling' movements that were not observed in the RSI using data from the synthetic matrices for car trips, and from the prior LGV and OGV matrices for Commercial Vehicle (CV) trips
- Replacing home-to-work and work-to-home trips with movements from the factored census matrices
- Matrix smoothing
- Re-allocating trips to and from Manchester Airport to parking zones using information about the percentage of parking trips supplied by AECOM (Manchester Airport's consultants).

5.6 The key steps in the matrix building procedure are described in more detail in the sections below.

Figure 5.1 SEMMMS7c Saturn Model Prior Matrix Building Procedure



Building Fully Observed Matrices from the SEMMMS, JETTS, GMATS and M60 After Study RSI Data

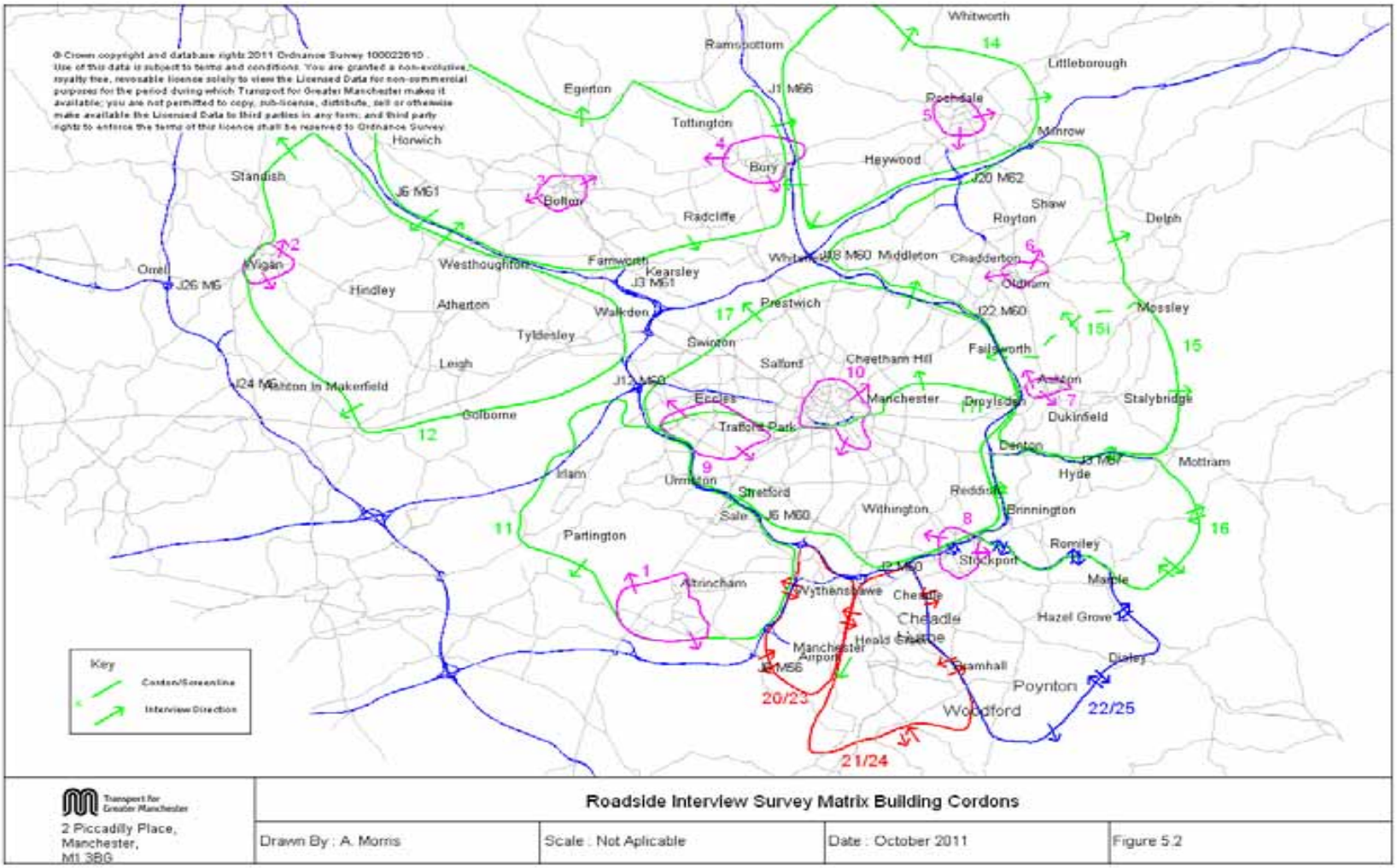
5.7 The fully observed matrices were built using software developed by HFAS. This comprised two programs named:

- MATBLD – which builds matrices of fully observed trips from roadside interview data and uses standard statistical techniques to estimate cell variances; and
- MATMER – which merges movements that have been observed on more than one cordon to give the greatest weight to the movements with the smallest variance.

5.8 The first step in the matrix building procedure was to combine the SEMMMS, JETTS, GMATS and M60 After Study RSI sites to form a series of cordons within the study area, as illustrated in Figure 5.2. The matrix building cordons are described below, in Table 5.1, which also shows the survey dates and interview directions.

Table 5.1 RSI Matrix Building Cordons

Cordon/ Sector Number	Cordon Description	Interview Direction	Survey	Year of Survey
1	Altrincham Town Centre	Outbound	GMATS	2002
2	Wigan Town Centre	Outbound	GMATS	2002
3	Bolton Town Centre	Outbound	GMATS	2002
4	Bury Town Centre	Outbound	GMATS	2002
5	Rochdale Town Centre	Outbound	GMATS	2002
6	Oldham Town Centre	Outbound	GMATS	2003
7	Ashton Town Centre	Outbound	GMATS	2003
8	Stockport Town Centre	Outbound	GMATS/M60	2002/2003
9	Trafford Park	Outbound	GMATS/M60	2003
10	Regional Centre	Outbound	GMATS	2002
11	Trafford Area	Outbound	GMATS/M60	2002/2003
12	Wigan Area	Outbound	JETTS/GMATS	2001/2002/2003
13	Bolton/Bury Area	Outbound	JETTS/GMATS	2001/2002/2003
14	Rochdale Area	Outbound	GMATS	2003
15	Oldham/Ashton area	Outbound	JETTTS/GMATS/M60	2001/2003
16	Stockport Area	Outbound	GMATS/M60/SEMMMS	2003/2011
17	Manchester/Salford Area	Outbound	JETTTS/GMATS/M60	2001/2002/2003/2004
18	Oldham/Ashton Area South	Outbound	GMATS/M60	2003
19	Manchester/Salford Area South	Outbound	GMATS/M60	2003/2004
20	SEMMMS Cordon1	Outbound	SEMMMS	2009
21	SEMMMS Cordon 2	Outbound	SEMMMS	2009
22	SEMMMS Cordon 3	Outbound	SEMMMS	2011
23	SEMMMS Cordon1	Inbound	SEMMMS	2009
24	SEMMMS Cordon 2	Inbound	SEMMMS	2009
25	SEMMMS Cordon3	Inbound	SEMMMS	2011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Whitworth
Ramsbottom
Littleborough
Egerton
Rochdale
Tottington
Bury
Heywood
Milnrow
Horwich
Standish
Bolton
Radcliffe
Royton
Shaw
Delph
Wigan
Westhoughton
Farnworth
Kearsley
Middleton
Chadderton
Oldham
Orrell
Hindley
Atherton
Prestwich
Messley
Tyldesley
Walkden
Swinton
Salford
Cheetham Hill
Failsworth
Leigh
Manchester
Eccles
Stalybridge
Dukinfield
Golborne
Trafford Park
Denton
Mottram
Irlam
Urmston
Stretford
Hyde
Sale
Withington
Partington
Brinnington
Stockport
Romiley
Altrincham
Wythenshawe
Cheadle
Hazel Grove
Manchester Airport
Heald Green
Poynton
Woodford
Key
Cordon/Screenline
Interview Direction
Roadside Interview Survey Matrix Building Cordons
2 Piccadilly Place, Manchester, M1 3BG
Drawn By : A. Morris
Scale : Not Aplicable
Date : October 2011
Figure 5.2

5.9 Prior to building the observed matrices, the expansion factors of the JETTS/GMATS and M60 After Study RSI data was factored to a 2009 October average weekday using local count conversion factors developed by HFAS. This allowed movements from the RSI to be converted to a common date prior to assignment, and also allowed the census journey to work matrices to be converted to 2009, as described later in the chapter. (Note, however, that the SEMMMS RSI data was not factored, since these surveys were carried out in Autumn 2009 and Spring 2011, and could be regarded as representing 2009 traffic flows for matrix building purposes).

5.10 The identification and selection of 'valid' interviews is an important part of the matrix building process. This is carried out automatically by matbld, which is run separately to build fully observed trip matrices for each cordon, journey purpose and time period. (Matbld also forms marker matrices from the survey data, to allow fully observed movements to be easily identified).

5.11 The types of movements that might be observed in a typical roadside interview survey are illustrated below, in Figure 5.3. These comprise

- Fully observed trips
- Partially (or non-observed) trips
- Double counted trips (which cross the same cordon more than once in the same direction)
- Duplicate trips, which are fully observed on more than one cordon.

Normally, only fully observed trips are selected for matrix building.

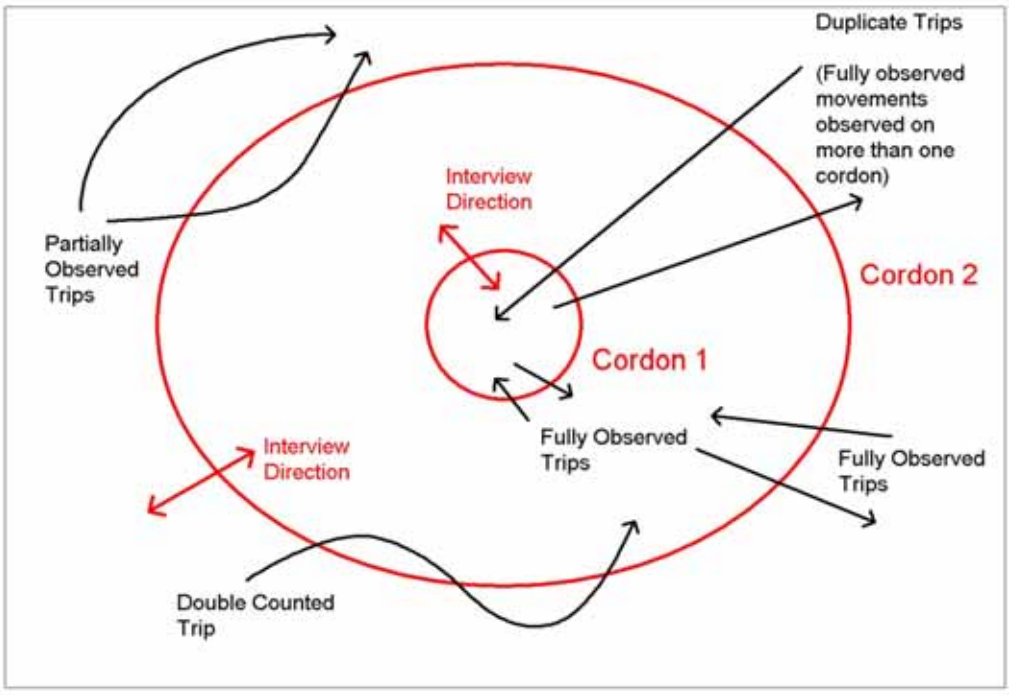


Figure 5.3 Types of Movements Observed in Roadside Interview Surveys

5.12 A movement between two zones is fully observed when interviews are conducted on all of the possible routes between the zones. These trips are identified (in program MATBLD) using site-to-cordon and zone-to-cordon correspondence files that allow the origin and the destination zones of the sampled trips to be automatically checked. Adopting this approach, outbound cordon crossing trips are only selected for matrix building if the origin zone of the trip is wholly inside the cordon and the destination zone of the trip is wholly outside the cordon. Conversely, inbound trips are only selected for inclusion in the survey matrix if the trip origin zone is entirely outside the cordon and the trip destination zone is entirely inside the cordon.

5.13 Movements are partially or non-observed when it is possible to travel between the trip origin and destination zones without passing through one of the interview sites on the survey cordon. These trips can only be partially sampled, therefore, leading to the under-estimation of their actual number in the matrices built from the survey data. Partially observed trips are therefore identified and removed by using the zone-to-cordon correspondence files developed for program MATBLD to exclude interviews with an internal origin and an internal destination zone, or an external origin and an external destination zone.

Double Counting

5.14 Double counting occurs when a trip in a fully observed matrix cell crosses the same cordon boundary more than once in the same direction. In contrast to partial observation, which leads to the under-estimation of trips between OD pairs, double counting leads to the over-estimation of the number of trips in the survey matrices.

5.15 Several techniques are available for identifying and removing double counted trips. Within MATBLD, double counted trips are identified using route choice data from the SATURN model. This involves using the assignment model to form PIJA files (Percentage of trips from origin zone I to destination zone J crossing cordon A) for each of the survey cordons defined in the study. (The PIJA files are formed by assigning a matrix containing an entry of 1000 in each cell to saved path files from the highway networks. These assignments were undertaken using the 2009 trip matrices developed for use with the SEMMMS8 SATURN model).

5.16 Using this method, fully observed trips that cross a cordon once only will have a PIJA value of 1000. In contrast, movements that cross the cordon more than once will have PIJA values greater than 1000. If, for example, all of the trips from origin zone i to destination zone j cross the cordon twice, then the PIJA value for this movement (on this cordon) will be 2000. If, however, only 50% of the trips cross the cordon twice, then the PIJA value will be 1500. Using this information, therefore, the actual number of trips between the origin zone and the destination zone that cross the cordon (TijA) can be estimated to be:

$$T_{ijA} = (1000 / P_{ijA}) * N_{ijA}$$

Where:

P_{ijA} is the modelled percentage of trips from origin zone i to destination zone j crossing cordon A.

N_{ijA} is the observed (sampled) number of trips from origin zone i to destination zone j crossing cordon A.

This formula is applied for each site on the cordon, with trips being aggregated across sites to build up the matrix for the cordon as a whole.

5.17 The impacts of correcting for double counting have been investigated by re-building the fully observed trip matrices using 'dummy' PIJA files, with entries of 1000 in all cells, for all cordons. This has the effect of setting the double counting factors equal to 1.000 for all movements, so that double counted trips are not corrected for when building the fully observed matrices.

5.18 The results of the analysis are presented in Appendix 5, Tables 5.1 – 5.3, which show the numbers of trips in the fully observed matrices both with and without the double counting factors. Separate results are presented for the AM peak, PM peak and average inter-peak hours, for each journey purpose. The figures in the columns headed 'Percentage Difference' show the percentage change in matrix totals as a result of applying the double counting factors.

5.19 As can be seen, the impacts of applying the double counting factors are relatively small, with the change in matrix totals, (for all trips combined), ranging from a reduction of -0.8 percentage points in the modelled AM peak hour to -1.2 percentage points in the PM peak hour. The changes in matrix totals are similar across purposes, with home-based employer's business trips in the AM peak hour showing the largest change, with a reduction in the overall matrix total of approximately -1.7 percentage points.

5.20 When building the matrices for the SEMMMS study, separate matrices were built from data collected in the morning peak period 0700-0930, the evening peak period 1600-1900 and the inter-peak period 0930-1600. Period, rather than hourly matrices were built to alleviate problems of 'lumpiness', (caused by under-sampling of some movements and over-sampling others), which often occur when trip matrices are formed from data collected in a single hour. The period matrices were factored to the AM peak hour 0800-0900, the PM peak hour 1700-1800 and the average inter-peak hour using adjustment factors calculated from the interview record expansion factors, separately for car, LGV and OGV trips, for each of the interview sites.

Matrix Merging

5.21 The locations of the survey sites mean that some movements are fully observed on more than one cordon. A trip from Hazel Grove to Manchester Airport, for example, will be observed in the outbound direction on SEMMMS cordon 3 (cordon number 22) and in the inbound direction on SEMMMS cordon 1 (cordon number 23). The data for these duplicated cells therefore has to be 'merged', to prevent double counting and to give the best estimate of the actual number of trips making the movement. Rather than simply averaging the estimated cell values, the DMRB recommends that the procedure for 'merging' matrix cells should take into account the respective accuracies of the different data sources.

5.22 The matrices were merged (using program MATMER), using a similar approach to that used in the Department for Transport's trip record database and matrix building suite, ERICA. This involved estimating the variance of the fully observed cells for each of the matrix building cordons, and using the estimated variance to calculate an index of dispersion, which can then be used to

combine multiple observations in such a way that the greatest weight is given to the observation with the smallest cell variance. These steps are described below.

Estimation of Cell Variances

5.23 Cell variances are estimated using the method described in Appendix D13 of TAM (Traffic Appraisal Manual). Using this approach, the variance of the number of vehicles in a traffic stream Q with an attribute of interest Qa can be calculated to be:

$$Var(Q_a) = \frac{Q\,(Q-q)\;q_a\,(q-q_a)}{q^2\,(q-1)} \qquad (1)$$

Where:

Q is the counted flow in the period (e.g. cars in the morning peak hour)

q is the number of vehicles that are interviewed (sampled)

q_a is the number of vehicles in the sample that have the attribute of interest (e.g. trips from origin zone i to destination zone j for journey purpose k).

5.24 This expression is derived assuming that the sampled population is finite and that the sample is taken without replacement, so that the probability distribution of the sample estimate is hypergeometric.

5.25 When Q is large and qa is small, however, (as is normally the case in most roadside interview surveys), equation (1) can be approximated by the simpler expression:

$$Var(Q_a) = \frac{Q}{q}\left(\frac{Q}{q} - 1\right)\; q_a \qquad (2)$$

which is equivalent to the variance equation for an isolated site used in ERICA. Using this expression, the matrix cell value for each cordon and its associated variance can be obtained by summing the contributions from the trips at each of the sites forming the cordon, to obtain totals for the cordon as a whole.

5.26 In MATBLD, the estimated variances are adjusted to allow for double counting and the application of the period to hour factors described above by multiplying each cell variance by the square of its associated PIJA value and the square of the period to hour factor for the site (described in paragraph 5.17). Site-specific variance factors are also applied, to adjust the variance for individual sites based on the age of the survey data. I.e.

$$Var(Q'_a) = V_{sfac} * \left(\frac{1000}{PIJA}\right)^2 * S_{hp}^{\ 2} * Var(Q_a) \qquad (3)$$

Where:

$Var(Q_a)$ is the variance calculated in equation (2)

PIJA is the PIJA value for this movement and cordon

S_{hp} is the site-specific hour to period factor

V_{sfac} is the site-specific variance factor.

5.27 When building the SEMMMS matrices, the variance factors for sites that were surveyed in 2001-2004 as part of the JETTTS, GMATS and M60 After Studies were set equal to 2.0, whilst the factors for sites that were surveyed in 2009 and 2011 as part of the SEMMMS RSI were set equal to 1.0, so that the SEMMMS RSI data was given approximately twice the weight (for movements observed on more than one cordon) during the matrix building procedure.

Calculation of Dispersion Indices

5.28 The index of dispersion of a matrix cell is defined to be the ratio of the variance of the expanded trips to the expanded trips themselves i.e.

$$I_a = \frac{Var(Q_a)}{Q_a}$$

5.29 This formula can only be applied, however, if the total number of trips in the cell (Qa) is greater than zero. An approximate method was therefore adopted for calculating the index of dispersion of fully observed movements where no trips were sampled, (observed zeros).

5.30 Within MATBLD, the dispersion index of fully observed zero cells, (which also have an associated level of sampling error), is approximated by the average variance of the non-zero cells for vehicle type of interest. i.e.

$$I_0 = \sum Var(Q_a)$$

$$\sum Q_a$$

5.31 Where the sum is over all non-zero fully observed cells for the cordon.

5.32 Where movements are surveyed crossing more than one cordon, the dispersion indices are used to combine movements in such a way that the greatest weight is given to the observation with the lowest cell variance, to provide the best estimate of the actual cell value. To achieve this, when combining two movements Q1 and Q2, with dispersion indices I1 and I2, the value of the merged cell is estimated to be:

$$Q_M = \frac{(I_2 Q_1 + I_1 Q_2)}{(I_1 + I_2)}$$

With a combined index of dispersion:

$$I_M = \frac{(I_1 * I_2)}{(I_1 + I_2)}$$

5.33 This formula can be applied pair-wise, in any order, to combine movements observed on three or more cordons if required.

Transposing Inter-Peak Movements

5.34 The final step of the RSI matrix building procedure involved transposing the fully observed inter-peak hour movements to estimate movements in the non-observed (reverse) direction. The AM peak and PM peak matrices were not, however, transposed, following advice given in the DMRB which recommends that it is not advisable to transpose critical movements in one peak period to estimate unobserved movements in the other peak period.

5.35 It is important to bear in mind, however, that the critical movements for the SEMMMS scheme had been observed in both directions on the SEMMMS RSI cordons, so that these movements did not require transposition.

Building Journey-to-Work Matrices from the 2001 National Census Data

5.36 The 2001 National Census provides information about the usual mode of travel to work at 'Output Area' level, based on a 100% sample. (Output areas are the smallest unit for which census data is available, and typically comprise approximately 125 households). The output areas can be grouped to form wards, or user defined zoning systems, so that the census provides full matrix data for all car driver work trips. Before the census matrices could be used with the SATURN model, however, they needed to be converted from the 2001 daily matrices

(represented by the census), to 2009 period-specific matrices for each of the modelled hours represented by the SATURN model.

5.37 To help convert the census matrices, the household interview survey (HIS) which formed part of the 2001-2003 Greater Manchester Area Transportation Surveys (GMATS) included a question about people's usual mode of travel to their main place of work. This question was designed to be consistent with the census, so that the census and HIS data could be easily compared, and so that factors could be generated from the household interview data to estimate home to work and work to home trips by mode, for selected time periods.

5.38 One issue of concern when transforming the census data is that the spatial distribution of work trips can vary by time of day. (It was thought, for example, that there might be more part time work trips in the inter-peak period, which might have a different trip length distribution to full time trips). To allow for this, therefore, the matrices were segmented by trip length, (using the average crow-fly distance between zones), with short and longer distance car driver trips being factored separately when estimating the work trips for each time-period.

5.39 In more detail, the method was to:

- Determine the crow-fly distance (in kilometres) between home and the usual place of work, for each employed person
- Allocate these distances to one of four travel bands: a) less than 2km, b) 2.00- 4.99km, c) 5.00-9.99km, d) 10.00km or more
- Tabulate from the GMATS HIS (where Greater Manchester residents were surveyed) the numbers of work trips by car-drivers for each travel band, both for daily trips and for trips made during each of the three modelling periods, for home to work trips and work to home trips
- Calculate factors by dividing, for each distance band, the number of work trips made in the modelled hour by the number of work trips made during the day, there being 24 factors (four distance bands, three time periods, two directions (to or from work)
- Transpose the home-work census matrix to form a work-home file
- Apply the factors to the two census matrices, thereby generating home to work and work to home car driver matrices by travel distance band
- Sum the separate travel distance matrices for each time period.

5.40 For example, the GMATS household interview data showed 97,200 average weekday car-driver trips from home to work with a trip length up to 2km – a further 495,600 home-work trips were longer than 2km. In the morning peak hour, 24,300 car-driver trips of less than 2km were recorded in household interview survey, implying that 25% of the daily car-driver journey to work trips of less than 2km took place in this period. A factor of 0.25 was therefore applied to the matrix of 2001 census car-driver trips of less than 2km to generate the matrix of morning peak hour vehicle trips for this travel band.

5.41 The procedure described above provided a first estimate of journey to work trips in each of the modelled hours. To ensure that the validation of modelled and observed traffic flows is as good as possible, however, it is important that the numbers of trips in the census matrices accurately

match the numbers of commuting car trips observed crossing the interview cordons defined for the RSI matrix building work, described above. Once the first set of matrices had been formed, therefore, the movements in the home to work and work to home census matrices were compared with fully observed trips for these purposes in the matrices built from the RSI data. This allowed adjustment factors to be calculated, which enabled the total number of trips in the census matrices to be constrained to match the numbers of home to work and work to home trips observed in the RSI, at a cordon level. (These factors also allowed the census matrices to be converted from the 2001 base represented by the census to the 2009 base represented by the RSI matrices, for an average weekday).

5.42 Separate factors were calculated for each RSI cordon and modelled time period, with row factors being applied for outbound trips and column factors for inbound trips. Trips that were wholly within cordons, (which were not observed in the RSI), were factored using the row factors for the cordon, to ensure that all intra-cordon trips were adjusted. Trips from zones wholly outside the RSI cordons were adjusted using area-wide factors, calculated from comparisons of fully observed trip totals for the census and RSI matrices as a whole.

5.43 Table 5.2 compares the fully observed commuting car trips from the RSI (for the three cordons in the SEMMMS area) with trips in the equivalent cells of the commuting car matrix derived from the census data. As can be seen, there is a good agreement between the trip totals in all time periods.

Table 5.2 Comparison of Fully Observed trips from the RSI and Census Matrices By Cordon and Time Period

Cordon	AM Peak		Inter-Peak		PM Peak	
	RSI	Census	RSI	Census	RSI	Census
SEMMMS 1 Out	1,946	1,940	728	718	2,461	2,454
SEMMMS 2 Out	4,432	4,433	839	824	3,805	3,815
SEMMMS 3 Out	4,909	4,907	941	910	3,634	3,586
SEMMMS 1 In	3,370	3,375	610	611	1,575	1,570
SEMMMS 2 In	5,053	5,057	866	866	3,644	3,637
SEMMMS 3 In	5,238	5,235	1,066	1,071	4,458	4,455
All	24,948	24,947	5,050	5,000	19,577	19,517

Treatment of Non-Observed Commuting Car Trips

5.44 The movements in the non-observed cells of the commuting car matrices, (comprising home to work and work to home trips), were derived from data collected during the 2001 Census of Population, factored to 2009. This provides information about the usual mode of travel to work, based on a 100% sample of residents of the UK. To some extent, therefore, these movements might also be regarded as being 'observed', rather than being based on synthesised data, (as was the case for non-observed movements for the other car purposes, which are derived from the synthetic matrices developed for the VDM).

5.45 It is not clear how the commuting car trips in the non-observed matrix cells should be treated. If, however, they can be regarded as being observed, (since they are based on observed rather than synthesised data), then roughly 70% of the most important car trips in the AOI have been observed, with approximately 30% being derived from synthesised data.

Treatment of Non-Observed Commercial Vehicle Trips

5.46 Non-observed movements in the commercial vehicle matrices were infilled using data from pre-existing matrices for Light Goods Vehicle (LGV) trips, and using information from the Great Britain Freight Model (GBFM) for Other Goods Vehicle (OGV) trips.

Summary of Highway Matrix Elements

5.47 The contributions of the different data sources to the final matrix are illustrated below, in **Tables 5.3 – 5.5**, which show the percentage of trips with an origin or destination in the SEMMMS Area of Influence, (AOI), which were fully observed in the RSI. This provides an indication of the extent to which trips in the AOI are based on observed movements, and to what extent movements were derived from other data sources.

5.48 **Table 5.3** shows the results of the analysis for the AM peak hour. These indicate that approximately 58% of car trips are in cells that were fully observed in the RSI. The corresponding figures for LGVS and OGVS are somewhat higher, being 64% and 84% respectively.

5.49 **Table 5.4** shows the results for the inter-peak matrices. These are slightly better than those for the AM peak hour, with approximately 63% of car trips being in cells that were fully observed in the RSI, with equivalent figures 82% and 87% for LGV and OGV trips respectively.

5.50 The results for the PM peak hour are presented in **Table 5.5**. As can be seen, approximately 68% of car trips are in cells that were fully observed in the RSI. As was the case for the other time periods, the corresponding figures for the LGV and OGV matrices are slightly higher, with equivalent figures of 78% and 91% respectively.

Table 5.3 Comparison of AM Peak Hour Prior Matrix Trip Totals for Movements with an Origin or Destination in the SEMMMS AOI (Vehicle Trips)			
Journey Purpose/Vehicle Type	**All Trips (Prior Matrix)**	**Trips in Fully Observed Cells**	**Percentage Fully Observed**
Home to Work Car	26,158	20,025	76.6
Work to Home Car	946	637	67.3
Home to Education Car	5,554	1,621	29.2
Education to Home Car	368	344	93.4
Home to Shopping Car	1,514	851	56.2
Shopping to Home Car	293	199	68.1
Home to Employer's Business Car	2,038	1,066	52.3
Employer's Business to Home Car	122	72	58.7
Home to Other Car	10,408	3,767	36.2
Other to Home Car	2,959	1,457	49.2
All Home Based Car	**50,360**	**30,038**	**59.6**
Non-Home Based Employers Business Car	928	805	86.7
Non-Home Based Other Car	7,591	3,334	43.9
All Non-Home Based Car	**8,519**	**4,138**	**48.6**
All Car	**58,880**	**34,177**	**58.0**
Light Goods Vehicles	**4,737**	**3,790**	**80.0**
Other Goods Vehicles	**1,439**	**1,255**	**87.2**
Total	**65,055**	**39,222**	**60.3**

Table 5.4 Comparison of Inter-Peak Hour Prior Matrix Trip Totals for Movements with an Origin or Destination in the SEMMMS AOI (Vehicle Trips)

Journey Purpose/Vehicle Type	All Trips (Prior Matrix)	Trips in Fully Observed Cells	Percentage Fully Observed
Home to Work Car	2,586	1,980	76.5
Work to Home Car	3,041	2,227	73.2
Home to Education Car	400	348	87.1
Education to Home Car	1,093	380	34.8
Home to Shopping Car	3,811	2,805	73.6
Shopping to Home Car	3,619	2,555	70.6
Home to Employer's Business Car	581	525	90.3
Employer's Business to Home Car	629	513	81.6
Home to Other Car	7,278	4,200	57.7
Other to Home Car	6,777	3,430	50.6
All Home Based Car	**29,815**	**18,962**	**63.6**
Non-Home Based Employers Business Car	3,094	2,859	92.4
Non-Home Based Other Car	9,857	5,328	54.1
All Non-Home Based Car	**12,951**	**8,187**	**63.2**
All Car	**42,767**	**27,148**	**63.5**
Light Goods Vehicles	**4,664**	**3,840**	**82.3**
Other Goods Vehicles	**1,380**	**1,204**	**87.3**
Total	**48,810**	**32,192**	**66.0**

Table 5.5 Comparison of PM Peak Hour Prior Matrix Trip Totals for Movements with an Origin or Destination in the SEMMMS AOI (Vehicle Trips)

Journey Purpose/Vehicle Type	All Trips (Prior Matrix)	Trips in Fully Observed Cells	Percentage Fully Observed
Home to Work Car	1,569	1,022	65.1
Work to Home Car	18,855	15,323	81.3
Home to Education Car	400	356	88.9
Education to Home Car	942	696	73.9
Home to Shopping Car	1,582	1,243	78.6
Shopping to Home Car	2,779	2,075	74.7
Home to Employer's Business Car	363	251	69.2
Employer's Business to Home Car	2,003	1,305	65.1
Home to Other Car	6,068	3,462	57.0
Other to Home Car	9,918	5,102	51.4
All Home Based Car	**44,479**	**30,834**	**69.3**
Non-Home Based Employers Business Car	1,215	1,057	87.0
Non-Home Based Other Car	8,443	4,859	57.5
All Non-Home Based Car	**9,658**	**5,916**	**61.3**
All Car	**54,138**	**36,750**	**67.9**
Light Goods Vehicles	**3,919**	**3,036**	**77.5**
Other Goods Vehicles	**645**	**586**	**90.8**
Total	**58,702**	**40,372**	**68.8**

6. Matrix Estimation

Introduction

6.1 HFAS's experience with large 'strategic' models has been that it is very difficult to meet the DMRB link flow validation criteria using a "prior" matrix except in limited parts of the network. Some degree of matrix estimation is always required.

6.2 The validation results for the prior PCU matrices indicated that only about 24% of the counted links across Greater Manchester had a GEH value of less than 5 in the AM peak hour. The corresponding figures for the PM peak and inter-peak hours were 23% and 21% respectively, indicating that matrix estimation using counts would have to be used if the assignment validation was to be significantly improved.

6.3 Separate matrix estimation runs were carried out for the car, LGV and OGV matrices for each of the modelled time periods. A total of four rounds of matrix estimation were carried out for each run, to ensure that the updated matrices did not change significantly between successive iterations, and that he procedure was satisfactorily converged. The method was as follows:

- Assign the prior matrix to the highway network to produce paths
- Run matrix estimation to produce a revised (estimated) demand matrix
- Assign the estimated demand matrix to produce revised paths
- Re-run matrix estimation using the prior matrix and the revised paths from above to produce a further estimate of the demand matrix
- Repeat
- Matrix Estimation stops once a degree of matrix 'stability' is reached

Traffic Count Data

6.4 The traffic count data for the matrix estimation runs was obtained from five sources:

- Manual classified counts from HFAS's traffic counts database (GMCounts)
- Automatic Traffic Counts (ATC) from HFAS's counts database
- ATC counts from the Highways Agency's TRADS database
- ATC and manual counts supplied by Cheshire East Council; and
- Entry and exit counts for car parks at Manchester Airport supplied by AECOM.

6.5 All counts were checked to exclude counts affected by known 'unusual' events such as accidents, road works, adverse weather conditions, holidays etc.

6.6 Where manual counts were used, separate counts were obtained for car, LGV, OGV and PCU flows for each of the modelled hours. Where ATC counts were used, all vehicle flows were obtained. These were converted into separate car, LGV, OGV and bus flows using vehicle composition factors calculated from manual counts at the same locations.

6.7 The counts were allocated to links in the highway network using an automatic count matching procedure developed by HFAS, based on the count OSGRs and the coordinates of the link polylines. The count and link direction and the count and link road class and number were also used as additional match criteria, to minimise the possibility of transcription errors.

6.8 For matrix estimation and validation purposes, all of the counts that were used in the validation were factored to a 2009 October average weekday using locally derived factors.

Count Checks

6.9 Matrix estimation procedures require accurate and consistent traffic counts if they are to work successfully. As matrix estimation strategies were developed, inconsistent counts were identified and eliminated from this process. Reasons for counts being eliminated included:

- Day-to-day variations in traffic flows
- Enumerator errors; and
- Other errors, such as count transcription errors, where counts are allocated to the wrong links or the wrong direction on a link.

6.10 Inconsistent counts were also identified through an automatic checking procedure within the SATURN programme, where counts violated 'Kirchoff's rule'. (These violations occur, for example, when two counts that are physically separated by intervening links are not equal, but where the assignment pattern indicates that all flows that pass through the first count site must also pass through the second).

6.11 Where it was thought that the discrepancies may have been caused by a counting error, or where the count might have been affected by unusual events that had not been picked up in the filtering exercise described above, then the counts were discarded. In situations where the inconsistencies were small, (such as might be caused by day-to-day variations in traffic flows), the counts were automatically averaged using the AVERK option in SATURN's SATPIJA program.

Cordons and Screenlines

6.12 To provide reassurance that the validation of the base year model was acceptable over a wider area counts on cordons and screenlines across Greater Manchester were included in the validation process. Overall, 916 counts were selected for matrix estimation and validation purposes across Greater Manchester. For the purposes of this report only cordons and screenlines within the SEMMMS Area of Influence have been reported in detail but results for other cordons and screenlines within Greater Manchester are available on request from HFAS.

6.13 In total, 297 of these counts were in the SEMMMS AOI comprising of 215 counts input to the matrix estimation runs and 82 counts providing an independent check on the calibrated model. The counts at the SEMMMS RSI sites were used as constraints during matrix estimation, to prevent the fully observed movements becoming inconsistent with the counts at these locations because of changes to the matrix to match counts at other sites.

6.14 Where possible, the matrix estimation counts were combined to form a series of cordons and screenlines within the study area, to intercept movements between local centres, and in those areas where the scheme benefits are most likely to occur.

6.15 In total, 10 (two-way) cordons and screenlines in the SEMMMS AOI were formed for use in matrix estimation, as illustrated in Figure 6.1 with descriptions of the crossing points outlined in Table 6.1. An additional screenline was also formed running parallel to the A34, (screenline 11), that was not used in matrix estimation, but which was set aside to provide an independent check on the calibrated model.

6.16 The remaining counts that were not used to form cordons and screenlines were divided into three groups comprising:

- TRADS counts on motorways for use in matrix estimation (approximately 40)
- Independent TRADS counts on motorways, (that were not used in matrix estimation), which were set aside to provide an independent check on the calibrated model (8); and
- Other Independent (ad hoc) counts on local roads in the study area, that were also set aside to provide an independent check on the calibrated model (approximately 60).

Point Zone Counts

6.17 In addition to the 'standard' zones representing areas with similar land use and travel patterns, the SEMMMS SATURN model also includes a number of 'point zones', representing developments such as large superstores, hospitals and industrial estates.

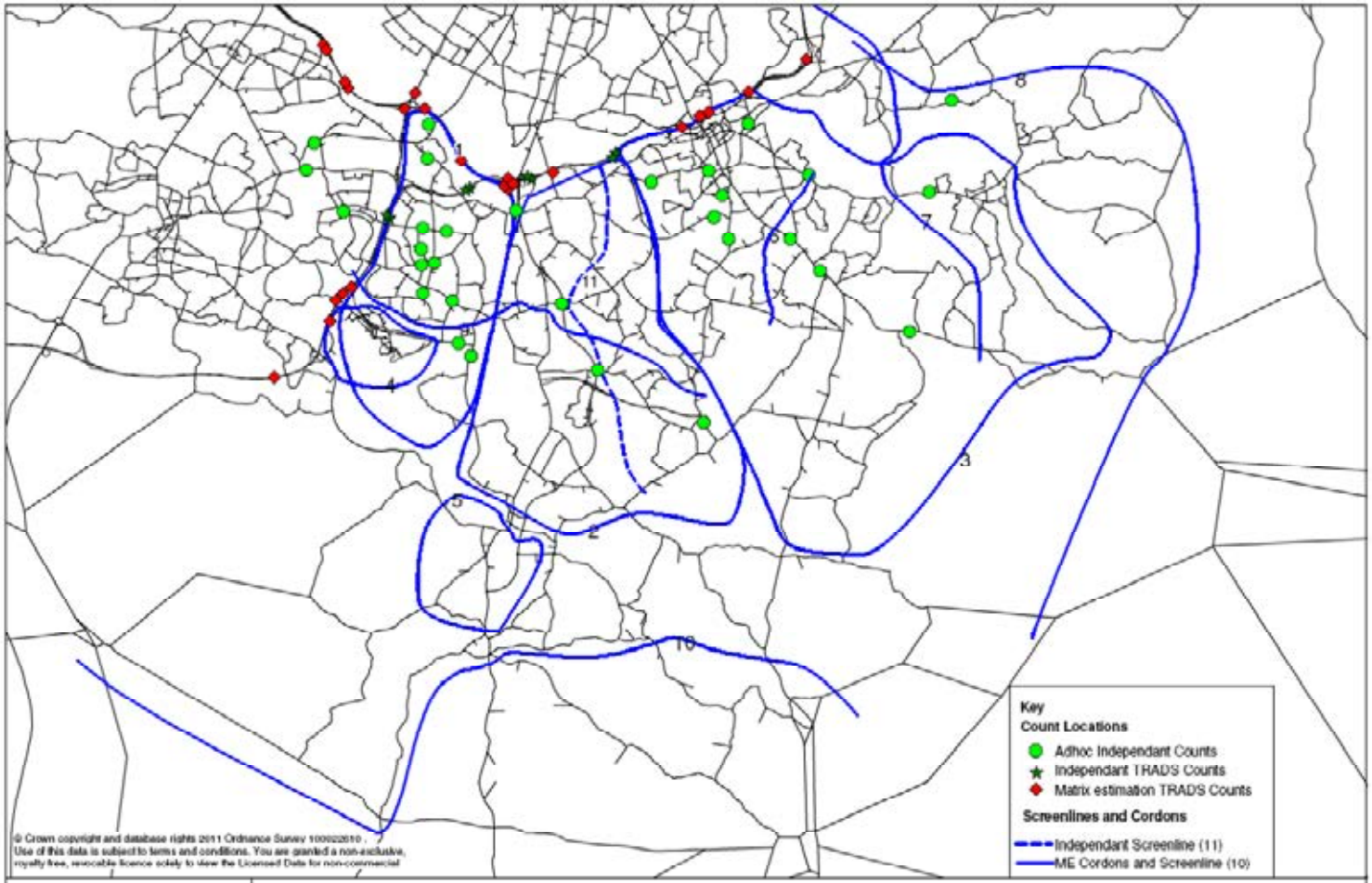
6.18 Where point zone counts were available, the entry and exit flows at the point zone sites were used as zonal constraints in the matrix estimation runs.

6.19 Point zones within the Area of Influence include:

- Car Parks at Manchester Airport
- Retail Parks such as Cheadle Royal and Handforth Dean
- Individual superstores such as TESCO in Didsbury; and
- Business Parks/Trading Estates such as Stockport Trading Estate.

Manchester Airport Car Park Counts

6.20 The Manchester Airport car park counts were also used as zonal constraints in the matrix estimation runs, to ensure that movements within the airport site were modelled as accurately as possible.


Key
Count Locations
Adhoc Independant Counts
Independant TRADS Counts
Matrix estimation TRADS Counts
Screenlines and Cordons
Independant Screenline (11)
ME Cordons and Screenline (10)
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Transport for Greater Manchester
2 Piccadilly Place,
Manchester,
M1 3BG
Traffic Count Locations
Drawn By : Michael Reese
Scale : NTS
Date : October 2011
Figure 6.1

Table 6.1		**Descriptions of Crossing Points for Cordons and Screenlines**					
1 .SEMMMS Cordon 1		**3. SEMMMS Cordon 3**		**6. Stockport-Hazel Grove Screenline**		**10. Manchester Airport/Heald Green/Bramhall Screenline**	
1	A560 Gatley Road	1	A523 London Road	1	Bramhall Moor Lane	1	Bailey Lane
2	Brown Lane	2	A5149 Chester Road	2	A6 Buxton Road	2	Shadowmoss Road
3	B5167 Palatine Road	3	A5102 Bramhall Lane South	2	A6 Buxton Road	3	B5166 Styal Road
4	Finney Lane	4	Manor Road	4	A626 Marple Road	4	Finney Lane
5	B5166 Styal Road	5	Adswood Road	5	A5143 Jacksons Lane	5	St Ann's Road
6	Thorley Lane	6	B5465 Edgeley Rd	**7. Romiley-Hazel Grove Screenline**		6	Finney Lane
7	M56 T2 onslip/offslip	7	A560 Stockport Rd	1	A6017 Ashton Road	7	B5358 Wilmslow Road
8	M56 T1 onslip/offslip	8	A5145 Hollywood Way	2	A560 Hyde Road	8	Gill Bent Road
9	Simonsway	9	A5145 Travis Brow	3	A627 Otterspool Road	9	B5094 Moss Lane
10	A560 Altrincham Road	10	A6 Wellington Road North	4	A626 Marple Road	10	A5102 Woodford Road
11	B5167 Palatine Road	11	B6167 Lancashire Hill	5	Windlehurst Road	11	A34 Kingsway Cheadle Hulme
12	Hollyhedge Road	12	A626 St Mary's Way	6	A6 Buxton Road	12	M56 Junctions 4-5
2 .SEMMMS Cordon 2		13	B6104 Carrington Road	7	B6104 Stockport Road	**11. Wilmslow/Macclesfield Screenline**	
1	A560 Gatley Road	14	B6104 Stockport Rd West	**8. M60 (South) Screenline**		1	A6017 Ashton Road
2	Brown Lane	15	A626 Marple Road	1	A5145 Travis Brow	2	A560 Hyde Road
3	Manchester Road	16	A626 Brabyns Row	2	Brinnington Rise	3	A627 Otterspool Road
4	Hollin Link	17	B6101 Haguebar Rd	3	A560 Ashton Road	4	A626 Marple Road
5	A34 Kingsway	18	A6 Buxton Road	4	A34 Kingsway	5	Windlehurst Road
6	Finney Lane	19	Roundy Lane	5	A560 Hollywood Way	6	A6 Buxton Road
7	B5166 Styal Road	20	A523 London Rd	6	A6 Wellington Road North	7	B6104 Stockport Road
8	A34 Wilmslow Bypass	21	A5149 Chester Rd	7	B6167 Lancashire Hill	8	B5090 Wellington Road
9	B5358 Lees Lane	**4.Manchester Airport Cordon**		8	A560 Great Portwood Street	**12. A34 Screenline**	
10	A5149 Chester Road	1	A538 Avro Way	9	A626 St. Mary's Way	1	B5094 Stanley Road
11	A5102 Bramhall Lane South	2	Sydney Avenue	10	B6104 Carrington Road	2	A555 MAELR
12	Robins Lane	3	World Way	11	M60 Cheadle Spur	3	A560 Stockport Road
13	Manor Road	4	Outwood Lane	12	B5095 Manchester Road	4	A5149 Cheadle Road
14	Adswood Road	5	Ringway Road	**9. Romiley New Mills Screenline**		5	Etchells Road
15	B5465 Edgeley Road	**5.Wilmslow Cordon**		1	A560 Hyde Road	6	A5102 Wilmslow Road
16	A560 Stockport Road	1	A538 Manchester Road	2	Sandy Lane	7	Councillor Lane
17	M60 Cheadle Spur	2	B5085/6 Knutsford Road	3	A626 Glossop Rd		
18	B5095 Manchester Road	3	A538 Prestbury Link Road	4	A6015 Church Road		
19	Chancel Lane	4	A34 Wilmslow Road	4	A6 Buxton Road		
20	A5102 Adlington Road			5	B5470 Macclesfield Road		

Matrix Estimation Results

6.21 Table 6.2 shows the total trips in the estimated matrices and the percentage change from the prior matrices by vehicle type and time period for trips with an origin or destination in the SEMMMS Area of Influence.

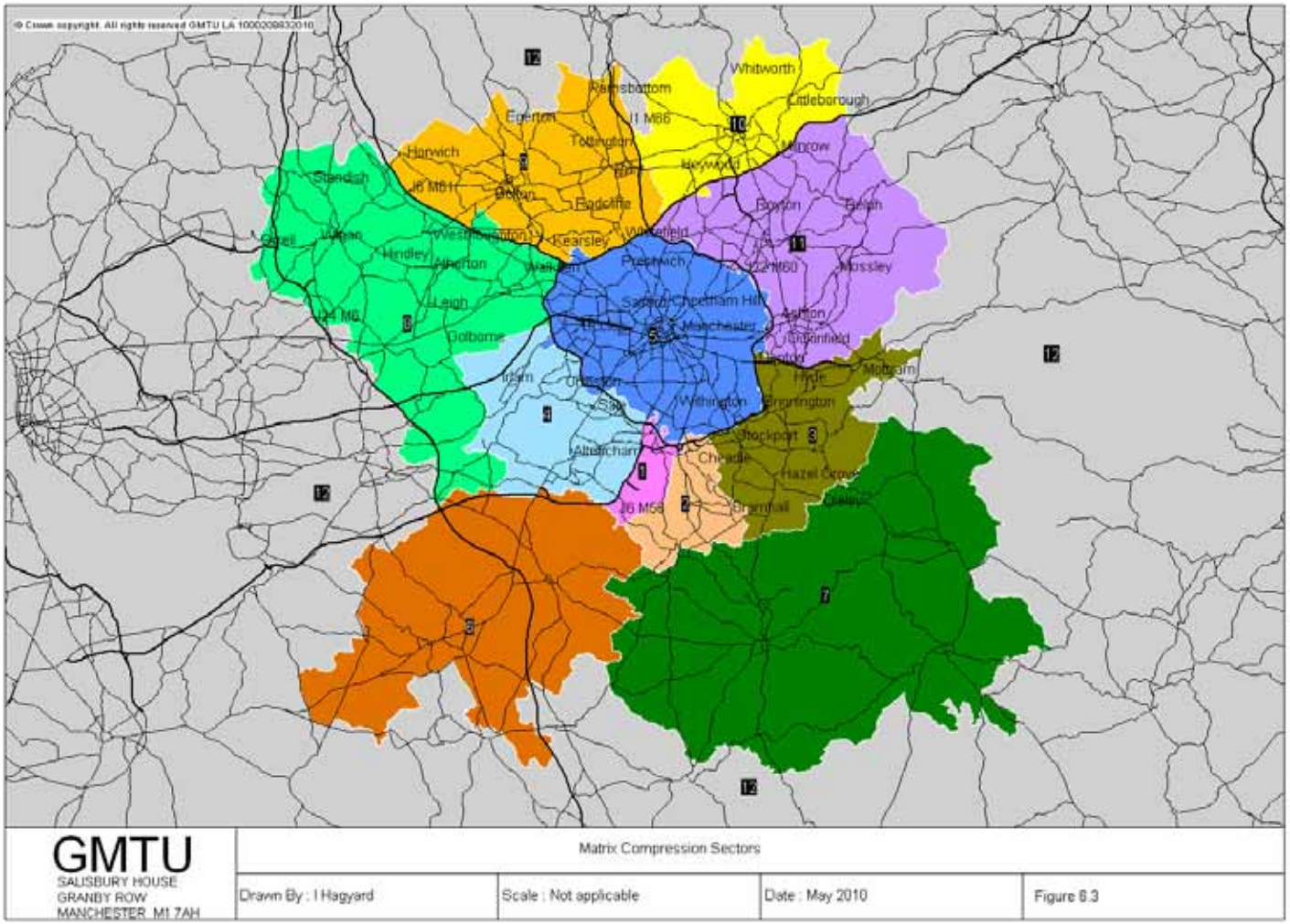
Table 6.2 Total Trips in Estimated Matrices and Percentage Change from Prior Matrices for Movements with an Origin or Destination in the SEMMMS Area of Influence

Vehicle Type	Time Period					
	AM Peak		Inter-Peak		PM Peak	
	Trips	% Change	Trips	% Change	Trips	% Change
Car	54,055	-5.6%	42,765	-2.7%	51940	-0.53%
LGV	4,960	19.5%	4,621	15.5%	3,895	11.4%
OGV	2,282	-3.6%	2,574	0.51%	908	-12.8%
Total (PCUS)	61,297	-3.9%	49,960	-1.1%	56,743	-0.02%

6.22 For cars, the total numbers of trips have reduced in all three time periods, by approximately 6% in the AM peak hour, 3% in the inter-peak and 0.5% in the PM peak hour. For LGVs the total trips have increased in all three time periods, ranging from an approximate 20 % increase in LGV trips in the AM peak hour to an approximate 11% increase in OGV trips in the PM peak hour. For OGVs the total trips have decreased in the AM and PM peak hour ranging from an approximate 4% decrease in OGV trips in the AM peak hour to an approximate 13% decrease in OGV trips in the PM peak hour whilst the inter-peak is broadly neutral. The percentage change in PM peak OGV trips represents an actual increase of only about 116 trips, however, which is relatively modest for a model of this size.

6.23 Overall, the total change in PCU trips is relatively small, ranging from a reduction of approximately 4% in the AM peak hour to a slight decrease of 0.02% in the PM peak hour.

6.24 Appendix 6 gives a more detailed comparison of the prior and estimated matrices based on the aggregation of the 1080 SEMMMS zones to the 12 sectors shown in Figure 6.2. In addition, it gives an indication of the degree of convergence of the matrix estimation procedure by comparing the penultimate and final estimated matrices at the sector level. For example, Table A2.4 shows that the penultimate and final AM peak hour PCU matrices differ by only 708 trips in total (out of 1,409,714) and that there are no sector-to-sector movement that differ by more than 10% and 100 trips.


Whitworth
Ramsbottom
Littleborough
Egerton
Tottington
Horwich
Middrow
Standish
Bolton
Radcliffe
Bowdon
Leigh
Kearsley
Prestwich
Mossley
Atherton
Golborne
Cheetham Hill
Ashton
Manchester
Urmston
Stretford
Wythenshawe
Eccles
Hyde
Mottram
Partington
Stockport
Altrincham
Cheadle
Hazel Grove
Disley
Urmston
GMTU
SALISBURY HOUSE
GRANBY ROW
MANCHESTER M1 7AH
Matrix Compression Sectors
Drawn By : I Hagyard
Scale : Not applicable
Date : May 2010
Figure 6.3

6.25 Tables 6.3 to 6.5 show GEH[1] frequency distributions from the assignment of the prior and estimated matrices for the AM peak, inter-peak and PM peak hours. The tables give an indication of the way in which the estimated matrices improve the assignment validation. Separate results are presented for the independent counts, the matrix estimation counts and for all counts combined.

6.26 Considering the results for the AM [1]peak hour, approximately 46% of the counted links have a GEH value of less than 6 for the prior matrix, for all counts combined. This figure increases to almost 92% for the updated matrix, demonstrating how matrix estimation has improved the assignment validation.

Table 6.3 AM Peak Hour GEH Cumulative Frequency Distributions for the Prior and Estimated Matrices

GEH Range	Prior Matrix			Estimated Matrix		
	Independent Counts (82)	Matrix Estimation Counts (215)	All Counts (297)	Independent Counts (82)	Matrix Estimation Counts (215)	All Counts (297)
0 - 2	23.8	18.0	19.7	39.0	64.5	57.4
0 - 4	36.9	29.4	31.5	61.0	85.5	78.7
0 - 6	58.3	41.7	46.4	85.4	93.9	91.6
0 - 8	69.1	54.5	58.6	90.2	97.7	95.6
0 - 10	75.0	64.9	67.8	96.3	98.6	98.0

6.27 The results for the inter-peak and PM peak hours follow a similar pattern, with approximately 47% of the counted links for the inter-peak prior matrix having a GEH value of less the 6, and an equivalent figure of 50% for the PM peak matrix. The link flow comparisons for the updated matrices indicate that approximately 93% of the counted links have a GEH value of less than 6 for the inter-peak hour and the PM peak hour.

[1] GEH is an error statistic incorporating both relative and absolute errors. The form of the statistic is defined in Paragraph 7.9 of this report.

Table 6.4 Inter-Peak Hour GEH Cumulative Frequency Distributions for the Prior and Estimated Matrices						
GEH Range	Prior Matrix			Estimated Matrix		
	Independent Counts (82)	Matrix Estimation Counts (215)	All Counts (297)	Independent Counts (82)	Matrix Estimation Counts (215)	All Counts (297)
0 - 2	23.2	15.4	17.5	45.1	81.9	71.7
0 - 4	43.9	32.6	35.7	74.4	90.7	86.2
0 - 6	57.3	43.3	47.1	86.6	95.4	92.9
0 - 8	74.4	60.0	64.0	93.9	97.7	96.6
0 - 10	87.8	74.0	77.8	100.0	99.0	99.3

Table 6.5 PM Peak Hour GEH Cumulative Frequency Distributions for the Prior and Estimated Matrices						
GEH Range	Prior Matrix			Estimated Matrix		
	Independent Counts (82)	Matrix Estimation Counts (215)	All Counts (297)	Independent Counts (82)	Matrix Estimation Counts (215)	All Counts (297)
0 - 2	17.1	20.9	20.0	37.8	71.6	62.3
0 - 4	39.0	36.9	34.8	69.5	85.6	81.1
0 - 6	52.4	47.6	49.8	87.8	94.4	92.6
0 - 8	67.1	60.7	57.7	92.7	96.3	95.3
0 - 10	81.7	68.0	67.0	96.3	97.7	97.3

6.28 Table 6.6 compares mean trip lengths for movements with an origin or destination in the SEMMMS Area of Influence in the prior and estimated matrices by vehicle type and time period.

6.29 For cars, the mean trip lengths have reduced in all time periods, with a reduction of approximately 4% (from 16.19km to 15.54km) in the AM peak hour, 5% (from 13.37km to 12.64km) in the inter-peak hour and 8% (from 16.86km to 15.45km) in the PM peak hour).

6.30 The LGV matrices exhibit decreases in mean trip lengths in all three time periods, ranging from approximately 6% (from 18.04km to 16,97km) in the AM peak hour to 10% (from18.81km to 17.01km) in the PM peak hour. However, the numbers of LGV trips are relatively small, so that these changes are modest in terms of overall network kilometres.

Table 6.6 Comparison of Mean Trip Lengths in the Prior and Estimated Matrices for Trips with an Origin or Destination in the SEMMMS Area of Influence

Vehicle Type	Time Period					
	AM Peak		Inter-Peak		PM Peak	
	Mean (km)	% Change	Mean (km)	% Change	Mean (km)	% Change
Car	15.54	-4.00%	12.64	-5.42%	15.45	-8.37%
LGV	16.97	-5.92%	17.00	-9.61%	17.72	-8.33%
OGV	26.88	14.52%	24.98	14.48%	37.41	42.36%

6.31 The OGV matrices exhibit the greatest changes in mean trip lengths, with increases in all three time periods, ranging from approximately 14.5% (from 23.48km to 26,89km) in the AM peak hour to 42% (from26.28km to 37.41km) in the PM peak hour. As noted earlier, however, the numbers of OGV trips are relatively small, so that these changes are modest in terms of overall network kilometres.

6.32 Figures 6.3 to 6.5 compare the prior and estimated trip length distributions for movements with an origin or destination in the SEMMMS Area of Influence for the AM peak hour car, LGV and OGV matrices respectively

6.33 From Figure 6.3 it can be seen that there has been a change in the trip length distributions for the estimated car matrices, with increased numbers of short distance trips (less than 5km) and reductions in medium and long distance trips. Overall, the percentage of trips with a trip length of 5km or less increases from 31% for the prior matrix to about 36% for the updated matrix.

6.34 Figures 6.4 and 6.5 show the AM peak trip length distributions for LGVs and OGVs respectively. For LGVs, there is a slight increase in the percentage of the trips of less than 10 km and a small reduction in longer distance trips of greater than 10 km. For OGVs, there is an increase in longer distance trips of greater than 25km, at the expense of short and medium distance trips, which has the consequence of increasing the average trip length by about 3.4km to 26.89 km for the estimated matrix.

6.35 Figures 6.6 to 6.8 compare the prior and estimated trip length distributions for the inter-peak hour car, LGV and OGV matrices for movements with an origin or destination in the SEMMMS Area of Influence. For cars, the average trip lengths of the estimated matrices fall by about 0.75km, with the proportion of the shortest distance trips (less than 5km) increasing by about five percentage points. For LGVs, there is a slight increase in the percentage of the trips of less than 10 km and a small reduction in longer distance trips of greater than 10 km. As in the AM peak hour, the number of longer distance OGV trips has increased for the estimated matrix, with the proportion of OGV trips in excess of 15km increasing from approximately 26% for the prior matrix to approximately 34% for the estimated matrix.

6.36 Figures 6.9 to 6.11 compare the prior and estimated trip length distributions for the PM peak hour car, LGV and OGV matrices for movements with an origin or destination in the SEMMMS Area of Influence.

6.37 Once again, there is an increase in the percentage of car trips of 5km or less, (from 29% for the prior matrix to 33% for the estimated matrix), and a compensating reduction in the percentage of medium and long distance trips. The mean trip length of the estimated LGV matrix has increased by approximately 1.5km, due mainly to an increase in the proportion of medium distance trips of greater than 10km. The mean trip length of the estimated OGV matrix has increased by approximately 11km, due mainly to an increase in the percentage of the very longest trips (in excess of 40km), from 19% to 27%. Once again, however, the numbers of OGV trips are relatively small, so that these changes are modest in terms of overall network kilometres.

6.38 In summary, the changes to car and LGV trip lengths in all periods are fairly small. Changes in OGV trip lengths are more significant, particularly in the inter-peak and PM peak hours when the numbers of longer distance trips increase. However, the numbers of OGV trips are relatively small. We therefore consider the changes to be acceptable.

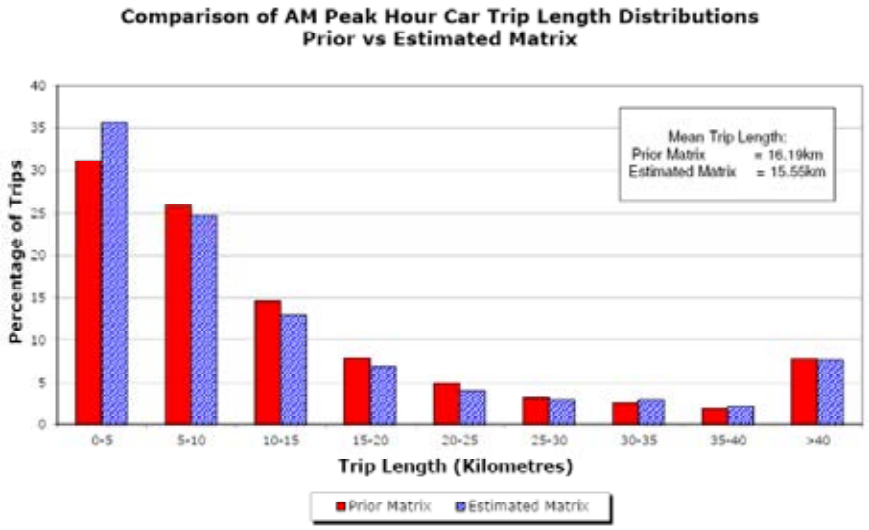


Figure 6.3

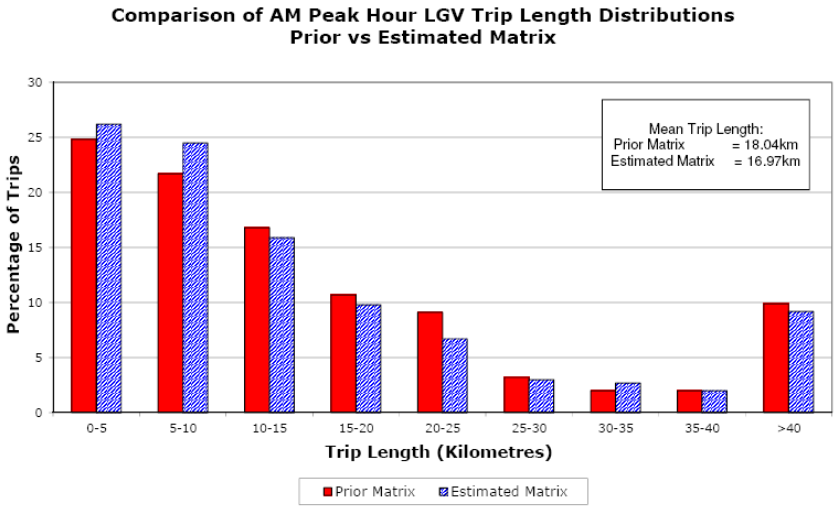


Figure 6.4

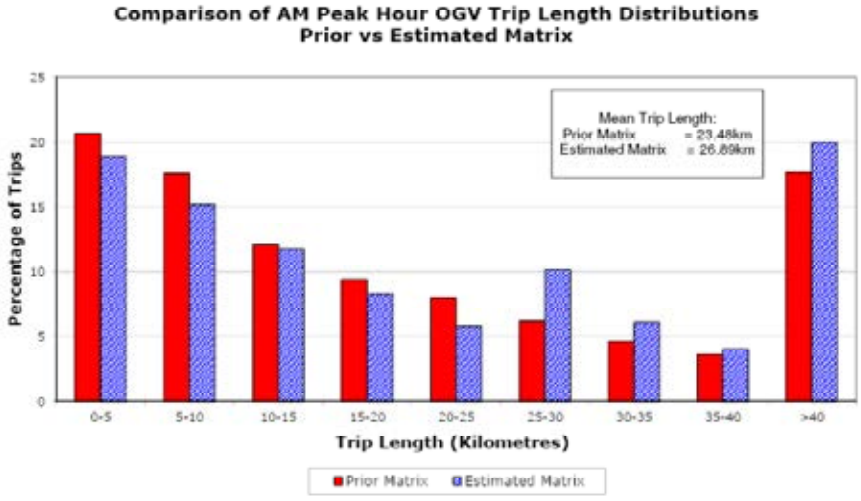


Figure 6.5

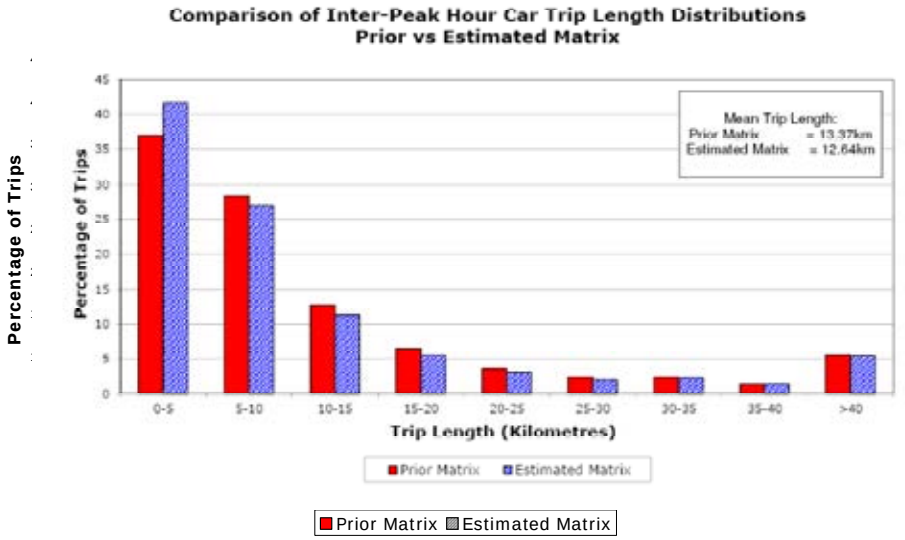


Figure 6.6

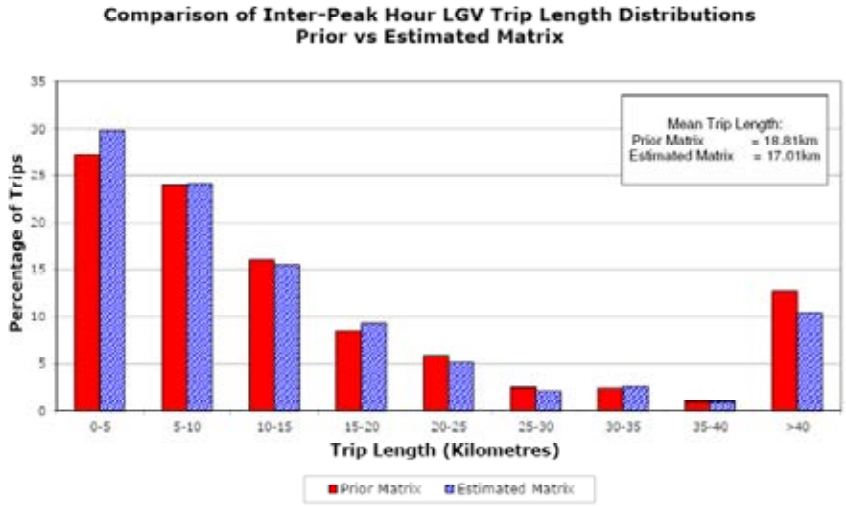
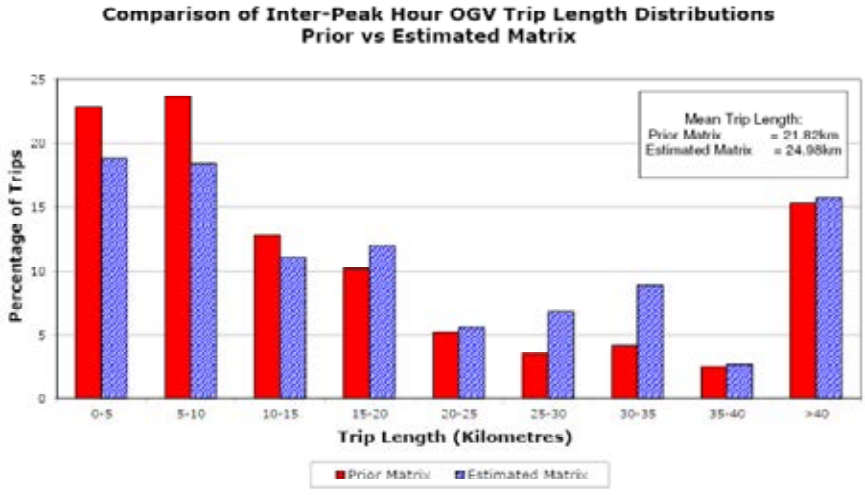


Figure 6.7



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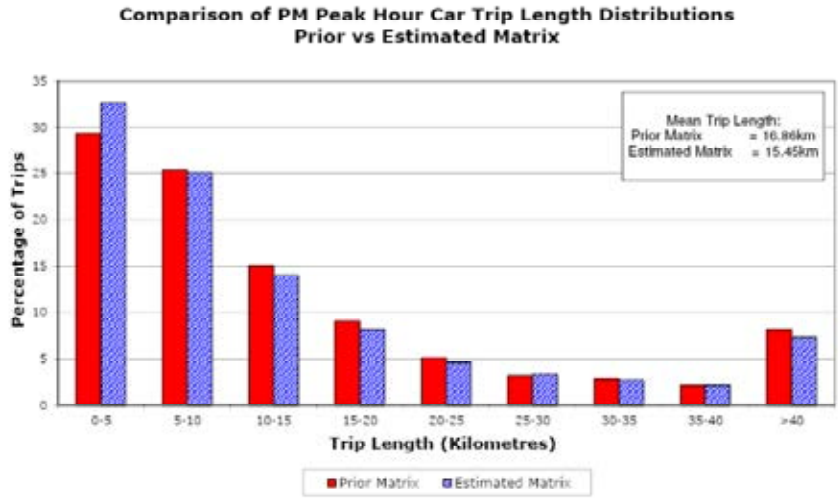


Figure 6.9

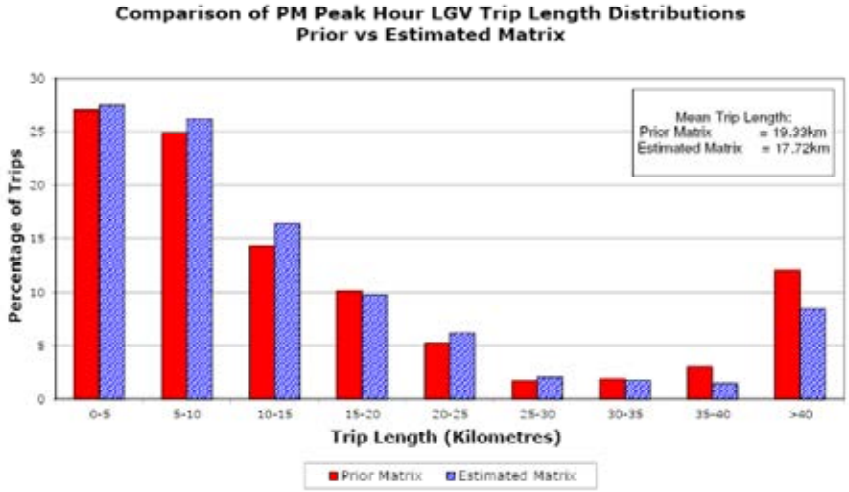


Figure 6.10

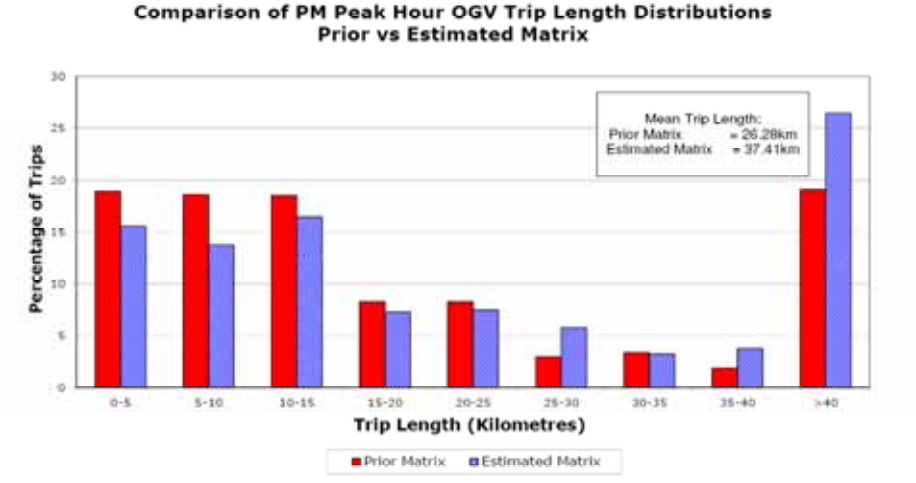


Figure 6.11

7. Traffic Flow Validation

Introduction

7.1 This section presents the link flow validation results for the updated matrices output from the matrix estimation procedure. It summarises the level of network convergence and compares assigned and observed link flows for each of the three modelled time periods using the criteria set out in the DMRB. Separate results are presented for the matrix estimation counts, for the independent counts and for all counts combined.

Network Convergence

7.2 The DMRB states that 'convergence is the key to robust economic appraisal' because, with a poorly converged base and/or test network, it is impossible to distinguish scheme effects from assignment 'noise'. Consequently, particular efforts were made to ensure that the networks were as highly converged as possible. This was achieved, but at the cost of protracted run times.

7.3 The DMRB criteria for an acceptable level of network convergence are that:

- Delta should be less than 1% on the final assignment; and
- More than 90% of links should have a flow that changes by less than 5% on the final 4 iterations. Note, however, that HFAS normally adopt stricter criteria, that more than 99% (98.5% prior to rounding) of links should have a flow change of less than 2% on the final four iterations.

7.4 Table 7.1 shows the above values for each of the modelled hours. The table indicates that the model meets DMRB convergence criteria, and that the model was well converged in all time periods, with Delta values well below 1% and the percentage of links with flows changing by less than 2% being over 98% in all cases.

Table 7.1 2009 SEMMMS SATURN Model Network Convergence Statistics

Criterion	Target	AM Peak	Inter Peak	PM Peak
Delta	<1%	0.009%	0.004%	0.017%
Percentage of links with <2% flow change on final iteration	>99%	99.2	99.6%	98.8%
Final iteration –1		99.2%	99.5%	99.2%
Final iteration –2		99.2%	99.6%	98.9%
Final iteration –3		98.9%	99.0%	99.0%

Assignment Validation Guidelines

7.5 The DMRB Volume 12 (reference 1) Table 4.2 sets out validation guidelines for comparing modelled and observed traffic flows based on the level of flow in vehicles per hour (vph). These are:

- **For observed flows less than 700 vph,** at least 85% of model flows should be within 100 vph of observations
- **For observed flows of between 700 and 2700 vph,** at least 85% of model flows should be within 15% of observations; and
- **For observed flows greater than 2700 vph,** at least 85% of model flows should be within 400 vph of observations

These criteria are referred to as the DMRB flow criteria in the text, and as 'All DMRB' in the tables.

7.6 Given that SATURN matrices are generally in units of PCUs per hour, the above criteria are assumed to apply to PCU flows.

7.7 In addition to the flow criteria described above, the DMRB also refers to the GEH statistic, where the guideline is that greater than 85% of counted links should have a GEH value of less than 5.

7.8 DMRB also requires that for any cordons and screenlines, the GEH value calculated over the cordon or screenline as a whole should be less than 4 in nearly all cases.

7.9 Finally, the DMRB requires that, taking all counts together, the slope of the best fit regression line should lie in the range 0.9 to 1.1, and the corresponding R-squared value should be greater than 0.95.

GEH Statistic

The GEH error statistic is a form of the Chi squared statistic incorporating both relative and absolute errors. The DMRB Volume 12 (reference 1) refers to the GEH statistic, where;

$$GEH = \sqrt{\frac{(M-C)^2}{(M+C)\ /2}}$$

and, M is the modelled flow

C is the observed flow (count).

Link Flow Comparisons for Matrix Estimation Counts

7.10 This section presents the assignment validation results for the sites in the SEMMMS AOI that were used during matrix estimation. Separate results are presented for the sites comprising the 10 cordons and screenlines that were used as constraints during the matrix estimation runs, and for the adhoc (TRADS) sites on the M56 and M60 Motorways.

Matrix Estimation Cordons and Screenlines

7.11 In total, counts on 10 (two-way) cordons and screenlines were used during matrix estimation, as illustrated in Figure 6.1 and described below in Table 7.2.

Table 7.2 Matrix Estimation Cordons and Screenlines

Cordon/Screenline Number/Name		Direction	Number of Sites
1	SEMMMS RSI Cordon 1	Inbound Outbound	12 13
2	SEMMMS RSI Cordon 2	Inbound Outbound	20 20
3	SEMMMS RSI Cordon 3	Inbound Outbound	21 21
4	Manchester Airport Cordon	Inbound Outbound	5 5
5	Wilmslow Cordon	Westbound Eastbound	4 4
6	Stockport – Bramhall Screenline	Westbound Eastbound	5 5
7	Romiley - Hazel Grove Screenline	Northbound Southbound	7 7
8	Romiley / New Mills Screenline	Westbound Eastbound	6 6
9	North-of-Scheme screenline Northbound	Northbound Southbound	12 12
10	South-of-Wilmslow Screenline	Northbound Southbound	8 8
Total sites		-	201

Notes:

The Wilmslow cordon is only partially complete due to a lack of suitable counts.

7.12 The validation results for the matrix estimation cordons and screenlines are shown below in Tables 7.3 to 7.5. Results are presented for each of the three time periods for all vehicle types combined as PCUs. For each screenline and direction of travel, the tables show the number of count sites, the total observed flow, the total modelled flow, the difference between the modelled and observed flows and the percentage difference between the modelled and

observed flows. The tables also show the screenline GEH value, which the DMRB recommends should be less than 4 in nearly all cases. The percentage of all individual count sites with a GEH value of less than 5 is shown at the bottom of the tables, together with the percentage of sites meeting either the DMRB1, DMRB2 or DMRB3 link flow criteria.

7.13 Table 7.3 compares modelled and observed flows in the AM peak hour. Overall, the comparisons are very good, with 17 out of 20 (two way) cordons/screenlines having a screenline GEH value of less than 4. Cordon number 5, (the Wilmslow Cordon), has the highest GEH value with a figure of 5.2 but it should be noted that the Wilmslow cordon is only partially complete due to a lack of suitable counts and is therefore light of traffic.

7.14 At the site level, approximately 91% of the sites have a GEH value of less than 5, and meet the combined DMRB link flow criteria, which satisfies the DMRB requirements.

Table 7.3 Comparison of AM Peak Hour Modelled and Observed Cordon and Screenline Crossing Flows for Counts used During Matrix Estimation (Actual Flows, All Vehicle Types)

Cordon	Direction	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	Screenline GEH
1	In	12	10,670	10,939	269	2.5	2.6
	Out	13	8,606	8586	-20	-0.2	0.2
2	In	20	17688	17252	-436	-2.5	3.3
	Out	20	17087	17155	68	0.4	0.5
3	In	21	14540	14654	114	0.8	0.9
	Out	21	13953	14310	357	2.6	3.0
4	In	5	2642	2611	-31	-1.2	0.6
	Out	5	1757	1662	-95	-5.4	2.3
5	West	4	3232	3187	-45	-1.4	0.8
	East	4	3487	3184	-303	-8.7	5.2
6	West	5	4458	4402	-56	-1.3	0.8
	East	5	4312	4250	-62	-1.4	0.9
7	North	7	4996	5271	275	5.5	3.8
	South	7	3830	3724	-106	-2.8	1.7
8	West	6	2928	2838	-90	-3.1	1.7
	East	6	2186	2151	-35	-1.6	0.8
9	North	12	13561	12999	-562	-4.1	4.9
	South	12	13637	13332	-305	-2.2	2.6
10	North	8	5140	4952	-188	-3.7	2.6
	South	8	5470	5117	-353	-6.5	4.9

Notes:

Percentage of <u>all sites</u> with GEH < 5 = 91.2%
Percentage of <u>all sites</u> meeting DMRB flow criteria = 91.2 %

7.15 Table 7.4 compares modelled and observed screenline crossing flows in the inter-peak hour in PCUs.

7.16 Overall, the comparisons are very good, with 16 out of 20 (two way) cordons/screenlines having a screenline GEH value of less than 4 with two screenlines (Romiley-Hazel Grove and North of Scheme) marginally greater than 4.0. The notable exception is the South of Wilmslow Screenline having a GEH value of 6.0. At the site level, approximately 94% of sites have a GEH value of less than 5 and meet the combined DMRB link flow criteria, which is well within the DMRB guidelines.

Table 7.4 Comparison of Inter-Peak Hour Modelled and Observed Cordon and Screenline Crossing Flows for Counts used During Matrix Estimation (Actual Flows, All Vehicle Types)

Cordon	Direction	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	Screenline GEH
1	In	12	7164	7246	82	1.1	1.0
	Out	13	7302	7134	-168	-2.3	2.0
2	In	20	12069	12047	-22	-0.2	0.2
	Out	20	11694	11747	53	0.5	0.5
3	In	21	11766	11383	-383	-3.3	3.6
	Out	21	12045	11743	-302	-2.5	2.8
4	In	5	1734	1747	13	0.8	0.3
	Out	5	1850	1838	-12	-0.7	0.3
5	West	4	2395	2340	-55	-2.3	1.1
	East	4	2396	2343	-53	-2.2	1.1
6	West	5	3293	3235	-58	-1.8	1.0
	East	5	3599	3561	-58	-1.1	0.6
7	North	7	3916	3856	-60	-1.5	1.0
	South	7	3786	3539	-247	-6.5	4.1
8	West	6	2151	2156	5	0.2	0.1
	East	6	2062	2130	68	3.3	1.5
9	North	12	10383	10165	-218	-2.1	2.2
	South	12	10262	9834	-428	-4.2	4.3
10	North	8	3431	3160	-329	-10.2	4.7
	South	8	3218	2889	-53	-4.0	6.0

Notes:

Percentage of <u>all sites</u> with GEH < 5 = 94.4%

Percentage of <u>all sites</u> meeting DMRB flow criteria = 94.4%

7.17 Table 7.5 compares modelled and observed screenline crossing flows in the PM peak hour for all vehicles combined as PCUs.

7.18 In total, 17 out of 20 of the (two way) cordons/screenlines have a GEH value of less than 4. Inbound flows on cordon 1, (the SEMMMS RSI cordon encompassing Wythenshawe and Manchester Airport), have the highest GEH value, with a figure of 6.1. The observed flows in the outbound direction are reproduced reasonably well, with a percentage difference between the modelled and observed flows of 1% and a cordon GEH value of 1.0.

7.19 At the site level, approximately 91% of the sites have a GEH value of less than 5, with 93% of the sites meeting the combined DMRB link flow criteria.

Table 7.5 Comparison of PM Peak Hour Modelled and Observed Cordon and Screenline Crossing Flows for Counts used During Matrix Estimation (Actual Flows, All Vehicle Types)

Cordon	Direction	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	Screenline GEH
1	In	12	9263	8686	-577	-6.2	6.1
	Out	13	9964	10068	104	1.0	1.0
2	In	20	17598	17647	49	0.3	0.4
	Out	20	16106	16312	206	1.3	1.6
3	In	21	14770	15230	460	3.1	3.8
	Out	21	15629	15664	35	0.2	0.3
4	In	5	1625	1640	15	0.9	0.4
	Out	5	2410	2364	-46	-1.9	0.9
5	West	4	3075	3163	88	2.9	1.6
	East	4	3330	3221	-109	-3.3	1.9
6	West	5	3995	3954	-41	-1.0	0.7
	East	5	4394	4399	5	0.1	0.1
7	North	7	4315	4425	110	2.6	1.7
	South	7	5657	6040	383	6.8	5.0
8	West	6	2377	2427	50	2.1	1.0
	East	6	3591	3625	34	1.0	0.6
9	North	12	12941	13026	-511	-3.6	0.7
	South	12	14077	13566	-145	-2.8	4.3
10	North	8	5172	5027	-248	-5.1	2.0
	South	8	4896	4648	-72	-4.2	3.6

Notes:

Percentage of all sites with GEH < 5 = 91.2%
Percentage of all sites meeting DMRB flow criteria = 92.6%

Matrix Estimation Motorway Sites

7.20 Table 7.6 compares modelled and observed flows for the matrix estimation sites on the M56 and M60 motorways for all vehicles combined as PCUs, for each of the modelled time periods. The table shows the number of sites, the total observed flow, the total modelled flow, the difference between the modelled and observed flows and the percentage difference between the modelled and observed flows. The table also shows the percentage of sites with a GEH value of less than 5. The figures in the column headed 'All DMRB' give the percentage of counted links that meet either the DMRB1, 2 or 3 link flow criteria.

7.21 In general, the comparisons are very good, with greater than 87.5% of the sites having a GEH value of less than 5 in all time periods. The comparisons against the DMRB link flow criteria are also very good, with 90% of sites achieving the required standard in the AM peak hour, and 97.5% and 95% of the sites meeting the standard in the inter-peak and PM peak hours respectively.

Table 7.6	**Link Flow Comparisons for Motorway Counts used During Matrix Estimation (Actual Flows, All Vehicles)**						
Time Period Period	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH < 5	% All DMRB
AM Peak	40	146,803	143,168	-3635	-2.5	87.5	90.0
Inter Peak	40	108,571	107,609	-962	-0.9	97.5	97.5
PM Peak	40	144,360	142,591	-1769	-1.2	95.0	95.0

Link Flow Comparisons for All Matrix Estimation Counts

7.22 Table 7.7 compares modelled and observed flows for all of the matrix estimation counts for each of the modelled time periods. These counts comprise the matrix estimation cordon and screenline counts plus the 40 TRADS counts on the M56 and M60 motorways in the SEMMMS area. It should be noted that where a cordon or screenline uses the same count, that count is only included once in the overall number of sites.

7.23 As a whole, the comparisons are very good, with 91% of the sites having a GEH value of less than 5 in the AM peak hour, and 91% of sites meeting the DMRB flow criteria. The results for the inter-peak hour are slightly better, with approximately 94% of sites having a GEH value of less than 5 and the same percentage meeting the DMRB flow criteria. The PM peak hour has approximately 91% of sites having a GEH value of less than 5 and approximately 93% meeting the DMRB flow criteria

7.24 At an aggregate level, the modelled flows are within 2% of the counted flows in the AM peak and inter-peak hours, and are within 1.0% of the counted flows in PM peak hour.

Table 7.7	**Link Flow Comparisons for All Matrix Estimation Counts (Actual Flows, All Vehicles)**						
Time Period Period	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH < 5	% All DMRB
AM Peak	215	283,915	278,363	-5552	-2.0	91.2	91.2
Inter-Peak	215	211,310	207,947	-3363	-1.6	94.4	94.4
PM Peak	215	280,949	278,528	-2421	-0.9	91.2	92.6

Link Flow Comparisons for Independent Counts

7.25 This section presents the assignment validation results for the independent counts that were reserved to check the accuracy of the calibrated model. Separate results are presented for the A34 screenline, the adhoc counts in the Area of Influence of the scheme and for all counts combined.

A34 Screenline

7.26 Table 7.8 compares modelled and observed flows for the A34 screenline, which runs to the east of A34 to intercept movements between Bramhall/Cheadle Hulme and Handforth/Wythenshawe/Manchester Airport. Results are presented for all vehicles combined ad PCUs, for each of the modelled time periods.

7.27 The table shows a good agreement between modelled and observed flows, with screenline GEH values of less than 4 in all time periods, with the exception of the PM peak hour in the eastbound direction, which has a GEH value equal to 5.8.

7.28 The percentage difference between the modelled and observed flows ranges from +0.6% in the westbound direction in the AM peak hour to –6.8% in the eastbound direction in the inter-peak hour. This equates to a difference of less than 500 PCU trips per hour over seven sites, which is fairly small.

Table 7.8 Link Flow Comparisons for the A34 Screenline (Actual Flows, All Vehicles)

Time Period	Direction	Observed Flow	Modelled Flow	Difference	% Difference	Screenline GEH
AM Peak	Westbound	6889	6930	41	0.6	0.5
	Eastbound	4629	4821	192	4.2	2.8
Inter-Peak	Westbound	4281	4183	-98	-2.3	1.5
	Eastbound	4235	4051	-184	-4.3	2.9
PM Peak	Westbound	4983	5196	213	4.3	3.0
	Eastbound	6986	6513	-473	-6.8	5.8

Adhoc Counts

7.29 Table 7.9 compares modelled and observed flows at the adhoc sites for each of the modelled time periods. These counts comprise the independent TRADS counts on the M56 and M60 motorways plus the adhoc counts on the local road network in the SEMMMS area.

7.30 In general, the comparisons are very good, with approximately 80% of sites having a GEH value of less than 5.0 in each of the time periods. The percentage of sites meeting the DMRB link flow criteria ranges approximately 77% in the PM peak hour to 82% in the inter-peak hour.

Table 7.9 Link Flow Comparisons for AdHoc Independent Counts (Actual Flows, All Vehicles)							
Time Period Period	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH < 5	% All DMRB
AM Peak	68	95,161	92,818	-2343	-2.5	80.9	78.0
Inter-Peak	68	73,829	71,821	-2008	-2.7	82.4	82.4
PM Peak	68	91,685	90,265	-1420	-1.5	79.4	76.5

All Independent Counts

7.31 Table 7.10 compares modelled and observed flows for all of the independent sites combined. Separate figures are presented for each of the modelled hours, for all vehicle flows expressed in PCUs.

Table 7.10 Link Flow Comparisons for All Independent Counts (Actual Flows, All Vehicles)							
Time Period Period	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH < 5	% All DMRB
AM Peak	82	106,679	104,569	-2110	-2.0	80.5	75.6
Inter-Peak	82	82,345	80,055	-2290	-2.8	80.5	78.0
PM Peak	82	103,654	101,974	-1680	-1.6	80.5	78.0

7.32 Overall, the comparisons are reasonably good, with the percentage of sites with a GEH value of less than 5 ranging from approximately 81% in all three time periods. The percentage of links meeting the combined DMRB link flow criteria ranges from 76% in the AM peak hour to 78% in the inter-peak and PM peak hours. The percentage differences between the modelled and observed flows are small, ranging from a slight under-assignment of less than 2% in the AM peak and PM peak hours, to and under-assignment of approximately 3% in the inter-peak hour.

7.33 Although the validation of the model against the independent counts just fails to achieve the standard required by the DMRB, the validation is nevertheless good, and is considered to be satisfactory.

Link Flow Comparisons for All Independent and Matrix Estimation Counts

7.34 Table 7.11 compares modelled and observed flows for all sites combined, comprising all of the matrix estimation counts plus all of the independent counts that were set aside to provide an independent check on the validated model.

7.35 The table shows that the overall validation is very good, with the percentage of sites with a GEH value of less than 5 being greater than 85% in all time periods. The percentage of sites meeting the DMRB link flow criteria ranges from 87% in the AM peak hour to 90% in the inter-peak hour.

7.36 On the whole, traffic flows are reproduced very well, with the percentage difference between the modelled and observed flows being less than 2% in all time periods, demonstrating that present day traffic levels are modelled correctly.

Table 7.11 Link Flow Comparisons for All Counts (Actual Flows, All Vehicles)

Time Period	Number Of sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH < 5	% All DMRB
AM Peak	297	390594	382932	-7662	-2.0%	88.2	86.9
Inter-Peak	297	293655	288002	-5653	-1.9%	90.6	89.9
PM Peak	297	384603	380502	-4101	-1.1%	88.2	88.6

7.37 Detailed assignment validation results for cordons & screenlines within the Area of Influence are included in Appendix 7 3.

7.38 Plots showing counts versus modelled flow within the Area of Influence are included in Appendix 8.

Regression Analysis

7.39 The regression parameters for the line y=ax are shown in Table 7.12. As noted in earlier, the DMRB recommends that the slope of the line should lie in the range 0.9 to 1.1, and the corresponding R-squared value should be greater than 0.95.

7.40 The table shows that the slopes of the regression lines and the R-squared values are comfortably within the guideline ranges specified in the DMRB for all three time periods.

Table 7.12 Regression Line Statistics for All Counted Links (All Vehicles)

Time Period	Parameter	Y=x	Within DMRB Range
AM Peak Hour	Slope	0.970	Yes
	R-squared	0.995	Yes
Inter-Peak Hour	Slope	0.985	Yes
	R-squared	0.996	Yes
PM Peak Hour	Slope	0.987	Yes
	R-squared	0.994	Yes

7.41 Regression Plots of modelled versus observed flow for the matrix estimation and the independent count set are shown in Figures 7.1 to 7.6.

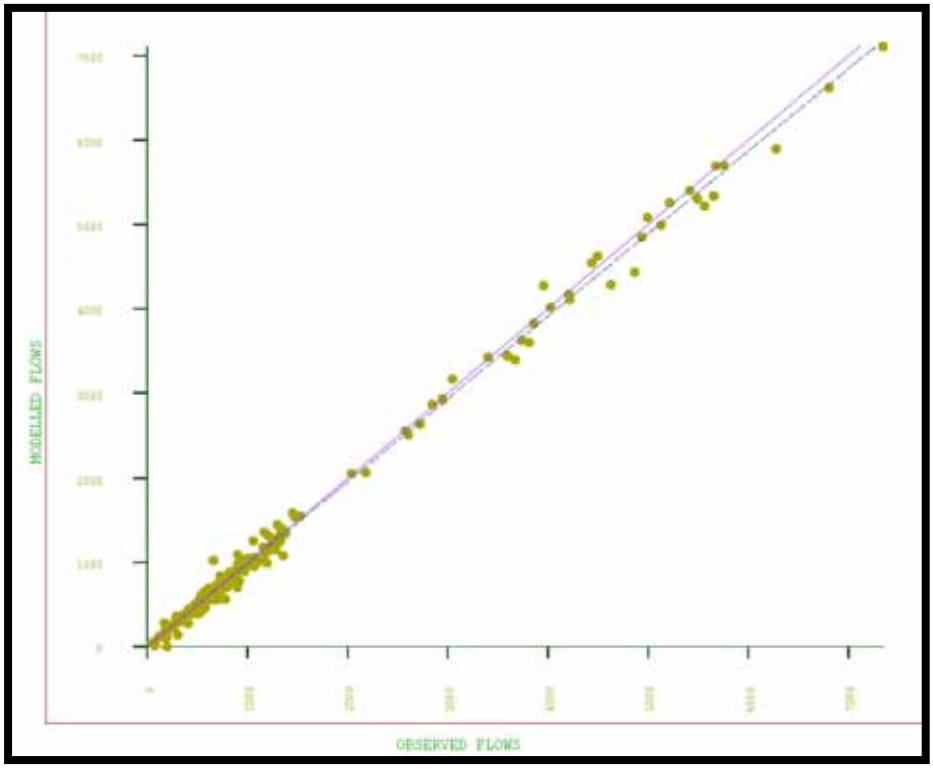


Figure 7.1: AM Peak Regression Analysis of Modelled Versus Observed Flow – Matrix Estimation Count Set

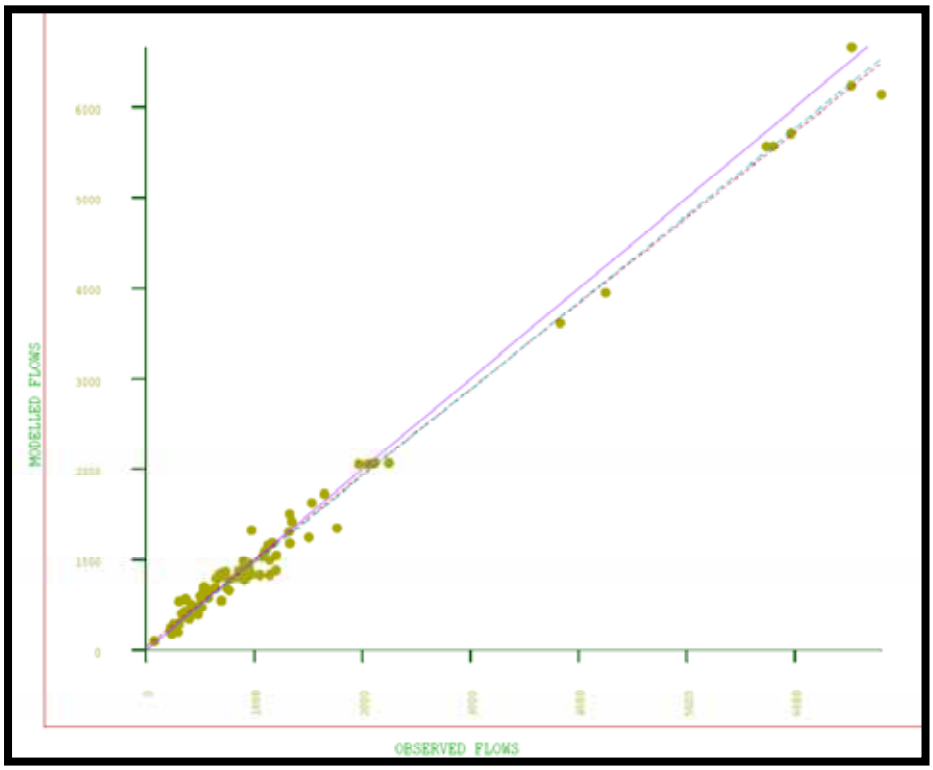


Figure 7.2: AM Peak Regression Analysis of Modelled Versus Observed Flow – Independent Count Set

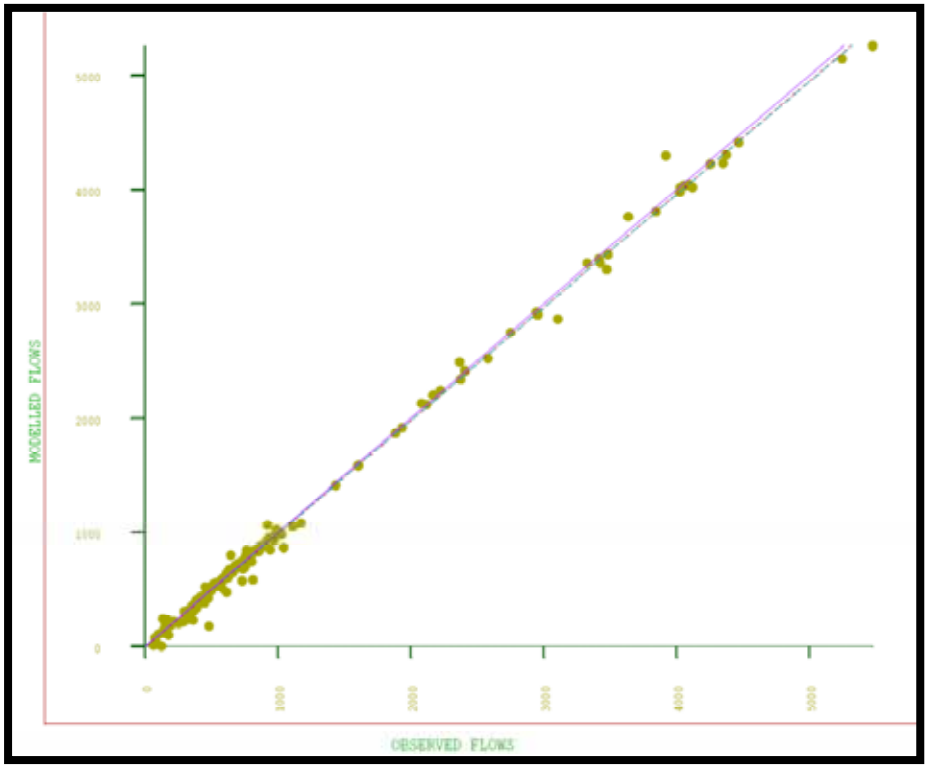


Figure 7.3: Inter-peak Peak Regression Analysis of Modelled Versus Observed Flow – Matrix Estimation Count Set

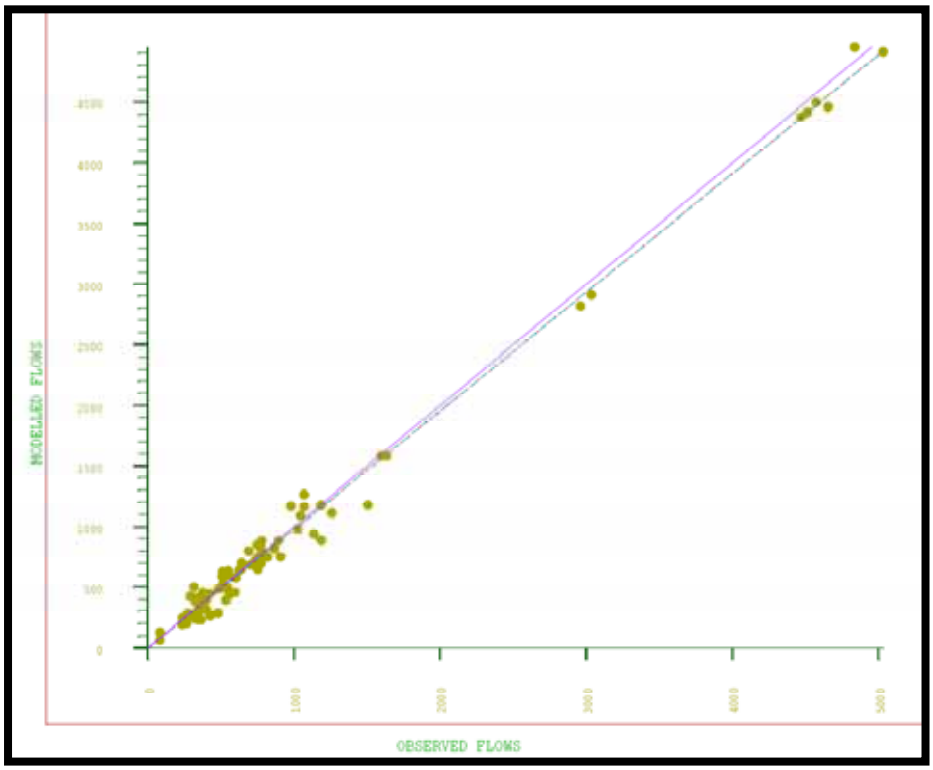


Figure 7.4: Inter-peak Peak Regression Analysis of Modelled Versus Observed Flow – Independent Count Set

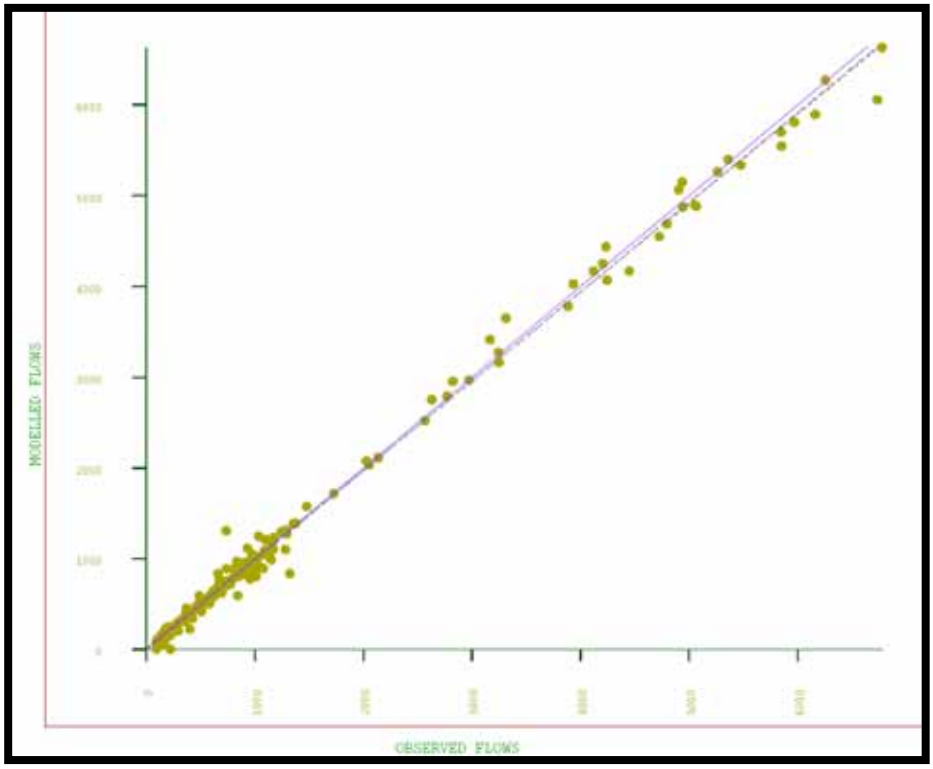


Figure 7.5: PM Peak Regression Analysis of Modelled Versus Observed Flow – Matrix Estimation Count Set

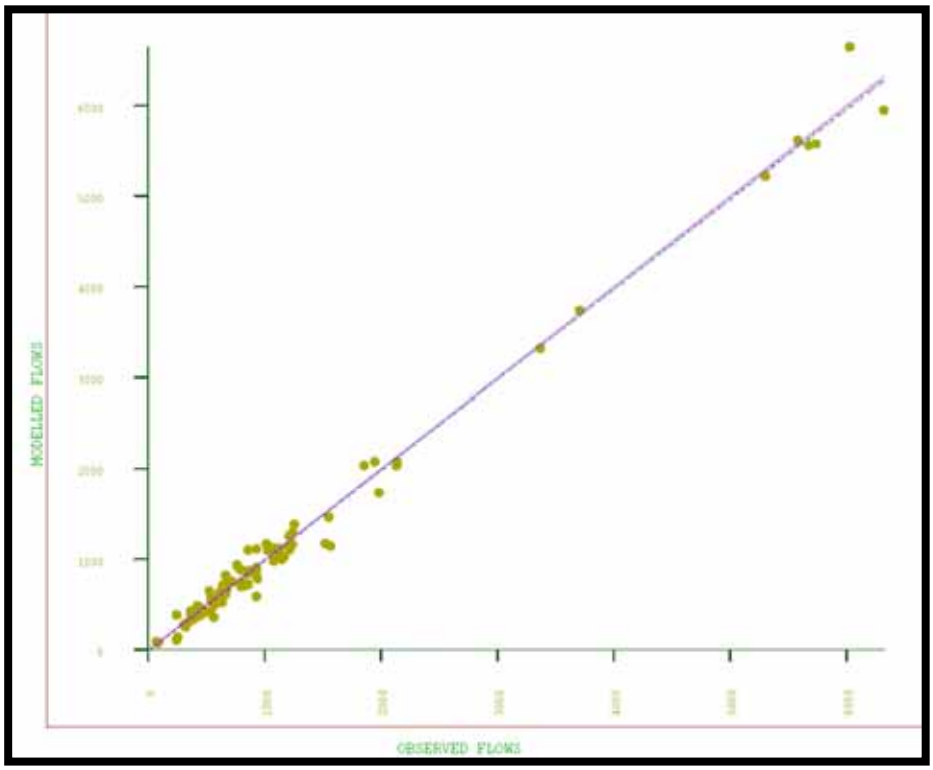


Figure 7.6: PM Peak Regression Analysis of Modelled Versus Observed Flow – Independent Count Set

8. Journey Time Validation

Introduction

8.1 Modelled and observed journey times have been compared on a selection of radial and orbital routes within the study area, as shown in Table 8.1 and illustrated in Figure 8.1. The routes are designed to replicate typical journeys within the Area of Influence of the scheme, with an average route length of approximately 11 km.

8.2 The observed journey times have been estimated using GPS data for 2009 from the Trafficmaster database. This information is collected on behalf of the Department for Transport by Trafficmaster PLC, and provides information about average vehicle speeds on roads across the UK for vehicles fitted with GPS devices. The information in the database has been processed by HFAS to exclude observations collected during school and national holidays, and to calculate average times for non-stopping vehicles (i.e. excluding buses and taxis) for standardized time periods. For the purpose of this analysis, the modelled times have been compared with observed times collected during for the morning peak hour 0800-0900, the evening peak hour 1700-1800 and the inter-peak period 0930-1430.

8.3 Taken together, the journey time routes cover approximately 330km of the highway network in the SEMMMS Area of Influence.

Journey Time Validation Guidelines

8.4 The DMRB requirement for journey time validation is that modelled times should be within 15% (or 1 minute if this is higher) of the observed time on more than 85% of routes.

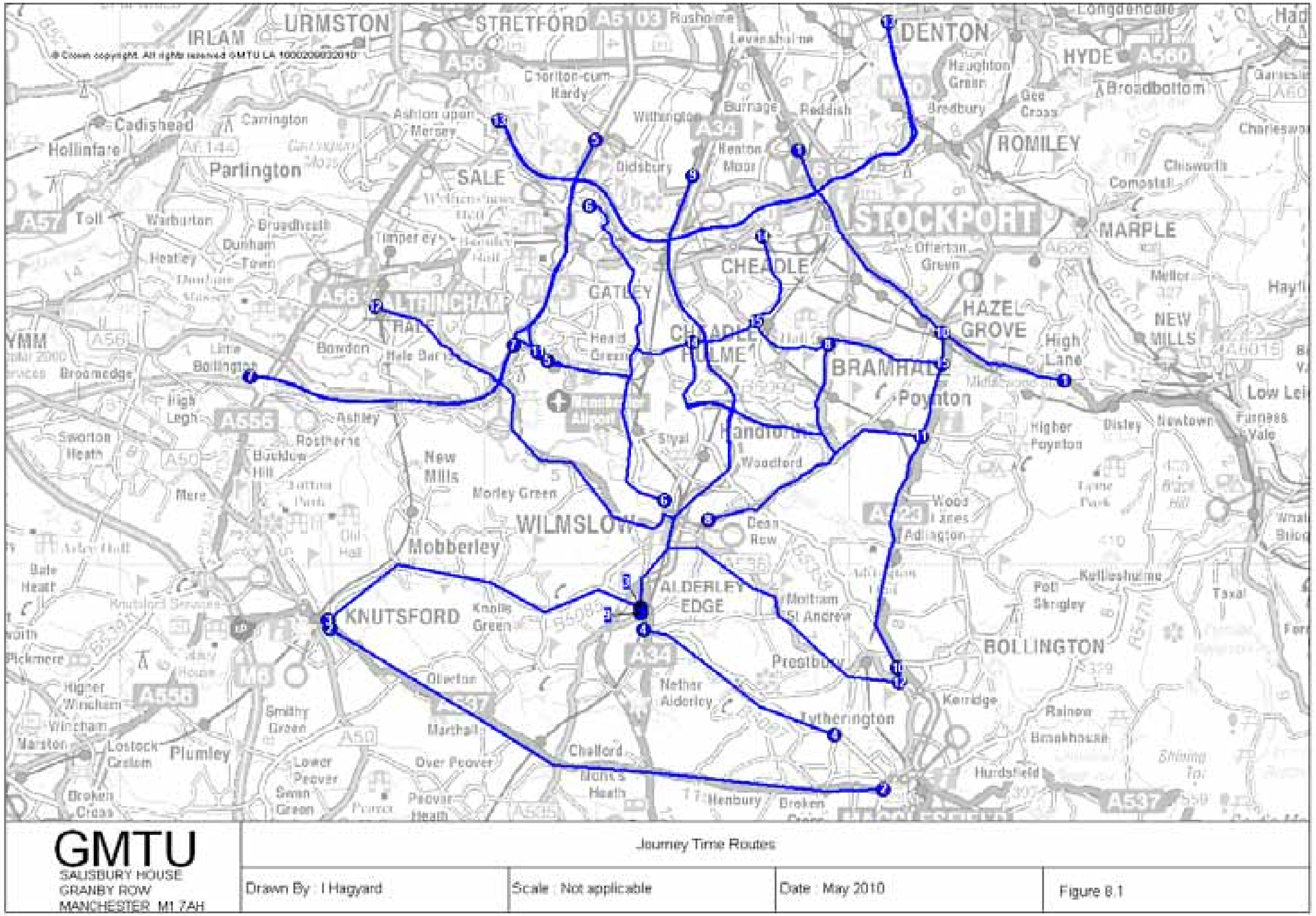
8.5 It should be noted, however, that paragraph 11.4.9 of the Traffic Appraisal Manual Volume 12) (reference 1) states:

"In congested conditions, where the journey times are flow dependent, the assignment package will provide estimates of link speeds and journey times for different times of day. These are not as accurate as the predictions of flows, as they are based on theoretical speed/flow relations that may not be the most appropriate for all parts of the network, and the standards for acceptance will generally be lower. Research has shown that, as long as the estimation of total travel time is unbiased, an empirically determined 95% confidence interval of +/- 20% can be taken to signify that the journey times are adequately modelled."

This range is also used for comparison in the following paragraphs.

8.6 Finally, it should also be noted that the modelled times represent the sum of the link travel times comprising each route, and therefore include flow-weighted delays for each of turns at the downstream ends of the constituent links. As a consequence, the route times do not necessarily represent the time taken to travel from the start point of the route to the routes end point, (as would be calculated using the SATURN 'Joy Ride' facility, for example), as this would only include the turn delays for a specific set of movements. Any differences should, however, be small. (This approach has been adopted for compatibility with the Trafficmaster data, and its procedure for allocating turning delays to links.)

Table 8.1 Journey Time Route Descriptions			
Route No.	**Description**	**Direction**	**Route Length (Modelled km)**
1	A6 High Lane to Heaton Moor	NW	8.7
	A6 Heaton Moor to High Lane	SE	8.7
2	A537 Knutsford to Macclesfield	E	16.4
	A537 Macclesfield to Knutsford	W	16.4
3	B5085 Knutsford to Alderley Edge	E	10.2
	B5085 Alderley Edge to Knutsford	W	10.2
4	B5087 Macclesfield to Alderley Edge	NW	6.6
	B5087 Alderley Edge to Macclesfield	SE	6.6
5	M56 Manchester Airport to West Didsbury	N	7.3
	M56 West Didsbury to Manchester Airport	S	6.8
6	B5166 Wilmslow to Northenden	N	10.0
	B5166 Northenden to Wilmslow	S	10.0
7	M56 J8 to J5	E	8.4
	M56 J5 to J8	W	8.4
8	A5102 Wilmslow to Bramhall	NE	7.6
	A5102 Bramhall to Wilmslow	SW	7.6
9	A34 Alderley Edge to East Didsbury	N	14.4
	A34 East Didsbury to Alderley Edge	S	14.3
10	A523 Prestbury to Hazel Grove	N	10.1
	A523 Hazel Grove to Prestbury	S	10.0
11	A555 MAELR Poynton to Manchester Airport	W	14.4
	A555 MAELR Manchester Airport to Poynton	E	14.4
12	A538 Prestbury to Hale	NW	22.1
	A538 Hale to Prestbury	SE	22.1
13	M60 J6 to J24	AC	17.0
	M60 J24 to J6	CW	17.2
14	Heald Green to Cheadle Heath	NE	5.2
	Cheadle Heath to Heald Green	SW	5.2
15	A5149/3 Cheadle Hulme to Hazel Grove	E	5.8
	A5143/9 Hazel Grove to Cheadle Hulme	W	5.8


GMTU
SALISBURY HOUSE
GRANBY ROW
MANCHESTER M1 7AH
Journey Time Routes
Drawn By : I Hagyard
Scale : Not applicable
Date : May 2010
Figure 8.1
URMSTON
STRETFORD
DENTON
HYDE
SALE
STOCKPORT
ROMILEY
MARPLE
CHEADLE
GATLEY
ALTRINCHAM
HAZEL GROVE
BRAMHALL
Poynton
WILMSLOW
Mobberley
KNUTSFORD
ALDERLEY EDGE
BOLLINGTON
Prestbury
Partington
Didsbury

AM Peak Hour Journey Time Validation Results

8.7 Table 8.2 compares modelled and observed journey times in the AM peak hour along the 30 journey time routes. In total, journey times on 27 out of 30 (or approximately 90%) of the routes meet DMRB journey time criteria that modelled times should be within 15% of observed times. The greatest differences between modelled and observed times are for routes 5 (northbound) and 13 (anticlockwise) on the M56 and M60, where the modelled times are too high on the M60 and too low on the M56.

8.8 Considering all of the routes together, the total modelled time is approximately 2.5% lower than the total observed time, which is within the DMRB criteria, but suggests that the modelled speeds are slightly too high in general.

Table 8.2 Modelled Versus Observed AM Peak Hour Journey Times (Minutes)

Route Number	Direction	Observed Time	Modelled Time	Modelled-Observed	% Error	Within DMRB
1	NW	27.2	26.9	-0.3	1.2%	Y
	SE	22.1	25.2	3.0	13.7%	Y
2	E	22.7	20.7	-2.0	8.9%	Y
	W	21.7	20.2	-1.5	6.8%	Y
3	E	13.8	15.1	1.3	9.4%	Y
	W	13.8	13.5	-0.3	2.3%	Y
4	NW	7.7	7.1	-0.6	7.2%	Y
	SE	7.4	6.8	-0.6	8.7%	Y
5	N	12.3	6.7	-5.6	45.4%	N
	S	5.2	6.1	0.9	17.2%	Y
6	N	16.5	16.7	0.2	1.4%	Y
	S	16.6	17.2	0.6	3.6%	Y
7	E	6.7	6.4	-0.3	4.4%	Y
	W	5.2	6.0	0.9	16.8%	Y
8	NE	11.6	11.7	0.1	1.2%	Y
	SW	13.9	12.0	-1.9	13.4%	Y
9	N	24.0	21.9	-2.1	8.8%	Y
	S	24.2	25.0	0.8	3.5%	Y
10	N	16.3	16.2	-0.1	0.5%	Y
	S	17.7	15.9	-1.8	10.0%	Y
11	W	24.7	22.3	-2.3	9.4%	Y
	E	23.2	24.3	1.1	4.9%	Y
12	NW	38.9	34.1	-4.7	12.2%	Y
	SE	38.8	36.2	-2.6	6.7%	Y
13	AC	11.2	14.7	3.5	31.5%	N
	CW	16.3	14.8	-1.5	9.1%	Y
14	NE	14.6	14.1	-0.5	3.6%	Y
	SW	14.1	14.1	0.0	0.2%	Y
15	E	10.7	13.5	2.9	26.9%	N
	W	14.9	15.2	0.2	1.6%	Y
Total		**513.7**	**500.7**	**-13**	**-2.54**	
Number of routes satisfying DMRB Criteria = 27out of 30 (90.0%)						

Inter-Peak Hour Journey Time Validation Results

8.9 Table 8.3 compares modelled and observed journey times in the inter-peak hour along the 30 journey time routes.

8.10 Overall, the comparisons are excellent, with 29 out of 30 (97%) of the routes meeting the DMRB criteria of +/-15%. Considering all of the routes together, the total modelled time is within 0.2% of the observed time, which represents a very good fit.

Table 8.3 Modelled Versus Observed Inter-Peak Hour Journey Times (Minutes)

Route Number	Direction	Observed Time	Modelled Time	Modelled-Observed	% Error	Within DMRB
1	Y	19.5	21.9	2.4	12.2%	Y
	Y	19.0	20.6	1.5	7.9%	Y
2	Y	18.5	19.8	1.3	6.8%	Y
	Y	18.0	19.7	1.7	9.7%	Y
3	Y	13.2	12.7	-0.5	3.7%	Y
	Y	13.1	12.3	-0.8	5.8%	Y
4	Y	7.5	6.6	-0.9	11.7%	Y
	Y	7.2	6.4	-0.8	10.9%	Y
5	Y	5.5	5.8	0.3	6.0%	Y
	Y	5.0	5.2	0.2	4.6%	Y
6	Y	15.5	14.3	-1.2	7.9%	Y
	Y	14.6	13.5	-1.2	8.0%	Y
7	Y	4.6	4.8	0.2	4.5%	Y
	Y	4.8	4.9	0.1	2.4%	Y
8	Y	10.8	10.1	-0.7	6.4%	Y
	Y	11.2	10.1	-1.1	9.7%	Y
9	Y	15.8	15.5	-0.3	2.1%	Y
	Y	16.4	15.8	-0.6	3.6%	Y
10	Y	14.8	14.8	0.0	0.1%	Y
	Y	13.4	13.0	-0.3	2.6%	Y
11	Y	19.1	17.5	-1.6	8.3%	Y
	Y	20.5	18.2	-2.4	11.6%	Y
12	Y	30.3	29.8	-0.5	1.7%	Y
	Y	30.8	31.2	0.4	1.4%	Y
13	N	9.8	12.0	2.1	21.6%	N
	Y	10.4	11.8	1.4	13.4%	Y
14	Y	10.6	10.1	-0.5	4.9%	Y
	Y	10.6	11.1	0.5	4.7%	Y
15	Y	9.8	10.3	0.5	4.9%	Y
	Y	9.8	9.7	-0.1	0.8%	Y
Total		**410.1**	**409.4**	**-0.7**	**-0.17%**	
Number of routes satisfying DMRB Criteria = 29 out of 30 (96.7%)						

PM Peak Hour Journey Time Validation Results

8.11 Table 8.4 compares modelled and observed journey times in the PM peak hour for the 30 journey time routes.

8.12 For most routes the comparisons are very good, with 28 out of 30 (93%) of the routes meeting the DMRB criteria of +/-15%.

8.13 Considering all of the routes together, the total modelled time is approximately 2% lower than the total observed time, which is within the DMRB criteria, but suggests that the modelled speeds are marginally too high. Overall, however, the journey time validation is good, and achieves the standard required by the DMRB.

Table 8.4 Modelled Versus Observed PM Peak Hour Journey Times (Minutes)

Route Number	Direction	Observed Time	Modelled Time	Modelled-Observed	% Error	Within DMRB
1	NW	Y	24.6	2.9	13.3%	Y
	SE	Y	26.9	-0.8	2.8%	Y
2	E	Y	20.1	0.0	0.1%	Y
	W	Y	20.2	0.7	3.6%	Y
3	E	Y	14.9	1.7	13.2%	Y
	W	Y	13.5	0.3	2.1%	Y
4	NW	Y	7.1	-0.3	3.6%	Y
	SE	Y	6.8	-0.3	4.5%	Y
5	N	N	6.6	-1.3	16.8%	N
	S	Y	6.2	0.2	2.9%	Y
6	N	Y	16.1	-1.1	6.7%	Y
	S	Y	15.2	-1.3	7.7%	Y
7	E	Y	5.5	-0.1	2.3%	Y
	W	Y	6.6	0.0	0.2%	Y
8	NE	Y	11.6	-1.6	12.4%	Y
	SW	Y	11.8	-1.4	10.4%	Y
9	N	Y	20.3	-1.3	6.0%	Y
	S	Y	22.0	0.8	3.9%	Y
10	N	Y	19.5	1.5	8.2%	Y
	S	Y	14.0	-0.1	0.5%	Y
11	W	Y	19.4	-1.8	8.4%	Y
	E	Y	23.7	-4.1	14.7%	Y
12	NW	Y	32.4	-0.1	0.3%	Y
	SE	Y	35.5	-2.0	5.3%	Y
13	AC	Y	15.8	-0.3	1.9%	Y
	CW	N	13.8	2.3	19.9%	N
14	NE	Y	13.5	-1.4	9.2%	Y
	SW	Y	14.1	0.3	2.5%	Y
15	E	Y	12.6	-1.1	8.3%	Y
	W	Y	11.7	0.6	5.3%	Y
Total		**491.2**	**482.1**	**-9.1**	**-1.85%**	
Number of routes satisfying DMRB Criteria = 28 out of 30 (93.3%)						

Commentary on Journey Time Outliers

8.14 In all three time periods the major outliers are the motorway-based routes along the M56/A5103 from Junction 5 to West Didsbury and the M60 from Junction 6 to Junction 24. These journey time routes display significant degrees of variability in times. For example:

- Route 5 (M56/A5103) northbound has 5th percentile time of 5 minutes and a 95th percentile time of 12 minutes with a Coefficient of Variation of 31%
- Route 13 (M60) anticlockwise has a 5th percentile time of 10 minutes and a 95th percentile time of 31 minutes, with a COV of 51%.

8.15 The variability in times reflects:

- The wider range of possible speeds on the motorway network (given the speed limit of 70mph);
- the closely spaced junctions along these sections of motorways and the resulting weaving, merging and shock wave effects; and
- the variations in flow on the motorway network that can result from 'strategic' diversion of traffic.

8.16 The frequency of junctions and associated weaving, merging, lane-drops/gains etc impact on driver behaviour and on lane chose e.g. lanes 1 and 2 may move much slower than lanes 3 and 4 causing drivers to switch lanes.

8.17 Flows (and therefore times/speeds) can vary significantly as a result of incidents elsewhere on the SRN which can cause traffic to divert. For example, an incident on the M62 west of Manchester can result in traffic diverting to the M56. Many of these incidents can be some distance from the section of motorway being observed and may not be identified when 'filtering' data for use in analysis.

8.18 Note that SATURN as a modelling package cannot model lane use, lane switching or driver behaviour to the same extent as microsimulation or mesoscopic models. Working with the Highways Agency and Leeds ITS, HFAS has undertaken extensive testing to improve the representation of motorways within the GMSM and SATURN models in general. Further changes are being made to SATURN software (for example, the introduction of link specific parameters which will reflect the willingness of vehicles to move out of the nearside lane to permit merging vehicles to join) which may improve the representation of urban motorways in the future.

Conclusions of Journey Time Validation

8.19 The results presented above indicate that the journey time validation fully meets DMRB requirements in all three time period.

8.20 The percentages of routes within 15% of the observed time ranges are 90%, 97% and 93% in the AM peak hour, inter-peak hour and PM peak hour respectively.

8.21 Graphs of observed versus modelled journey times are included in Appendix 9.

9. Conclusions

9.1 The SEMMMS SATURN model (SEMMMS8) has been built to inform the development of the business case for the proposed SEMMMS (A6 to Manchester Airport) Relief Road. The SATURN model represents traffic movements by road, and it forms part of a modelling system that also includes a travel demand model known as SEMMMS-VDM.

9.2 The models have been developed from the GM-SATURN model and GM Strategy Planning model (GMSPM2).

9.3 The SEMMMS8 modelling network is in full SATURN simulation detail throughout the SEMMMS Area of Influence (Stockport, South Manchester and the northern part of Cheshire East) and the remainder of Greater Manchester, and SATURN buffer network outside of these areas.

9.4 The initial ('prior') trip matrices for the SEMMMS8 SATURN Model were built using information from the 2001 National Census for journeys to and from work, from roadside interview surveys undertaken specifically for SEMMMS in October 2009 and June 2011, and from other RSI surveys undertaken across Greater Manchester since 2001 for other trip purposes. Other elements of the car matrices were taken from synthetic matrices developed by MVA. The corresponding elements of the LGV and OGV matrices were taken from RSI surveys and from the Great Britain Freight Model.

9.5 For the purposes of assignment validation trip matrices were built for car, LGV and OGV trips for a 2009 October average weekday. Separate matrices were built for the AM peak hour (08:00-09:00), an average inter-peak hour ((09:30-16:00)/6.5) and the PM peak hour (17:00-18:00).

9.6 Matrix estimation was used to enhance the prior trip matrices and thereby improve the match between observed and modelled flows.

9.7 Traffic counts for both assignment validation and matrix estimation were drawn from HFAS's count database and from data held by Cheshire East Council and Manchester Airport. The counts considered were all link counts from January 2007 excluding counts affected by known 'special' events (e.g., accidents, road works, and holidays). Some 297 counts in the SEMMMS Area of Influence were selected for matrix estimation and validation purposes of which 215 were used in the matrix estimation runs and 82 were used to provide an "independent" (of ME) check on the calibrated model. The counts were factored to 2009 average October weekday values using locally developed factors.

9.8 A number of matrix estimation strategies were explored, using different combinations of counts and parameter values. The final matrix estimation strategy changed the size of the individual vehicle (pcu) matrices by between –3.9% and -0.02%. Changes of this magnitude were considered acceptable.

9.9 The SEMMMS8 model was well converged in all time periods, with Delta values well below 1% and the percentage of links with flows changing by less than 2% over approximately 99% in all periods.

9.10 The SATURN model has been built to evaluate the SEMMMS Relief Road. The model has therefore been validated by comparing modelled link flows and journey times with observed data across the SEMMMS Area of Influence, for the 2009 base year.

9.11 In the AM peak, inter-peak and PM peak hours the percentages of all motorway and local road sites used in matrix estimation which met DMRB validation criteria were 91%, 94% and 93% respectively.

9.12 For independent counts as a whole, the percentage meeting DMRB GEH criteria was 81%, in all time periods

9.13 Eleven cordons and screenlines were formed for the link flow validation within the AOI. Ten were made up of counts used in matrix estimation, while one was kept aside to act as an independent validation check along the A34 corridor.

9.14 Considering the 10 ME cordon and screenlines together, the percentage with screenline GEH values less than 4 is 85% in the AM peak, 80% in the inter-peak and 85% in the PM peak. In the inter-peak period two of the screenlines are marginal with a screenline GEH of 4.1 and 4.3 For the independent A34 screenline, GEH values ranged from 0.5 to 5.8 depending on direction and time period. These figures confirm that the model meets DMRB criteria (GEH<4 for 85% of sites) with the exception of the Eastbound direction in the evening peak.

9.15 The slopes of the regression lines and the R-squared values are within the guideline ranges specified in the DMRB for all time periods.

9.16 Modelled and observed journey times were compared on 15 (two-way) routes covering key radials and orbitals crossing or parallel to the proposed scheme.

9.17 The DMRB guideline for journey time validation is that modelled times should be within 15% (or 1 minute if this is higher) of the observed time on more than 85% of route. The percentages of routes within 15% of the observed time ranges were 90%, 97% and 93% in the AM peak hour, inter-peak hour and PM peak hour respectively. All time periods therefore comfortably meet DMRB criteria.

9.18 The model is well converged in all three modelled time periods and the modelled traffic volumes are therefore very stable.

9.19 The results presented above indicate that the model meets DMRB requirements in almost all regards. Where it falls short of these requirements it does so only marginally.

9.20 Overall we consider that the model provides a sound basis for forecasting the effects of the proposed SEMMMS (A6 to Manchester Airport Relief Road).

10. References

1. Traffic Appraisal of Road Schemes – Traffic Appraisal Advice, Design Manual for Roads and Bridges, Volume 12, Highways Agency, May 1996

2. Manchester Airport Master Plan to 2030, Manchester Airport, 2007

3. Manchester Airport Ground Transport Plan, Manchester Airport, 2007

4. The Need for Land – Manchester Airport Company's Response to Manchester City Council's LDF Option Development, Manchester Airport, December 2009

5. SEMMMS (A6 to Manchester Airport) Relief Road Area of Influence, Greater Manchester Transportation Unit, SEMMMS Briefing Note 24,

Appendix 1 SATURN Links within the AOI with Length Discrepancies of > 30m

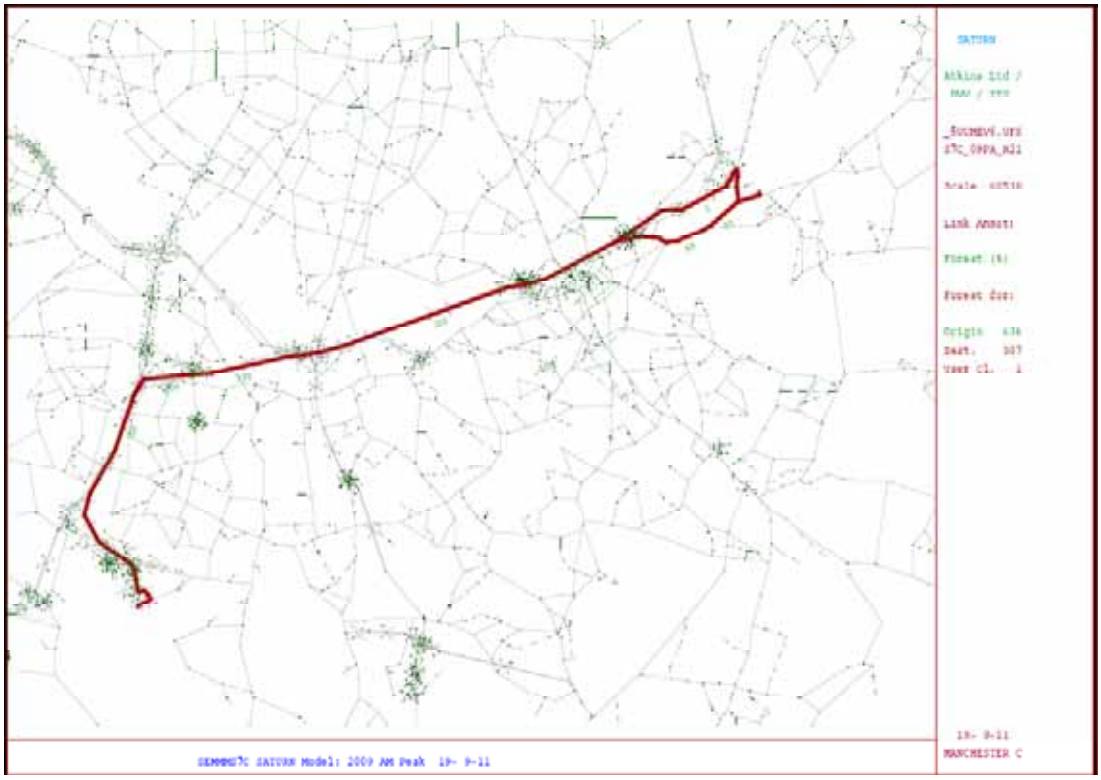
Table 1.1 : SATURN Links in SEMMMS AOI with Link Length Discrepancies of Greater Than 30m						
SATURN Link	**Anode**	**Bnode**	**Saturn Distance**	**Measured Distance**	**Saturn - Measured**	**Reason**
31112:31113	31112	31113	193	159	34	31112 coordinate wrong. Saturn distance correct
31113:31112	31113	31112	193	159	34	31112 coordinate wrong. Saturn distance correct
7295:15272	7295	15272	930	895	35	15272 coordinate wrong. Saturn distance correct
15272:7295	15272	7295	930	895	35	15272 coordinate wrong. Saturn distance correct
13258:15329	13258	15329	220	174	46	15329 coordinate wrong. Saturn distance correct
15329:13258	15329	13258	220	174	46	15329 coordinate wrong. Saturn distance correct
14505:14506	14505	14506	322	274	48	14506 coordinate wrong. Saturn distance correct
14506:14505	14506	14505	322	274	48	14506 coordinate wrong. Saturn distance correct
13293:13294	13293	13294	95	39	56	Nodes in correct position. Saturn distance incorrect.
15501:15504	15501	15504	279	215	64	Nodes in correct position. Saturn distance incorrect.
15504:15501	15504	15501	279	215	64	Nodes in correct position. Saturn distance incorrect.
15321:15322	15321	15322	817	750	67	Nodes in correct position. Saturn distance incorrect.
15322:15321	15322	15321	817	750	67	Nodes in correct position. Saturn distance incorrect.
15507:15508	15507	15508	1654	1575	79	Nodes in correct position. Saturn distance incorrect.

SATURN Link	Anode	Bnode	Saturn Distance	Measured Distance	Saturn - Measured	Reason
15508:15507	15508	15507	1654	1575	79	Nodes in correct position. Saturn distance incorrect.
8840:15293	8840	15293	264	164	100	15293 coordinate wrong. Saturn distance correct
15293:8840	15293	8840	264	164	100	15293 coordinate wrong. Saturn distance correct
14536:3900	14536	3900	444	343	101	Saturn distance incorrect.
13904:15337	13904	15337	182	71	111	15337 coordinate wrong. Saturn distance correct
15337:13904	15337	13904	182	71	111	15337 coordinate wrong. Saturn distance correct
13893:13894	13893	13894	312	177	135	Saturn distance incorrect.
13908:15320	13908	15320	266	57	209	15337 coordinate wrong. Saturn distance correct
15320:13908	15320	13908	266	57	209	13908 coordinate wrong. Saturn distance correct
1922:15268	1922	15268	408	87	321	15268 coordinate wrong. Saturn distance correct
15268:1922	15268	1922	408	87	321	15268 coordinate wrong. Saturn distance correct
2445:15268	2445	15268	20	341	-321	15268 coordinate wrong. Saturn distance correct
15268:2445	15268	2445	20	341	-321	15268 coordinate wrong. Saturn distance correct
13241:13908	13241	13908	20	216	-196	13908 coordinate wrong. Saturn distance correct
13908:13241	13908	13241	20	216	-196	13908 coordinate wrong. Saturn distance correct
13293:15337	13293	15337	41	151	-110	15337 coordinate wrong. Saturn distance correct

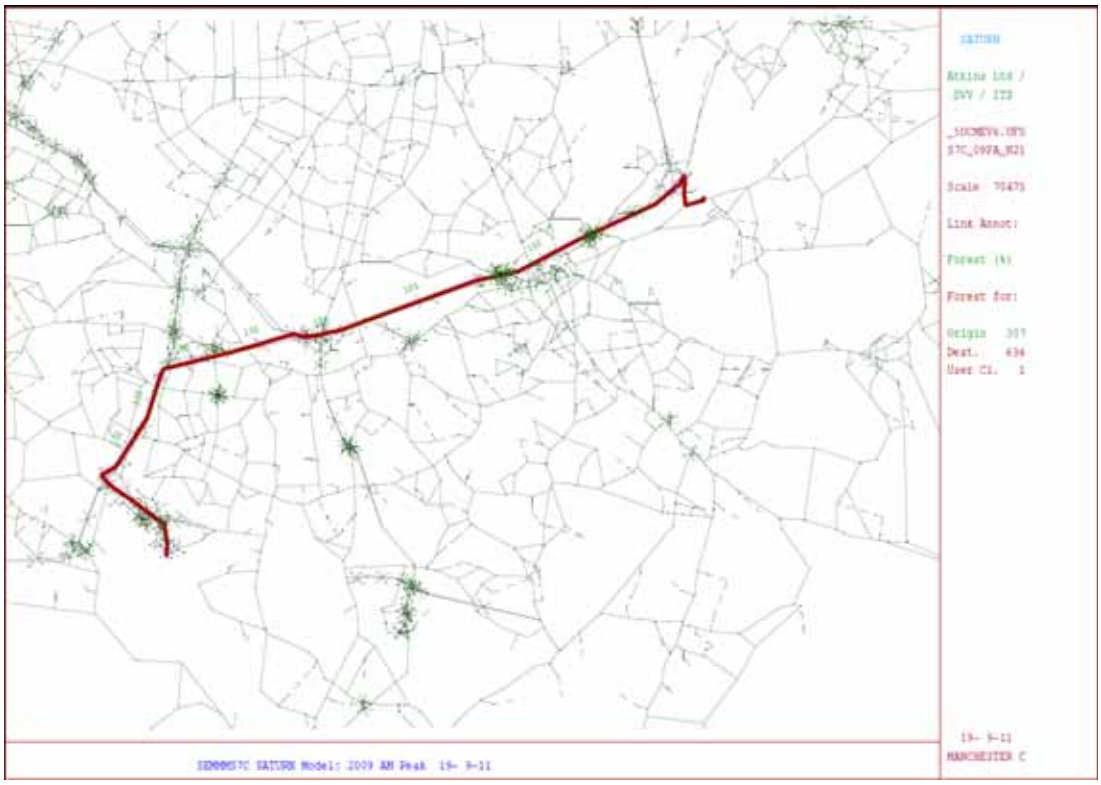
SATURN Link	Anode	Bnode	Saturn Distance	Measured Distance	Saturn - Measured	Reason
15337:13293	15337	13293	41	151	-110	15337 coordinate wrong. Saturn distance correct
2188:15293	2188	15293	40	141	-101	15293 coordinate wrong. Saturn distance correct
15293:2188	15293	2188	40	141	-101	15293 coordinate wrong. Saturn distance correct
14531:14537	14531	14537	88	174	-86	Saturn distance incorrect.
14537:14531	14537	14531	88	174	-86	Saturn distance incorrect.
14505:14534	14505	14534	149	232	-83	Saturn distance incorrect.
14534:14505	14534	14505	149	232	-83	Saturn distance incorrect.
13502:13503	13502	13503	1942	2017	-75	13502 coordinate wrong. Saturn distance also incorrect.
13503:13502	13503	13502	1942	2017	-75	13502 coordinate wrong. Saturn distance also incorrect.
15506:15507	15506	15507	220	293	-73	Nodes in correct positions. Saturn distance incorrect.
15507:15506	15507	15506	220	293	-73	Nodes in correct positions. Saturn distance incorrect.
13246:15322	13246	15322	15	81	-66	Nodes in correct positions, Saturn distance incorrect.
15322:13246	15322	13246	15	81	-66	Nodes in correct positions, Saturn distance incorrect.
15275:15277	15275	15277	600	650	-50	Nodes in correct positions, Saturn distance incorrect.
15277:15275	15277	15275	600	650	-50	Nodes in correct positions, Saturn distance incorrect.

SATURN Link	Anode	Bnode	Saturn Distance	Measured Distance	Saturn - Measured	Reason
3795:8969	3795	8969	128	173	-45	Staggered Jct. Saturn distances correct
8969:3795	8969	3795	128	173	-45	Staggered Jct. Saturn distances correct
13201:15522	13201	15522	975	1018	-43	Saturn distance incorrect.
15522:13201	15522	13201	975	1018	-43	Saturn distance incorrect.
13259:15329	13259	15329	20	57	-37	Saturn distance incorrect.
15329:13259	15329	13259	20	57	-37	Saturn distance incorrect.
14510:14590	14510	14590	50	86	-36	Saturn distance incorrect.
14590:14510	14590	14510	50	86	-36	Saturn distance incorrect.
1918:15272	1918	15272	55	89	-34	Saturn distance incorrect.
15272:1918	15272	1918	55	89	-34	Saturn distance incorrect.
13476:13296	13476	13296	50	83	-33	Saturn distance correct
13202:15524	13202	15524	240	270	-30	Saturn distance correct
15524:13202	15524	13202	240	270	-30	Saturn distance correct

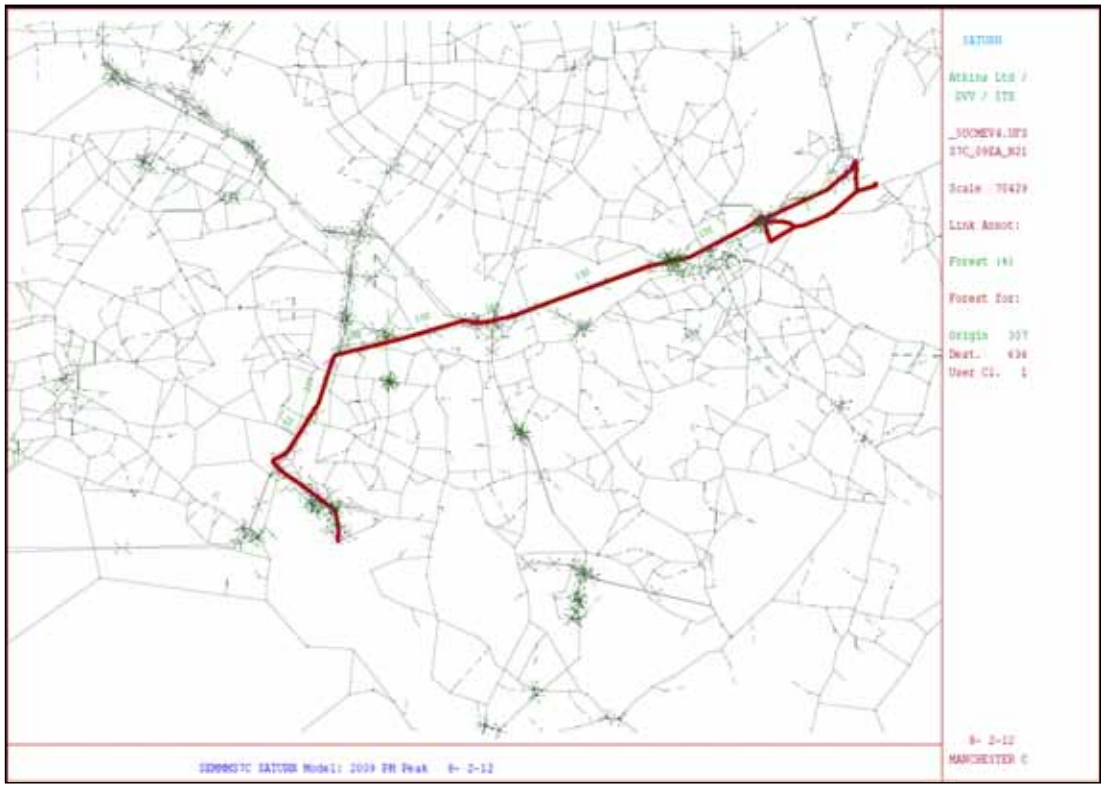
Appendix 2 SATURN Route Choice Tree Plots



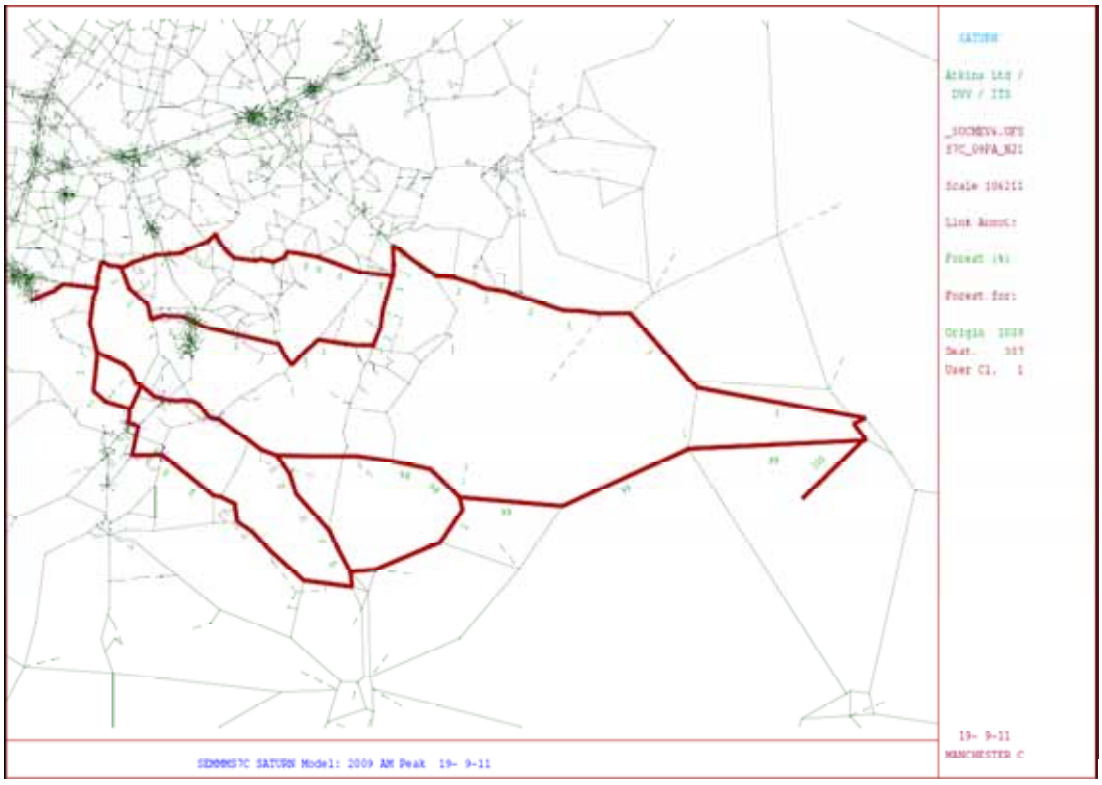
Bredbury to Manchester Airport – Common Route AM/IP/PM



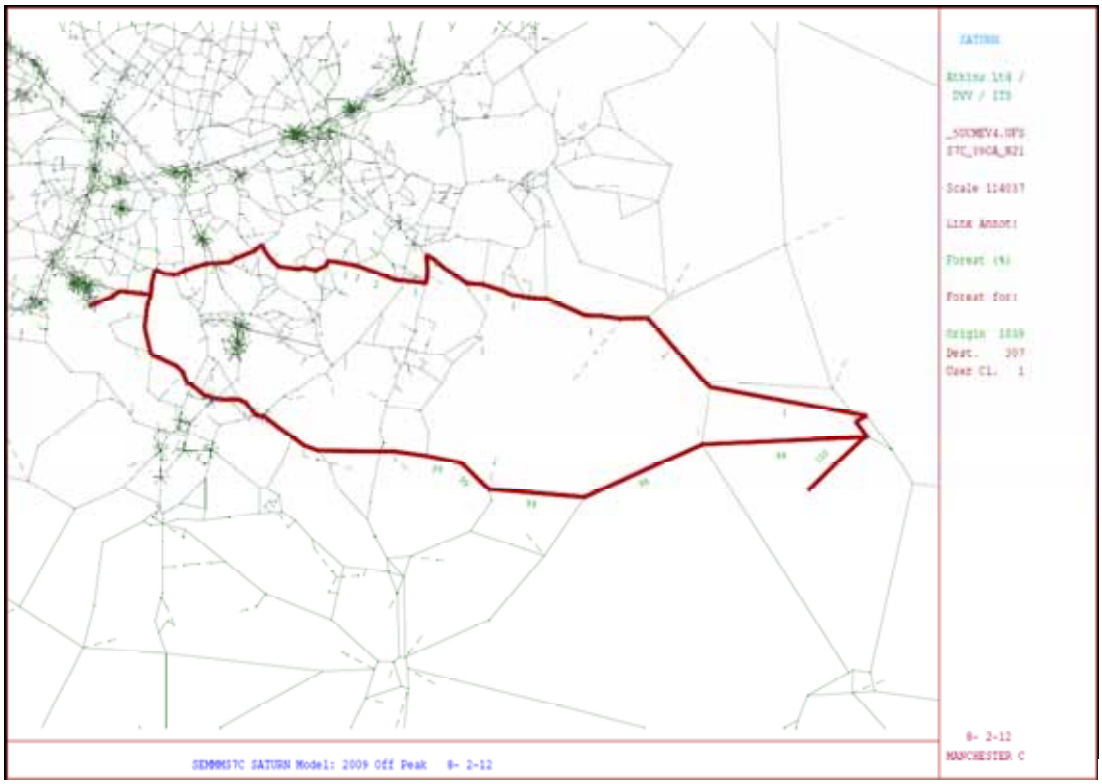
Manchester Airport to Bredbury – Common Route AM/IP



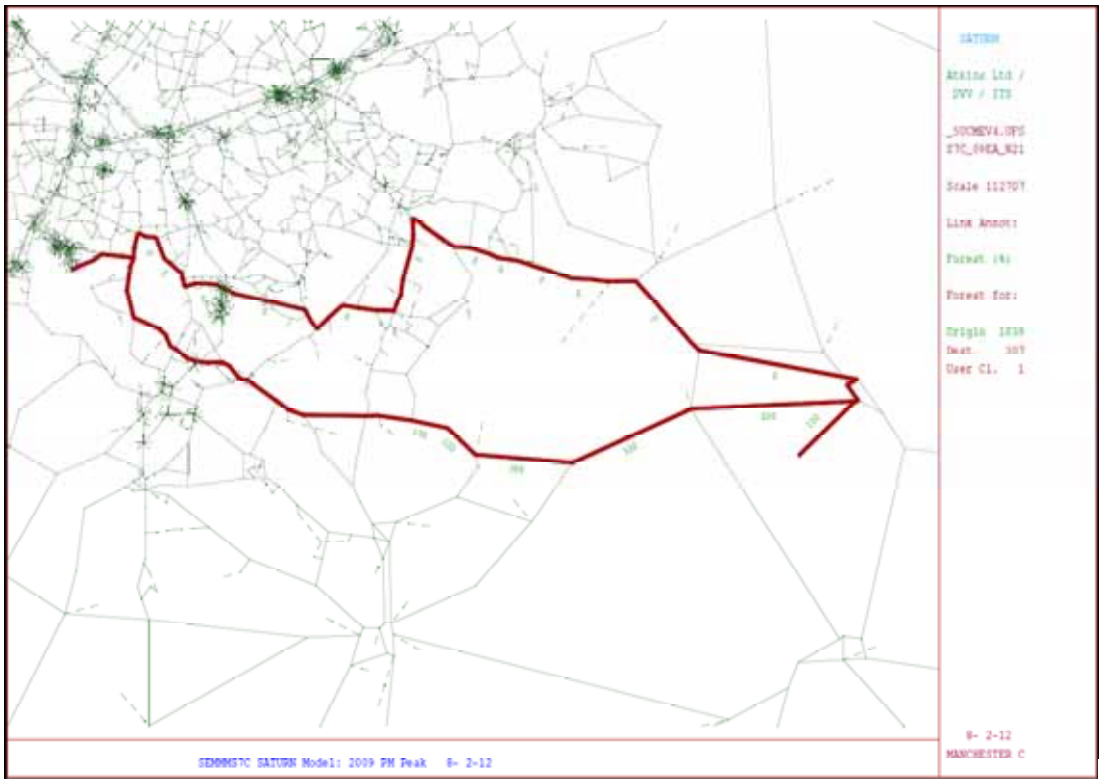
Manchester Airport to Bredbury – PM Peak Route



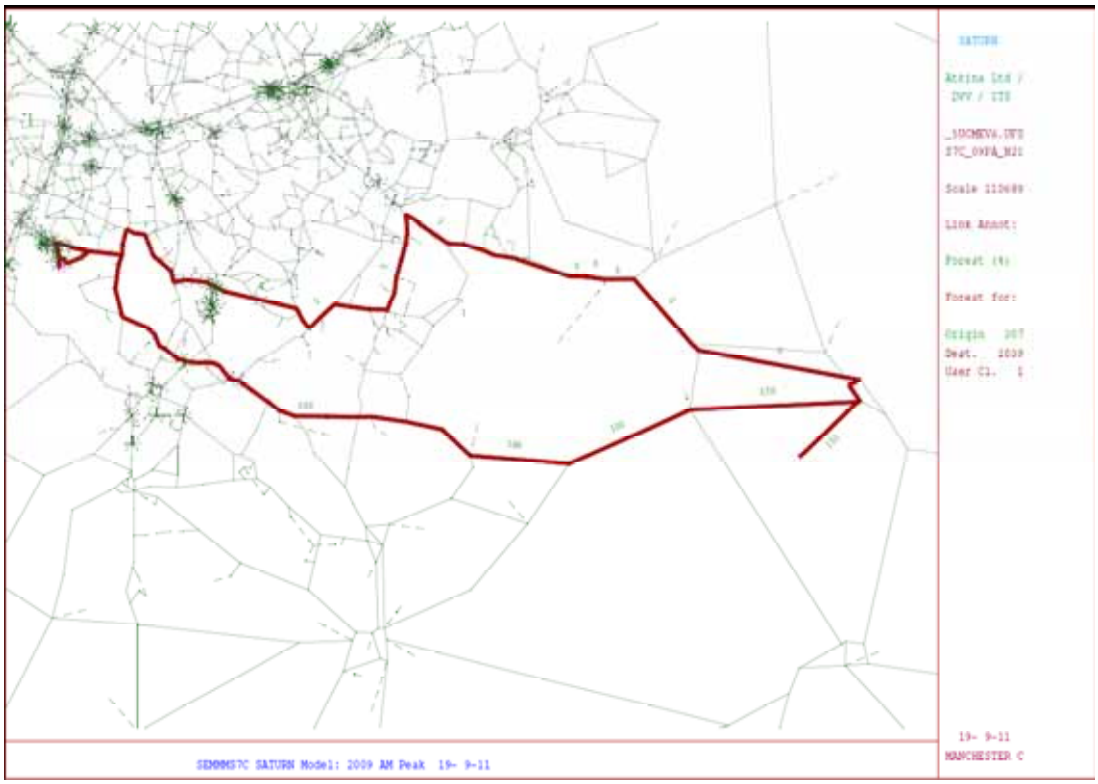
Chapel-en-le-Frith to Manchester Airport – AM Peak



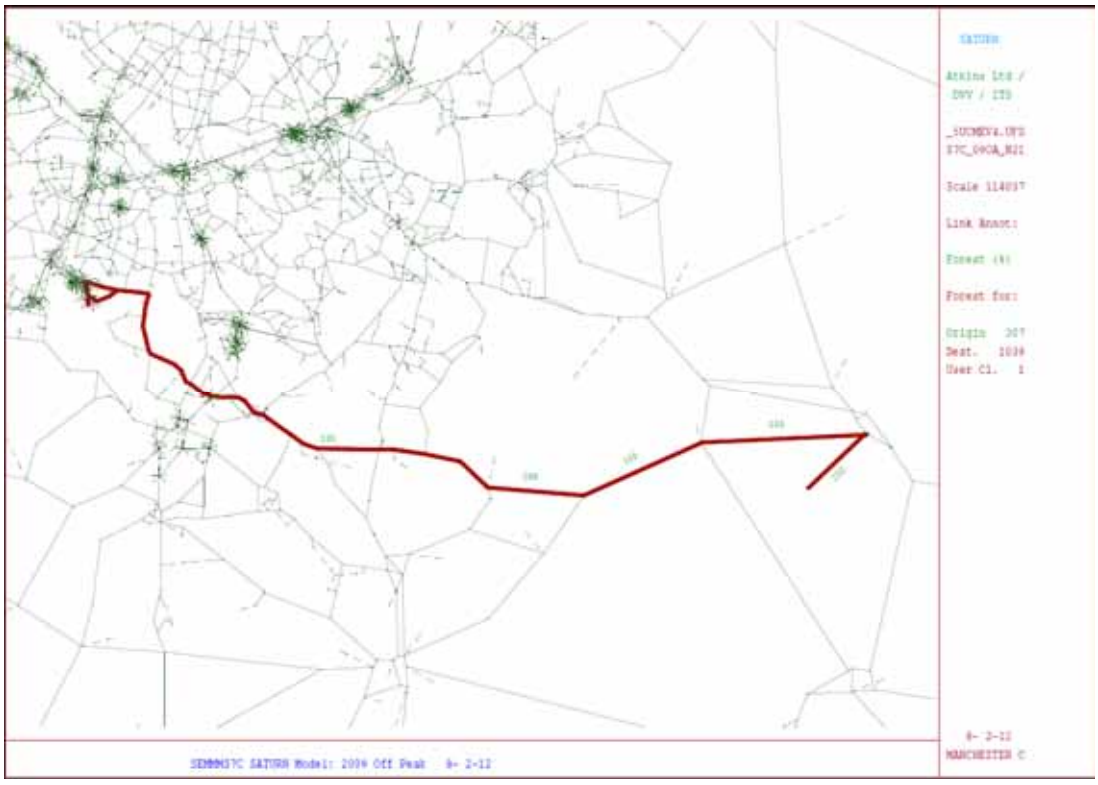
Chapel-en-le-Frith to Manchester Airport – Inter Peak



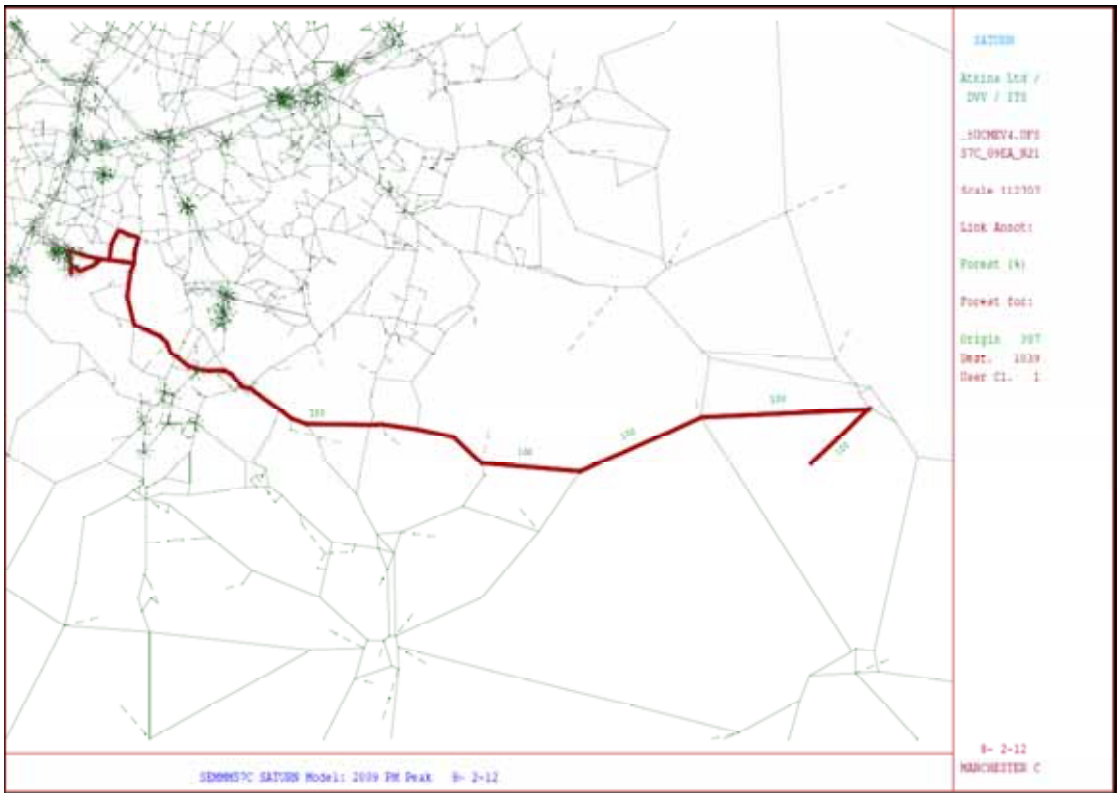
Chapel-en-le-Frith to Manchester Airport – PM Peak



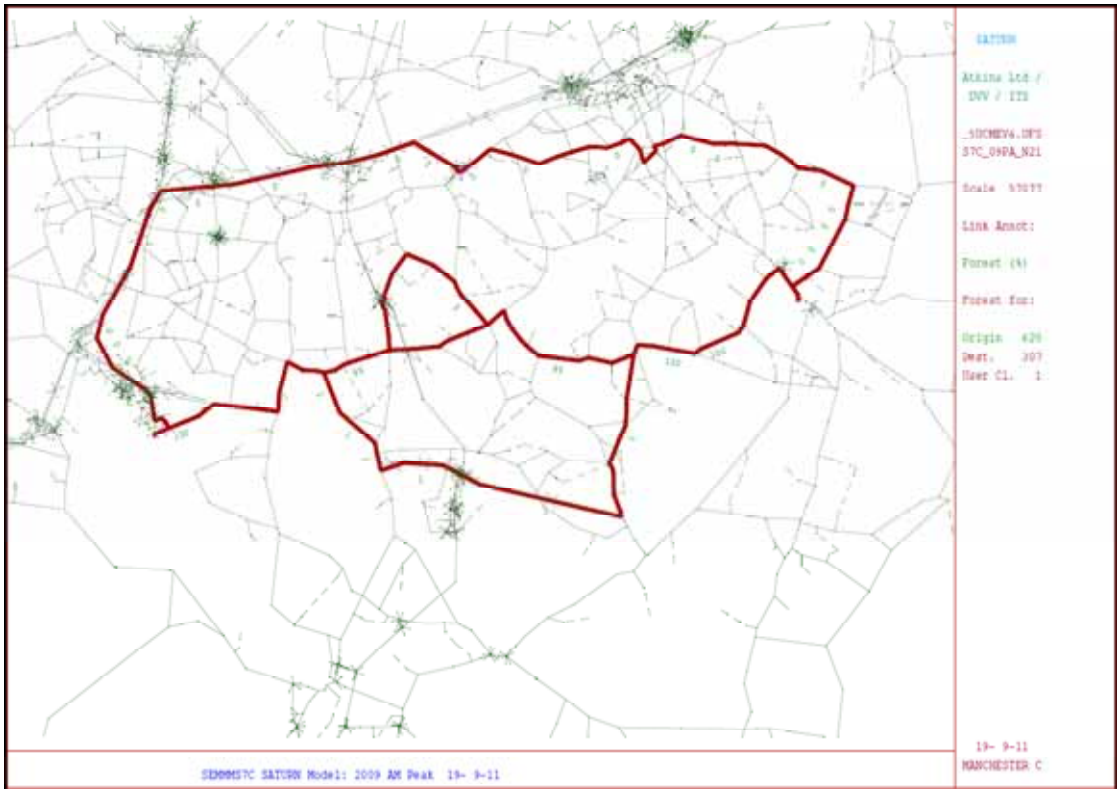
Manchester Airport to Chapel-en-le-Frith – AM Peak



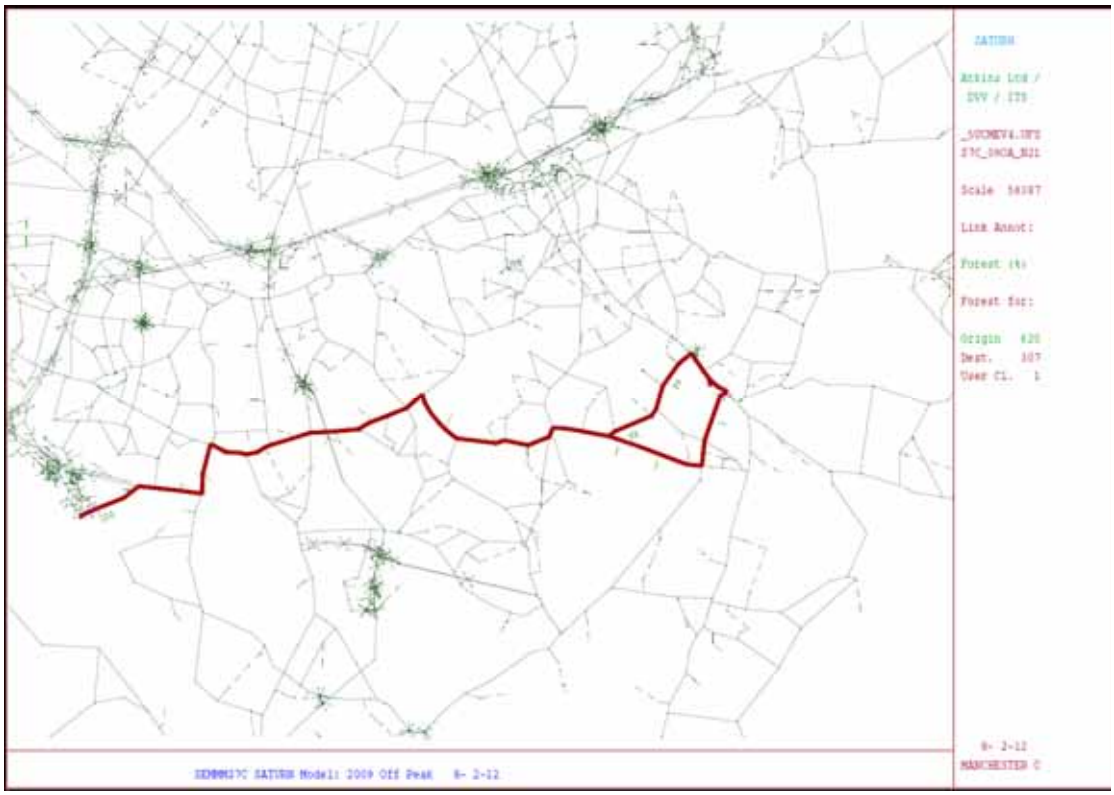
Manchester Airport to Chapel-en-le-Frith – Interpeak



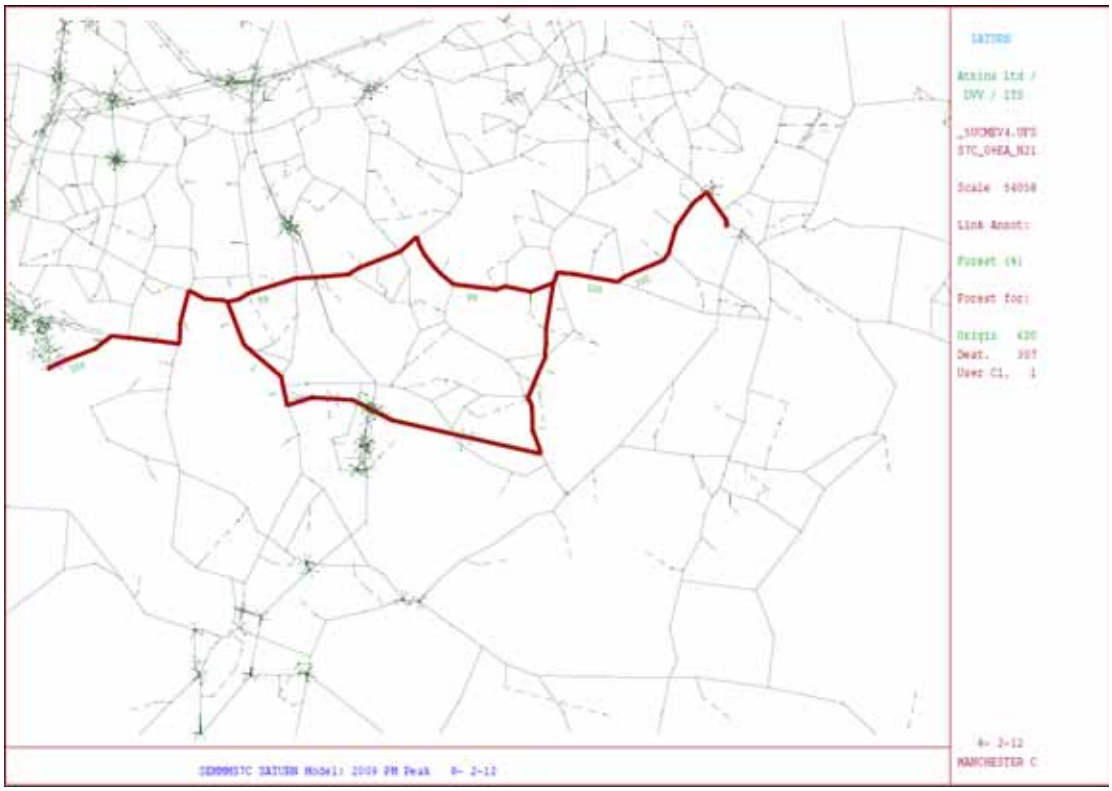
Manchester Airport to Chapel-en-le-Frith – PM Peak



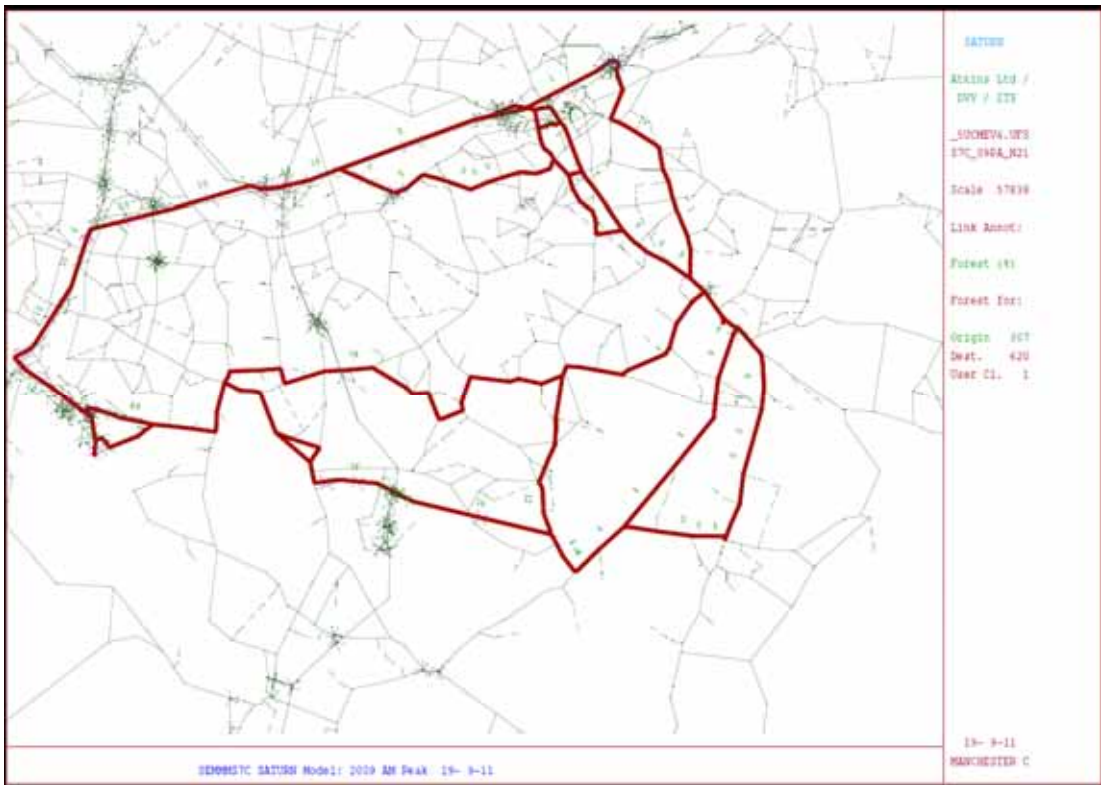
Hazel Grove to Manchester Airport – AM Peak



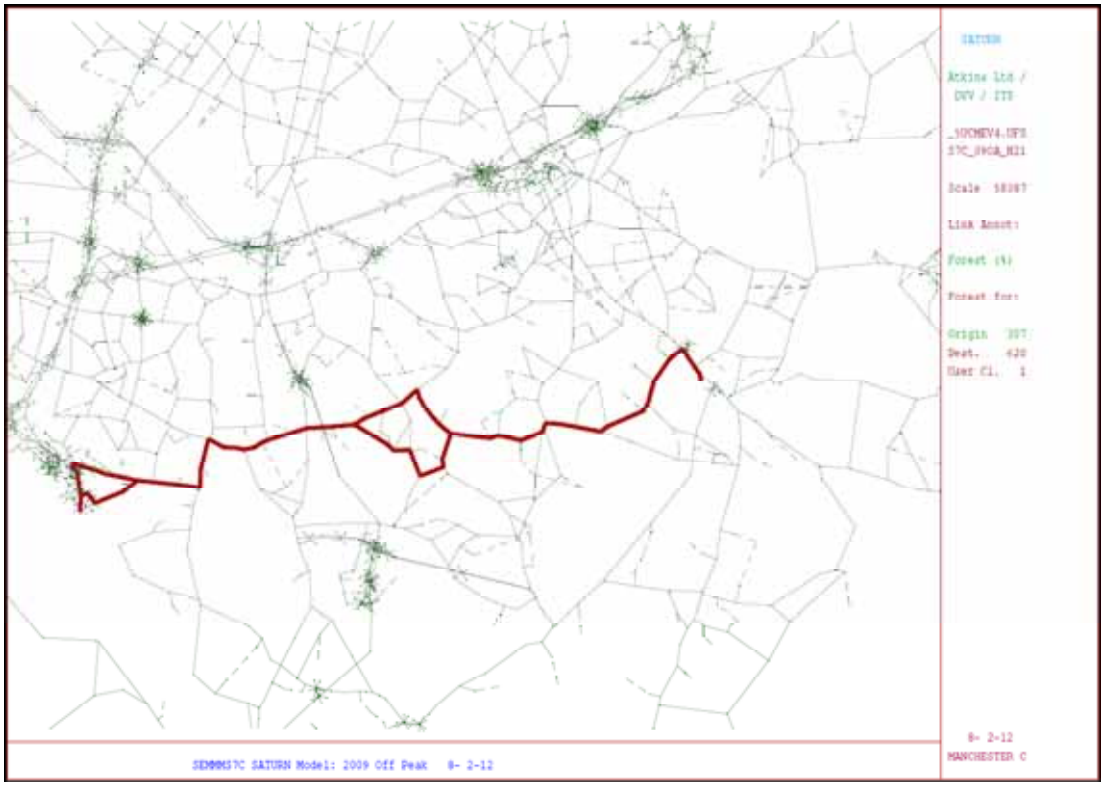
Hazel Grove to Manchester Airport – Interpeak



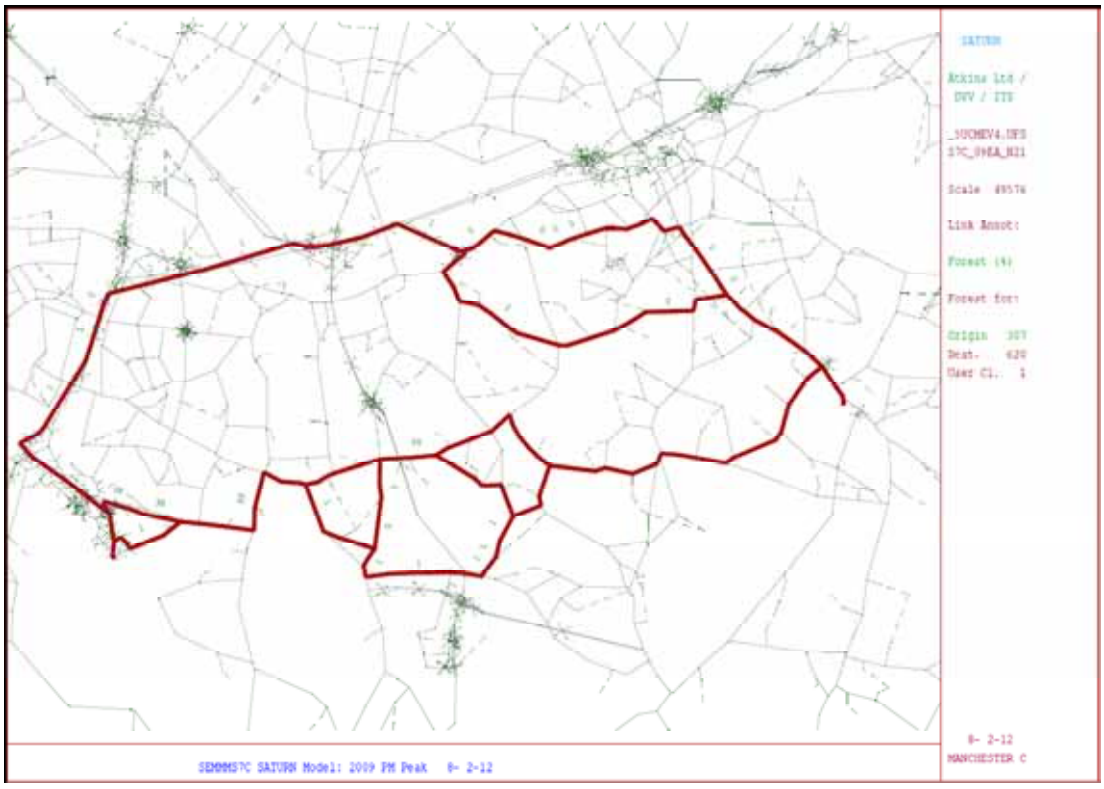
Hazel Grove to Manchester Airport – PM peak



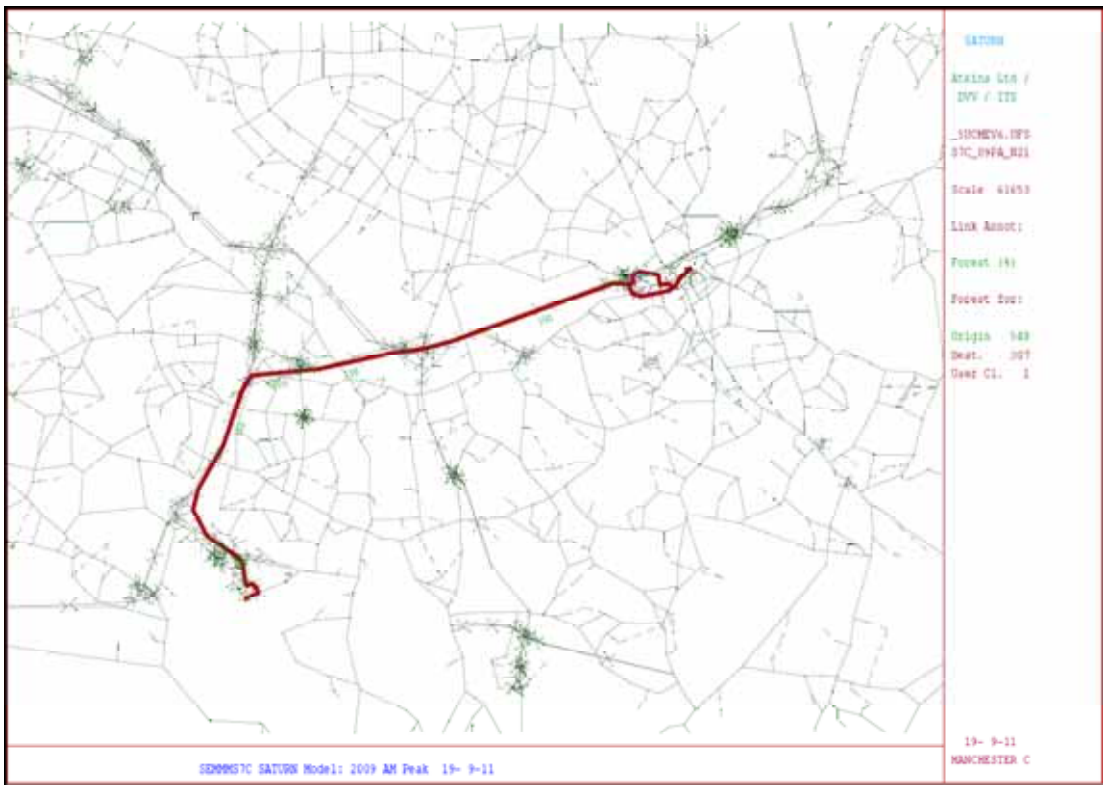
Manchester Airport to Hazel Grove – AM Peak



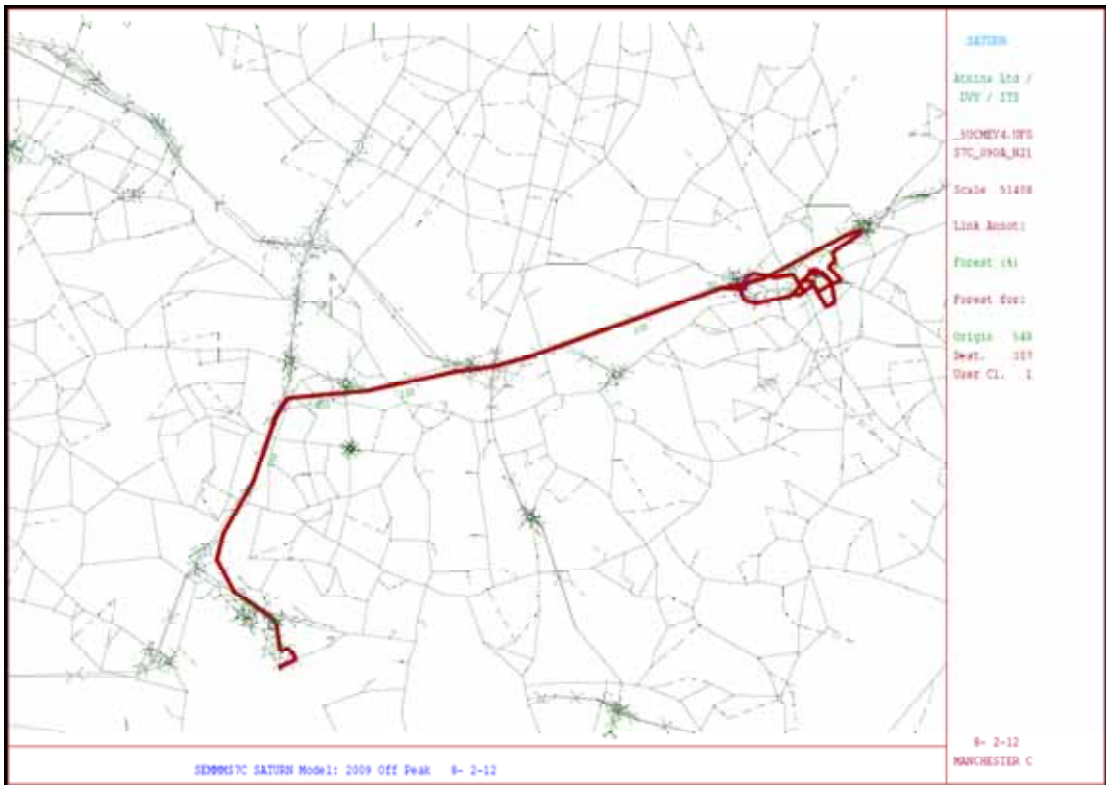
Manchester Airport to Hazel Grove – Interpeak



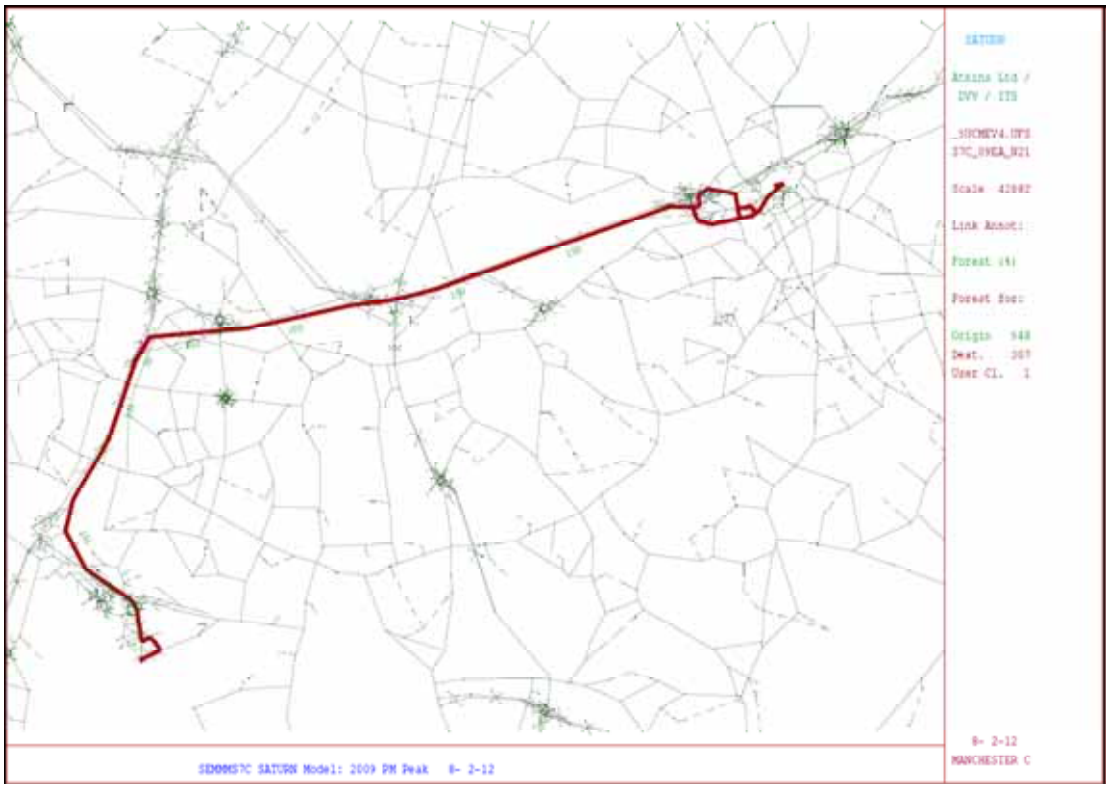
Manchester Airport to Hazel Grove – PM Peak



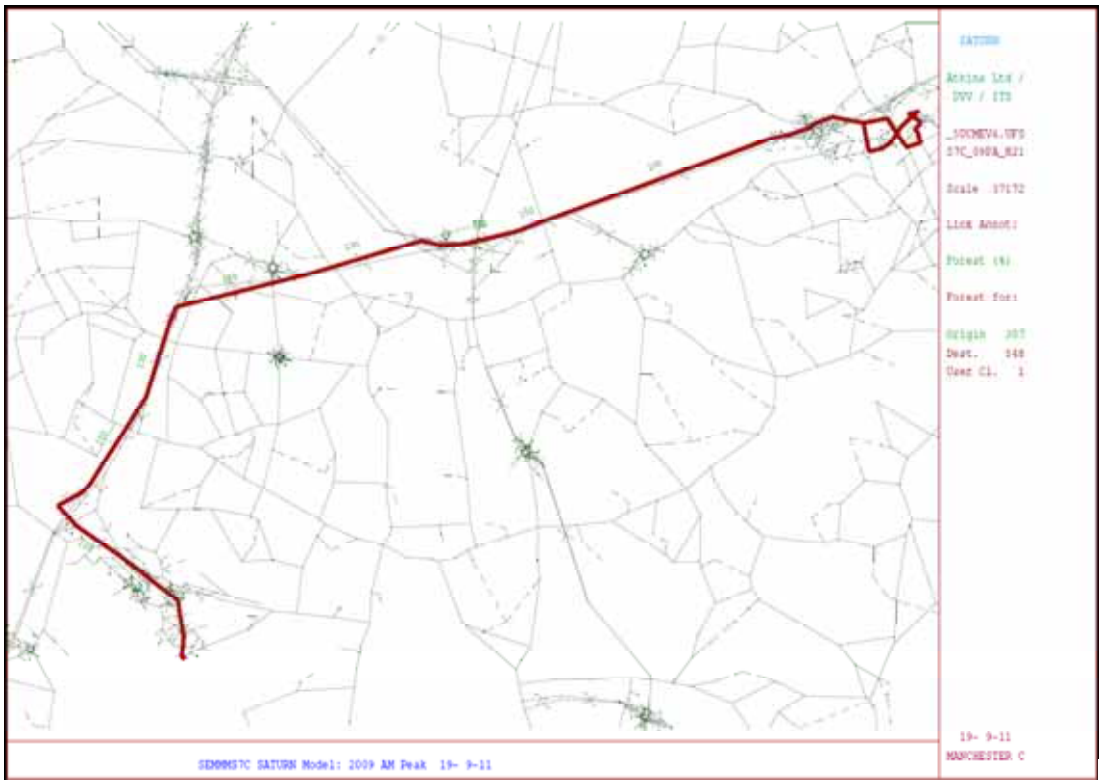
Stockport TC to Manchester Airport – AM Peak



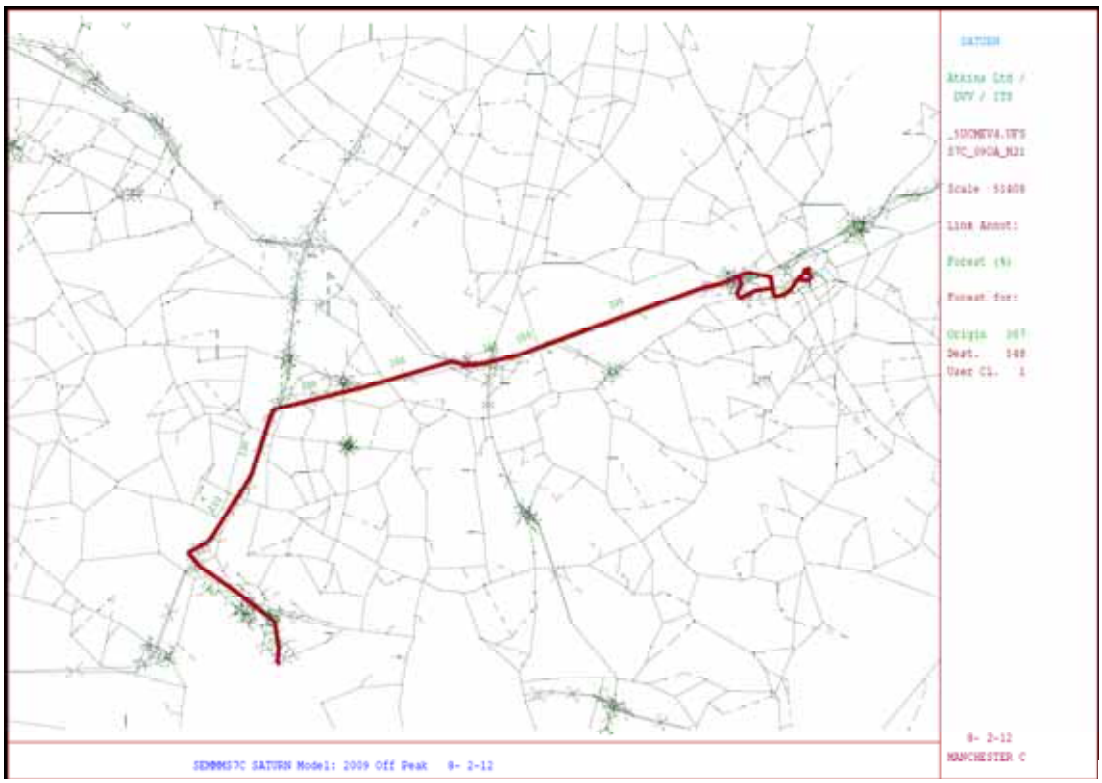
Stockport TC to Manchester Airport – Interpeak



Stockport TC to Manchester Airport – AM Peak



Manchester Airport to Stockport TC – AM Peak



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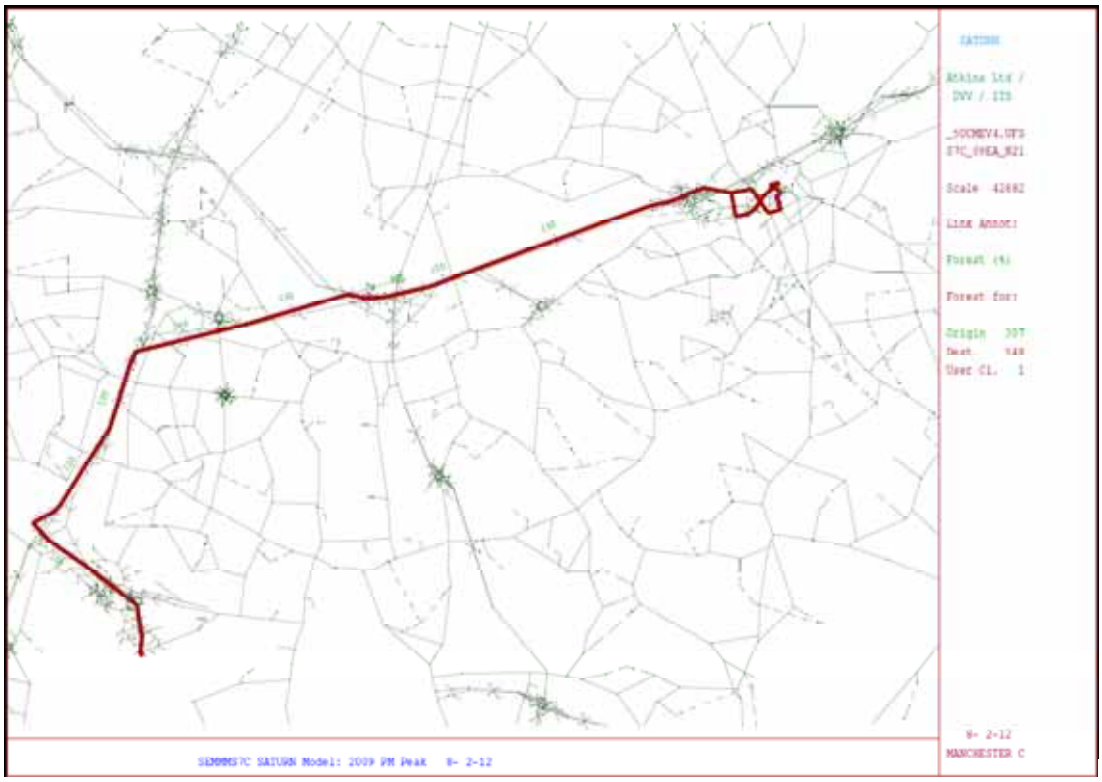
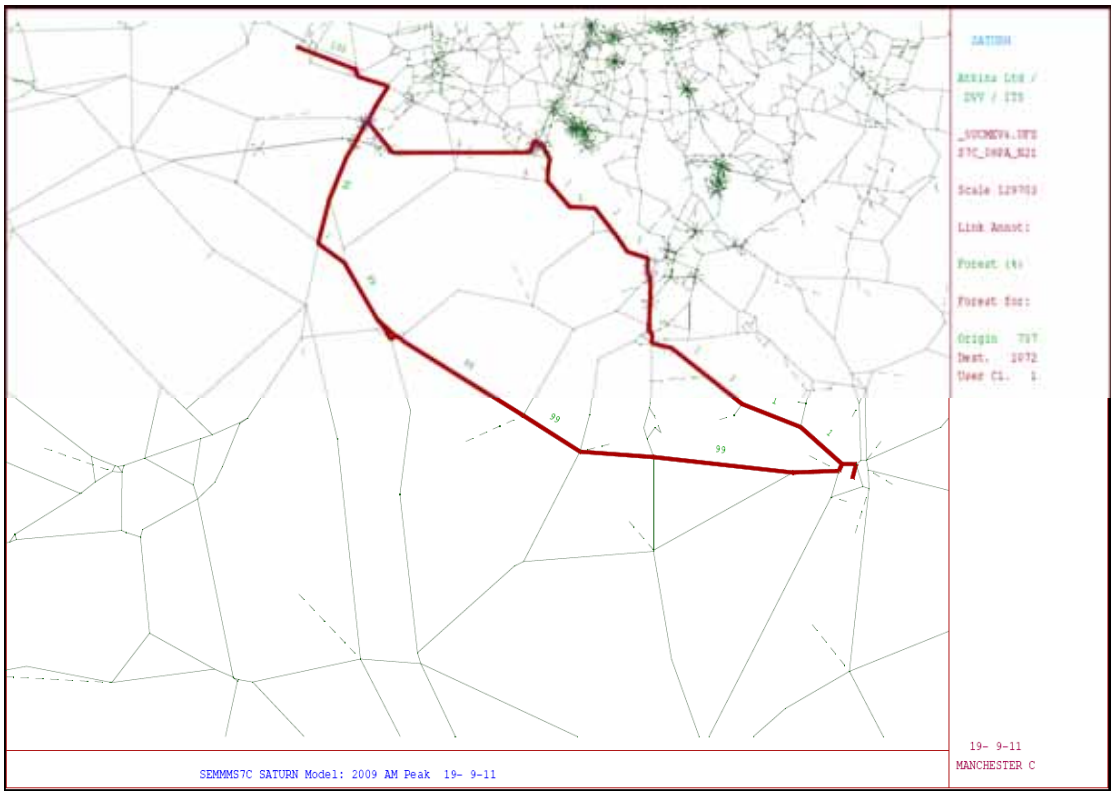
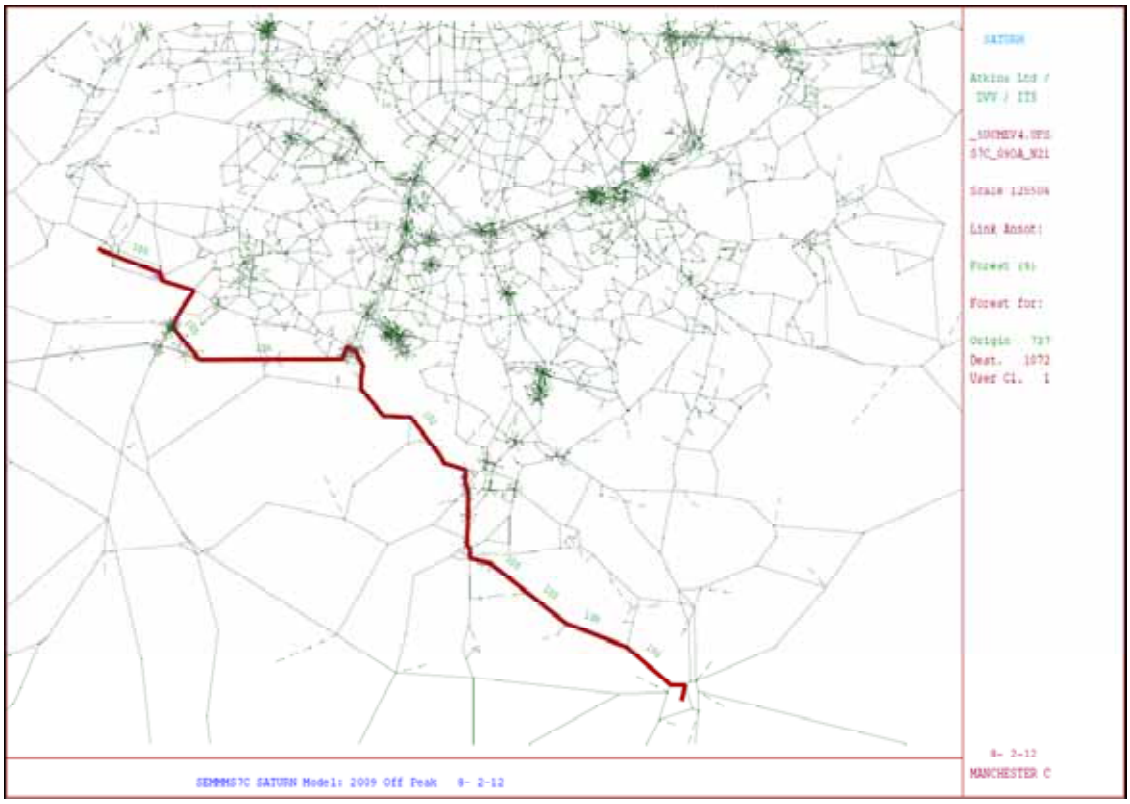


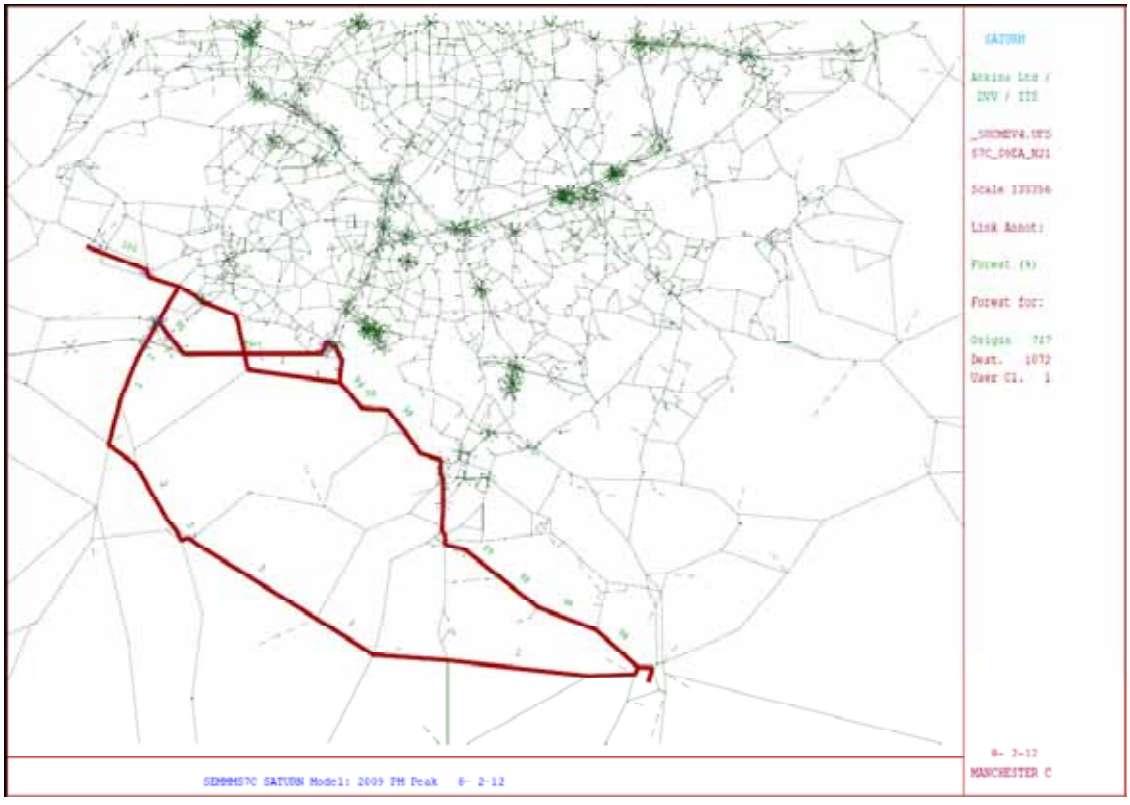
Manchester Airport to Stockport TC – PM Peak



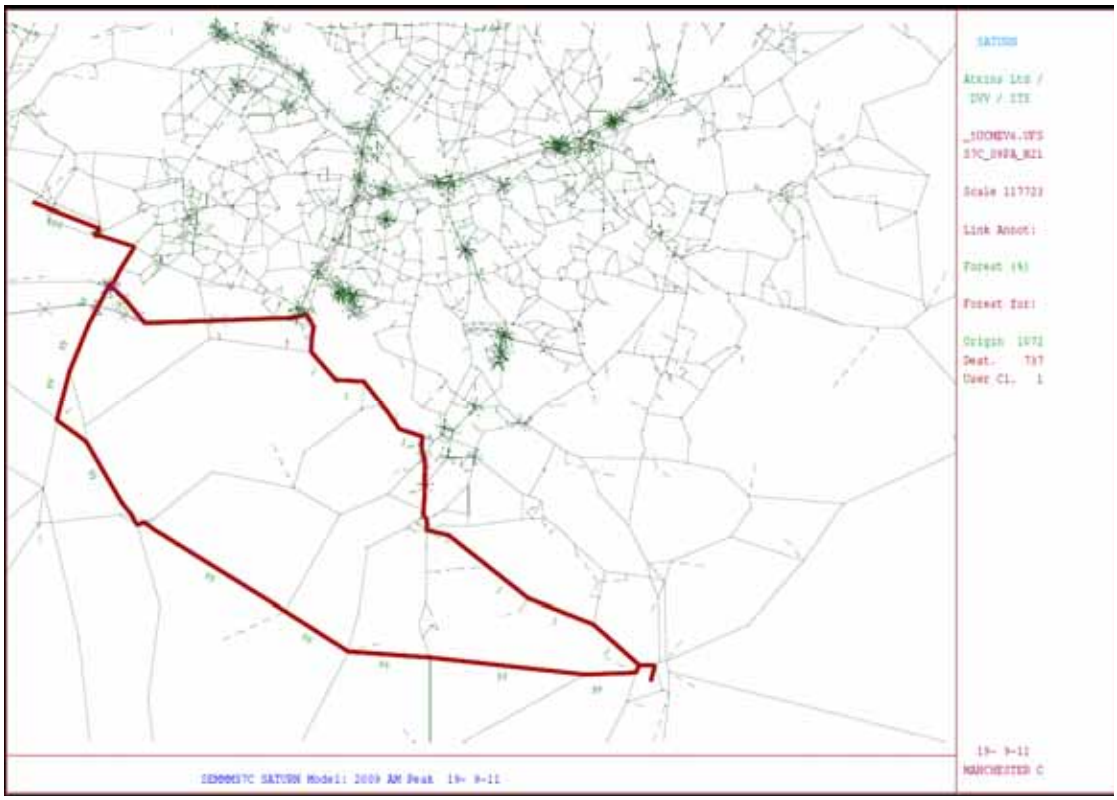
West Altrincham to Macclesfield– AM Peak



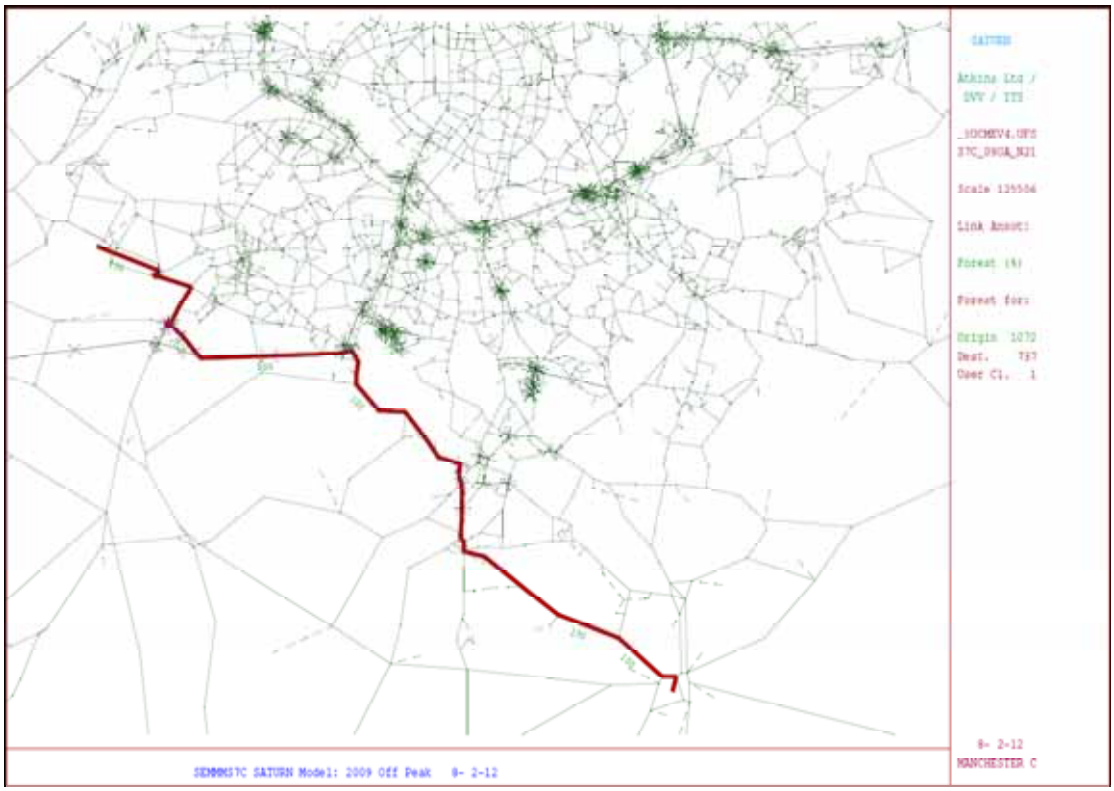
West Altrincham to Macclesfield– Interpeak



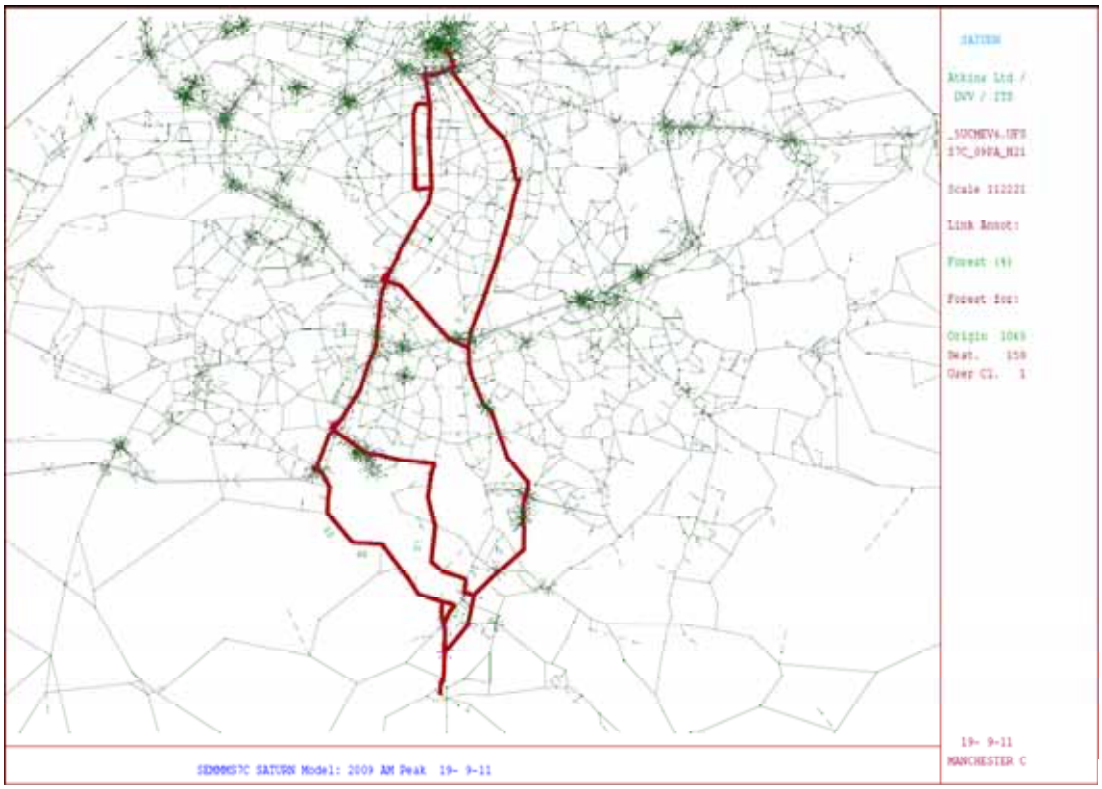
West Altrincham to Macclesfield– PM Peak



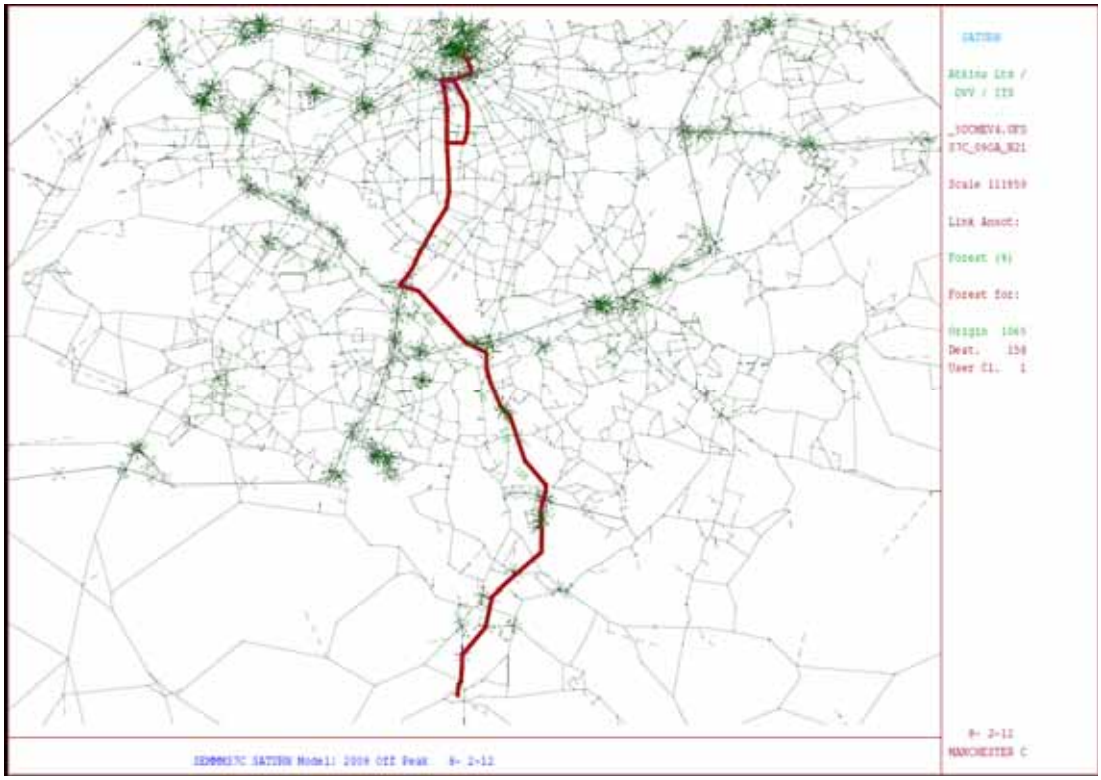
Macclesfield to West Altrincham – AM and PM Peaks



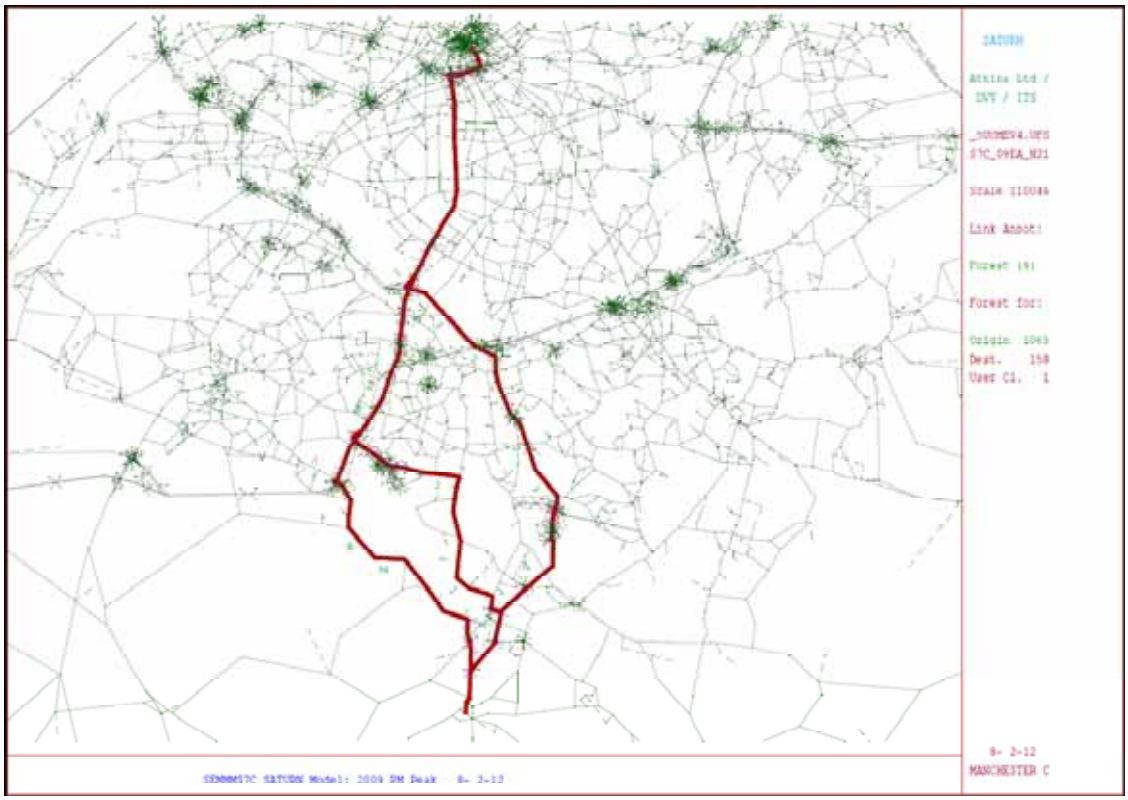
Macclesfield to West Altrincham – Interpeak



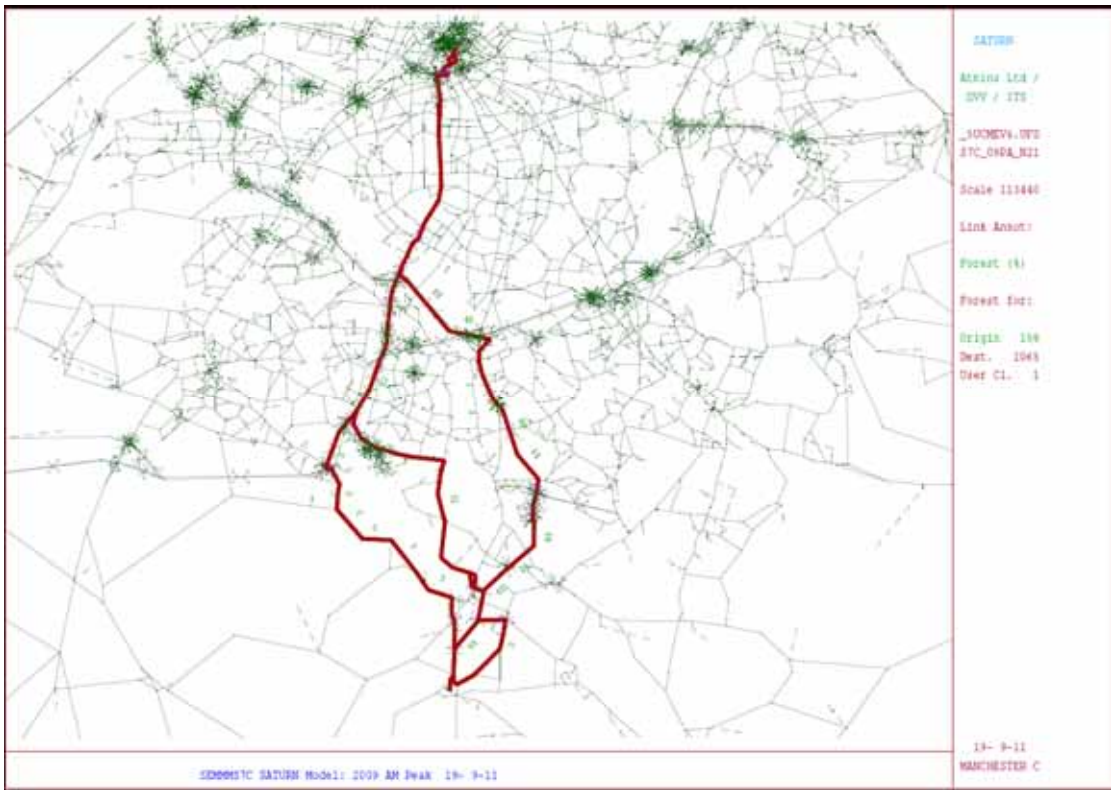
Alderley Edge to Manchester City Centre – AM Peak



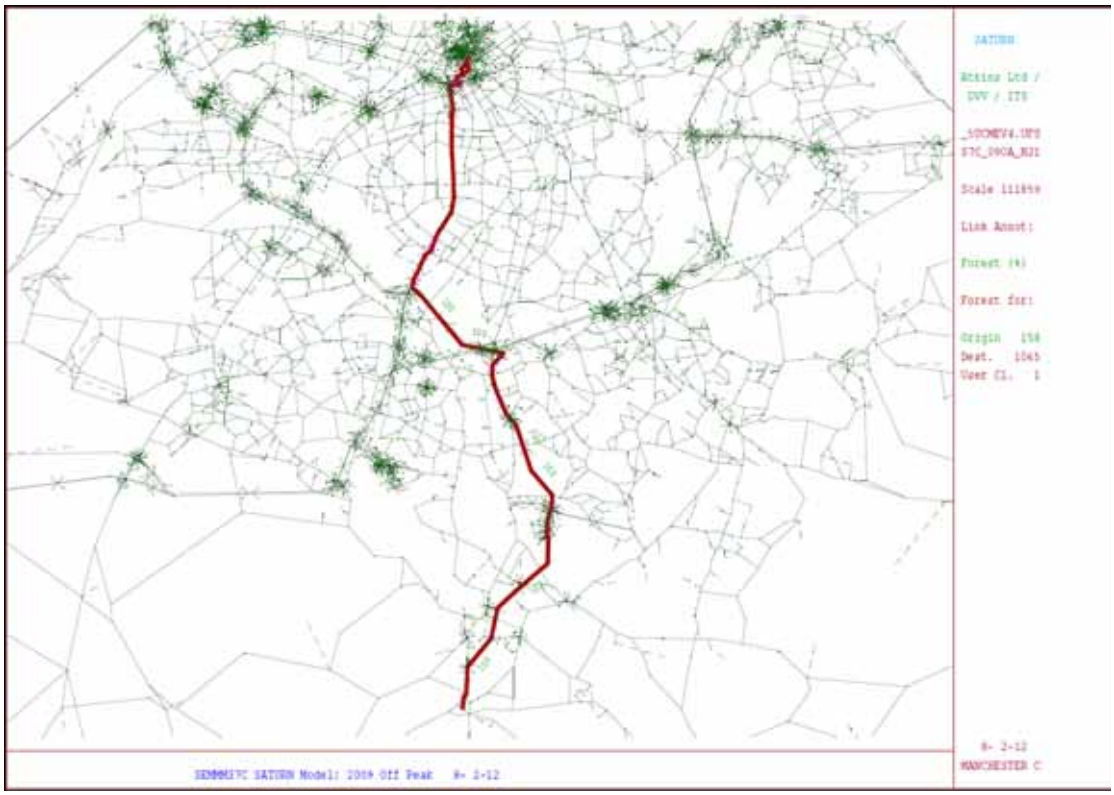
Alderley Edge to Manchester City Centre – Interpeakpeak



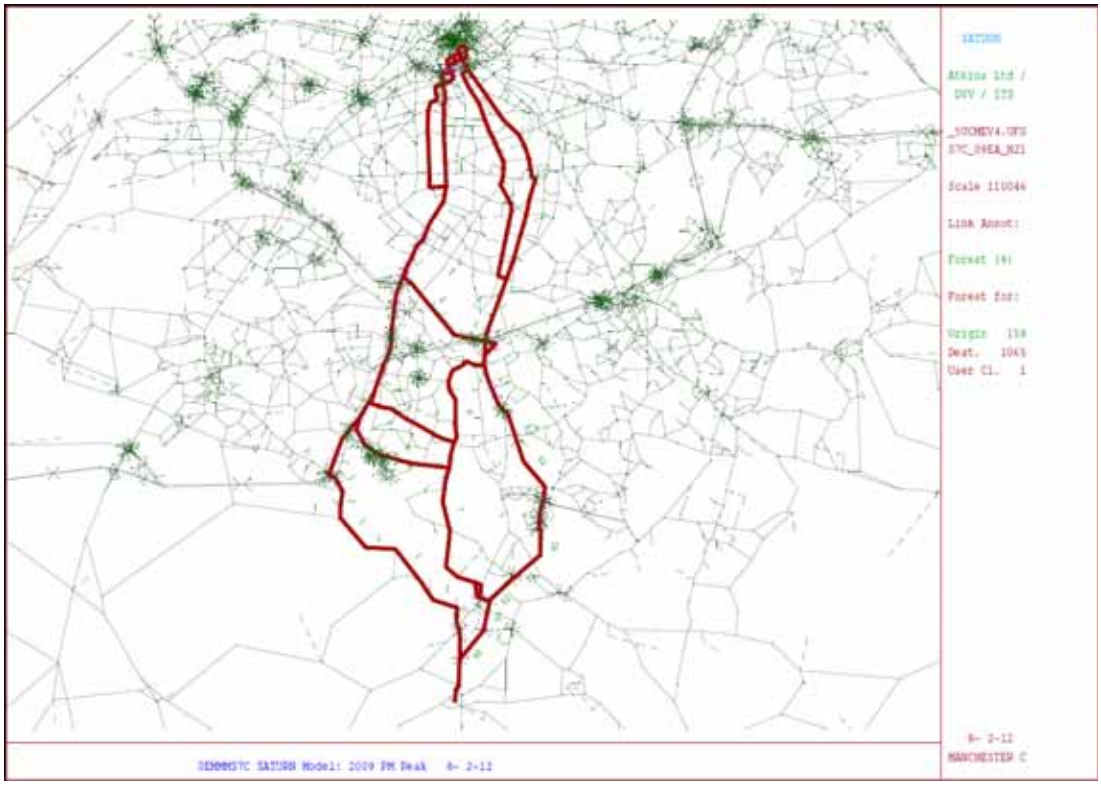
Alderley Edge to Manchester City Centre – PM Peak



Manchester City Centre to Alderley Edge – AM Peak



Manchester City Centre to Alderley Edge – Interpeak



Manchester City Centre to Alderley Edge – PM Peak

Appendix 3 Calculation of Generalised Cost for SEMMMS8

SEMMMS8 uses a set of user class specific generalised costs. These are calculated using an excel workbook prepared initially by MVA Consultancy The basic approach has been applied in a number of studies from the Greater Manchester TIF bid onwards, with regular reviews and updates to reflect the impact of changes to WebTAG parameters. The approach is summarised below

Basic Parameters

The basic parameter inputs to the calculation process consist of:

- Perceived Values of Time per person expressed as pence per hour at average 2002 prices and values, sourced from Tables 1 and 2 of WebTag Unit 3.5.6
- Vehicle Occupancies per trip by vehicle type and work/non-work, sourced from WebTag Unit 3.5.6, Table 4
- Vehicle Operating Costs (fuel) sourced from WebTag Unit 3.5.6 Table 10 (parameter values), Table 11 (Fuel cost factors) and Table 12 (fleet composition)
- Vehicle Operating Costs (non-fuel) sourced from WebTag Unit 3.5.6 Table 15
- Goods vehicle splits from GMTU monitoring (class by proportion of vehicles and proportion of veh/km) and GMATS RSI data (work, non-work).

All WebTag inputs are drawn from the April 2011 edition of Unit 3.5.6.

Growth Rates

Information on growth in parameter values is based on WebTag Unit 3.5.6, April 2011. Tables used are:

- Value of Time per person 2003-2052, Table 3
- Car passenger occupancy by period, 2000-2036, Table 6
- Fleet composition 2002-2031, Table 12
- Fuel Efficiency improvements 2002-2035, Table 13
- Fuel price – increase in resource cost/hr, Table 14; and
- Fuel Price – fuel costs, duties and VAT, Table 11.

Process – Worked Example - 2009 Car Work-Time AM Peak Hour

Value of Time (PPM)

Value of Time for car work-time driver 2002 = 2186 pence per hour
Growth in VOT for car work-time from 2002 to 2009 = 1.05
VOT for car work-time driver, 2009 = 2186*1.05 = 2296 pence per hour per person
Value of Time for car work-time passenger 2002 = 1566 pence per hour
Growth in VOT for car work-time from 2002 to 2009 = 1.05

VOT for car work-time passenger, 2009 = 1566*1.05 = 1645 pence per hour per person
Occupants per car work-time, 2000 = 1.20
Growth in Passengers from 2000 to 2009 (AM Peak) = 0.9576
Occupants per car work-time, 2009 = (1.20 – 1)*0.9576=0.19

Value of time, pence per hour at 2009 = 2296 + (1645*0.19) = 2611 pence
Value of time, pence per minute at 2009 = 2611/60 = 43.52 pence

Value of Distance (PPK)

Fuel Consumption (Petrol)

From WebTag, Consumption Formula is $L = (a + bV + cV^2 + dV^3) / V$

For Petrol:
A = 1.04285
B= 0.04484
C=-0.00005
D=0.0000021781
V= 37.8 kph (AM Peak Network speed)

Substituting in above formula
$L =(1.054285+0.04484*37.8+-0.00005*37.8^2+0.0000021781*37.8^3)/37.8$
L= 0.07368

Growth adjustment for Petrol based on WebTag Unit 3.5.6, Table 13
= 0.07368*0.94 = 0.0695

For Diesel

A = 0.48099
B= 0.06450
C=-0.00058
D=0.0000045416
V= 37.8 kph

Substituting in above formula

$L = (0.48099+0.06450*37.8+-0.00058*37.8^2+0.0000045416*37.8^3)/37.8$
L= 0.06188

Growth adjustment for Diesel based on WebTag Unit 3.5.6, Table 13
= 0.06188*0.92 = 0.570

Fuel Price Per Litre

Price = Resource Cost + Duty + VAT

Petrol

Resource Cost = Fuel Cost Factor*(2009 Resource Cost Growth Factor/2005 Resource Cost Growth Factor) = 25 * (1.617/1.497) = 27.00

Fuel Duty = Duty*(2009 Duty Growth Factor/2005 Duty Growth Factor) =43.7 * (1.002/0.954) = 45.51

VAT = 2009 VAT Rate * Fuel Cost Factor = 0 * 1 = 0

Petrol price = (27 + 45.51)*0 = 72.51p/ltr

Diesel

Resource Cost = Fuel Cost Factor*(2009 Resource Cost Growth Factor/2005 Resource Cost Growth Factor) = 28 * (1.636/1.522) = 30.10

Fuel Duty = Duty*(2009 Duty Growth Factor/2005 Duty Growth Factor) = 43.7 * (1.002/0.954) = 45.51

VAT = 2009 VAT Rate * Fuel Cost Factor = 0* 1 = 0

Diesel price = (30.1 + 45.51)*0= 75.61p/ltr

Cost Per Km

Proportion of fleet using petrol & diesel

2009 Petrol = 0.621
2009 Diesel = 0.379

Petrol = 0.0695*72.51*0.621 = 3.129
Diesel = 0.0570*75.61*0.379 = 1.633
Cost per KM = 4.76

Vehicle Operating Costs – Non-Fuel
Based on formula C=a1 + b1/v

For car work-time:
A1=4.069
B1= 111.391

VOC (Non-Fuel) = 4.069 + 111.391/37.8 = 7.016

Final Values:

PPM= 43.52
PPK = (4.76+7.016) =11.78

Appendix 4 Technical Note on Synthesis of Trips for Prior Matrix

Technical Note 13 Version: 2

Table 8.2 Comparison of 12 hour Car Person Trip Totals (Prior to Matrix Estimation) with TEMPRO

Purpose	SEMMMS 12-hour Matrix Totals	SEMMMS 12-hour Purpose Share	TEMPRO Purpose shares for GM	Percentage Observed
Home Based Work	4,149,179	22%	27%	14%
Home Based Employers Business	382,294	2%	3%	21%
Home Based Education	1,182,442	6%	9%	7%
Home Based Shop	2,449,690	13%	17%	15%
Home Based Other	7,538,402	39%	33%	8%
Non-Home Based Employers Business	293,986	2%	2%	60%
Non-Home Based Other	3,202,527	17%	9%	14%
Totals	**19,198,519**	**100%**	**100%**	**12%**

8.3.1 Table 8.3 shows 12 hour car person trip totals for trips to/from and within the AofI, prior to matrix estimation. The area for which full representations of travel demand are included in the model contains a population four times the 2.5 million population of Greater Manchester. Consequently, despite the geographical coverage of the RIS cordons only 12% of car trip making in the whole model has been observed (see Table 8.2). However, the proportion of demand to/from and within the AofI that has been observed is considerably higher at 29% (see Table 8.3). Despite this a large proportion of the car demand matrix required synthesis.

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Highway Demand Matrices 9

Note – Double click on above sheet to access whole document

Appendix 5 Fully Observed Matrices with and without the Double Counting Factors

Table 5.1 Fully Observed AM Peak Hour Matrix Totals With and Without the Application of Double Counting Factors (Vehicles)			
Journey Purpose/Vehicle Type	**Applying Double Counting Factors**	**Without Applying Double Counting Factors**	**Percentage Difference**
Home to Work Car	72,565	73,160	-0.8
Work to Home Car	2,853	2,878	-0.9
Home to Education Car	4,875	4,896	-0.4
Education to Home Car	1,197	1,210	-1.1
Home to Shopping Car	2,035	2,041	-0.3
Shopping to Home Car	675	682	-1.0
Home to Employer's Business Car	4,736	4,783	-1.0
Employer's Business to Home Car	288	293	-1.7
Home to Other Car	10,535	10,600	-0.6
Other to Home Car	4,228	4,246	-0.4
All Home Based Car	**103,986**	**104,788**	**-0.8**
Non-Home Based Employers Business Car	3,756	3,779	-0.6
Non-Home Based Other Car	10,484	10,571	-0.8
All Non-Home Based Car	**14,239**	**14,351**	**-0.8**
All Car	**118,226**	**119,139**	**-0.8**
Light Goods Vehicles	**16,381**	**16,515**	**-0.8**
Other Goods Vehicles	**5,993**	**6,023**	**-0.5**
Total	**140,600**	**141,677**	**-0.8**

Table 5.2 Fully Observed Average Inter-Peak Hour Matrix Totals With and Without the Application of Double Counting Factors (Vehicles)			
Journey Purpose/Vehicle Type	**Applying Double Counting Factors**	**Without Applying Double Counting Factors**	**Percentage Difference**
Home to Work Car	11,073	11,172	-0.9
Work to Home Car	11,925	12,070	-1.2
Home to Education Car	1,876	1,896	-1.0
Education to Home Car	1,888	1,917	-1.6
Home to Shopping Car	12,684	12,783	-0.8
Shopping to Home Car	11,986	12,112	-1.0
Home to Employer's Business Car	2,864	2,899	-1.2
Employer's Business to Home Car	2,948	2,991	-1.4
Home to Other Car	16,172	16,313	-0.9
Other to Home Car	14,296	14,430	-0.9
All Home Based Car	**87,711**	**88,582**	**-1.0**
Non-Home Based Employers Business Car	18,967	19,192	-1.2
Non-Home Based Other Car	24,772	24,983	-0.9
All Non-Home Based Car	**43,739**	**44,175**	**-1.0**
All Car	**131,450**	**132,757**	**-1.0**
Light Goods Vehicles	**21,445**	**21,640**	**-0.9**
Other Goods Vehicles	**8,589**	**8,644**	**-0.6**
Total	**161,484**	**163,041**	**-1.0**

Table 5.3 Fully Observed PM Peak Hour Matrix Totals With and Without the Application of Double Counting Factors (Vehicles)			
Journey Purpose/Vehicle Type	**Applying Double Counting Factors**	**Without Applying Double Counting Factors**	**Percentage Difference**
Home to Work Car	3,758	3797.43	-1.1
Work to Home Car	76,823	77950.99	-1.5
Home to Education Car	1,166	1171.83	-0.5
Education to Home Car	2,660	2688.73	-1.1
Home to Shopping Car	3,588	3611.77	-0.7
Shopping to Home Car	9,378	9492.13	-1.2
Home to Employer's Business Car	779	788.31	-1.2
Employer's Business to Home Car	5,613	5671.97	-1.0
Home to Other Car	13,349	13456.72	-0.8
Other to Home Car	17,992	18182.83	-1.1
All Home Based Car	**135,107**	**136,813**	**-1.3**
Non-Home Based Employers Business Car	4,645	4703.84	-1.3
Non-Home Based Other Car	17,821	18039.87	-1.2
All Non-Home Based Car	**22,466**	**22,744**	**-1.2**
All Car	**157,573**	**159,556**	**-1.3**
Light Goods Vehicles	**12,938**	**13064.27**	**-1.0**
Other Goods Vehicles	**2,814**	**2829.63**	**-0.6**
Total	**173,325**	**175,450**	**-1.2**

Appendix 6 Prior and Estimated Matrix Comparisons by Sector

Table Number	Description
A2.1	AM Peak Hour Car Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.2	AM Peak Hour LGV Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.3	AM Peak Hour OGV Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.4	AM Peak Hour PCU Sector to Sector Comparison – Final Versus Penultimate Estimated Matrix
A2.5	Inter-Peak Hour Car Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.6	Inter-Peak Hour LGV Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.7	Inter-Peak Hour OGV Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.8	Inter-Peak Hour PCU Sector to Sector Comparison – Final Versus Penultimate Estimated Matrix
A2.9	PM Peak Hour Car Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.10	PM Peak Hour LGV Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.11	PM Peak Hour OGV Sector to Sector Comparison - Prior Versus Estimated Matrix
A2.12	PM Peak Hour PCU Sector to Sector Comparison – Final Versus Penultimate Estimated Matrix

Table A2.1 AM Peak Hour Car Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	460.4	2596.5	19482.8	540.0	5125.6	122.0	1154.6	165.3	174.5	83.5	2267.6	1803.9	33976.8
	After	455.6	2163.8	18333.3	557.7	4265.4	178.9	1046.1	293.2	221.8	70.1	1935.2	1848.3	31369.3
	Perc Diff	-1.0%	-16.7%	-5.9%	3.3%	-16.8%	46.7%	-9.4%	77.3%	27.1%	-16.1%	-14.7%	2.5%	-7.7%
2	Prior	1276.2	746.6	572.3	19287.5	7320.2	427.7	264.3	625.3	296.2	78.5	275.6	1970.5	33140.8
	After	1320.8	778.4	641.4	18078.1	7651.3	429.7	203.9	358.1	247.4	136.1	455.8	1816.0	32117.0
	Perc Diff	3.5%	4.3%	12.1%	-6.3%	4.5%	0.5%	-22.9%	-42.7%	-16.5%	73.2%	65.4%	-7.8%	-3.1%
3	Prior	1061.6	1430.1	3666.7	3645.6	63019.4	290.5	479.7	1662.0	2229.7	745.4	4320.6	4318.1	86869.4
	After	1322.4	2178.5	3324.7	3728.3	61410.3	376.2	587.3	1984.8	2422.8	769.9	4043.4	4698.0	86846.7
	Perc Diff	24.6%	52.3%	-9.3%	2.3%	-2.6%	29.5%	22.4%	19.4%	8.7%	3.3%	-6.4%	8.8%	0.0%
4	Prior	182.6	310.7	122.6	625.2	888.3	5280.8	638.3	467.5	72.5	11.8	67.8	5516.8	14185.1
	After	220.3	471.9	144.0	601.0	621.5	5292.2	492.5	399.4	32.0	7.5	111.6	5600.1	13993.9
	Perc Diff	20.7%	51.9%	17.5%	-3.9%	-30.0%	0.2%	-22.8%	-14.6%	-55.9%	-36.2%	64.6%	1.5%	-1.3%
5	Prior	306.0	1290.4	1550.5	419.9	1950.5	620.2	11115.4	168.4	121.4	58.4	463.5	5053.2	23117.6
	After	123.4	1040.5	954.0	203.2	718.9	341.5	10453.2	76.3	52.6	12.9	203.0	4452.1	18631.7
	Perc Diff	-59.7%	-19.4%	-38.5%	-51.6%	-63.1%	-44.9%	-6.0%	-54.7%	-56.7%	-77.8%	-56.2%	-11.9%	-19.4%
6	Prior	240.3	149.5	183.6	961.3	5409.0	399.2	145.0	34188.0	4915.9	214.0	395.2	15592.0	62793.2
	After	289.8	152.0	168.3	684.7	4129.0	375.4	106.5	31239.9	4140.2	124.5	247.6	12761.1	54419.1
	Perc Diff	20.6%	1.7%	-8.4%	-28.8%	-23.7%	-6.0%	-26.5%	-8.6%	-15.8%	-41.8%	-37.4%	-18.2%	-13.3%
7	Prior	142.5	120.2	212.4	450.6	6324.4	46.1	65.8	2898.2	34871.3	1330.8	894.6	4589.8	51946.8
	After	119.2	125.3	168.7	247.3	4574.5	5.0	43.2	2538.5	32505.9	1718.1	879.9	3987.5	46913.1
	Perc Diff	-16.3%	4.2%	-20.6%	-45.1%	-27.7%	-89.2%	-34.3%	-12.4%	-6.8%	29.1%	-1.6%	-13.1%	-9.7%
8	Prior	47.9	44.9	94.4	90.1	1479.9	19.4	32.3	131.5	1368.6	13717.5	2448.9	1810.4	21285.8
	After	50.1	63.3	103.3	71.8	1177.3	0.5	16.2	107.8	1429.9	13314.7	2746.1	1657.3	20738.2
	Perc Diff	4.5%	41.0%	9.5%	-20.4%	-20.4%	-97.7%	-49.9%	-18.0%	4.5%	-2.9%	12.1%	-8.5%	-2.6%
9	Prior	182.2	252.0	2245.2	299.4	7568.6	67.9	160.0	263.9	632.0	2204.9	33531.8	2441.2	49849.0
	After	196.7	227.6	1822.4	280.3	6569.1	113.0	98.2	203.0	618.7	2320.6	31527.8	2201.0	46178.5
	Perc Diff	7.9%	-9.7%	-18.8%	-6.4%	-13.2%	66.4%	-38.6%	-23.1%	-2.1%	5.2%	-6.0%	-9.8%	-7.4%
10	Prior	1273.0	1277.1	2282.1	2840.4	11940.0	6473.2	5805.4	16287.2	7667.2	3530.6	4825.2	917819.3	982020.6
	After	1275.4	1005.5	1691.1	2293.6	5552.6	6320.3	5204.9	12739.0	5834.5	2622.5	2967.1	914820.4	962326.8
	Perc Diff	0.2%	-21.3%	-25.9%	-19.3%	-53.5%	-2.4%	-10.3%	-21.8%	-23.9%	-25.7%	-38.5%	-0.3%	-2.0%
11	Prior	8625.0	16718.5	32723.8	30690.9	114579.5	14085.9	21093.3	57102.3	52467.2	22012.0	49778.2	962576.1	1382452.6
	After	8759.1	16761.2	29503.6	28540.0	99334.0	13836.3	19281.4	50197.0	47681.6	21150.0	45430.6	955744.8	1336219.5
	Perc Diff	1.6%	0.3%	-9.8%	-7.0%	-13.3%	-1.8%	-8.6%	-12.1%	-9.1%	-3.9%	-8.7%	-0.7%	-3.3%
12	Prior	460.4	2596.5	19482.8	540.0	5125.6	122.0	1154.6	165.3	174.5	83.5	2267.6	1803.9	33976.8
	After	455.6	2163.8	18333.3	557.7	4265.4	178.9	1046.1	293.2	221.8	70.1	1935.2	1848.3	31369.3
	Perc Diff	-1.0%	-16.7%	-5.9%	3.3%	-16.8%	46.7%	-9.4%	77.3%	27.1%	-16.1%	-14.7%	2.5%	-7.7%
Dest Totals	Prior	1276.2	746.6	572.3	19287.5	7320.2	427.7	264.3	625.3	296.2	78.5	275.6	1970.5	33140.8
	After	1320.8	778.4	641.4	18078.1	7651.3	429.7	203.9	358.1	247.4	136.1	455.8	1816.0	32117.0
	Perc Diff	3.5%	4.3%	12.1%	-6.3%	4.5%	0.5%	-22.9%	-42.7%	-16.5%	73.2%	65.4%	-7.8%	-3.1%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.2 AM Peak Hour LGV Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	141.5	23.0	11.7	128.1	99.8	1.9	7.0	2.3	7.4	0.0	0.0	60.0	482.8
	After	146.1	41.2	9.8	154.5	122.3	2.4	10.0	5.3	21.5	0.0	0.3	94.7	608.1
	Perc Diff	3.2%	79.0%	-16.3%	20.6%	22.5%	28.2%	42.6%	131.3%	190.6%	-19.0%	1088.6%	58.0%	26.0%
2	Prior	76.5	191.0	205.9	59.7	220.9	13.8	97.3	5.6	0.5	2.9	9.2	44.2	927.5
	After	73.5	283.8	197.6	76.4	216.0	43.7	112.1	10.7	0.9	3.4	9.5	58.8	1086.3
	Perc Diff	-3.9%	48.6%	-4.1%	27.8%	-2.2%	216.4%	15.3%	91.1%	104.5%	16.0%	3.1%	32.9%	17.1%
3	Prior	21.4	221.7	1108.3	50.4	614.0	12.5	193.9	26.3	19.7	17.4	260.7	193.4	2739.7
	After	25.7	224.2	1378.2	66.0	693.7	15.2	237.2	42.6	19.4	37.1	343.6	182.2	3265.0
	Perc Diff	20.5%	1.1%	24.4%	30.9%	13.0%	22.2%	22.4%	62.0%	-1.7%	113.5%	31.8%	-5.8%	19.2%
4	Prior	160.7	31.4	83.0	1037.1	612.9	78.9	27.6	66.0	19.3	27.9	33.1	226.8	2404.8
	After	139.6	48.8	96.8	1173.7	606.8	79.4	29.7	59.9	10.7	21.5	48.9	201.6	2517.3
	Perc Diff	-13.2%	55.2%	16.6%	13.2%	-1.0%	0.6%	7.3%	-9.2%	-44.5%	-23.0%	47.8%	-11.1%	4.7%
5	Prior	99.5	174.2	763.8	489.9	6563.8	11.6	51.4	231.8	280.7	127.9	740.5	734.0	10269.2
	After	148.5	171.9	453.7	561.6	6253.6	8.9	48.2	334.1	279.8	126.3	794.3	786.5	9967.6
	Perc Diff	49.4%	-1.3%	-40.6%	14.6%	-4.7%	-23.1%	-6.2%	44.1%	-0.3%	-1.3%	7.3%	7.2%	-2.9%
6	Prior	4.2	48.3	14.6	80.9	24.8	1.2	6.1	3.2	1.0	0.1	1.3	1.4	187.0
	After	10.7	38.9	32.9	95.2	61.1	1.2	9.5	8.5	0.9	0.0	9.7	1.9	270.4
	Perc Diff	156.8%	-19.6%	125.4%	17.8%	146.0%	0.0%	54.7%	164.5%	-6.1%	-71.8%	641.3%	40.0%	44.6%
7	Prior	1.1	28.2	144.3	19.2	48.0	4.1	29.8	0.8	18.7	7.3	3.8	49.3	354.5
	After	0.9	25.0	173.0	27.6	44.5	11.2	44.2	1.6	16.7	5.3	4.3	73.7	428.0
	Perc Diff	-18.9%	-11.2%	19.9%	43.8%	-7.3%	174.7%	48.3%	112.0%	-10.8%	-27.9%	13.9%	49.4%	20.7%
8	Prior	13.1	10.6	104.7	121.6	484.7	14.1	8.9	3255.1	590.6	34.5	35.7	1146.7	5820.3
	After	30.0	18.0	48.3	146.1	465.8	14.7	6.7	3473.4	653.1	16.2	34.0	1259.2	6165.5
	Perc Diff	129.3%	70.4%	-53.8%	20.1%	-3.9%	3.8%	-25.2%	6.7%	10.6%	-52.9%	-4.7%	9.8%	5.9%
9	Prior	12.4	0.9	44.1	40.5	470.8	1.6	5.4	432.8	3474.7	149.3	95.8	530.0	5258.2
	After	6.7	0.8	37.3	41.2	443.1	0.4	4.3	494.6	3365.0	212.0	126.9	539.5	5272.0
	Perc Diff	-45.9%	-10.7%	-15.4%	1.7%	-5.9%	-71.5%	-19.0%	14.3%	-3.2%	42.0%	32.4%	1.8%	0.3%
10	Prior	3.8	5.2	22.3	4.5	209.3	0.0	0.9	16.4	175.5	1317.7	370.1	240.8	2366.7
	After	3.3	10.9	15.9	5.5	221.2	0.0	0.8	7.9	194.4	1267.6	428.3	222.9	2378.6
	Perc Diff	-14.7%	107.1%	-28.8%	21.0%	5.7%	0.0%	-17.3%	-51.8%	10.8%	-3.8%	15.7%	-7.4%	0.5%
11	Prior	8.8	62.8	379.3	57.6	924.9	1.5	21.5	44.4	64.9	356.9	2379.4	310.3	4612.3
	After	14.4	45.9	338.1	70.9	835.1	2.8	18.1	56.4	62.1	354.2	2241.9	325.4	4365.2
	Perc Diff	62.9%	-26.9%	-10.9%	23.1%	-9.7%	82.7%	-15.7%	26.9%	-4.3%	-0.7%	-5.8%	4.9%	-5.4%
12	Prior	65.4	70.4	410.6	162.8	420.8	21.3	18.3	793.7	456.5	242.0	138.7	377.5	3177.9
	After	104.2	99.9	358.3	206.0	592.6	25.9	39.4	1113.1	586.4	240.4	196.0	598.5	4160.7
	Perc Diff	59.4%	41.9%	-12.7%	26.5%	40.8%	21.4%	115.9%	40.3%	28.4%	-0.6%	41.3%	58.5%	30.9%
Dest Totals	Prior	608.3	867.9	3292.7	2252.3	10694.7	162.5	468.1	4878.4	5109.5	2283.8	4068.2	3914.3	38600.8
	After	703.6	1009.3	3140.0	2624.5	10555.7	205.9	560.3	5608.1	5211.0	2284.0	4237.6	4344.9	40484.8
	Perc Diff	15.7%	16.3%	-4.6%	16.5%	-1.3%	26.7%	19.7%	15.0%	2.0%	0.0%	4.2%	11.0%	4.9%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.3 AM Peak Hour OGV Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	37.7	41.7	8.7	61.6	125.8	12.6	5.3	7.0	0.0	0.0	0.1	46.8	347.2
	After	31.9	16.9	1.2	40.8	123.2	10.4	3.3	32.1	0.0	0.0	0.0	45.9	305.7
	Perc Diff	-15.3%	-59.5%	-86.2%	-33.8%	-2.1%	-17.6%	-37.8%	359.9%	-51.7%	-79.2%	-74.7%	-1.7%	-11.9%
2	Prior	10.4	53.1	167.4	24.8	61.1	39.2	43.5	3.7	2.1	0.3	17.5	66.3	489.3
	After	12.5	60.2	123.3	19.1	56.2	20.7	28.5	14.2	4.5	0.7	47.2	86.2	473.4
	Perc Diff	20.4%	13.5%	-26.3%	-22.9%	-8.1%	-47.2%	-34.4%	288.3%	120.5%	121.9%	169.9%	30.0%	-3.3%
3	Prior	13.9	140.2	414.6	38.0	375.2	23.1	84.6	23.7	14.1	34.8	138.2	231.7	1532.1
	After	19.8	109.4	421.1	60.1	183.9	4.6	42.5	154.5	38.2	14.5	158.5	296.1	1503.2
	Perc Diff	42.7%	-21.9%	1.6%	58.4%	-51.0%	-80.1%	-49.7%	552.6%	170.2%	-58.3%	14.7%	27.8%	-1.9%
4	Prior	74.0	44.4	91.5	232.3	307.0	7.9	14.6	63.7	68.9	0.1	21.8	218.3	1144.7
	After	79.2	57.9	132.9	216.6	455.5	7.5	4.0	31.4	84.2	0.2	23.3	160.6	1253.2
	Perc Diff	7.0%	30.3%	45.2%	-6.8%	48.3%	-4.9%	-72.7%	-50.8%	22.2%	110.8%	6.9%	-26.4%	9.5%
5	Prior	35.2	67.3	306.2	202.7	2362.3	16.1	76.9	201.3	270.8	115.4	419.8	1194.6	5268.5
	After	55.7	113.4	187.7	166.7	2242.1	5.0	20.9	275.9	167.4	112.4	387.7	1306.6	5041.5
	Perc Diff	58.5%	68.5%	-38.7%	-17.7%	-5.1%	-69.0%	-72.8%	37.0%	-38.2%	-2.6%	-7.7%	9.4%	-4.3%
6	Prior	0.0	6.2	0.7	5.5	13.3	0.9	7.9	1.6	2.2	1.5	6.0	101.8	147.5
	After	0.0	2.4	3.3	6.2	28.7	0.9	5.4	5.5	4.2	2.6	53.9	144.2	257.3
	Perc Diff	0.0%	-61.9%	403.8%	13.5%	116.5%	0.0%	-31.9%	241.8%	86.4%	79.6%	795.8%	41.7%	74.5%
7	Prior	0.6	27.9	172.2	5.9	56.5	10.7	13.3	23.9	9.3	7.1	34.2	105.0	466.5
	After	0.6	31.6	46.0	2.7	19.3	4.2	18.6	41.3	1.9	2.5	22.6	102.5	293.9
	Perc Diff	1.3%	13.2%	-73.3%	-53.7%	-65.8%	-61.1%	39.7%	72.9%	-79.4%	-64.5%	-33.8%	-2.4%	-37.0%
8	Prior	12.2	11.1	32.1	26.0	285.5	1.1	16.0	1180.4	233.4	69.4	64.3	802.2	2733.7
	After	68.9	18.0	56.1	28.8	252.2	2.5	16.2	1176.2	204.4	106.7	101.7	1157.2	3188.8
	Perc Diff	466.3%	62.4%	74.9%	10.5%	-11.7%	116.2%	1.0%	-0.4%	-12.4%	53.7%	58.3%	44.3%	16.6%
9	Prior	16.4	1.1	32.2	8.4	225.8	17.0	2.0	158.2	1275.3	50.8	42.1	403.4	2232.5
	After	58.9	3.1	47.1	1.8	175.6	0.4	2.6	201.9	1189.2	54.9	32.9	560.4	2328.8
	Perc Diff	258.6%	190.5%	46.5%	-79.1%	-22.3%	-97.9%	33.2%	27.7%	-6.8%	8.2%	-21.7%	38.9%	4.3%
10	Prior	5.5	6.3	11.1	3.1	87.3	6.6	20.6	23.0	92.8	435.1	122.0	234.1	1047.5
	After	2.1	0.9	13.4	5.0	102.1	0.1	19.0	27.4	121.7	436.3	54.4	242.2	1024.6
	Perc Diff	-61.2%	-86.4%	21.2%	63.2%	16.9%	-99.0%	-7.5%	18.9%	31.2%	0.3%	-55.5%	3.5%	-2.2%
11	Prior	0.9	24.2	145.2	24.2	485.5	1.1	5.5	77.1	155.5	119.4	1294.1	486.5	2819.1
	After	3.2	32.4	121.5	14.1	296.3	0.5	4.0	45.0	116.6	121.1	1194.4	378.0	2327.2
	Perc Diff	271.2%	33.7%	-16.3%	-41.6%	-39.0%	-53.8%	-26.6%	-41.6%	-25.0%	1.4%	-7.7%	-22.3%	-17.5%
12	Prior	116.3	165.4	396.7	87.6	850.6	157.8	152.7	716.9	231.8	140.1	479.6	9196.5	12692.0
	After	145.4	103.4	422.4	115.4	959.8	171.0	133.7	1226.3	277.2	197.2	551.0	10709.0	15011.6
	Perc Diff	25.0%	-37.5%	6.5%	31.7%	12.8%	8.4%	-12.4%	71.1%	19.6%	40.7%	14.9%	16.4%	18.3%
Dest Totals	Prior	323.0	588.9	1778.5	720.0	5236.0	294.0	442.8	2480.4	2356.2	974.0	2639.7	13087.1	30920.7
	After	478.3	549.5	1576.2	677.2	4894.8	227.5	298.7	3231.7	2209.6	1049.2	2627.6	15188.8	33009.3
	Perc Diff	48.1%	-6.7%	-11.4%	-5.9%	-6.5%	-22.6%	-32.5%	30.3%	-6.2%	7.7%	-0.5%	16.1%	6.8%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.4 AM Peak Hour PCU Sector to Sector Comparison – Final Versus Penultimate Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	2756.5	683.6	243.3	1121.1	1152.4	84.8	84.2	180.3	59.7	17.4	136.4	993.4	7513.0
	After	2758.0	702.1	234.5	1167.6	1150.3	83.7	73.9	153.7	64.8	20.0	141.0	1006.1	7555.7
	Perc Diff	0.1%	2.7%	-3.6%	4.1%	-0.2%	-1.2%	-12.2%	-14.7%	8.7%	14.9%	3.4%	1.3%	0.6%
2	Prior	877.6	8189.9	2271.0	894.0	2130.8	407.6	1086.8	154.6	135.1	35.3	220.7	1210.2	17613.6
	After	891.5	8254.5	2249.8	917.3	2031.4	397.1	1109.2	165.6	138.0	37.2	229.0	1182.6	17603.3
	Perc Diff	1.6%	0.8%	-0.9%	2.6%	-4.7%	-2.6%	2.1%	7.1%	2.2%	5.3%	3.8%	-2.3%	-0.1%
3	Prior	488.6	2587.0	20026.3	661.5	5251.6	197.0	1348.0	416.3	278.7	141.3	2420.4	2354.8	36171.5
	After	501.1	2497.4	20132.7	683.9	5142.9	198.7	1325.9	490.3	279.3	121.7	2437.2	2326.5	36137.6
	Perc Diff	2.6%	-3.5%	0.5%	3.4%	-2.1%	0.9%	-1.6%	17.8%	0.2%	-13.9%	0.7%	-1.2%	-0.1%
4	Prior	1588.2	912.9	878.0	19528.8	8482.3	519.8	257.2	487.9	344.7	162.0	510.4	2304.9	35977.0
	After	1539.5	885.2	871.1	19468.3	8713.6	516.6	237.6	449.3	342.3	157.7	528.0	2178.2	35887.5
	Perc Diff	-3.1%	-3.0%	-0.8%	-0.3%	2.7%	-0.6%	-7.6%	-7.9%	-0.7%	-2.7%	3.4%	-5.5%	-0.2%
5	Prior	1524.9	2386.1	4047.5	4385.9	70050.2	390.9	643.1	2514.1	2905.1	1038.5	5195.4	6949.1	102030.9
	After	1526.7	2463.7	3966.2	4456.6	69906.0	390.2	656.4	2594.8	2870.0	1008.5	5225.4	6791.1	101855.7
	Perc Diff	0.1%	3.3%	-2.0%	1.6%	-0.2%	-0.2%	2.1%	3.2%	-1.2%	-2.9%	0.6%	-2.3%	-0.2%
6	Prior	222.6	505.8	172.7	705.8	678.5	5292.2	510.3	417.3	35.6	9.0	159.6	5692.1	14401.7
	After	230.9	513.1	180.3	702.4	711.3	5294.2	507.4	413.4	37.1	10.2	175.3	5746.2	14521.7
	Perc Diff	3.7%	1.4%	4.3%	-0.5%	4.8%	0.0%	-0.6%	-0.9%	4.2%	13.4%	9.9%	1.0%	0.8%
7	Prior	121.8	1086.2	1113.2	240.4	869.0	351.4	10482.2	111.0	75.3	22.1	233.3	4644.5	19350.3
	After	124.9	1097.1	1173.1	233.5	782.7	356.9	10516.0	119.2	71.2	20.7	229.9	4628.3	19353.6
	Perc Diff	2.5%	1.0%	5.4%	-2.8%	-9.9%	1.6%	0.3%	7.4%	-5.5%	-6.1%	-1.4%	-0.3%	0.0%
8	Prior	402.0	193.4	283.7	882.9	5041.4	392.8	136.0	35698.2	5078.1	257.4	388.6	15274.6	64029.0
	After	388.6	188.1	272.8	859.5	4847.1	392.5	129.4	35889.4	4997.8	247.5	383.3	15177.6	63773.5
	Perc Diff	-3.3%	-2.8%	-3.8%	-2.7%	-3.9%	-0.1%	-4.9%	0.5%	-1.6%	-3.9%	-1.4%	-0.6%	-0.4%
9	Prior	198.3	126.9	241.9	283.8	5237.7	7.3	50.3	3155.2	37064.3	1993.1	1051.1	5149.1	54559.0
	After	184.8	129.2	253.1	290.2	5193.2	5.8	50.2	3235.1	37060.1	1985.0	1039.7	5087.4	54513.9
	Perc Diff	-6.8%	1.8%	4.6%	2.2%	-0.8%	-20.5%	-0.2%	2.5%	0.0%	-0.4%	-1.1%	-1.2%	-0.1%
10	Prior	59.8	68.8	143.0	83.9	1568.4	0.6	37.7	130.0	1792.4	15013.8	3196.0	2138.4	24232.7
	After	55.5	75.1	132.6	82.2	1500.6	0.5	36.0	143.1	1746.1	15018.6	3228.7	2122.4	24141.4
	Perc Diff	-7.2%	9.2%	-7.2%	-2.1%	-4.3%	-18.3%	-4.5%	10.1%	-2.6%	0.0%	1.0%	-0.7%	-0.4%
11	Prior	202.5	286.5	2294.0	346.8	7576.3	111.4	120.3	283.4	810.8	2750.5	35026.4	2944.3	52753.1
	After	214.4	305.9	2282.1	365.2	7700.5	116.3	120.3	304.5	797.4	2795.9	34964.1	2904.3	52870.8
	Perc Diff	5.9%	6.8%	-0.5%	5.3%	1.6%	4.4%	0.1%	7.4%	-1.6%	1.6%	-0.2%	-1.4%	0.2%
12	Prior	1503.7	1197.0	2477.0	2630.1	7265.5	6500.3	5363.3	15001.3	6797.6	3053.9	3719.6	926273.7	981783.0
	After	1525.0	1208.7	2471.7	2614.9	7105.0	6517.1	5378.0	15078.4	6698.1	3060.2	3714.1	926127.8	981499.1
	Perc Diff	1.4%	1.0%	-0.2%	-0.6%	-2.2%	0.3%	0.3%	0.5%	-1.5%	0.2%	-0.1%	0.0%	0.0%
Dest Totals	Prior	9946.4	18224.1	34191.5	31765.1	115304.2	14256.2	20119.3	58549.6	55377.2	24494.4	52257.8	975929.1	1410414.9
	After	9941.0	18320.0	34219.8	31841.7	114784.6	14269.7	20140.4	59036.8	55102.2	24483.1	52295.8	975278.4	1409713.6
	Perc Diff	-0.1%	0.5%	0.1%	0.2%	-0.5%	0.1%	0.1%	0.8%	-0.5%	0.0%	0.1%	-0.1%	-0.05%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.5 Inter-Peak Hour Car Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	1513.9	713.4	246.5	989.7	702.9	97.7	142.3	101.9	52.5	22.6	97.2	675.1	5355.9
	After	1666.7	724.6	227.5	1232.1	717.2	75.0	73.9	79.0	65.3	51.7	158.2	555.6	5626.9
	Perc Diff	10.1%	1.6%	-7.7%	24.5%	2.0%	-23.2%	-48.0%	-22.5%	24.3%	128.6%	62.7%	-17.7%	5.1%
2	Prior	668.6	6061.1	2177.9	587.9	1169.7	210.5	943.2	64.0	62.2	25.0	85.8	763.5	12819.3
	After	749.6	6222.5	2120.9	571.5	1093.3	199.3	731.9	62.1	55.2	48.5	93.3	595.1	12543.2
	Perc Diff	12.1%	2.7%	-2.6%	-2.8%	-6.5%	-5.3%	-22.4%	-3.0%	-11.2%	94.2%	8.8%	-22.1%	-2.2%
3	Prior	210.3	2315.1	15673.2	268.5	3241.4	63.5	837.7	78.4	114.6	51.6	1728.4	1184.5	25767.1
	After	244.9	2261.2	14576.7	295.1	3418.5	68.3	686.3	131.3	157.5	64.9	1536.9	1153.7	24595.5
	Perc Diff	16.4%	-2.3%	-7.0%	9.9%	5.5%	7.6%	-18.1%	67.4%	37.4%	26.0%	-11.1%	-2.6%	-4.5%
4	Prior	914.1	582.9	329.4	13811.0	3645.3	307.2	145.0	502.3	192.3	43.6	153.6	1034.5	21661.2
	After	1134.9	519.9	283.6	13523.8	3442.1	306.6	109.1	275.9	143.1	56.3	213.1	905.7	20914.2
	Perc Diff	24.2%	-10.8%	-13.9%	-2.1%	-5.6%	-0.2%	-24.7%	-45.1%	-25.5%	29.3%	38.7%	-12.5%	-3.4%
5	Prior	754.5	1374.1	3246.1	4034.4	47771.8	232.7	423.9	2131.8	2555.8	638.0	4054.7	4423.3	71641.1
	After	755.9	1318.8	3453.8	3992.4	50943.1	212.5	249.1	1837.1	2354.1	731.3	4192.1	3669.9	73710.0
	Perc Diff	0.2%	-4.0%	6.4%	-1.0%	6.6%	-8.7%	-41.2%	-13.8%	-7.9%	14.6%	3.4%	-17.0%	2.9%
6	Prior	85.3	261.1	66.4	307.3	218.7	3283.2	490.5	312.5	25.1	4.3	32.1	4115.5	9201.9
	After	88.8	221.3	62.6	311.7	237.4	3283.4	287.9	298.8	20.9	7.0	62.4	4078.8	8961.3
	Perc Diff	4.1%	-15.2%	-5.7%	1.5%	8.6%	0.0%	-41.3%	-4.4%	-16.8%	61.7%	94.4%	-0.9%	-2.6%
7	Prior	132.9	991.2	853.8	143.9	410.3	486.8	7715.5	92.6	60.2	18.9	102.6	4706.4	15715.0
	After	89.1	742.9	720.8	123.9	264.2	306.9	6954.8	59.7	36.9	7.3	51.3	4075.5	13433.4
	Perc Diff	-33.0%	-25.1%	-15.6%	-13.9%	-35.6%	-36.9%	-9.9%	-35.6%	-38.6%	-61.2%	-50.0%	-13.4%	-14.5%
8	Prior	82.5	97.2	76.4	463.4	1910.8	300.7	91.8	26919.9	2790.7	72.1	123.7	11300.1	44229.4
	After	66.5	59.0	64.7	256.8	2187.6	271.0	46.1	24357.6	2521.1	73.2	132.1	9485.4	39521.0
	Perc Diff	-19.5%	-39.3%	-15.3%	-44.6%	14.5%	-9.9%	-49.7%	-9.5%	-9.7%	1.5%	6.8%	-16.1%	-10.6%
9	Prior	53.3	72.5	98.9	143.2	2211.3	27.4	58.5	2736.9	28179.6	1157.5	461.7	3605.6	38806.3
	After	98.2	74.8	106.5	145.5	2350.0	12.5	32.6	2569.7	25967.3	1442.3	519.0	3278.9	36597.3
	Perc Diff	84.4%	3.1%	7.7%	1.6%	6.3%	-54.2%	-44.3%	-6.1%	-7.9%	24.6%	12.4%	-9.1%	-5.7%
10	Prior	19.3	29.1	47.6	46.8	557.6	4.4	18.4	75.3	1217.3	11783.8	1754.4	1580.0	17134.0
	After	26.8	36.6	43.4	69.7	546.9	2.8	6.4	76.5	1528.6	11545.5	1859.1	1522.4	17264.9
	Perc Diff	39.0%	26.1%	-8.8%	48.9%	-1.9%	-35.9%	-65.5%	1.7%	25.6%	-2.0%	6.0%	-3.6%	0.8%
11	Prior	66.0	112.8	1796.8	139.5	4127.1	31.7	102.7	126.4	408.7	1605.7	26262.5	1526.4	36306.2
	After	86.8	109.2	1646.6	180.8	4470.3	46.6	53.8	150.3	458.9	1912.2	26167.0	1478.6	36760.8
	Perc Diff	31.5%	-3.2%	-8.4%	29.6%	8.3%	46.8%	-47.7%	19.0%	12.3%	19.1%	-0.4%	-3.1%	1.3%
12	Prior	533.3	675.2	1224.1	1030.0	4244.2	4105.7	4764.0	11521.6	3602.8	1529.6	1538.4	611086.4	645855.3
	After	629.8	564.4	1095.2	977.5	3596.2	4084.5	4134.7	10016.7	3317.7	1598.5	1396.5	610977.8	642389.4
	Perc Diff	18.1%	-16.4%	-10.5%	-5.1%	-15.3%	-0.5%	-13.2%	-13.1%	-7.9%	4.5%	-9.2%	0.0%	-0.5%
Dest Totals	Prior	5034.0	13285.8	25837.1	21965.5	70211.1	9151.3	15733.3	44663.5	39261.8	16952.6	36395.2	646001.4	944492.6
	After	5638.1	12855.3	24402.2	21680.8	73266.8	8869.4	13366.5	39914.7	36626.7	17538.9	36381.1	641777.3	932317.9
	Perc Diff	12.0%	-3.2%	-5.6%	-1.3%	4.4%	-3.1%	-15.0%	-10.6%	-6.7%	3.5%	0.0%	-0.7%	-1.3%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.6 Inter-Peak Hour LGV Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	160.7	70.7	18.0	161.7	131.9	0.0	16.2	6.2	17.0	7.9	11.8	61.9	664.0
	After	155.9	61.1	12.9	197.6	141.8	0.0	15.0	8.1	26.9	11.3	10.9	67.1	708.5
	Perc Diff	-3.0%	-13.6%	-28.4%	22.2%	7.5%	36.0%	-7.4%	29.8%	58.1%	42.7%	-7.1%	8.4%	6.7%
2	Prior	50.9	194.0	185.2	56.0	164.5	15.0	82.8	10.2	2.1	5.2	11.6	49.5	826.7
	After	90.4	308.3	182.1	84.5	208.2	33.6	68.5	14.5	3.9	4.4	14.9	76.3	1089.5
	Perc Diff	77.7%	59.0%	-1.7%	50.9%	26.6%	124.4%	-17.3%	43.1%	82.3%	-14.4%	28.4%	54.3%	31.8%
3	Prior	28.2	238.4	996.9	52.8	519.3	6.1	158.5	31.0	23.7	15.9	276.8	161.8	2509.3
	After	46.7	204.5	1222.4	79.6	558.6	4.3	162.2	40.9	20.4	16.3	308.8	157.7	2822.5
	Perc Diff	65.7%	-14.2%	22.6%	50.7%	7.6%	-30.2%	2.3%	32.2%	-13.7%	2.7%	11.6%	-2.5%	12.5%
4	Prior	120.0	58.4	86.3	1119.7	531.8	55.2	20.7	78.0	42.0	15.0	25.0	172.7	2324.8
	After	139.2	50.4	71.6	1175.8	611.1	54.2	15.6	43.7	48.6	26.4	39.9	194.7	2471.2
	Perc Diff	16.0%	-13.7%	-17.0%	5.0%	14.9%	-1.7%	-24.9%	-44.0%	15.6%	76.2%	59.8%	12.8%	6.3%
5	Prior	121.0	203.2	605.9	576.5	6817.1	38.2	60.3	367.2	333.6	152.3	613.6	724.7	10613.6
	After	150.8	172.8	570.0	714.2	6992.3	42.4	45.9	395.8	403.9	158.2	722.1	743.5	11111.9
	Perc Diff	24.7%	-15.0%	-5.9%	23.9%	2.6%	11.0%	-23.9%	7.8%	21.1%	3.9%	17.7%	2.6%	4.7%
6	Prior	7.8	7.2	1.5	55.2	38.9	6.4	4.9	8.9	0.3	2.5	0.6	5.2	139.4
	After	14.9	24.5	2.9	66.8	60.5	6.4	12.7	12.5	0.3	2.9	1.2	10.9	216.5
	Perc Diff	90.6%	241.9%	98.0%	21.0%	55.4%	0.0%	159.5%	40.4%	-16.2%	17.4%	100.6%	110.1%	55.3%
7	Prior	5.4	88.5	149.3	20.8	56.1	6.9	30.3	4.9	10.1	3.6	19.1	21.5	416.5
	After	4.7	71.6	162.8	19.2	40.6	16.9	43.2	11.5	10.0	0.9	25.9	41.3	448.7
	Perc Diff	-11.7%	-19.1%	9.1%	-7.4%	-27.7%	143.3%	42.7%	133.4%	-1.0%	-74.3%	36.0%	92.5%	7.7%
8	Prior	11.1	14.2	89.6	78.0	306.2	6.1	3.2	2665.6	402.4	16.7	19.1	799.9	4412.3
	After	12.6	18.7	23.5	52.1	413.0	8.5	2.9	2862.7	432.5	13.3	27.5	919.4	4786.8
	Perc Diff	13.3%	31.6%	-73.7%	-33.2%	34.9%	39.2%	-10.9%	7.4%	7.5%	-20.3%	44.1%	14.9%	8.5%
9	Prior	8.7	3.8	19.0	11.5	280.7	0.1	11.7	365.0	3250.9	166.6	82.9	537.3	4738.3
	After	19.6	4.6	20.5	12.5	347.8	0.0	7.3	451.3	3382.1	218.0	114.8	645.2	5223.7
	Perc Diff	126.0%	19.3%	8.0%	8.3%	23.9%	-96.4%	-37.2%	23.6%	4.0%	30.8%	38.4%	20.1%	10.2%
10	Prior	3.5	1.4	8.0	12.6	99.1	2.5	5.2	28.4	177.3	1732.4	298.8	221.3	2590.4
	After	7.2	1.4	9.3	27.2	116.6	1.6	1.6	30.5	244.4	1703.0	346.4	234.4	2723.6
	Perc Diff	110.1%	2.5%	16.1%	116.5%	17.7%	-37.1%	-69.0%	7.3%	37.9%	-1.7%	15.9%	5.9%	5.1%
11	Prior	5.6	26.5	326.7	40.9	643.2	0.6	20.1	24.5	52.2	274.7	2237.6	204.3	3856.9
	After	9.1	20.8	299.5	63.6	725.7	0.8	31.6	26.9	76.0	325.2	2365.4	240.3	4184.9
	Perc Diff	63.3%	-21.7%	-8.3%	55.7%	12.8%	34.8%	57.1%	9.6%	45.6%	18.4%	5.7%	17.6%	8.5%
12	Prior	66.0	67.9	434.1	171.5	723.0	4.9	32.6	761.8	516.7	221.6	198.6	462.4	3661.3
	After	107.9	68.7	244.1	166.6	715.6	7.3	60.1	902.7	616.8	223.9	231.7	762.4	4107.9
	Perc Diff	63.5%	1.2%	-43.8%	-2.9%	-1.0%	49.6%	84.4%	18.5%	19.4%	1.0%	16.7%	64.9%	12.2%
Dest Totals	Prior	588.8	974.2	2920.5	2357.2	10311.8	142.1	446.5	4351.9	4828.4	2614.4	3795.4	3422.5	36753.5
	After	759.2	1007.3	2821.8	2659.7	10931.7	176.0	466.6	4801.1	5265.8	2703.8	4209.6	4093.2	39895.7
	Perc Diff	28.9%	3.4%	-3.4%	12.8%	6.0%	23.9%	4.5%	10.3%	9.1%	3.4%	10.9%	19.6%	8.5%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.7 Inter-Peak Hour OGV Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	55.5	52.1	23.2	58.6	83.6	5.8	12.5	11.4	4.5	0.0	2.8	33.3	343.4
	After	49.8	20.8	11.7	96.6	129.8	4.5	4.8	74.3	55.4	0.0	6.1	61.2	515.1
	Perc Diff	-10.2%	-60.1%	-49.4%	64.9%	55.2%	-21.6%	-61.4%	549.9%	1135.2%	0.0%	113.5%	83.4%	50.0%
2	Prior	51.0	86.6	162.2	26.4	67.7	19.3	59.2	5.7	6.5	8.0	12.8	64.1	569.5
	After	32.0	87.5	105.5	24.8	63.7	8.5	33.4	9.4	7.5	46.9	32.3	58.5	510.0
	Perc Diff	-37.2%	1.1%	-35.0%	-6.1%	-5.8%	-55.9%	-43.6%	65.1%	16.0%	488.4%	152.0%	-8.8%	-10.4%
3	Prior	18.3	175.9	456.4	43.3	309.7	2.0	120.3	18.3	59.0	23.3	172.8	249.1	1648.4
	After	8.3	134.2	356.7	30.3	352.0	1.0	93.7	17.9	90.8	66.3	128.7	269.3	1549.3
	Perc Diff	-54.5%	-23.7%	-21.9%	-29.9%	13.6%	-48.5%	-22.1%	-2.1%	53.8%	184.2%	-25.5%	8.1%	-6.0%
4	Prior	60.6	27.8	44.0	216.6	308.6	11.5	10.1	39.8	31.1	5.7	33.3	232.8	1021.9
	After	54.6	20.8	37.6	201.6	396.4	10.5	5.0	39.9	26.7	5.1	71.7	298.5	1168.2
	Perc Diff	-10.0%	-25.1%	-14.4%	-6.9%	28.4%	-8.9%	-50.7%	0.3%	-14.3%	-11.4%	115.0%	28.2%	14.3%
5	Prior	71.8	79.0	345.2	280.1	2839.6	25.2	63.2	191.0	262.5	108.9	376.0	1088.0	5730.6
	After	128.3	92.7	255.1	325.2	2412.9	22.7	20.2	263.8	183.8	117.1	286.2	1243.6	5351.6
	Perc Diff	78.7%	17.4%	-26.1%	16.1%	-15.0%	-9.9%	-68.1%	38.1%	-30.0%	7.6%	-23.9%	14.3%	-6.6%
6	Prior	0.1	9.6	1.5	11.5	22.3	0.5	5.8	4.9	0.2	2.6	11.8	117.3	187.9
	After	0.1	7.8	2.3	10.9	30.5	0.5	4.3	2.6	0.4	10.7	59.4	181.6	311.0
	Perc Diff	88.3%	-18.9%	56.9%	-5.5%	37.0%	0.0%	-25.3%	-47.3%	111.5%	316.5%	403.6%	54.8%	65.5%
7	Prior	9.7	26.6	130.5	10.2	60.0	8.9	21.5	29.4	3.6	0.5	22.9	120.3	444.1
	After	4.9	17.0	75.4	3.1	15.9	3.9	21.6	39.4	4.4	0.7	4.5	106.7	297.5
	Perc Diff	-49.6%	-36.0%	-42.3%	-69.1%	-73.6%	-55.7%	0.4%	33.7%	23.9%	40.3%	-80.5%	-11.3%	-33.0%
8	Prior	15.8	6.4	46.7	52.0	227.0	5.7	24.4	1272.8	208.5	18.7	63.3	832.8	2774.0
	After	25.1	9.6	81.3	36.9	227.8	7.0	22.0	1270.3	196.0	20.4	44.1	1163.1	3103.6
	Perc Diff	59.1%	51.5%	74.2%	-29.1%	0.4%	23.3%	-10.1%	-0.2%	-6.0%	9.3%	-30.4%	39.7%	11.9%
9	Prior	5.2	4.8	45.1	29.3	229.6	0.7	3.2	242.5	1247.4	74.6	63.6	426.3	2372.2
	After	24.7	20.1	108.7	26.3	298.7	0.9	7.1	216.5	1156.0	85.6	72.5	556.5	2573.4
	Perc Diff	378.4%	319.5%	140.7%	-10.3%	30.1%	37.3%	117.8%	-10.7%	-7.3%	14.7%	14.0%	30.5%	8.5%
10	Prior	4.8	5.0	21.1	9.0	108.9	2.6	0.5	27.3	129.2	630.6	191.5	346.0	1476.6
	After	5.5	24.0	31.2	9.9	96.7	0.8	0.8	51.7	140.7	630.6	141.9	385.5	1519.3
	Perc Diff	13.4%	377.5%	47.8%	9.8%	-11.2%	-70.9%	77.6%	89.1%	8.9%	0.0%	-25.9%	11.4%	2.9%
11	Prior	3.9	8.1	131.0	29.2	489.0	12.9	23.8	71.0	81.9	138.9	1188.7	468.8	2647.1
	After	11.2	11.7	102.4	36.4	359.3	61.8	6.5	63.0	63.8	145.5	1028.8	549.5	2439.9
	Perc Diff	187.9%	44.4%	-21.8%	24.8%	-26.5%	378.1%	-72.7%	-11.2%	-22.1%	4.7%	-13.5%	17.2%	-7.8%
12	Prior	73.2	121.1	388.8	237.3	1081.7	181.3	116.0	920.5	435.9	343.0	463.9	10603.2	14966.0
	After	97.8	103.8	356.4	173.0	1068.8	197.1	128.5	1411.1	587.7	442.0	435.6	12310.9	17312.9
	Perc Diff	33.8%	-14.3%	-8.3%	-27.1%	-1.2%	8.7%	10.8%	53.3%	34.8%	28.8%	-6.1%	16.1%	15.7%
Dest Totals	Prior	369.7	603.0	1795.7	1003.3	5827.8	276.3	460.8	2834.7	2470.2	1354.8	2603.5	14582.1	34181.8
	After	442.3	550.0	1524.2	974.8	5452.6	319.3	347.9	3459.8	2513.2	1570.8	2311.7	17185.1	36651.8
	Perc Diff	19.6%	-8.8%	-15.1%	-2.8%	-6.4%	15.5%	-24.5%	22.1%	1.7%	15.9%	-11.2%	17.9%	7.2%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.8 Inter-Peak Hour PCU Sector to Sector Comparison – Final Versus Penultimate Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	1870.2	804.0	252.8	1517.5	987.9	79.1	99.3	179.4	137.7	60.8	179.0	682.7	6850.4
	After	1872.4	806.4	252.1	1526.3	988.8	79.6	93.8	161.4	147.6	63.0	175.2	683.8	6850.5
	Perc Diff	0.1%	0.3%	-0.3%	0.6%	0.1%	0.6%	-5.5%	-10.0%	7.2%	3.6%	-2.1%	0.2%	0.0%
2	Prior	873.1	6591.2	2417.6	699.9	1360.8	238.2	824.8	90.6	62.7	102.9	135.4	724.9	14122.2
	After	872.0	6618.3	2408.5	680.7	1365.3	241.3	833.7	86.0	66.6	99.7	140.5	729.9	14142.7
	Perc Diff	-0.1%	0.4%	-0.4%	-2.7%	0.3%	1.3%	1.1%	-5.0%	6.2%	-3.1%	3.7%	0.7%	0.1%
3	Prior	298.3	2591.8	16062.9	401.7	4292.3	75.3	940.7	175.7	285.7	147.7	1977.6	1622.8	28872.4
	After	299.9	2599.9	16155.8	405.0	4329.1	73.6	942.2	190.1	268.8	147.5	1974.5	1580.7	28967.3
	Perc Diff	0.6%	0.3%	0.6%	0.8%	0.9%	-2.2%	0.2%	8.2%	-5.9%	-0.1%	-0.2%	-2.6%	0.3%
4	Prior	1325.5	598.8	389.2	14916.2	4482.6	372.3	133.6	364.1	227.4	91.9	315.1	1404.2	24620.9
	After	1328.7	591.1	392.8	14901.1	4449.5	371.3	129.7	359.5	218.4	87.8	324.7	1398.9	24553.6
	Perc Diff	0.2%	-1.3%	0.9%	-0.1%	-0.7%	-0.3%	-2.9%	-1.3%	-4.0%	-4.4%	3.0%	-0.4%	-0.3%
5	Prior	1030.2	1592.4	4255.7	5047.1	60335.6	276.9	319.8	2477.6	2998.9	1021.6	5210.7	5671.1	90237.6
	After	1035.0	1584.3	4278.8	5031.8	60348.4	277.6	315.2	2496.6	2941.8	1006.6	5200.4	5657.0	90173.5
	Perc Diff	0.5%	-0.5%	0.5%	-0.3%	0.0%	0.3%	-1.4%	0.8%	-1.9%	-1.5%	-0.2%	-0.2%	-0.1%
6	Prior	103.8	255.9	68.5	389.5	330.2	3290.3	303.2	313.3	21.4	20.7	123.7	4265.6	9486.0
	After	103.9	253.6	67.8	389.4	328.5	3290.3	304.9	314.0	21.5	20.7	123.0	4271.3	9488.8
	Perc Diff	0.1%	-0.9%	-1.1%	0.0%	-0.5%	0.0%	0.6%	0.2%	0.6%	-0.2%	-0.5%	0.1%	0.0%
7	Prior	99.1	829.4	946.2	140.5	331.2	331.8	7017.8	105.1	50.9	9.2	81.0	4222.7	14164.8
	After	98.7	831.5	959.0	146.3	320.7	327.7	7019.7	110.5	51.4	9.0	81.7	4223.5	14179.6
	Perc Diff	-0.4%	0.3%	1.3%	4.2%	-3.2%	-1.2%	0.0%	5.2%	0.8%	-2.6%	0.9%	0.0%	0.1%
8	Prior	105.8	86.9	167.6	357.8	2819.8	287.0	72.3	28507.5	3123.3	108.2	204.8	11540.8	47382.0
	After	104.2	87.3	169.5	345.8	2828.3	286.5	71.0	28490.5	3149.6	106.9	203.6	11567.9	47411.3
	Perc Diff	-1.6%	0.4%	1.2%	-3.4%	0.3%	-0.2%	-1.9%	-0.1%	0.8%	-1.2%	-0.6%	0.2%	0.1%
9	Prior	141.8	92.6	231.6	200.5	3047.3	12.3	49.4	3251.9	30454.7	1755.7	704.2	4457.1	44399.1
	After	142.5	99.4	235.7	184.2	2996.4	13.5	47.0	3237.4	30505.4	1745.9	706.3	4480.7	44394.4
	Perc Diff	0.5%	7.3%	1.8%	-8.1%	-1.7%	9.5%	-4.9%	-0.4%	0.2%	-0.6%	0.3%	0.5%	0.0%
10	Prior	40.0	59.4	80.8	100.8	772.8	5.2	9.0	158.5	1913.4	13867.9	2335.2	2155.7	21498.7
	After	39.5	62.1	83.9	106.8	760.3	5.1	8.8	158.7	1913.7	13879.1	2347.4	2142.3	21507.8
	Perc Diff	-1.3%	4.6%	3.9%	5.9%	-1.6%	-0.5%	-2.0%	0.1%	0.0%	0.1%	0.5%	-0.6%	0.0%
11	Prior	105.5	139.6	2059.9	289.9	5550.9	109.1	95.1	240.9	585.6	2375.7	29613.8	2267.3	43433.3
	After	107.1	141.6	2048.5	280.8	5555.3	109.2	91.9	240.2	598.7	2382.9	29561.2	2268.4	43385.7
	Perc Diff	1.5%	1.4%	-0.6%	-3.2%	0.1%	0.1%	-3.4%	-0.3%	2.2%	0.3%	-0.2%	0.0%	-0.1%
12	Prior	849.7	724.3	1687.9	1311.2	5425.2	4290.3	4326.7	12340.8	4500.7	2263.7	2065.0	623947.7	663733.0
	After	835.6	736.9	1695.7	1317.1	5380.6	4288.9	4323.4	12330.5	4522.2	2264.4	2063.9	624051.1	663810.2
	Perc Diff	-1.7%	1.7%	0.5%	0.4%	-0.8%	0.0%	-0.1%	-0.1%	0.5%	0.0%	-0.1%	0.0%	0.0%
Dest Totals	Prior	6843.0	14366.4	28620.5	25372.5	89736.4	9367.7	14191.5	48205.5	44362.5	21826.0	42945.3	662962.8	1008800.2
	After	6839.5	14412.6	28748.1	25315.3	89651.2	9364.7	14181.1	48175.7	44405.7	21813.5	42902.4	663055.6	1008865.4
	Perc Diff	-0.1%	0.3%	0.4%	-0.2%	-0.1%	0.0%	-0.1%	-0.1%	0.1%	-0.1%	-0.1%	0.0%	0.01%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.9 PM Peak Hour Car Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	1763.8	815.4	394.1	1418.9	991.2	145.0	219.4	224.3	140.4	50.9	182.8	1311.6	7657.7
	After	2028.0	914.7	343.1	1834.1	973.7	159.5	118.0	143.9	74.5	35.0	233.0	1106.2	7963.5
	Perc Diff	15.0%	12.2%	-13.0%	29.3%	-1.8%	10.1%	-46.2%	-35.9%	-46.9%	-31.3%	27.5%	-15.7%	4.0%
2	Prior	712.3	6370.1	2842.3	803.0	1516.6	272.7	1180.1	153.2	120.0	54.5	233.6	1380.0	15638.5
	After	750.8	6510.6	2645.2	777.1	1480.6	382.7	1143.8	82.2	86.3	94.4	292.6	1172.5	15418.8
	Perc Diff	5.4%	2.2%	-6.9%	-3.2%	-2.4%	40.3%	-3.1%	-46.3%	-28.1%	73.1%	25.2%	-15.0%	-1.4%
3	Prior	290.4	2622.0	15228.6	534.9	4414.6	99.3	1177.9	162.3	215.6	105.9	2371.3	1695.5	28918.2
	After	291.7	2405.2	15509.3	637.0	4166.3	161.5	1100.8	93.3	303.6	88.1	2132.5	1668.1	28557.4
	Perc Diff	0.4%	-8.3%	1.8%	19.1%	-5.6%	62.7%	-6.5%	-42.5%	40.8%	-16.8%	-10.1%	-1.6%	-1.2%
4	Prior	842.0	864.9	674.6	14701.6	4780.3	601.2	335.5	1026.2	446.8	127.8	327.2	2347.1	27075.3
	After	959.5	861.4	452.5	15086.1	5182.5	631.1	200.6	854.8	199.9	74.6	387.1	2102.7	26993.0
	Perc Diff	14.0%	-0.4%	-32.9%	2.6%	8.4%	5.0%	-40.2%	-16.7%	-55.3%	-41.6%	18.3%	-10.4%	-0.3%
5	Prior	1128.5	2413.0	5502.8	7305.3	50289.0	587.6	1049.7	4762.5	5563.5	1542.3	7285.8	9297.5	96727.3
	After	1212.9	2415.9	5102.7	7171.2	56394.5	528.9	745.2	4960.5	4944.0	1650.5	7776.0	7734.2	100636.5
	Perc Diff	7.5%	0.1%	-7.3%	-1.8%	12.1%	-10.0%	-29.0%	4.2%	-11.1%	7.0%	6.7%	-16.8%	4.0%
6	Prior	70.0	354.0	166.4	688.4	555.9	4098.0	579.9	470.8	82.5	18.9	93.3	5666.2	12844.4
	After	63.8	362.2	145.5	712.7	539.4	4106.9	324.5	393.4	34.0	11.3	128.9	5369.1	12191.7
	Perc Diff	-8.9%	2.3%	-12.6%	3.5%	-3.0%	0.2%	-44.0%	-16.4%	-58.8%	-40.1%	38.1%	-5.2%	-5.1%
7	Prior	126.3	1401.2	1522.9	509.2	1290.4	576.7	9239.1	184.1	134.8	70.0	558.4	5804.3	21417.4
	After	50.1	1187.2	1154.7	271.2	756.2	432.8	8685.1	87.5	55.6	30.0	347.1	5425.0	18482.6
	Perc Diff	-60.3%	-15.3%	-24.2%	-46.7%	-41.4%	-24.9%	-6.0%	-52.5%	-58.8%	-57.1%	-37.8%	-6.5%	-13.7%
8	Prior	91.4	113.1	199.8	852.0	2697.2	383.9	135.3	30509.0	4079.5	214.3	422.2	14376.9	54074.7
	After	117.8	97.9	148.6	598.5	2520.6	348.9	72.5	28410.8	3271.8	174.9	298.5	12201.2	48262.1
	Perc Diff	28.9%	-13.5%	-25.6%	-29.8%	-6.5%	-9.1%	-46.4%	-6.9%	-19.8%	-18.3%	-29.3%	-15.1%	-10.7%
9	Prior	51.3	85.6	209.1	464.8	2881.7	58.1	66.9	5005.6	31740.8	1523.1	882.4	5489.6	48459.2
	After	84.7	91.9	188.7	354.7	2964.0	11.2	30.6	4240.1	31382.0	1864.1	848.3	5305.4	47365.7
	Perc Diff	65.1%	7.4%	-9.8%	-23.7%	2.9%	-80.8%	-54.2%	-15.3%	-1.1%	22.4%	-3.9%	-3.4%	-2.3%
10	Prior	16.1	23.6	80.6	86.0	853.3	10.7	29.0	216.7	1677.3	12486.7	2632.2	2253.3	20365.4
	After	37.7	42.3	77.8	148.7	991.1	0.6	12.7	260.5	2126.7	12304.6	2784.5	2169.1	20956.6
	Perc Diff	134.7%	79.4%	-3.4%	73.0%	16.1%	-94.1%	-56.0%	20.2%	26.8%	-1.5%	5.8%	-3.7%	2.9%
11	Prior	91.8	203.6	2596.2	350.1	5424.5	45.1	196.0	390.9	859.5	2514.2	28551.0	2604.6	43827.4
	After	144.3	240.9	2431.9	483.0	6072.4	99.5	148.2	473.8	964.9	2758.0	28109.4	2587.2	44513.4
	Perc Diff	57.2%	18.3%	-6.3%	38.0%	11.9%	120.6%	-24.4%	21.2%	12.3%	9.7%	-1.5%	-0.7%	1.6%
12	Prior	575.4	1019.5	2579.5	3170.7	8606.7	5103.8	4787.4	17649.5	8053.2	3685.2	6119.9	777899.4	839250.2
	After	671.1	932.8	1590.2	2929.5	5164.3	5446.6	4200.7	13545.1	6494.5	2610.7	3187.7	776483.9	823257.0
	Perc Diff	16.6%	-8.5%	-38.4%	-7.6%	-40.0%	6.7%	-12.3%	-23.3%	-19.4%	-29.2%	-47.9%	-0.2%	-1.9%
Dest Totals	Prior	5759.3	16286.0	31997.0	30884.9	84301.2	11982.0	18996.3	60755.1	53113.9	22393.8	49660.2	830126.1	1216255.7
	After	6412.5	16063.1	29790.2	31003.7	87205.6	12310.2	16782.8	53546.0	49937.8	21696.2	46525.5	823324.7	1194598.2
	Perc Diff	11.3%	-1.4%	-6.9%	0.4%	3.4%	2.7%	-11.7%	-11.9%	-6.0%	-3.1%	-6.3%	-0.8%	-1.8%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.10 PM Peak Hour LGV Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	142.4	67.8	20.1	81.3	66.8	1.5	2.4	11.3	12.3	2.7	17.0	56.0	481.7
	After	146.4	81.3	17.3	128.2	66.2	2.2	3.6	15.7	21.2	3.7	13.0	44.1	542.7
	Perc Diff	2.8%	19.9%	-14.2%	57.6%	-0.9%	48.3%	47.0%	38.7%	72.0%	35.6%	-23.8%	-21.2%	12.7%
2	Prior	24.8	166.2	192.7	49.1	125.9	16.3	44.6	7.2	1.2	0.2	11.9	53.5	693.6
	After	45.0	209.7	162.9	75.9	167.3	21.5	44.5	11.9	1.0	0.1	19.4	60.4	819.6
	Perc Diff	81.5%	26.2%	-15.5%	54.5%	32.9%	31.8%	-0.2%	66.1%	-16.6%	-31.8%	62.8%	12.9%	18.2%
3	Prior	9.3	151.9	1032.2	60.5	392.8	13.1	177.6	15.5	27.6	24.3	266.8	148.5	2320.1
	After	9.7	110.3	1156.7	88.3	472.4	12.6	166.6	19.5	33.3	21.5	323.3	118.0	2532.3
	Perc Diff	4.4%	-27.4%	12.1%	46.0%	20.3%	-4.0%	-6.2%	25.9%	20.8%	-11.7%	21.2%	-20.5%	9.1%
4	Prior	104.4	42.6	66.4	944.6	391.3	17.7	15.4	66.0	54.8	11.4	25.6	167.3	1907.4
	After	102.4	47.9	40.4	1051.2	585.2	18.5	14.4	66.0	53.0	8.7	47.7	227.5	2262.9
	Perc Diff	-2.0%	12.6%	-39.1%	11.3%	49.5%	4.5%	-6.8%	0.1%	-3.2%	-23.7%	86.3%	36.0%	18.6%
5	Prior	96.1	115.3	599.3	456.5	5422.1	47.9	54.9	392.9	340.3	199.5	522.3	551.8	8799.0
	After	124.9	130.4	472.6	449.4	5198.4	140.2	53.4	517.3	400.7	138.9	562.5	689.4	8878.3
	Perc Diff	29.9%	13.1%	-21.1%	-1.6%	-4.1%	192.5%	-2.8%	31.7%	17.8%	-30.4%	7.7%	24.9%	0.9%
6	Prior	1.3	12.7	8.6	46.8	32.9	2.2	3.2	15.1	3.2	0.4	17.7	21.4	165.5
	After	1.5	29.6	6.8	55.2	46.5	2.2	9.3	19.3	3.6	0.7	19.4	57.1	251.1
	Perc Diff	17.3%	133.5%	-21.0%	17.9%	41.2%	0.0%	192.1%	27.8%	12.4%	53.6%	10.0%	166.1%	51.7%
7	Prior	0.8	35.1	215.9	30.0	66.6	7.8	18.5	7.4	6.7	2.2	10.5	25.0	426.5
	After	0.3	45.7	164.5	38.5	71.9	19.0	23.9	6.2	4.0	0.8	14.6	53.9	443.4
	Perc Diff	-64.2%	30.2%	-23.8%	28.3%	8.0%	145.4%	28.8%	-16.2%	-40.0%	-65.1%	39.5%	115.9%	4.0%
8	Prior	4.4	7.0	18.4	49.4	224.0	0.0	3.2	2929.7	439.3	29.5	25.9	765.2	4495.9
	After	8.2	21.6	13.7	37.3	231.9	0.0	5.4	3126.6	390.7	15.6	24.8	976.6	4852.3
	Perc Diff	87.8%	209.2%	-25.2%	-24.6%	3.5%	0.0%	68.9%	6.7%	-11.0%	-47.2%	-4.3%	27.6%	7.9%
9	Prior	0.3	6.2	23.5	19.1	308.7	0.0	25.6	378.6	2716.4	134.5	58.1	433.4	4104.4
	After	2.2	4.3	11.2	26.4	319.5	0.0	18.7	363.9	2790.8	163.2	51.8	491.6	4243.5
	Perc Diff	624.6%	-31.2%	-52.1%	37.9%	3.5%	-95.9%	-26.9%	-3.9%	2.7%	21.3%	-10.9%	13.4%	3.4%
10	Prior	0.0	4.5	7.2	14.3	79.3	2.9	1.4	9.0	170.7	1392.5	177.8	168.8	2028.2
	After	0.0	2.2	8.2	32.4	127.9	0.4	0.5	11.5	183.6	1359.8	241.9	190.2	2158.6
	Perc Diff	0.0%	-51.3%	13.9%	127.5%	61.3%	-86.1%	-62.5%	27.4%	7.5%	-2.3%	36.1%	12.7%	6.4%
11	Prior	7.9	16.9	251.0	13.7	428.3	0.5	20.3	25.7	84.5	322.0	2306.3	261.7	3738.9
	After	16.0	17.8	221.1	40.3	515.7	1.0	23.4	31.7	118.5	270.4	2306.5	328.3	3890.8
	Perc Diff	102.1%	5.1%	-11.9%	193.7%	20.4%	94.7%	15.5%	23.2%	40.2%	-16.0%	0.0%	25.5%	4.1%
12	Prior	34.7	82.3	531.5	254.4	548.4	1.3	23.7	931.4	481.3	117.8	339.8	427.6	3774.2
	After	43.8	75.0	269.5	349.0	500.2	2.9	29.2	1090.1	584.3	92.9	301.2	689.2	4027.2
	Perc Diff	26.4%	-9.0%	-49.3%	37.2%	-8.8%	121.9%	23.2%	17.0%	21.4%	-21.1%	-11.3%	61.2%	6.7%
Dest Totals	Prior	426.4	708.5	2966.7	2019.7	8087.3	111.2	390.8	4789.8	4338.2	2237.0	3779.6	3080.3	32935.4
	After	500.3	775.8	2545.0	2372.0	8303.1	220.5	392.8	5279.8	4584.8	2076.3	3926.1	3926.4	34902.9
	Perc Diff	17.3%	9.5%	-14.2%	17.4%	2.7%	98.3%	0.5%	10.2%	5.7%	-7.2%	3.9%	27.5%	6.0%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.11 PM Peak Hour OGV Sector to Sector Comparison - Prior Versus Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	17.9	22.6	13.8	16.7	20.7	1.3	24.6	0.2	0.0	0.0	0.0	22.6	140.5
	After	20.1	8.4	3.0	33.8	43.5	3.2	2.6	2.4	0.0	0.0	0.0	40.7	157.7
	Perc Diff	12.2%	-62.8%	-78.6%	102.7%	110.4%	138.2%	-89.3%	1161.3%	-50.4%	-21.8%	-4.5%	80.0%	12.3%
2	Prior	17.2	17.0	76.6	17.1	21.3	0.5	20.2	0.6	0.3	0.2	14.3	29.9	215.1
	After	7.4	15.0	61.6	10.0	12.9	2.1	9.4	8.9	1.8	1.3	36.4	35.5	202.4
	Perc Diff	-56.7%	-12.0%	-19.5%	-41.5%	-39.2%	309.2%	-53.4%	1506.1%	471.4%	443.4%	154.9%	18.7%	-5.9%
3	Prior	8.3	80.8	148.7	26.8	114.9	8.7	42.4	2.7	16.8	6.8	60.8	168.8	686.6
	After	2.1	53.8	95.0	19.9	95.1	21.1	14.5	2.5	77.4	11.1	43.4	112.2	548.1
	Perc Diff	-74.0%	-33.5%	-36.1%	-25.8%	-17.2%	141.6%	-65.9%	-8.1%	360.3%	63.4%	-28.6%	-33.5%	-20.2%
4	Prior	40.4	9.9	26.2	75.1	112.3	12.5	3.8	10.4	10.8	7.9	3.5	83.4	396.2
	After	27.1	6.2	38.8	69.9	229.7	12.4	2.2	56.9	21.3	11.4	9.4	178.0	663.4
	Perc Diff	-32.9%	-37.1%	48.2%	-6.9%	104.5%	0.0%	-41.7%	447.6%	98.0%	43.0%	166.5%	113.6%	67.5%
5	Prior	52.8	34.8	159.3	149.1	980.6	1.4	55.7	114.0	115.7	20.5	173.0	460.0	2316.8
	After	80.4	35.1	143.2	132.7	786.3	1.2	30.3	229.8	128.8	45.6	143.1	677.7	2434.3
	Perc Diff	52.3%	0.9%	-10.1%	-11.0%	-19.8%	-12.6%	-45.6%	101.5%	11.3%	122.3%	-17.3%	47.3%	5.1%
6	Prior	0.5	5.1	13.8	6.7	7.1	0.0	2.4	0.8	1.0	0.7	3.3	58.8	100.1
	After	3.2	0.4	1.2	6.6	20.2	0.0	1.2	2.2	3.0	4.1	48.2	106.0	196.3
	Perc Diff	591.2%	-91.8%	-91.3%	-1.6%	186.5%	0.0%	-50.3%	166.5%	189.0%	509.5%	1375.9%	80.1%	96.1%
7	Prior	0.3	23.3	69.7	3.6	36.2	4.5	5.2	14.1	5.8	4.2	20.3	62.8	249.9
	After	0.0	7.5	45.0	0.4	6.8	2.5	6.1	10.9	2.8	1.8	4.8	55.4	144.0
	Perc Diff	-87.4%	-67.8%	-35.4%	-88.8%	-81.1%	-44.3%	17.6%	-22.2%	-51.9%	-58.3%	-76.4%	-11.8%	-42.4%
8	Prior	8.3	1.3	2.6	10.9	121.2	0.4	7.8	413.7	54.3	8.3	30.1	440.5	1099.5
	After	13.9	3.6	4.1	7.5	164.8	1.4	3.3	398.8	65.4	25.6	33.7	613.4	1335.5
	Perc Diff	66.4%	176.6%	55.7%	-31.2%	36.0%	245.7%	-57.2%	-3.6%	20.3%	207.5%	12.0%	39.2%	21.5%
9	Prior	0.0	5.1	15.0	0.9	60.0	0.5	1.2	135.2	344.4	20.4	7.9	172.0	762.5
	After	0.4	48.1	7.9	2.3	71.6	1.1	4.2	103.4	321.8	34.9	17.3	172.0	785.1
	Perc Diff	1530.2%	843.9%	-47.6%	163.5%	19.5%	110.6%	254.9%	-23.5%	-6.6%	71.5%	120.6%	0.0%	3.0%
10	Prior	0.0	0.0	7.3	2.8	64.1	0.0	14.4	30.6	45.0	182.8	79.7	267.3	693.9
	After	0.0	0.0	7.3	16.6	46.2	0.0	2.7	28.8	24.1	183.8	49.5	307.2	666.2
	Perc Diff	0.0%	-88.8%	0.3%	489.5%	-27.9%	-92.4%	-81.5%	-5.7%	-46.5%	0.5%	-37.8%	14.9%	-4.0%
11	Prior	2.5	11.2	73.1	26.4	205.5	9.6	6.4	18.5	51.8	82.1	384.0	424.4	1295.4
	After	10.2	7.2	53.8	15.6	135.7	108.7	3.3	19.6	73.5	65.9	339.4	352.3	1185.3
	Perc Diff	313.6%	-35.5%	-26.5%	-40.7%	-34.0%	1036.3%	-47.5%	6.3%	41.8%	-19.8%	-11.6%	-17.0%	-8.5%
12	Prior	28.3	37.7	84.3	61.0	501.6	92.7	57.8	389.1	125.5	83.6	280.2	5348.0	7089.9
	After	70.1	74.8	81.1	71.6	476.7	103.0	49.7	630.0	154.5	125.3	282.9	6657.9	8777.6
	Perc Diff	147.6%	98.5%	-3.8%	17.4%	-5.0%	11.0%	-14.0%	61.9%	23.1%	50.0%	1.0%	24.5%	23.8%
Dest Totals	Prior	176.5	248.8	690.2	396.9	2245.4	132.2	241.9	1129.8	771.5	417.5	1057.0	7538.5	15046.2
	After	235.0	260.3	541.9	386.9	2089.7	256.8	129.6	1494.4	874.3	510.8	1008.3	9308.1	17096.0
	Perc Diff	33.1%	4.6%	-21.5%	-2.5%	-6.9%	94.2%	-46.4%	32.3%	13.3%	22.3%	-4.6%	23.5%	13.6%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Table A2.12 PM Peak Hour PCU Sector to Sector Comparison – Final Versus Penultimate Estimated Matrix

Sectors	SATME2	1	2	3	4	5	6	7	8	9	10	11	12	Orig Totals
1	Prior	2204.3	978.5	362.2	2016.7	1066.0	162.4	134.4	167.3	106.2	47.0	234.6	1177.4	8657.0
	After	2194.4	1004.5	363.3	1996.0	1083.4	164.9	124.2	161.9	95.7	38.7	246.0	1191.0	8664.0
	Perc Diff	-0.4%	2.7%	0.3%	-1.0%	1.6%	1.6%	-7.6%	-3.2%	-9.8%	-17.8%	4.8%	1.2%	0.1%
2	Prior	808.9	6716.9	2870.7	880.9	1675.7	401.1	1163.2	107.1	98.1	91.1	318.2	1265.0	16396.9
	After	803.3	6735.3	2869.7	863.1	1660.8	406.3	1197.7	103.1	89.1	95.8	348.3	1268.4	16440.8
	Perc Diff	-0.7%	0.3%	0.0%	-2.0%	-0.9%	1.3%	3.0%	-3.7%	-9.2%	5.2%	9.5%	0.3%	0.3%
3	Prior	319.4	2585.4	16545.8	727.7	4728.6	186.8	1268.1	120.9	398.7	132.5	2473.8	1896.9	31384.8
	After	303.6	2569.2	16761.0	745.2	4733.8	195.2	1282.0	115.4	414.3	120.6	2499.2	1898.3	31637.8
	Perc Diff	-5.0%	-0.6%	1.3%	2.4%	0.1%	4.5%	1.1%	-4.5%	3.9%	-9.0%	1.0%	0.1%	0.8%
4	Prior	1100.3	913.0	544.9	16089.6	6017.2	655.5	217.1	1039.3	290.9	98.6	432.9	2480.3	29879.7
	After	1089.0	915.6	531.7	16207.2	5997.4	662.1	217.2	977.7	274.2	94.6	444.2	2508.2	29919.3
	Perc Diff	-1.0%	0.3%	-2.4%	0.7%	-0.3%	1.0%	0.0%	-5.9%	-5.7%	-4.0%	2.6%	1.1%	0.1%
5	Prior	1407.2	2574.4	5738.6	7700.5	62085.9	653.9	871.0	5740.6	5507.0	1868.0	8466.7	9307.9	111921.6
	After	1418.1	2581.5	5718.6	7753.4	62379.2	670.3	828.9	5707.7	5473.5	1835.1	8481.7	9101.3	111949.2
	Perc Diff	0.8%	0.3%	-0.3%	0.7%	0.5%	2.5%	-4.8%	-0.6%	-0.6%	-1.8%	0.2%	-2.2%	0.0%
6	Prior	68.7	383.1	151.7	746.5	599.8	4107.0	343.8	421.6	40.3	14.2	180.7	5494.4	12551.8
	After	68.5	392.2	153.5	774.4	606.1	4109.1	335.0	414.9	40.5	16.1	196.5	5532.2	12639.1
	Perc Diff	-0.3%	2.4%	1.2%	3.7%	1.1%	0.1%	-2.6%	-1.6%	0.5%	13.3%	8.7%	0.7%	0.7%
7	Prior	51.4	1250.9	1401.3	322.0	895.7	463.7	8708.0	110.3	70.2	38.6	397.8	5525.3	19235.1
	After	50.4	1240.5	1364.2	310.1	834.9	454.4	8715.1	104.6	62.4	32.6	366.4	5534.3	19070.0
	Perc Diff	-1.8%	-0.8%	-2.6%	-3.7%	-6.8%	-2.0%	0.1%	-5.2%	-11.0%	-15.6%	-7.9%	0.2%	-0.9%
8	Prior	144.3	123.7	165.6	679.9	2982.9	350.1	82.3	31913.5	3733.4	221.9	352.6	13633.9	54384.2
	After	139.9	123.1	166.4	643.2	2917.3	350.3	81.2	31936.2	3727.9	216.1	357.1	13791.2	54449.9
	Perc Diff	-3.1%	-0.4%	0.5%	-5.4%	-2.2%	0.1%	-1.4%	0.1%	-0.1%	-2.6%	1.3%	1.2%	0.1%
9	Prior	89.6	147.9	218.8	403.1	3303.7	17.3	58.7	4708.4	34418.4	2057.7	920.3	6004.2	52348.2
	After	87.3	144.3	207.8	383.4	3355.2	12.3	53.4	4707.5	34494.6	2062.1	917.5	5969.0	52394.4
	Perc Diff	-2.6%	-2.5%	-5.0%	-4.9%	1.6%	-28.9%	-8.9%	0.0%	0.2%	0.2%	-0.3%	-0.6%	0.1%
10	Prior	36.6	41.7	93.7	200.0	1159.4	1.3	17.7	299.4	2332.1	13844.4	3077.0	2678.4	23781.6
	After	37.7	44.5	93.3	197.8	1165.2	1.0	15.9	300.8	2334.4	13848.2	3076.0	2666.6	23781.3
	Perc Diff	3.1%	6.7%	-0.4%	-1.1%	0.5%	-18.1%	-9.8%	0.4%	0.1%	0.0%	0.0%	-0.4%	0.0%
11	Prior	175.7	248.2	2701.4	525.6	6691.2	214.6	177.2	522.8	1153.3	3049.4	30647.5	3281.4	49388.3
	After	170.5	265.9	2706.8	538.9	6723.8	209.2	175.0	525.1	1156.9	3094.3	30755.3	3267.8	49589.5
	Perc Diff	-3.0%	7.1%	0.2%	2.5%	0.5%	-2.5%	-1.3%	0.4%	0.3%	1.5%	0.4%	-0.4%	0.4%
12	Prior	784.6	1112.8	1978.0	3345.3	6140.4	5538.6	4262.0	15661.7	7241.8	2829.1	3783.2	783823.9	836501.4
	After	785.0	1082.6	1940.8	3350.0	6141.3	5552.4	4279.6	15265.2	7233.3	2828.9	3771.8	783831.0	836061.9
	Perc Diff	0.0%	-2.7%	-1.9%	0.1%	0.0%	0.3%	0.4%	-2.5%	-0.1%	0.0%	-0.3%	0.0%	-0.1%
Dest Totals	Prior	7191.2	17076.4	32772.8	33637.9	97346.5	12752.3	17303.5	60812.8	55390.4	24292.6	51285.3	836568.9	1246430.6
	After	7147.8	17099.2	32877.0	33762.7	97598.5	12787.5	17305.2	60320.1	55396.9	24283.2	51459.9	836559.2	1246597.2
	Perc Diff	-0.6%	0.1%	0.3%	0.4%	0.3%	0.3%	0.0%	-0.8%	0.0%	0.0%	0.3%	0.0%	0.01%

Note: The shading indicates those sector to sector comparisons where the percentage difference is >10% and the absolute difference is >500

Appendix 7 Detailed Assignment Validation Results for Cordons & Screenlines

Table A3.1	**Detailed Assignment Validation Results (Actual Flows, Cars, AM Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	9,246	9,358	112	1.2%	100.0%	100.0%	1.2
		Out	13	7,430	7,474	44	0.6%	100.0%	100.0%	0.5
	SEMMMS RSI Cordon 2	In	20	15,453	15,008	-445	-2.9%	90.0%	90.0%	3.6
		Out	20	14,954	14,962	8	0.01%	95.0%	100.0%	0.1
	SEMMMS RSI Cordon 3	In	21	11,597	11,620	23	0.2%	95.2%	100.0%	0.2
		Out	21	11,089	11,484	395	3.6%	90.5%	95.2%	3.7
	Manchester Airport Cordon	In	5	2,371	2,395	24	1.0%	100.0%	100.0%	0.5
		Out	5	1,543	1,509	-34	-2.2%	100.0%	100.0%	0.9
	Wilmslow Cordon	In	4	2,822	2,810	-12	-0.4%	100.0%	100.0%	0.2
		Out	4	2,987	2,785	-202	-6.8%	100.0%	100.0%	3.8
	Stockport/Bramhall Screenline	West	5	3,650	3,735	85	2.3%	80.0%	80.0%	1.4
		East	5	3,505	3,512	7	0.2%	100.0%	100.0%	0.1
	Romiley/Hazel Grove Screenline	West	7	4,039	4,361	322	8.0%	85.7%	85.7%	5.0
		East	7	2,757	2,736	-21	-0.8%	100.0%	100.0%	0.4
	Romiley/New Mills Screenline	West	6	2,399	2,373	-26	-1.1%	100.0%	100.0%	0.5
		East	6	1,531	1,583	52	8.5%	83.3%	100.0%	1.3
	North of Scheme Screenline	North	12	11,338	10,968	-370	-3.3%	91.7%	91.7%	3.5
		South	12	11,385	11,310	-75	-0.7%	91.7%	91.7%	0.7
	South of Wilmslow Screenline	North	8	4,315	4,380	65	1.5%	87.5%	87.5%	1.0
		South	8	4,588	4,489	-99	-2.2%	100.0%	100.0%	1.5
	TRADS Motorway Counts	N/A	40	114,154	113,211	-943	-0.8%	95.0%	97.5%	2.8
	All Matrix Estimation Counts	N/A	215	228,754	227,248	-1506	-0.7%	94.4%	96.3%	3.2
Independent Counts	A34 Screenline	West	7	6,084	6,120	36	0.6%	85.7%	57.1%	0.5
		East	7	3,920	4,129	209	5.3%	57.1%	57.1%	3.3
	TRADS Motorway Counts	N/A	8	35,475	34,208	-1,267	-3.6%	87.5%	87.5%	6.8
	Adhoc Counts	N/A	60	40,887	41,211	324	0.8%	81.7%	75.0%	1.6
	All Independent Counts	N/A	82	86,366	85,668	-698	-0.8%	80.5%	73.2%	2.4
All Counts	N/A	N/A	297	315,120	312,916	-2,204	-0.7%	90.6%	89.9%	3.9

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.2	**Detailed Assignment Validation Results (Actual Flows, LGVS, AM Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	731	825	94	12.9%	83.3%	100.0%	3.4
		Out	13	645	672	27	4.2%	100.0%	100.0%	1.1
	SEMMMS RSI Cordon 2	In	20	1,202	1,209	7	0.6%	100.0%	100.0%	0.2
		Out	20	1,163	1,257	94	8.1%	95.0%	100.0%	2.7
	SEMMMS RSI Cordon 3	In	21	1,501	1,554	53	3.5%	100.0%	100.0%	1.4
		Out	21	1,539	1,587	48	3.1%	100.0%	100.0%	1.2
	Manchester Airport Cordon	In	5	136	131	-5	-3.7%	100.0%	100.0%	0.4
		Out	5	94	78	-16	-17.0%	100.0%	100.0%	1.7
	Wilmslow Cordon	In	4	231	241	10	4.3%	100.0%	100.0%	0.7
		Out	4	304	290	-14	-4.6%	100.0%	100.0%	0.8
	Stockport/Bramhall Screenline	West	5	452	416	-36	-8.0%	80.0%	100.0%	1.7
		East	5	456	434	-22	-4.8%	100.0%	100.0%	1.0
	Romiley/Hazel Grove Screenline	West	7	527	539	12	2.3%	100.0%	100.0%	0.5
		East	7	593	596	3	0.5%	100.0%	100.0%	0.1
	Romiley/New Mills Screenline	West	6	272	254	-18	-6.6%	100.0%	100.0%	1.1
		East	6	305	289	-16	-5.3%	100.0%	100.0%	0.9
	North of Scheme Screenline	North	12	1,126	1,126	0	0.0%	100.0%	100.0%	0.0
		South	12	1,092	1,039	-53	-4.9%	91.7%	100.0%	1.6
	South of Wilmslow Screenline	North	8	447	300	-147	-32.9%	75.0%	100.0%	7.6
		South	8	452	363	-89	-19.7%	87.5%	100.0%	4.4
	TRADS Motorway Counts	N/A	40	14,835	14,553	-282	-1.9%	97.5%	100.0%	2.3
	All Matrix Estimation Counts	N/A	215	26,763	26,355	-408	-1.5%	96.3%	100.0%	2.5
Independent Counts	A34 Screenline	West	7	493	498	5	1.0%	100.0%	100.0%	0.2
		East	7	408	361	-47	-11.5%	100.0%	100.0%	2.4
	TRADS Motorway Counts	N/A	8	4,619	4,552	-67	-1.5%	100.0%	100.0%	1.0
	Adhoc Counts	N/A	60	4,733	4,274	-459	-9.7%	86.7%	98.3%	6.8
	All Independent Counts	N/A	82	10,253	9,685	-568	-5.5%	90.2%	98.8%	5.7
All Counts	N/A	N/A	297	37,016	36,040	-976	-2.6%	94.6%	99.7%	5.1

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.3	**Detailed Assignment Validation Results (Actual Flows, OGVS, AM Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	390	628	238	61.0%	75.0%	91.7%	10.5
		Out	13	303	321	18	5.9%	100.0%	100.0%	1.0
	SEMMMS RSI Cordon 2	In	20	769	937	168	21.9%	90.0%	95.0%	5.8
		Out	20	685	835	150	21.9%	85.0%	100.0%	5.4
	SEMMMS RSI Cordon 3	In	21	964	1,184	220	22.8%	95.2%	95.2%	6.7
		Out	21	896	951	55	6.1%	100.0%	100.0%	1.8
	Manchester Airport Cordon	In	5	125	44	-81	-64.8%	80.0%	100.0%	8.8
		Out	5	113	40	-73	-64.6%	80.0%	100.0%	8.3
	Wilmslow Cordon	In	4	124	124	0	0.0%	100.0%	100.0%	0.0
		Out	4	123	99	-24	-19.5%	100.0%	100.0%	2.3
	Stockport/Bramhall Screenline	West	5	145	173	28	19.3%	100.0%	100.0%	2.2
		East	5	204	222	18	8.8%	100.0%	100.0%	1.2
	Romiley/Hazel Grove Screenline	West	7	301	328	27	9.0%	100.0%	100.0%	1.5
		East	7	303	353	50	16.5%	100.0%	100.0%	2.8
	Romiley/New Mills Screenline	West	6	173	181	8	4.6%	100.0%	100.0%	0.6
		East	6	218	250	32	14.7%	83.3%	100.0%	2.1
	North of Scheme Screenline	North	12	838	817	-21	-2.5%	100.0%	100.0%	0.7
		South	12	882	884	2	0.2%	100.0%	100.0%	0.1
	South of Wilmslow Screenline	North	8	278	255	-23	-8.3%	87.5%	100.0%	1.4
		South	8	286	248	-38	-13.3%	100.0%	100.0%	2.3
	TRADS Motorway Counts	N/A	40	16,317	15,281	-1036	-6.4%	87.5%	95.0%	8.2
	All Matrix Estimation Counts	N/A	215	23,531	23,195	-336	-1.4%	91.6%	97.7%	2.2
Independent Counts	A34 Screenline	West	7	196	259	63	32.1%	85.7%	100.0%	4.2
		East	7	183	277	94	51.4%	85.7%	100.0%	6.2
	TRADS Motorway Counts	N/A	8	4,891	4,667	-224	-4.6%	87.5%	87.5%	3.2
	Adhoc Counts	N/A	60	2,626	3,017	391	14.9%	78.3%	98.3%	7.4
	All Independent Counts	N/A	82	7,896	8,220	324	4.1%	80.5%	97.6%	3.6
All Counts	N/A	N/A	297	31,427	31,415	-12	0.0%	88.6%	97.6%	0.1

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.4	**Detailed Assignment Validation Results (Actual Flows, PCUS, AM Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	10,670	10,939	269	2.5%	100.0%	100.0%	2.6
		Out	13	8,606	8,586	-20	-0.2%	100.0%	92.3%	0.2
	SEMMMS RSI Cordon 2	In	20	17,688	17,252	-436	-2.5%	90.0%	90.0%	3.3
		Out	20	17,087	17,155	68	0.4%	95.0%	100.0%	0.5
	SEMMMS RSI Cordon 3	In	21	14,540	14,654	114	0.8%	95.2%	100.0%	0.9
		Out	21	13,953	14,310	357	2.6%	90.5%	90.5%	3.0
	Manchester Airport Cordon	In	5	2,642	2,611	-31	-1.2%	100.0%	100.0%	0.6
		Out	5	1,757	1,662	-95	-5.4%	80.0%	100.0%	2.3
	Wilmslow Cordon	In	4	3,232	3,187	-45	-1.4%	100.0%	100.0%	0.8
		Out	4	3,487	3,184	-303	-8.7%	75.0%	75.0%	5.2
	Stockport/Bramhall Screenline	West	5	4,458	4,402	-56	-1.3%	80.0%	60.0%	0.8
		East	5	4,312	4,250	-62	-1.4%	100.0%	100.0%	0.9
	Romiley/Hazel Grove Screenline	West	7	4,996	5,271	275	5.5%	71.4%	71.4%	3.8
		East	7	3,830	3,724	-106	-2.8%	100.0%	100.0%	1.7
	Romiley/New Mills Screenline	West	6	2,928	2,838	-90	-3.1%	100.0%	100.0%	1.7
		East	6	2,186	2,151	-35	-1.6%	83.3%	83.3%	0.8
	North of Scheme Screenline	North	12	13,561	12999	-562	-4.1%	91.7%	91.7%	4.9
		South	12	13,637	13,332	-305	-2.2%	91.7%	91.7%	2.6
	South of Wilmslow Screenline	North	8	5,140	4,952	-188	-3.7%	75.0%	62.5%	2.6
		South	8	5,470	5,117	-353	-6.5%	100.0%	100.0%	4.9
	TRADS Motorway Counts	N/A	40	146,803	143,168	-3,635	-2.5%	87.5%	90.0%	9.5
	All Matrix Estimation Counts	N/A	215	283,915	278,363	-5,552	-2.0%	91.2%	91.2%	10.5
Independent Counts	A34 Screenline	West	7	6,889	6,930	41	0.6%	85.7%	71.4%	0.5
		East	7	4,629	4,821	192	4.2%	71.4%	57.1%	2.8
	TRADS Motorway Counts	N/A	8	45,419	43,456	-1,963	-4.3%	87.5%	87.5%	9.3
	Adhoc Counts	N/A	60	49,742	49,362	-380	-0.8%	80.0%	76.7%	1.7
	All Independent Counts	N/A	82	106,679	104,569	-2,110	-2.0%	80.5%	75.6%	6.5
All Counts	N/A	N/A	297	390,594	382,932	-7,662	-2.0%	88.2%	86.9%	12.3

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.5	**Detailed Assignment Validation Results (Actual Flows, Cars, Inter-Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	5,801	5,801	0	0.0%	100.0%	100.0%	0.0
		Out	13	5,934	5,779	-155	-2.6%	92.3%	92.3%	2.0
	SEMMMS RSI Cordon 2	In	20	10,000	9,901	-99	-1.0%	95.0%	95.0%	1.0
		Out	20	9,544	9,561	17	0.2%	100.0%	100.0%	0.2
	SEMMMS RSI Cordon 3	In	21	8,984	8,560	-424	-4.7%	90.5%	95.2%	4.5
		Out	21	9,172	9,011	-161	-1.8%	95.2%	100.0%	1.7
	Manchester Airport Cordon	In	5	1,519	1,519	0	0.0%	100.0%	100.0%	0.0
		Out	5	1,629	1,585	-44	-2.7%	100.0%	100.0%	1.1
	Wilmslow Cordon	In	4	1,961	1,922	-39	-2.0%	100.0%	100.0%	0.9
		Out	4	1,931	1,925	-6	-0.3%	100.0%	100.0%	0.1
	Stockport/Bramhall Screenline	West	5	2,593	2,589	-4	-0.2%	100.0%	100.0%	0.1
		East	5	2,923	2,915	-8	-0.3%	100.0%	100.0%	0.1
	Romiley/Hazel Grove Screenline	West	7	2,856	2,856	0	0.0%	100.0%	100.0%	0.0
		East	7	2,714	2,594	-120	-4.4%	85.7%	85.7%	2.3
	Romiley/New Mills Screenline	West	6	1,573	1,627	54	3.4%	100.0%	100.0%	1.4
		East	6	1,471	1,571	100	6.8%	83.3%	100.0%	2.6
	North of Scheme Screenline	North	12	7,964	7,903	-61	-0.8%	100.0%	100.0%	0.7
		South	12	7,841	7,658	-183	-2.3%	91.7%	91.7%	2.1
	South of Wilmslow Screenline	North	8	2,581	2,516	-65	-2.5%	100.0%	100.0%	1.3
		South	8	2,395	2,324	-71	-3.0%	100.0%	100.0%	1.5
	TRADS Motorway Counts	N/A	40	73,831	74,368	537	0.7%	95.0%	97.5%	2.0
	All Matrix Estimation Counts	N/A	215	153,979	153,259	-720	-0.5%	95.3%	97.2%	1.8
Independent Counts	A34 Screenline	West	7	3,537	3,445	-92	-2.6%	71.4%	71.4%	1.6
		East	7	3,553	3,292	-261	-7.4%	85.7%	85.7%	4.5
	TRADS Motorway Counts	N/A	8	23,234	23,205	-29	-0.1%	100.0%	100.0%	0.2
	Adhoc Counts	N/A	60	31,327	30,564	-763	-2.4%	78.3%	80.0%	4.3
	All Independent Counts	N/A	82	61,651	60,506	-1,145	-1.9%	80.5%	81.7%	4.6
All Counts	N/A	N/A	297	215,630	213,765	-1,865	-0.9%	91.2%	92.9%	4.0

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.6	**Detailed Assignment Validation Results (Actual Flows, LGVS, Inter-Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	686	788	102	14.9%	91.7%	100.0%	3.8
		Out	13	751	772	21	2.8%	100.0%	100.0%	0.8
	SEMMMS RSI Cordon 2	In	20	1,080	1,128	48	4.4%	95.0%	100.0%	1.4
		Out	20	1,183	1,189	6	0.5%	95.0%	100.0%	0.2
	SEMMMS RSI Cordon 3	In	21	1,420	1,440	20	1.4%	100.0%	100.0%	0.5
		Out	21	1,449	1,425	-24	-1.7%	100.0%	100.0%	0.6
	Manchester Airport Cordon	In	5	121	121	0	0.0%	100.0%	100.0%	0.0
		Out	5	118	118	0	0.0%	100.0%	100.0%	0.0
	Wilmslow Cordon	In	4	268	268	0	0.0%	100.0%	100.0%	0.0
		Out	4	298	278	-20	-6.7%	100.0%	100.0%	1.2
	Stockport/Bramhall Screenline	West	5	396	383	-13	-3.3%	100.0%	100.0%	0.7
		East	5	398	398	0	0.0%	100.0%	100.0%	0.0
	Romiley/Hazel Grove Screenline	West	7	533	525	-8	-1.5%	100.0%	100.0%	0.3
		East	7	540	498	-42	-7.8%	100.0%	100.0%	1.8
	Romiley/New Mills Screenline	West	6	280	259	-21	-7.5%	100.0%	100.0%	1.3
		East	6	289	290	1	0.4%	100.0%	100.0%	0.1
	North of Scheme Screenline	North	12	1,141	1,109	-32	-2.8%	100.0%	100.0%	1.0
		South	12	1,140	1,091	-49	-4.3%	100.0%	100.0%	1.5
	South of Wilmslow Screenline	North	8	455	331	-124	-27.3%	75.0%	100.0%	6.3
		South	8	446	298	-148	-33.2%	62.5%	100.0%	7.7
	TRADS Motorway Counts	N/A	40	13762	13922	160	1.2%	100.0%	100.0%	1.4
	All Matrix Estimation Counts	N/A	215	25,449	25,298	-151	-0.6%	96.7%	100.0%	0.9
Independent Counts	A34 Screenline	West	7	461	384	-77	-16.7%	100.0%	100.0%	3.7
		East	7	418	372	-46	-11.0%	100.0%	100.0%	2.3
	TRADS Motorway Counts	N/A	8	4,268	4,373	105	2.5%	100.0%	100.0%	1.6
	Adhoc Counts	N/A	60	4,518	4,133	-385	-8.5%	96.7%	100.0%	5.9
	All Independent Counts	N/A	82	9,665	9,262	-403	-4.2%	97.6%	100.0%	4.1
All Counts	N/A	N/A	297	35,114	34,560	-554	-1.6%	97.0%	100.0%	3.0

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.7	**Detailed Assignment Validation Results (Actual Flows, OGVS, Inter-Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	431	518	87	20.2%	91.7%	100.0%	4.0
		Out	13	377	440	63	16.7%	100.0%	100.0%	3.1
	SEMMMS RSI Cordon 2	In	20	813	908	95	11.7%	95.0%	100.0%	3.2
		Out	20	777	890	113	14.5%	95.0%	100.0%	3.9
	SEMMMS RSI Cordon 3	In	21	991	1,063	72	7.3%	100.0%	100.0%	2.2
		Out	21	1,025	997	-28	-2.7%	95.2%	100.0%	0.9
	Manchester Airport Cordon	In	5	83	66	-17	-20.5%	80.0%	100.0%	2.0
		Out	5	94	93	-1	-1.1%	100.0%	100.0%	0.1
	Wilmslow Cordon	In	4	137	139	2	1.5%	100.0%	100.0%	0.2
		Out	4	133	128	-5	-3.8%	100.0%	100.0%	0.4
	Stockport/Bramhall Screenline	West	5	185	185	0	0.0%	100.0%	100.0%	0.0
		East	5	166	165	-1	-0.6%	100.0%	100.0%	0.1
	Romiley/Hazel Grove Screenline	West	7	414	423	9	2.2%	100.0%	100.0%	0.4
		East	7	411	395	-16	-3.9%	100.0%	100.0%	0.8
	Romiley/New Mills Screenline	West	6	219	232	13	5.9%	100.0%	100.0%	0.9
		East	6	218	229	11	5.1%	100.0%	100.0%	0.7
	North of Scheme Screenline	North	12	1,089	1,060	-29	-2.7%	100.0%	100.0%	0.9
		South	12	1,093	991	-102	-9.3%	100.0%	100.0%	3.2
	South of Wilmslow Screenline	North	8	320	299	-21	-6.6%	100.0%	100.0%	1.2
		South	8	305	252	-53	-17.4%	100.0%	100.0%	3.2
	TRADS Motorway Counts	N/A	40	19,938	19,168	-770	-3.9%	90.0%	95.0%	5.5
	All Matrix Estimation Counts	N/A	215	28,280	27,677	-603	-2.1%	95.8%	99.1%	3.6
Independent Counts	A34 Screenline	West	7	211	298	87	41.2%	71.4%	100.0%	5.5
		East	7	191	327	136	71.2%	71.4%	100.0%	8.5
	TRADS Motorway Counts	N/A	8	6,325	5,681	-644	-10.2%	87.5%	87.5%	8.3
	Adhoc Counts	N/A	60	2,658	2,903	245	9.2%	83.3%	100.0%	4.6
	All Independent Counts	N/A	82	9,385	9,209	-176	-1.9%	81.7%	98.8%	1.8
All Counts	N/A	N/A	297	37,665	36,886	-779	-2.1%	91.9%	99.0%	4.0

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.8 Detailed Assignment Validation Results (Actual Flows, PCUS, Inter-Peak Hour)

Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	7,164	7,246	82	1.1%	100.0%	91.7%	1.0
		Out	13	7,302	7,134	-168	-2.3%	92.3%	92.3%	2.0
	SEMMMS RSI Cordon 2	In	20	12,069	12,047	-22	-0.2%	95.0%	95.0%	0.2
		Out	20	11,694	11,747	53	0.5%	100.0%	95.0%	0.5
	SEMMMS RSI Cordon 3	In	21	11,766	11,383	-383	-3.3%	90.5%	95.2%	3.6
		Out	21	12,045	11,743	-302	-2.5%	90.5%	95.2%	2.8
	Manchester Airport Cordon	In	5	1,734	1,747	13	0.8%	100.0%	100.0%	0.3
		Out	5	1,850	1,838	-12	-0.7%	100.0%	100.0%	0.3
	Wilmslow Cordon	In	4	2,395	2,340	-55	-2.3%	100.0%	100.0%	1.1
		Out	4	2,396	2,343	-53	-2.2%	100.0%	100.0%	1.1
	Stockport/Bramhall Screenline	West	5	3,293	3,235	-58	-1.8%	100.0%	100.0%	1.0
		East	5	3,599	3,561	-38	-1.1%	100.0%	100.0%	0.6
	Romiley/Hazel Grove Screenline	West	7	3,916	3,856	-60	-1.5%	100.0%	100.0%	1.0
		East	7	3,786	3,539	-247	-6.5%	85.7%	85.7%	4.1
	Romiley/New Mills Screenline	West	6	2,151	2,156	5	0.2%	100.0%	100.0%	0.1
		East	6	2,062	2,130	68	3.3%	83.3%	83.3%	1.5
	North of Scheme Screenline	North	12	10,383	10,165	-218	-2.1%	100.0%	100.0%	2.2
		South	12	10,262	9,834	-428	-4.2%	91.7%	91.7%	4.3
	South of Wilmslow Screenline	North	8	3,431	3,160	-271	-7.9%	87.5%	87.5%	4.7
		South	8	3,218	2,889	-329	-10.2%	87.5%	87.5%	6.0
	TRADS Motorway Counts	N/A	40	108,571	107,609	-962	-0.9%	97.5%	97.5%	2.9
	All Matrix Estimation Counts	N/A	215	211,310	207,947	-3363	-1.6%	94.4%	94.4%	7.3
Independent Counts	A34 Screenline	West	7	4,281	4,183	-98	-2.3%	57.1%	28.6%	1.5
		East	7	4,235	4,051	-184	-4.3%	85.7%	85.7%	2.9
	TRADS Motorway Counts	N/A	8	34,078	33,289	-789	-2.3%	100.0%	100.0%	4.3
	Adhoc Counts	N/A	60	39,751	38,532	-1,219	-3.1%	80.0%	80.0%	6.2
	All Independent Counts	N/A	82	82,345	80,055	-2,290	-2.8%	80.5%	78.0%	8.0
All Counts	N/A	N/A	297	293,655	288,002	-5,653	-1.9%	90.6%	89.9%	10.5

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.9	**Detailed Assignment Validation Results (Actual Flows, Cars, PM Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	7,778	7,691	-87	-1.1%	100.0%	100.0%	1.0
		Out	13	9,054	9,123	69	0.8%	100.0%	100.0%	0.7
	SEMMMS RSI Cordon 2	In	20	16,251	16,102	-149	-0.9%	90.0%	95.0%	1.2
		Out	20	14,663	14,813	150	1.0%	100.0%	100.0%	1.2
	SEMMMS RSI Cordon 3	In	21	12,904	13,239	335	2.6%	81.0%	81.0%	2.9
		Out	21	13,757	13,729	-28	-0.2%	85.7%	85.7%	0.2
	Manchester Airport Cordon	In	5	1,435	1,435	0	0.0%	100.0%	100.0%	0.0
		Out	5	2,207	2,193	-14	-0.6%	80.0%	100.0%	0.3
	Wilmslow Cordon	In	4	2,830	2,904	74	2.6%	100.0%	100.0%	1.4
		Out	4	3,077	2,970	-107	-3.5%	100.0%	100.0%	1.9
	Stockport/Bramhall Screenline	West	5	3,537	3,503	-34	-1.0%	100.0%	100.0%	0.6
		East	5	3,871	3,874	3	0.1%	80.0%	80.0%	0.0
	Romiley/Hazel Grove Screenline	West	7	3,747	3,809	62	1.7%	100.0%	85.7%	1.0
		East	7	4,934	5,291	357	7.2%	71.4%	71.4%	5.0
	Romiley/New Mills Screenline	West	6	2,060	2,097	37	1.8%	100.0%	100.0%	0.8
		East	6	3,139	3,180	41	1.3%	100.0%	100.0%	0.7
	North of Scheme Screenline	North	12	11,422	11,576	154	1.4%	100.0%	100.0%	1.4
		South	12	12,447	11,990	-457	-3.7%	91.7%	91.7%	4.1
	South of Wilmslow Screenline	North	8	4,677	4,636	-41	-0.9%	100.0%	100.0%	0.6
		South	8	4,473	4,326	-147	-3.3%	87.5%	87.5%	2.2
	TRADS Motorway Counts	N/A	40	121,243	120,364	-879	-0.7%	95.0%	95.0%	2.5
	All Matrix Estimation Counts	N/A	215	242,764	241,597	-1,167	-0.5%	93.0%	93.5%	2.4
Independent Counts	A34 Screenline	West	7	4,456	4,687	231	5.2%	85.7%	71.4%	3.4
		East	7	6,448	5,959	-489	-7.6%	57.1%	57.1%	6.2
	TRADS Motorway Counts	N/A	8	35,154	35,014	-140	-0.4%	87.5%	87.5%	0.7
	Adhoc Counts	N/A	60	44,366	43,115	-1,251	-2.8%	68.3%	70.0%	6.0
	All Independent Counts	N/A	82	90,424	88,775	-1,649	-1.8%	70.7%	70.7%	5.5
All Counts	N/A	N/A	297	333,188	330,372	-2,816	-0.9%	86.9%	87.2%	4.9

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.10	**Detailed Assignment Validation Results (Actual Flows, LGVS, PM Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	566	591	25	4.4%	100.0%	100.0%	1.0
		Out	13	559	642	83	14.9%	100.0%	100.0%	3.4
	SEMMMS RSI Cordon 2	In	20	857	969	112	13.1%	95.0%	95.0%	3.7
		Out	20	963	987	24	2.5%	100.0%	100.0%	0.8
	SEMMMS RSI Cordon 3	In	21	1,125	1,177	52	4.6%	100.0%	100.0%	1.5
		Out	21	1,183	1,211	25	2.4%	100.0%	100.0%	0.8
	Manchester Airport Cordon	In	5	100	100	0	0.0%	100.0%	100.0%	0.0
		Out	5	102	76	-26	-25.5%	100.0%	100.0%	2.8
	Wilmslow Cordon	In	4	193	198	5	2.6%	100.0%	100.0%	0.4
		Out	4	185	191	6	3.2%	100.0%	100.0%	0.4
	Stockport/Bramhall Screenline	West	5	313	309	-4	-1.3%	100.0%	100.0%	0.2
		East	5	380	382	2	0.5%	100.0%	100.0%	0.1
	Romiley/Hazel Grove Screenline	West	7	417	422	5	1.2%	100.0%	100.0%	0.2
		East	7	540	558	18	3.3%	100.0%	100.0%	0.8
	Romiley/New Mills Screenline	West	6	220	233	13	5.9%	100.0%	100.0%	0.9
		East	6	301	320	19	6.3%	100.0%	100.0%	1.1
	North of Scheme Screenline	North	12	973	912	-61	-6.3%	100.0%	100.0%	2.0
		South	12	1,035	953	-82	-7.9%	100.0%	100.0%	2.6
	South of Wilmslow Screenline	North	8	333	259	-74	-22.2%	75.0%	100.0%	4.3
		South	8	305	217	-88	-28.9%	75.0%	100.0%	5.4
	TRADS Motorway Counts	N/A	40	13,357	13,130	-227	-1.7%	100.0%	100.0%	2.0
	All Matrix Estimation Counts	N/A	215	22,876	22,592	-284	-1.2%	97.7%	99.5%	1.9
Independent Counts	A34 Screenline	West	7	382	329	-53	-13.9%	85.7%	100.0%	2.8
		East	7	396	348	-48	-12.1%	100.0%	100.0%	2.5
	TRADS Motorway Counts	N/A	8	3,860	3,859	-1	0.0%	100.0%	100.0%	0.0
	Adhoc Counts	N/A	60	3,755	3,409	-346	-9.2%	91.7%	100.0%	5.8
	All Independent Counts	N/A	82	8,393	7,945	-448	-5.3%	92.7%	100.0%	5.0
All Counts	N/A	N/A	297	31,269	30,537	-732	-2.3%	96.3%	99.7%	4.2

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.11	**Detailed Assignment Validation Results (Actual Flows, OGVS, PM Peak Hour)**									
Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	232	276	44	19.0%	83.3%	100.0%	2.8
		Out	13	149	183	34	22.8%	92.3%	100.0%	2.6
	SEMMMS RSI Cordon 2	In	20	358	471	113	31.6%	95.0%	100.0%	5.6
		Out	20	339	406	67	19.8%	90.0%	100.0%	3.5
	SEMMMS RSI Cordon 3	In	21	390	490	100	25.6%	95.2%	100.0%	4.8
		Out	21	369	419	50	13.6%	100.0%	100.0%	2.5
	Manchester Airport Cordon	In	5	82	60	-22	-26.8%	60.0%	100.0%	2.6
		Out	5	76	53	-23	-30.3%	100.0%	100.0%	2.9
	Wilmslow Cordon	In	4	24	50	26	108.3%	100.0%	100.0%	4.3
		Out	4	35	46	11	31.4%	100.0%	100.0%	1.7
	Stockport/Bramhall Screenline	West	5	66	64	-2	-3.0%	100.0%	100.0%	0.2
		East	5	67	61	-6	-9.0%	100.0%	100.0%	0.8
	Romiley/Hazel Grove Screenline	West	7	93	138	45	48.4%	100.0%	100.0%	4.2
		East	7	114	138	24	21.1%	100.0%	100.0%	2.1
	Romiley/New Mills Screenline	West	6	55	62	7	12.7%	100.0%	100.0%	0.9
		East	6	82	90	8	9.8%	100.0%	100.0%	0.9
	North of Scheme Screenline	North	12	411	437	26	6.3%	100.0%	100.0%	1.3
		South	12	466	525	59	12.7%	91.7%	100.0%	2.7
	South of Wilmslow Screenline	North	8	121	120	-1	-0.8%	100.0%	100.0%	0.1
		South	8	86	89	3	3.5%	100.0%	100.0%	0.3
	TRADS Motorway Counts	N/A	40	9,492	8,958	-534	-5.6%	95.0%	95.0%	5.6
	All Matrix Estimation Counts	N/A	215	12,661	12,662	1	0.0%	94.4%	99.1%	0.0
Independent Counts	A34 Screenline	West	7	66	127	61	92.4%	85.7%	100.0%	6.2
		East	7	79	143	64	81.00%	85.7%	100.0%	6.1
	TRADS Motorway Counts	N/A	8	2,692	2,719	27	1.0%	100.0%	100.0%	0.5
	Adhoc Counts	N/A	60	848	1,219	371	43.8%	85.0%	100.0%	11.5
	All Independent Counts	N/A	82	3,685	4,208	523	14.2%	86.6%	100.0%	8.3
All Counts	N/A	N/A	297	16,346	16,870	524	3.2%	92.3%	99.3%	4.1

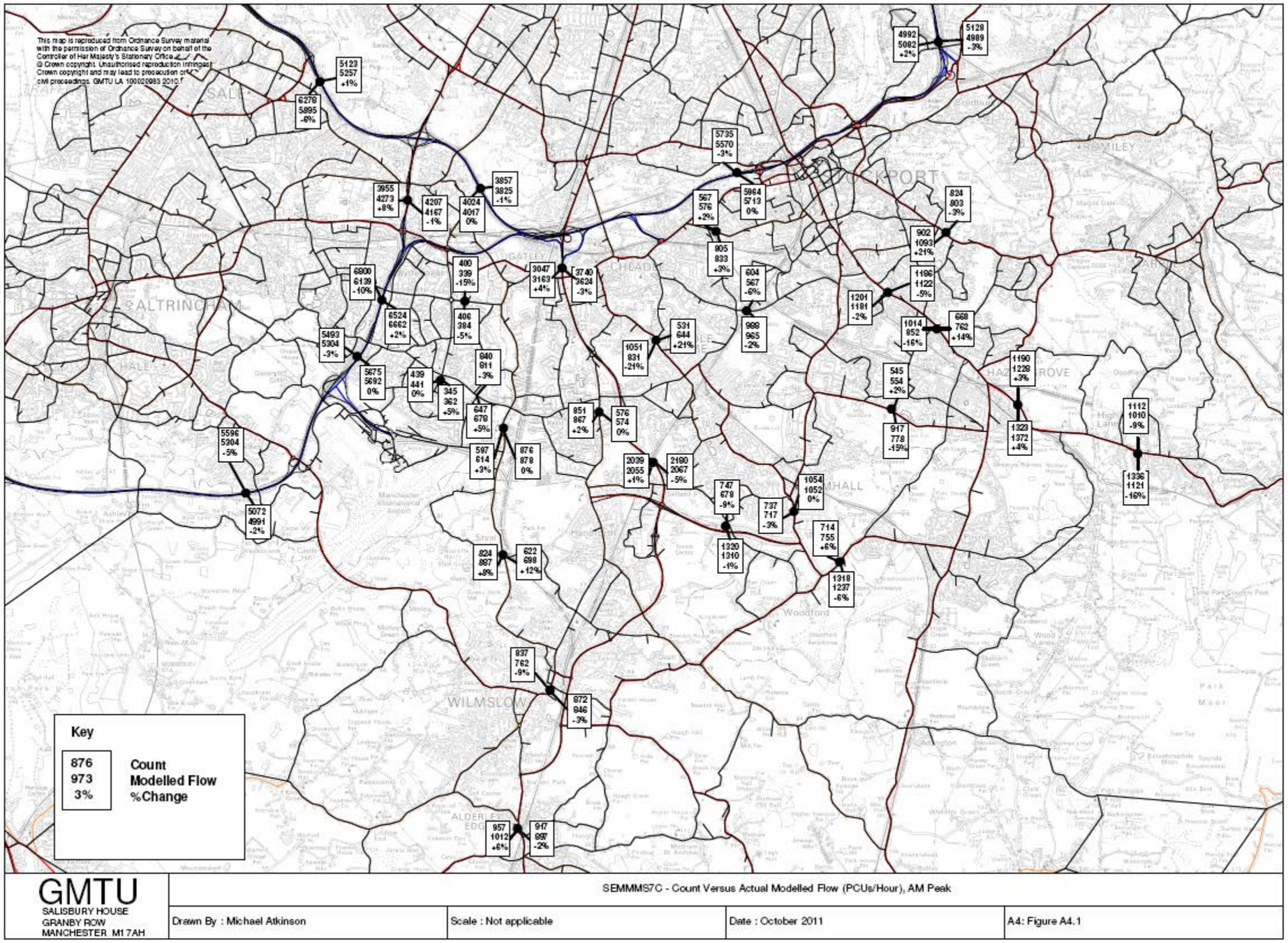
Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Table A3.12 Detailed Assignment Validation Results (Actual Flows, PCUS, PM Peak Hour)

Count Set	Count Sub-Set	Direction	Count Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH<5	% All DMRB	Screenline GEH
Matrix Estimation Counts	SEMMMS RSI Cordon 1	In	12	9,263	8,686	-577	-6.2%	91.7%	91.7%	6.1
		Out	13	9,964	10,068	104	1.0%	100.0%	100.0%	1.0
	SEMMMS RSI Cordon 2	In	20	17,598	17,647	49	0.3%	85.0%	90.0%	0.4
		Out	20	16,106	16,312	206	1.3%	100.0%	100.0%	1.6
	SEMMMS RSI Cordon 3	In	21	14,770	15,230	460	3.1%	81.0%	81.0%	3.8
		Out	21	15,629	15,664	35	0.2%	85.7%	81.0%	0.3
	Manchester Airport Cordon	In	5	1,625	1,640	15	0.9%	100.0%	100.0%	0.4
		Out	5	2,410	2,364	-46	-1.9%	80.0%	100.0%	0.9
	Wilmslow Cordon	In	4	3,075	3,163	88	2.9%	100.0%	100.0%	1.6
		Out	4	3,330	3,221	-109	-3.3%	100.0%	100.0%	1.9
	Stockport/Bramhall Screenline	West	5	3,995	3,954	-41	-1.0%	100.0%	100.0%	0.7
		East	5	4,394	4,399	5	0.1%	60.0%	80.0%	0.1
	Romiley/Hazel Grove Screenline	West	7	4,315	4,425	110	2.6%	85.7%	85.7%	1.7
		East	7	5,657	6,040	383	6.8%	71.4%	71.4%	5.0
	Romiley/New Mills Screenline	West	6	2,377	2,427	50	2.1%	100.0%	100.0%	1.0
		East	6	3,591	3,625	34	1.0%	100.0%	100.0%	0.6
	North of Scheme Screenline	North	12	12,941	13,026	85	0.7%	100.0%	100.0%	0.7
		South	12	14,077	13,566	-511	-3.6%	91.7%	91.7%	4.3
	South of Wilmslow Screenline	North	8	5,172	5,027	-145	-2.8%	100.0%	100.0%	2.0
		South	8	4,896	4,648	-248	-5.1%	87.5%	87.5%	3.6
	TRADS Motorway Counts	N/A	40	144,360	142,591	-1769	-1.2%	95.0%	95.0%	4.7
	All Matrix Estimation Counts	N/A	215	280,949	278,528	-2421	-0.9%	91.2%	92.6%	4.6
Independent Counts	A34 Screenline	West	7	4,983	5,196	213	4.3%	100.0%	100.0%	3.0
		East	7	6,986	6,513	-473	-6.8%	71.4%	71.4%	5.8
	TRADS Motorway Counts	N/A	8	41,704	41,624	-80	-0.2%	87.5%	87.5%	0.4
	Adhoc Counts	N/A	60	49,981	48,641	-1,340	-2.7%	78.3%	75.0%	6.0
	All Independent Counts	N/A	82	103,654	101,974	-1,680	-1.6%	80.5%	78.0%	5.2
All Counts	N/A	N/A	297	384,603	380,502	-4,101	-1.1%	88.2%	88.6%	6.6

Note: the overall number of Matrix Estimation Count Sites excludes duplicate sites on cordons and screenlines

Appendix 8 Counts Versus Modelled Flows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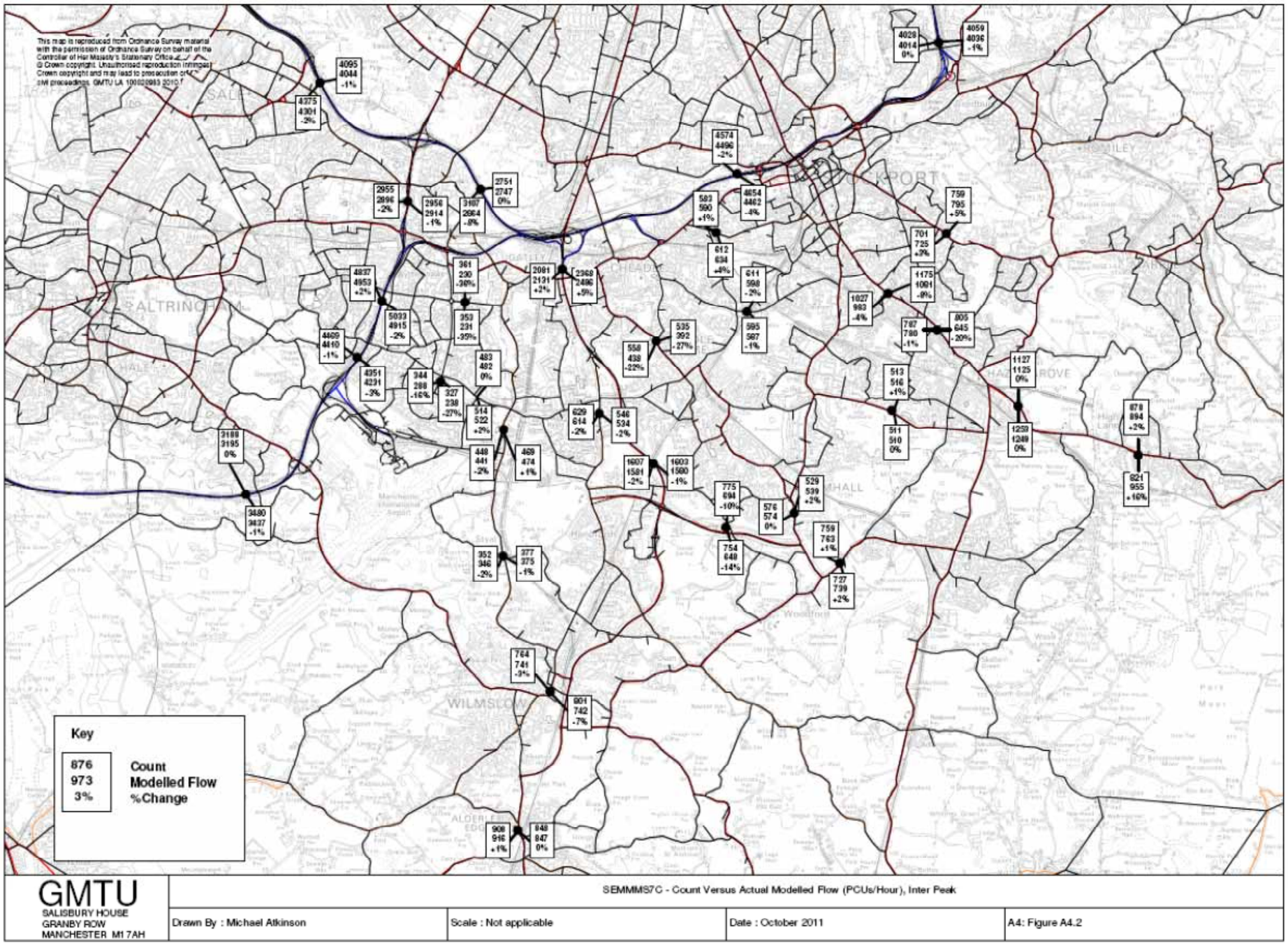
Key
876
973
3%
Count
Modelled Flow
%Change
GMTU
SALISBURY HOUSE
GRANBY ROW
MANCHESTER M1 7AH
SEMMMS7C - Count Versus Actual Modelled Flow (PCUs/Hour), AM Peak
Drawn By : Michael Atkinson
Scale : Not applicable
Date : October 2011
A4: Figure A4.1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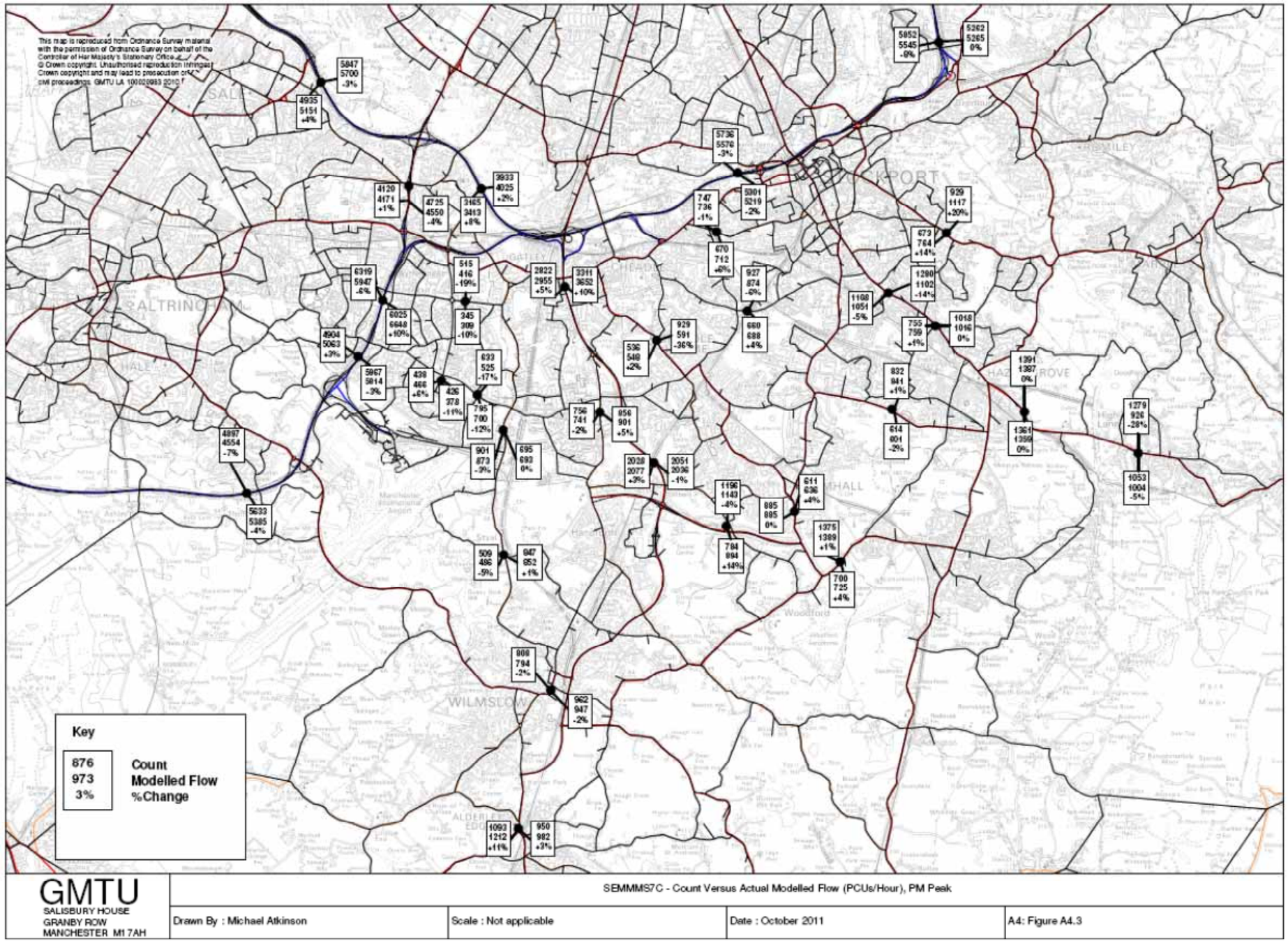
Key
876
973
3%
Count
Modelled Flow
%Change
GMTU
SALISBURY HOUSE
GRANBY ROW
MANCHESTER M1 7AH
SEMMMS7C - Count Versus Actual Modelled Flow (PCUs/Hour), Inter Peak
Drawn By : Michael Atkinson
Scale : Not applicable
Date : October 2011
A4: Figure A4.2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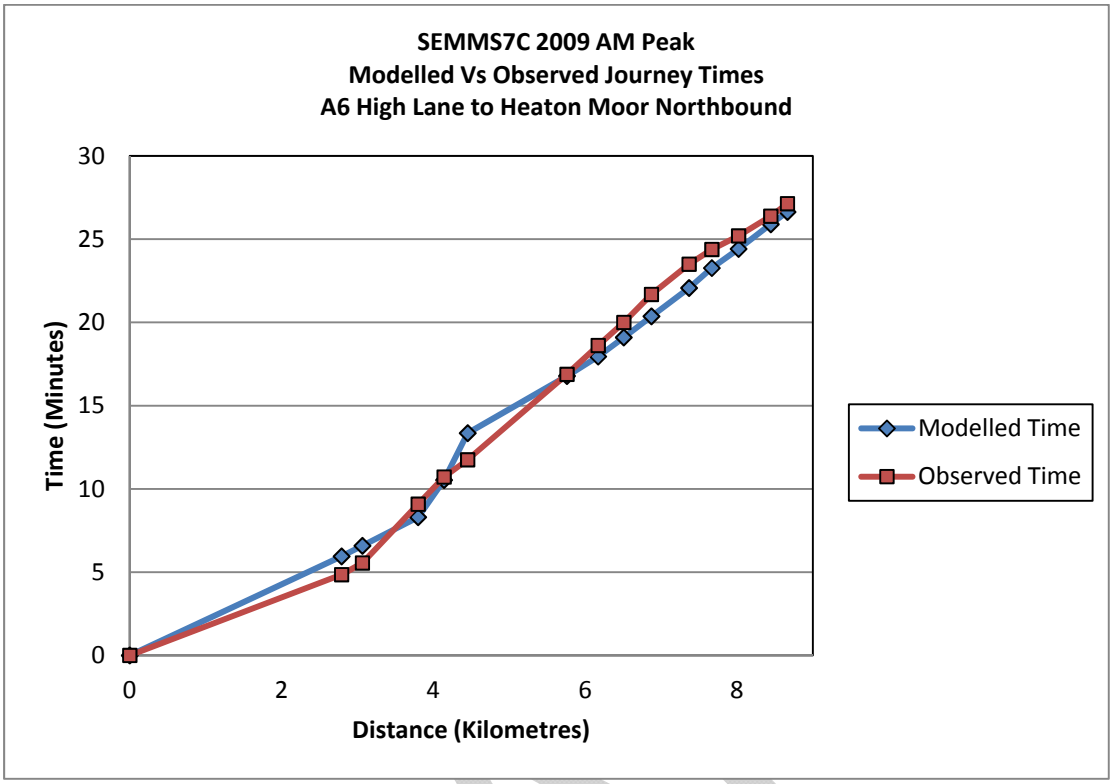
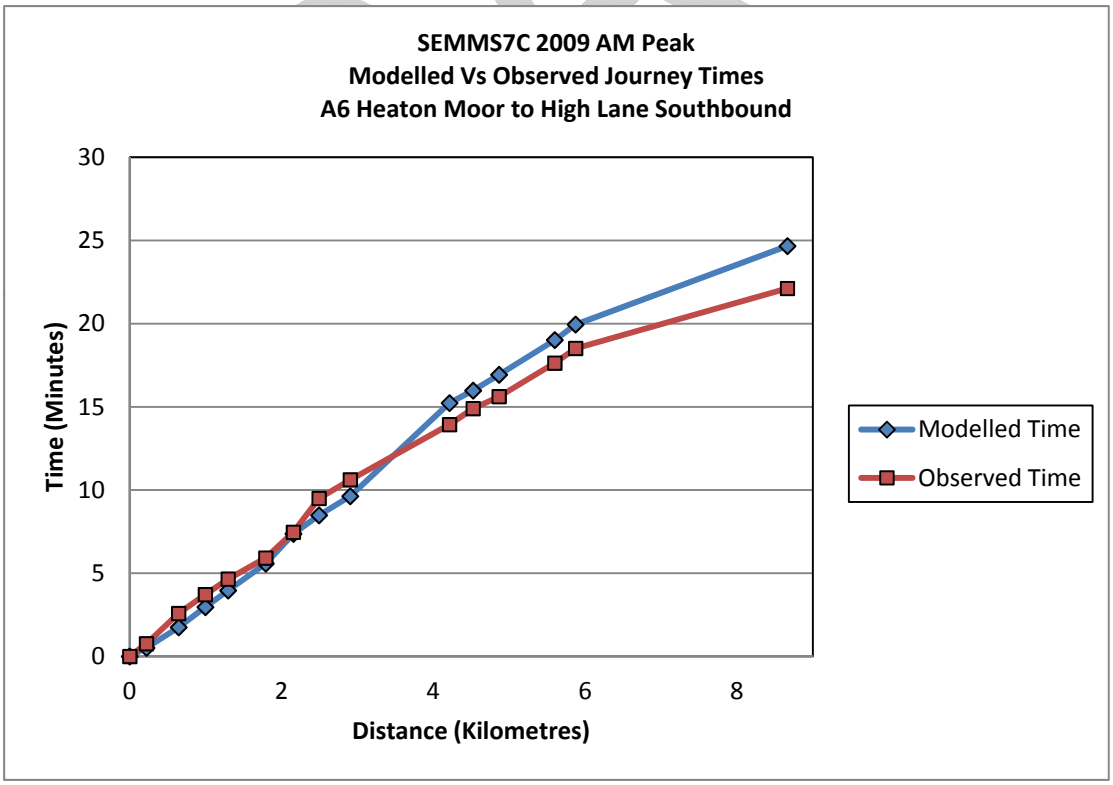
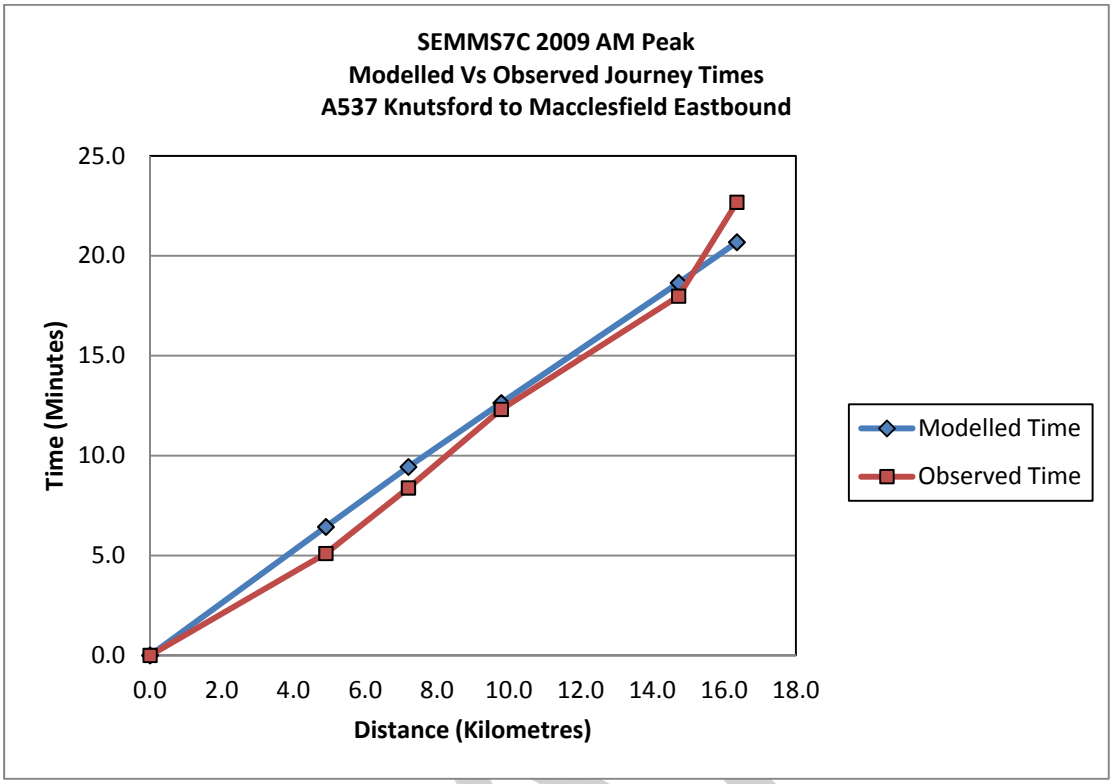
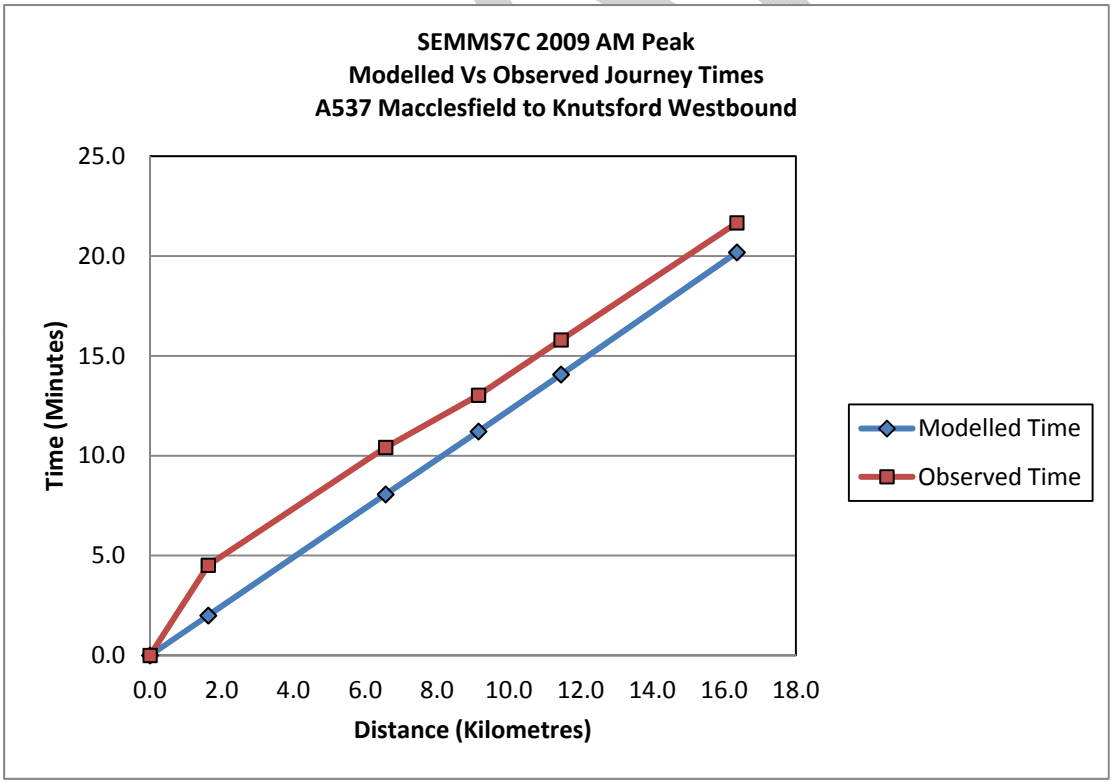
Key
876
973
3%
Count
Modelled Flow
%Change
GMTU
SALISBURY HOUSE
GRANBY ROW
MANCHESTER M1 7AH
SEMMMS7C - Count Versus Actual Modelled Flow (PCUs/Hour), PM Peak
Drawn By : Michael Atkinson
Scale : Not applicable
Date : October 2011
A4: Figure A4.3

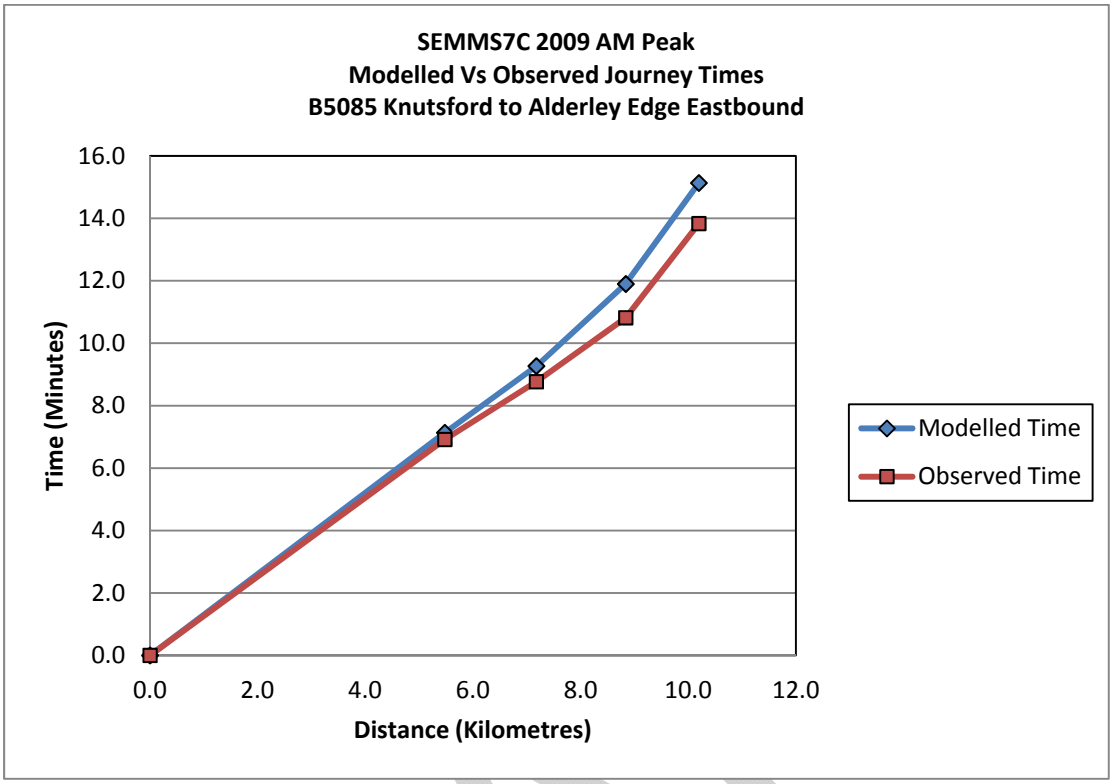
Appendix 9 Graphs of Observed Versus Modelled Journey Times

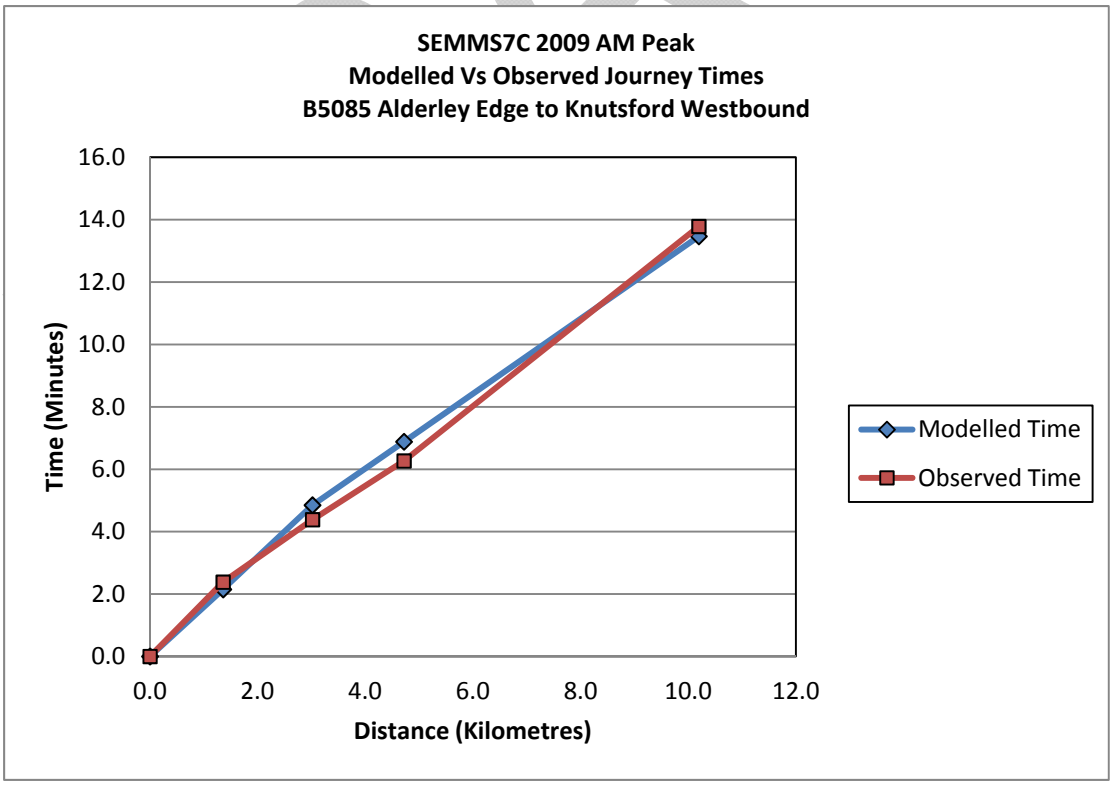

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A6 High Lane to Heaton Moor Northbound
Time (Minutes)
Distance (Kilometres)
Modelled Time
Observed Time

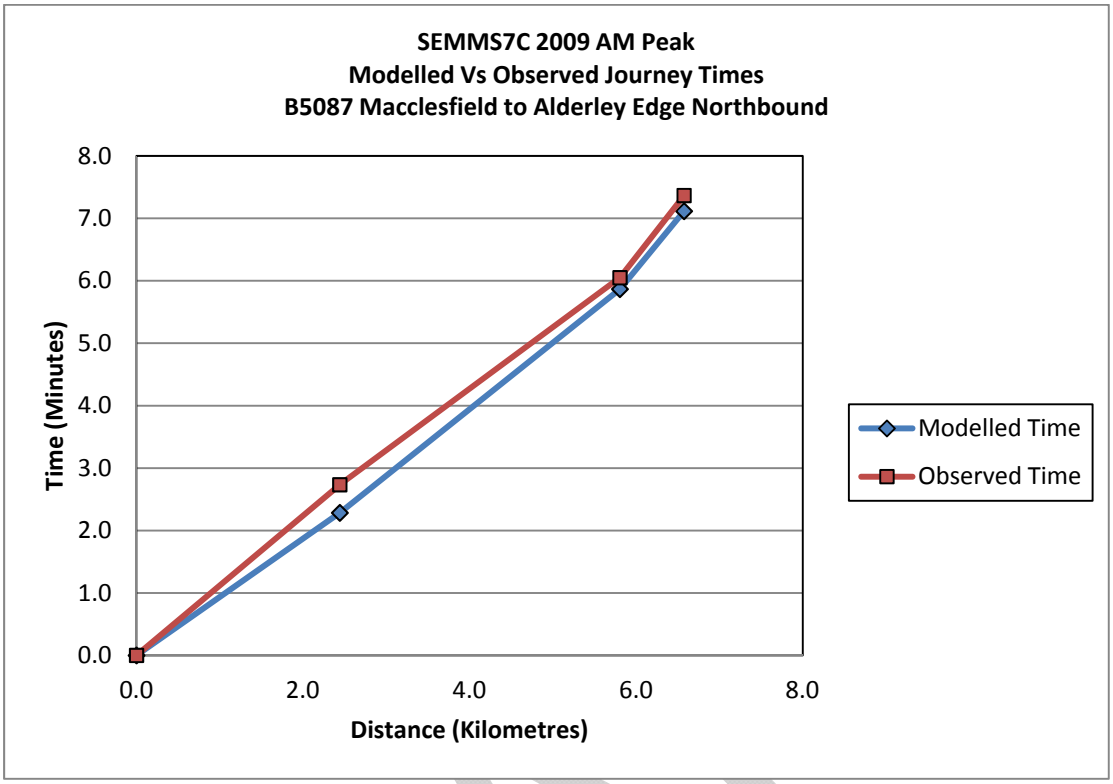

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A6 Heaton Moor to High Lane Southbound
Time (Minutes)
Distance (Kilometres)
Modelled Time
Observed Time

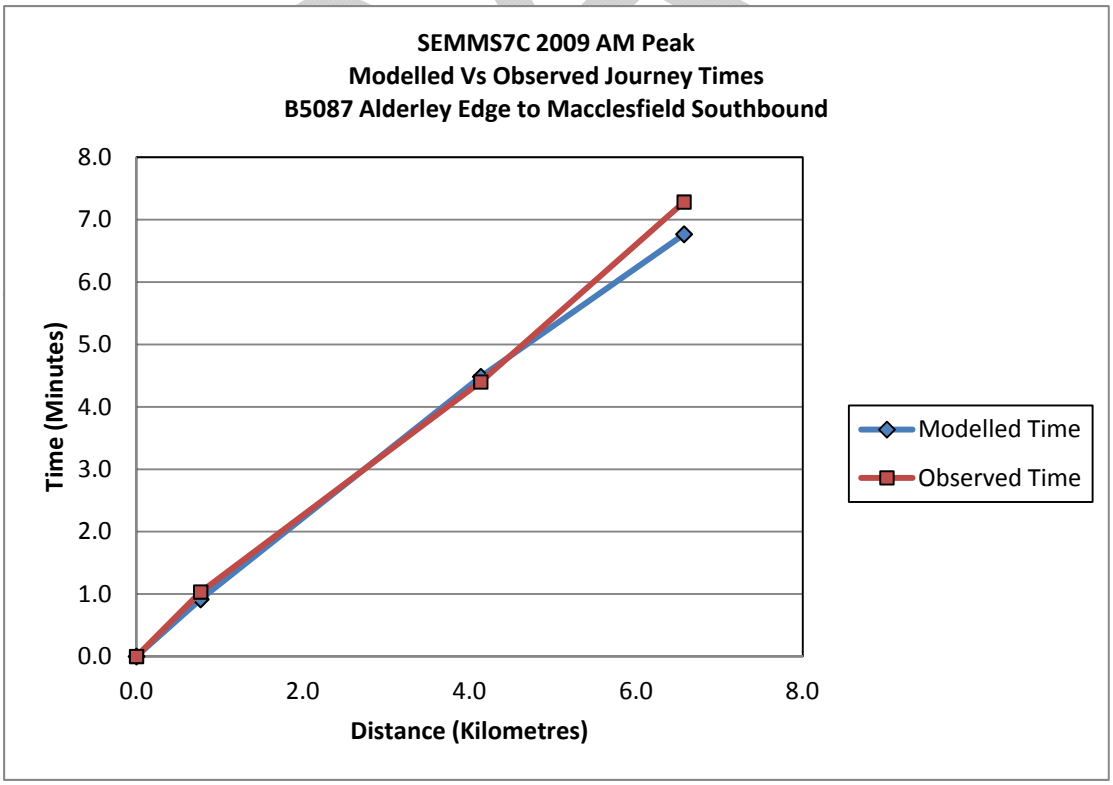

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A537 Knutsford to Macclesfield Eastbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Distance (Kilometres)
Modelled Time
Observed Time

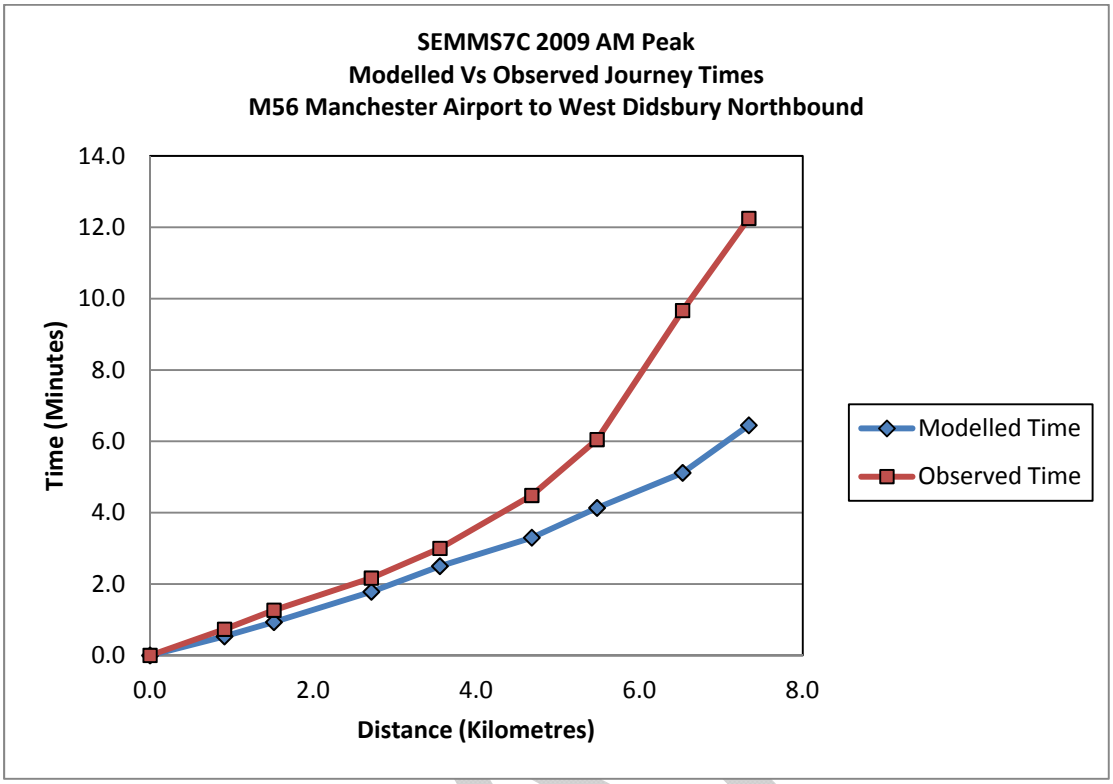

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A537 Macclesfield to Knutsford Westbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Distance (Kilometres)
Modelled Time
Observed Time

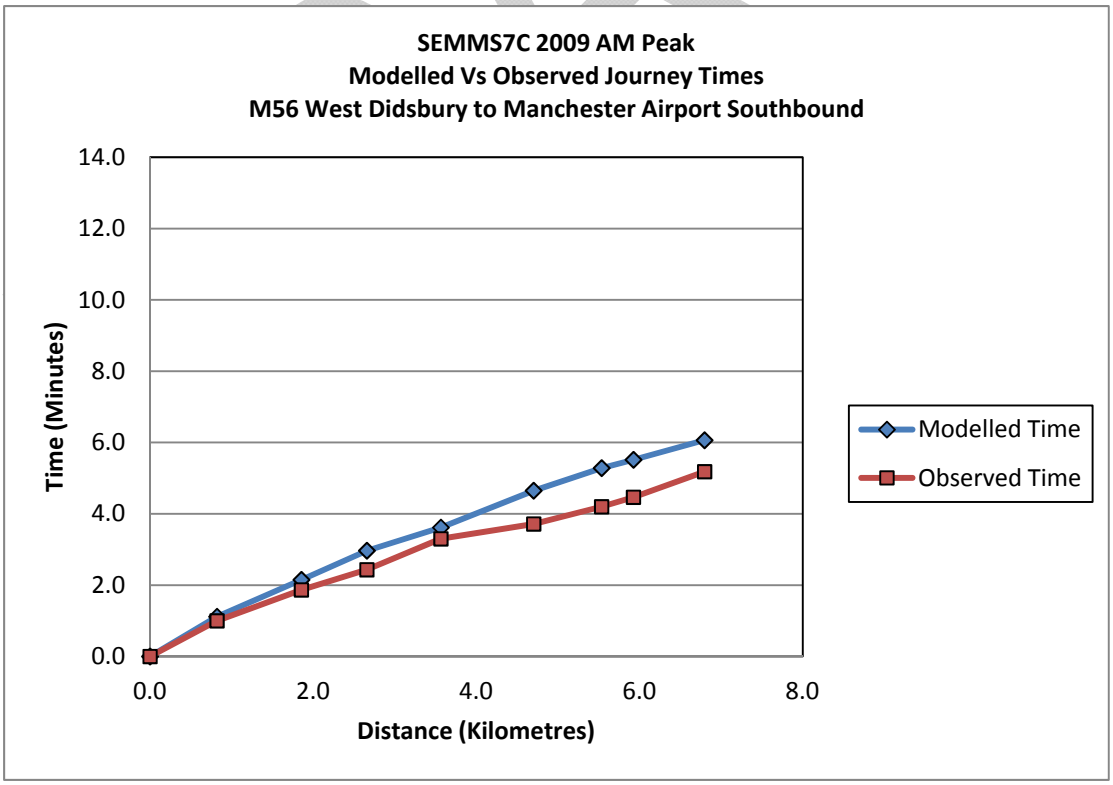

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
B5085 Knutsford to Alderley Edge Eastbound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

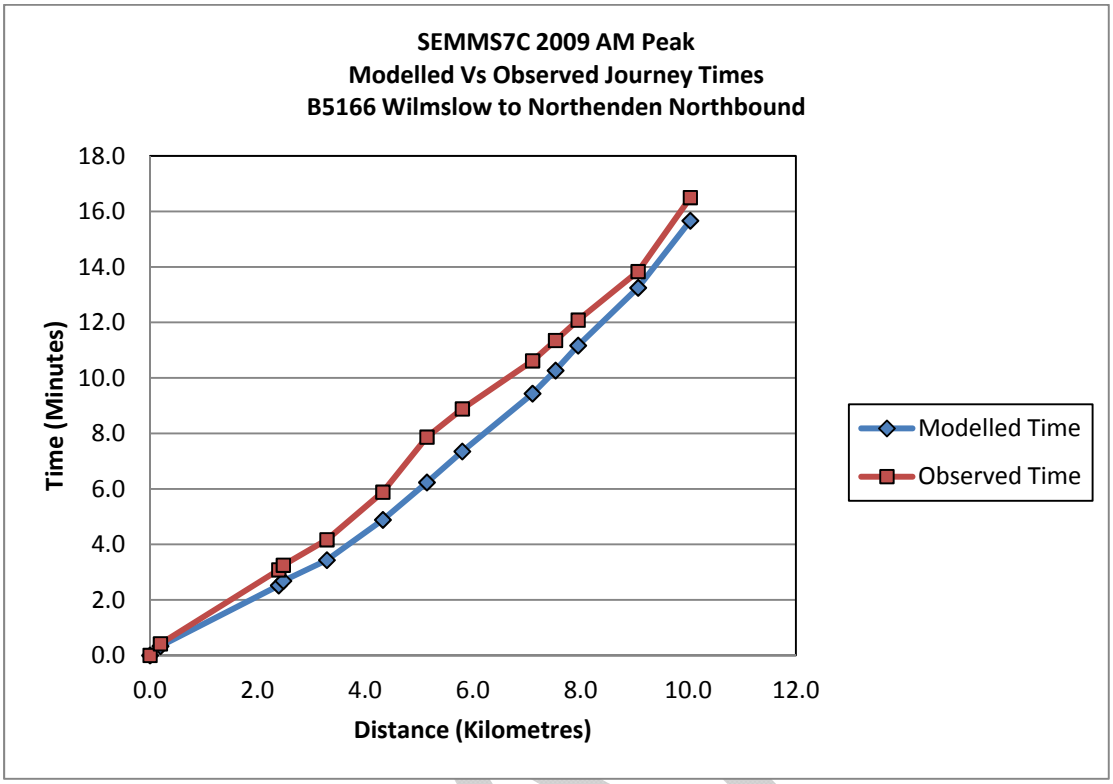

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
B5085 Alderley Edge to Knutsford Westbound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

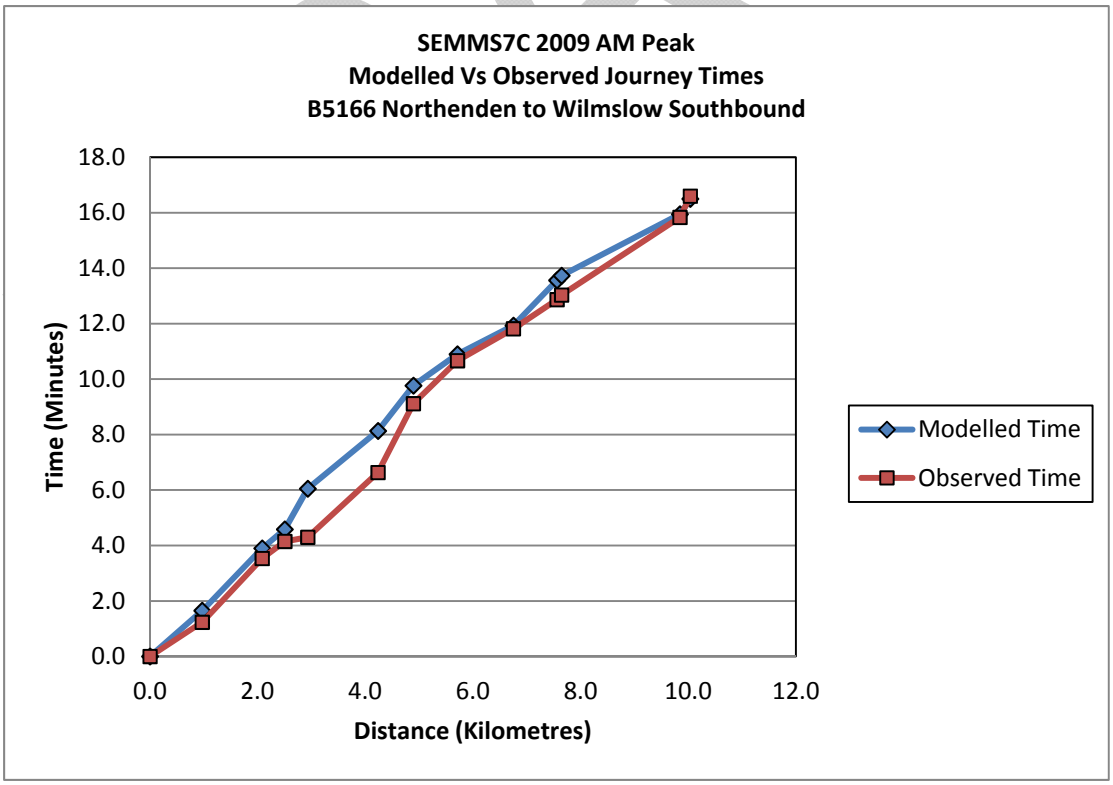

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
B5087 Macclesfield to Alderley Edge Northbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

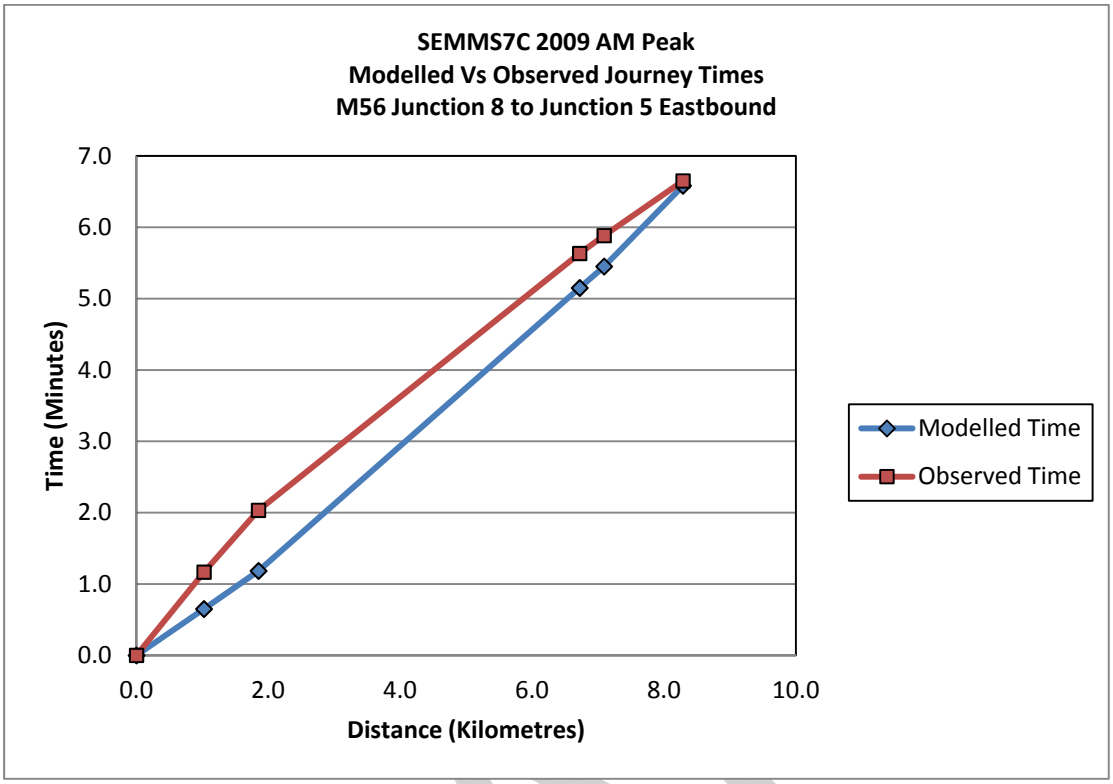

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
B5087 Alderley Edge to Macclesfield Southbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

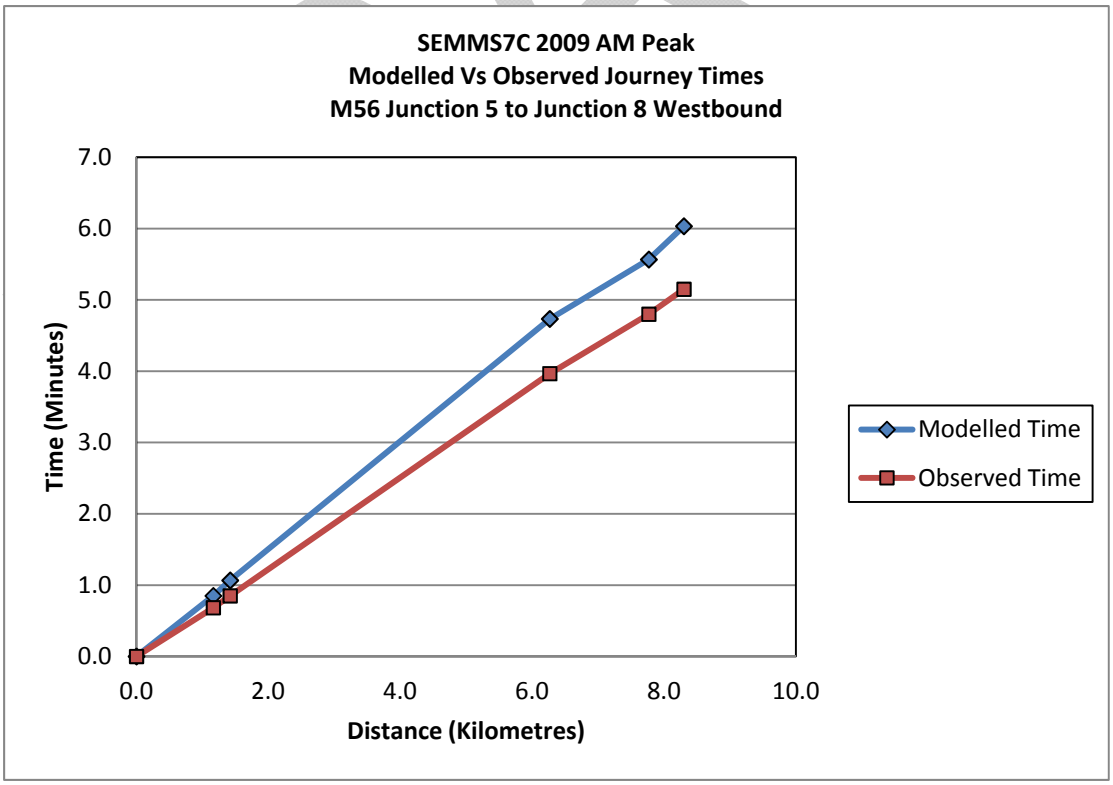

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
M56 Manchester Airport to West Didsbury Northbound
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

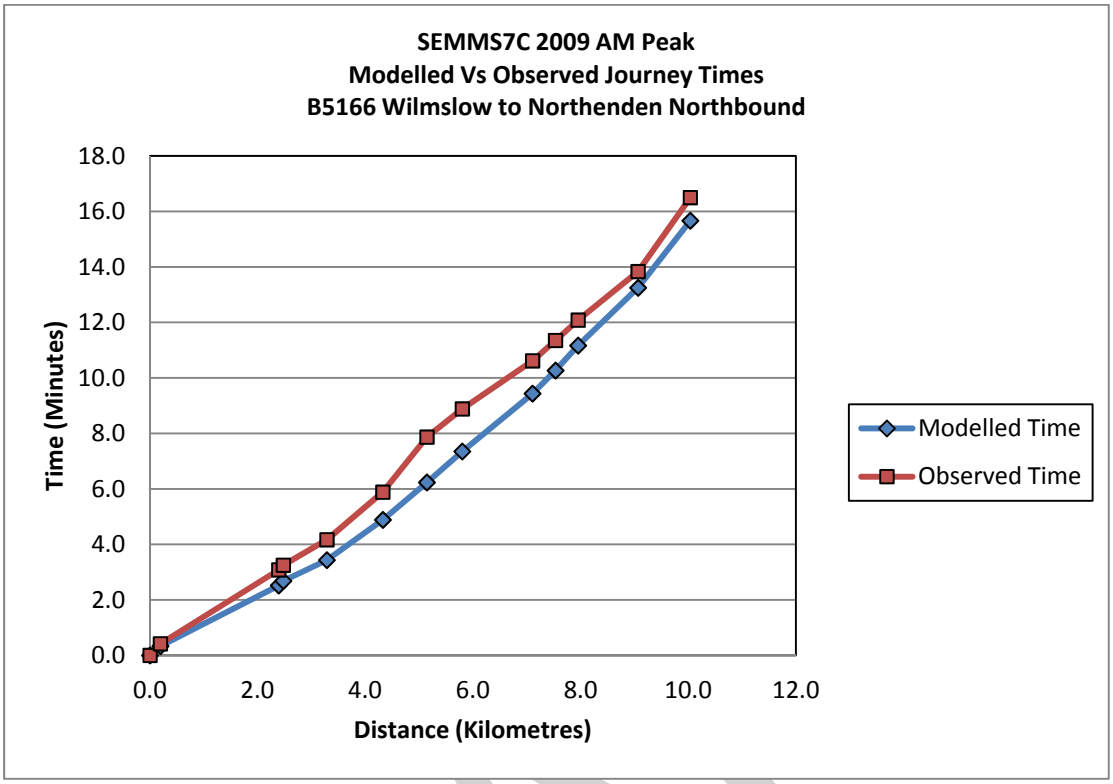

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
M56 West Didsbury to Manchester Airport Southbound
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

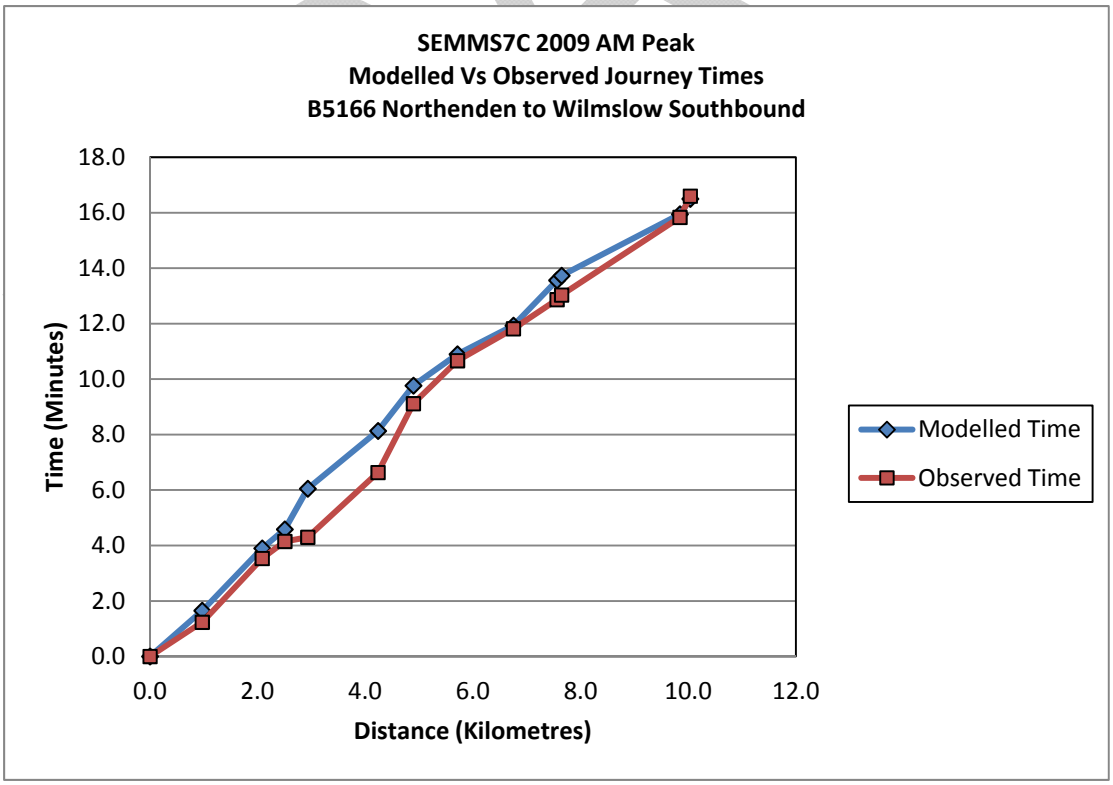

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
B5166 Wilmslow to Northenden Northbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

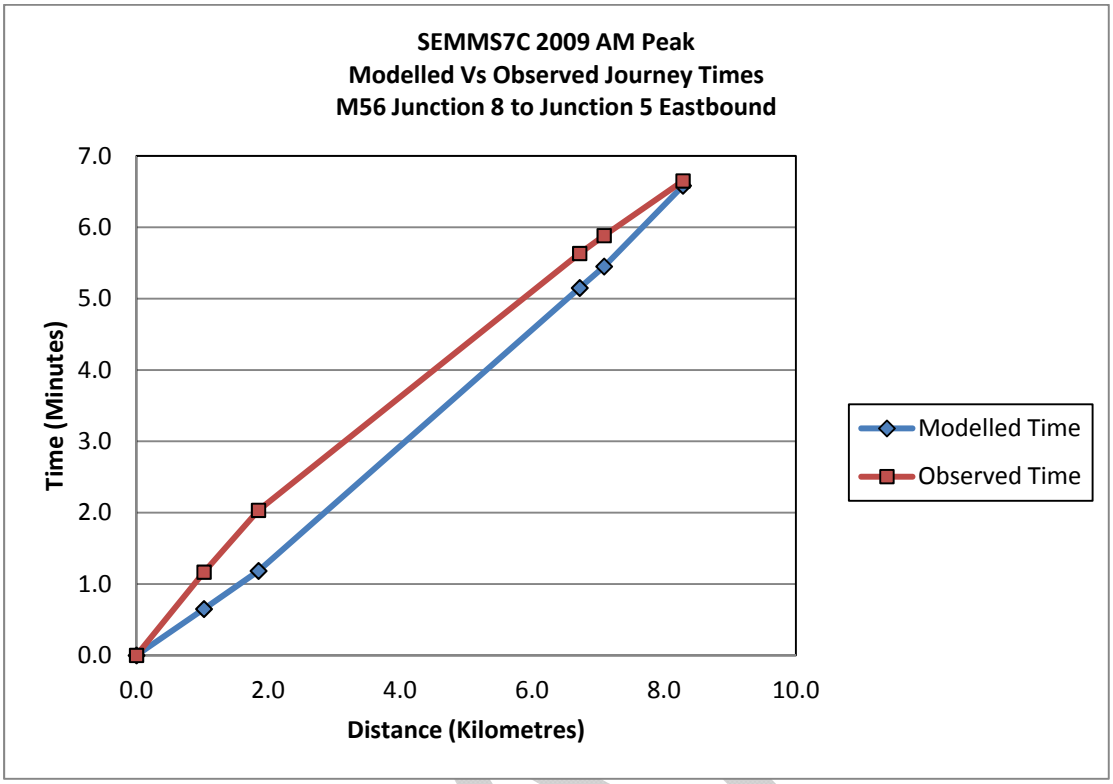

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
B5166 Northenden to Wilmslow Southbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

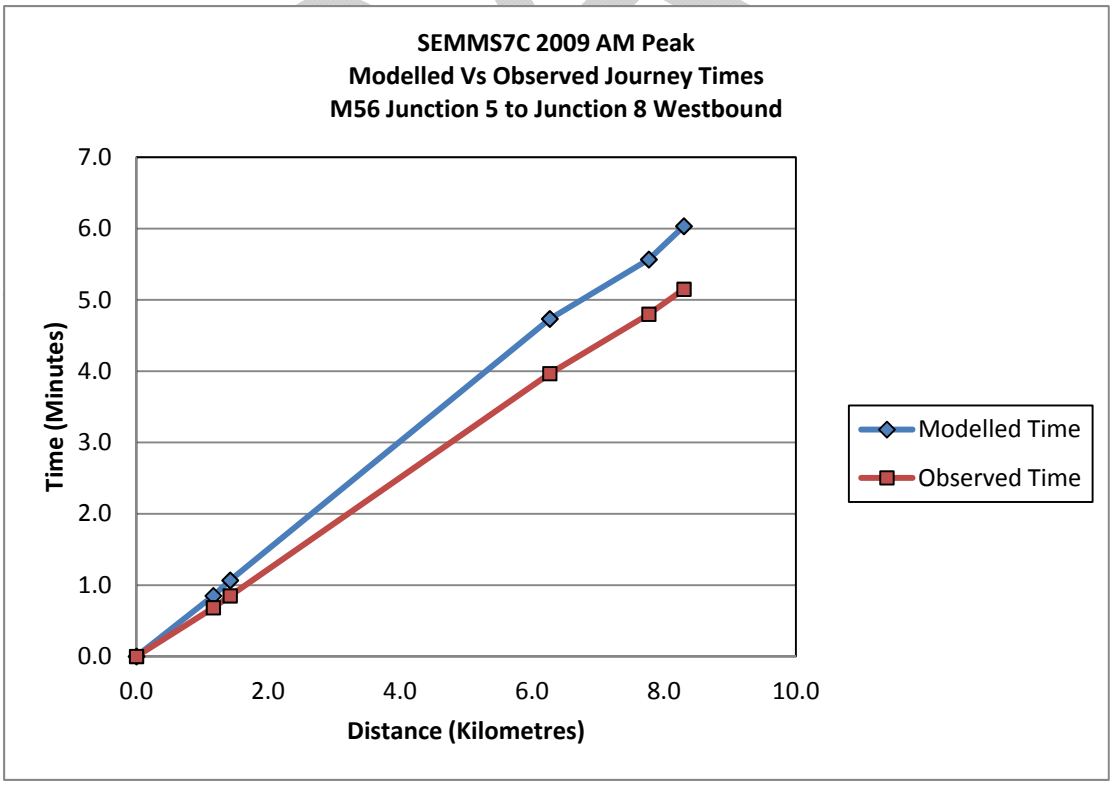

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
M56 Junction 8 to Junction 5 Eastbound
Time (Minutes)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
Distance (Kilometres)
Modelled Time
Observed Time

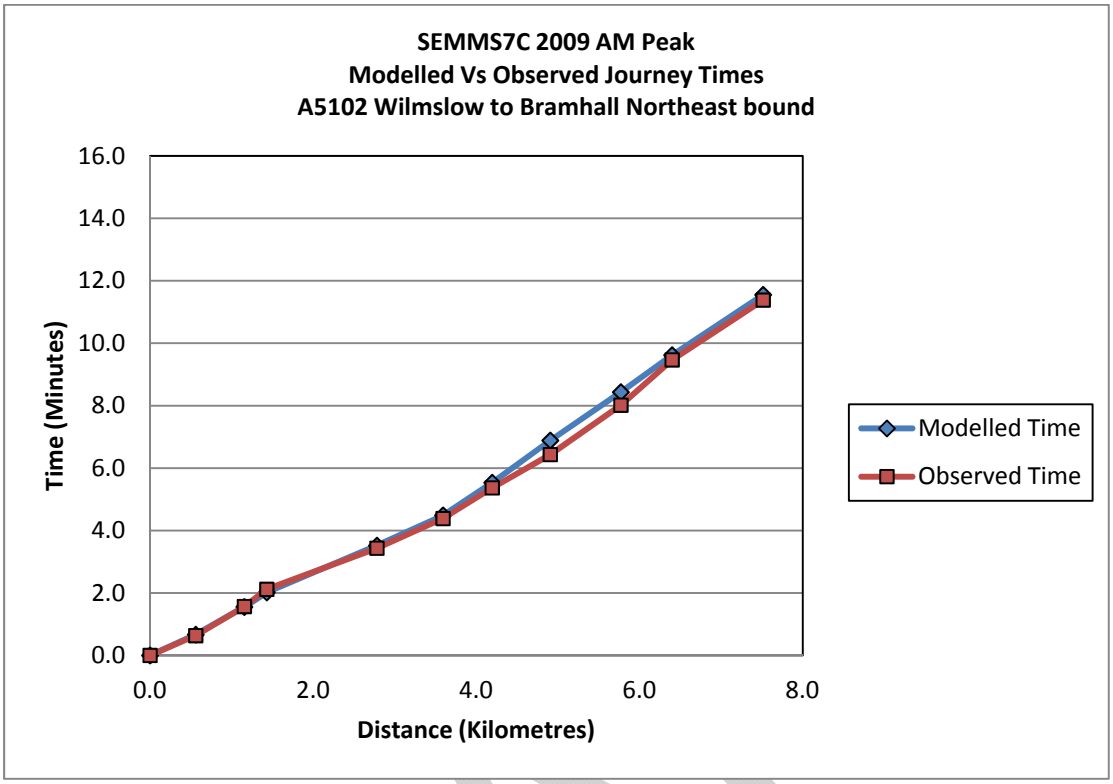

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
M56 Junction 5 to Junction 8 Westbound
Time (Minutes)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
Distance (Kilometres)
Modelled Time
Observed Time

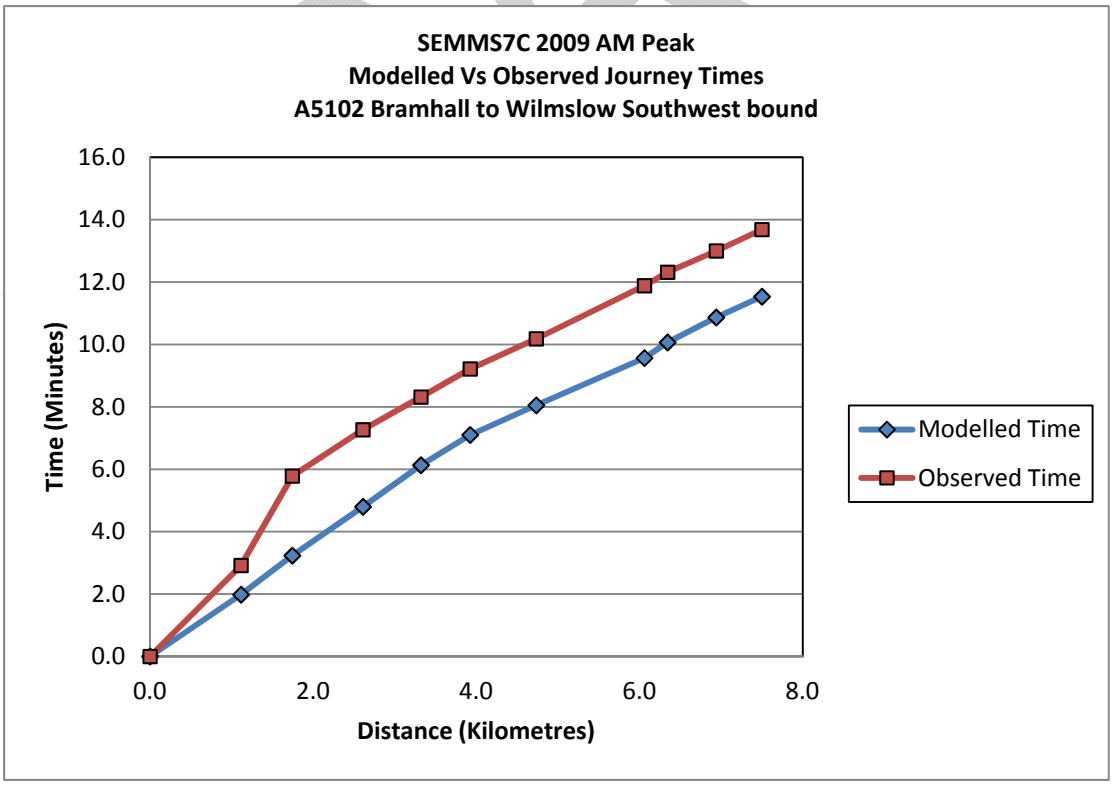

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
B5166 Wilmslow to Northenden Northbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

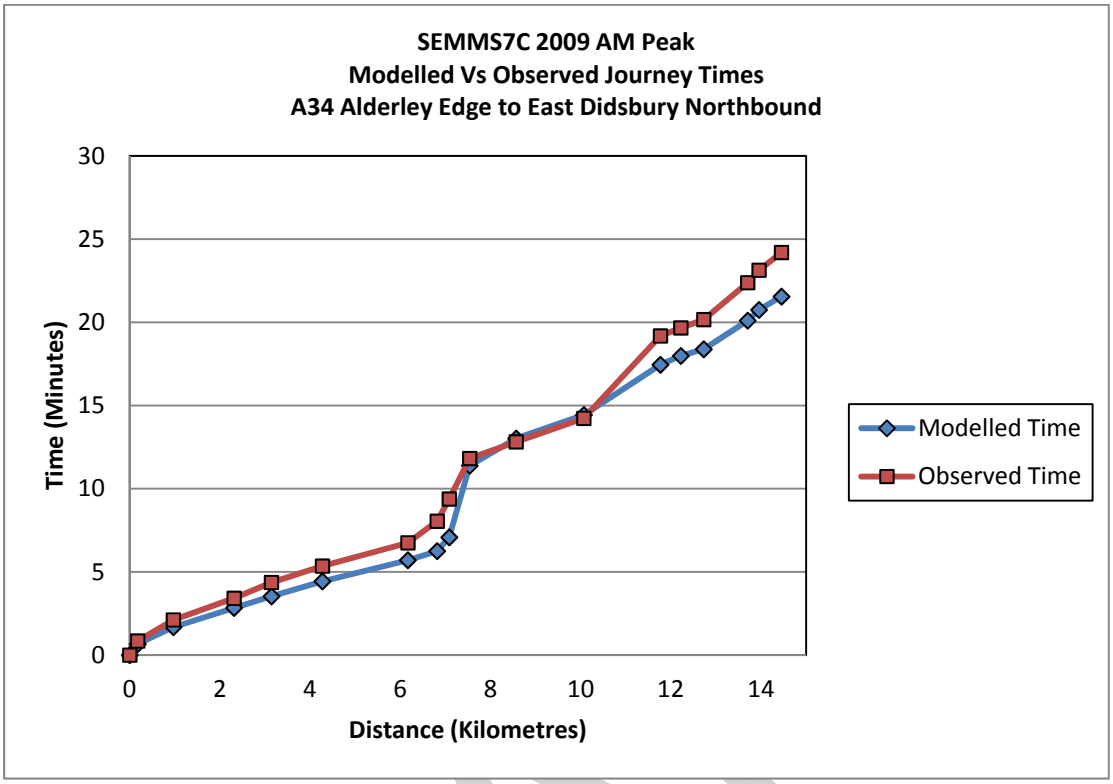

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
B5166 Northenden to Wilmslow Southbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

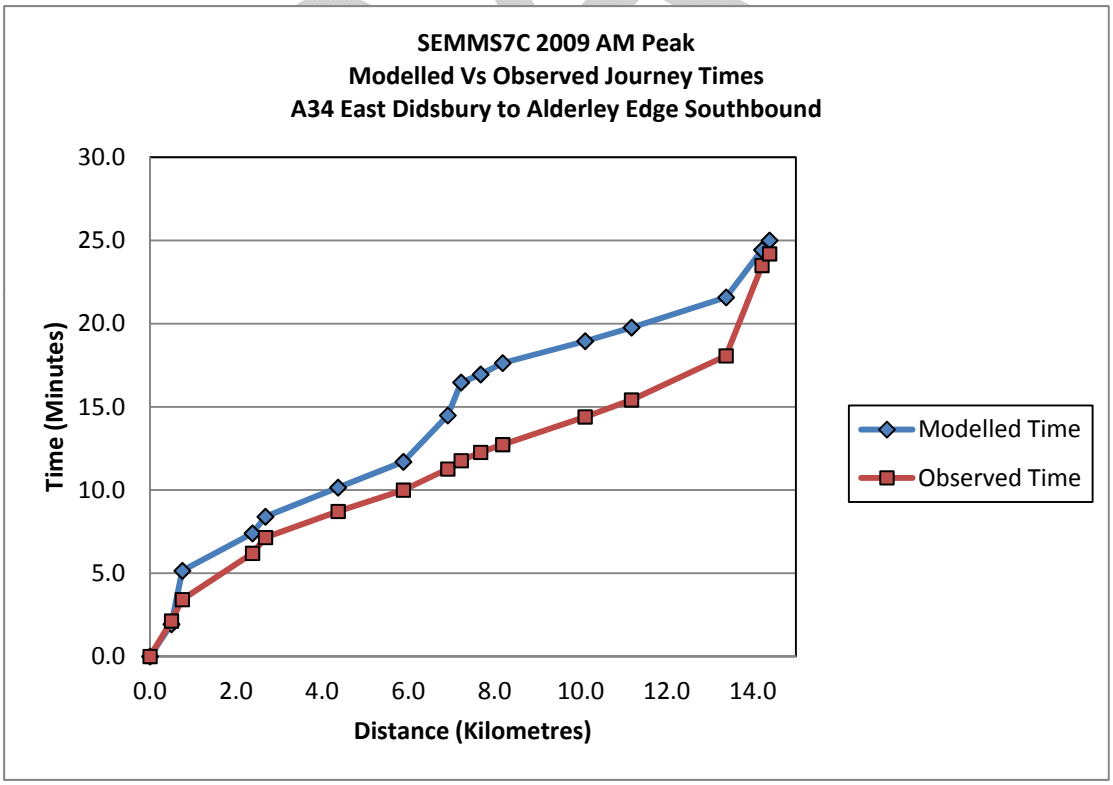

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
M56 Junction 8 to Junction 5 Eastbound
Time (Minutes)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
Distance (Kilometres)
Modelled Time
Observed Time

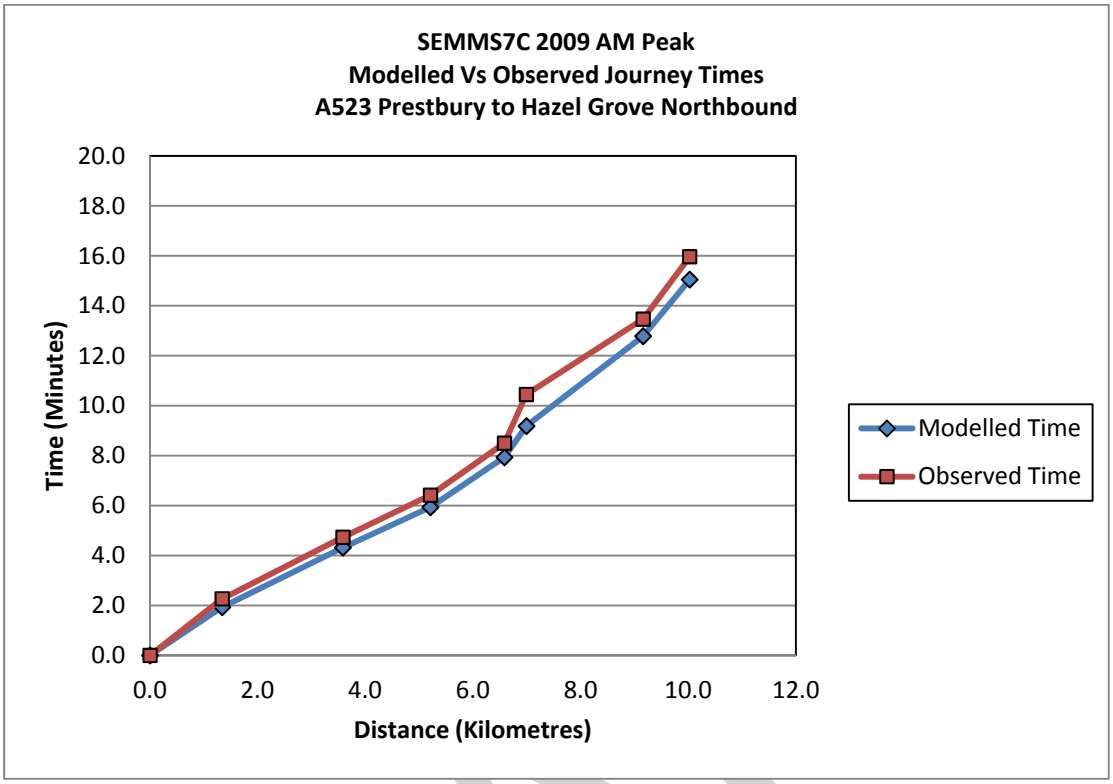

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
M56 Junction 5 to Junction 8 Westbound
Time (Minutes)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
Distance (Kilometres)
Modelled Time
Observed Time

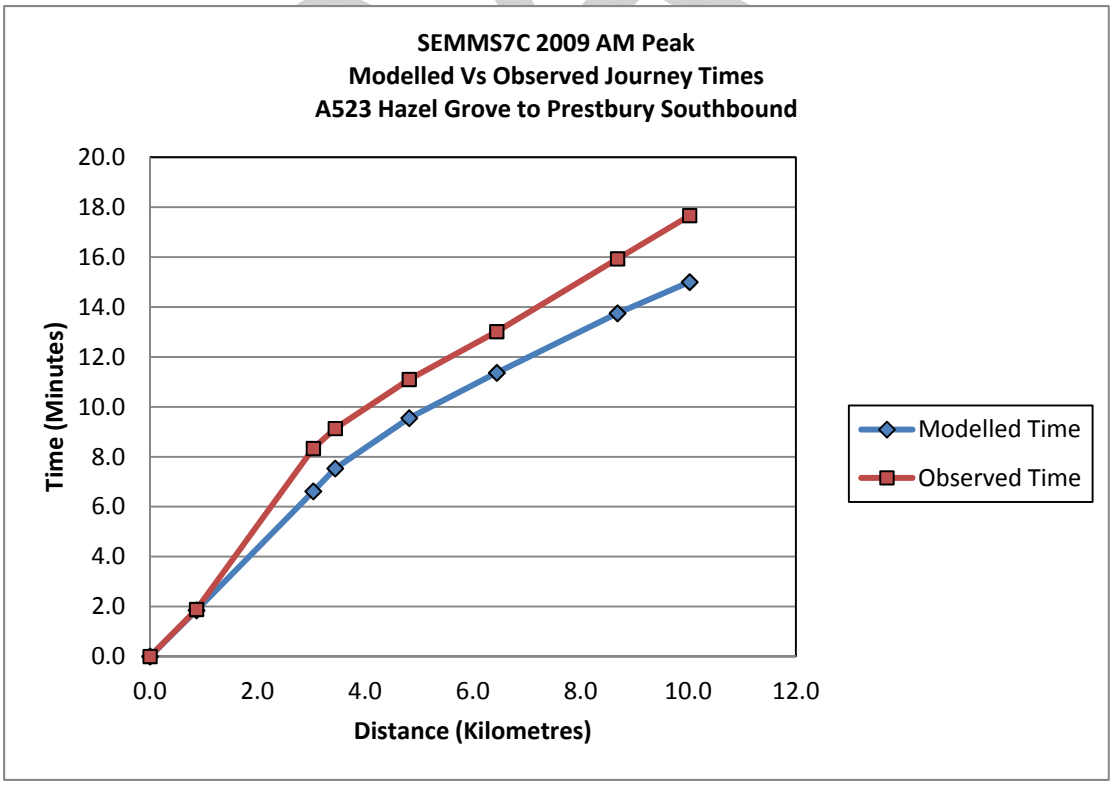

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A5102 Wilmslow to Bramhall Northeast bound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

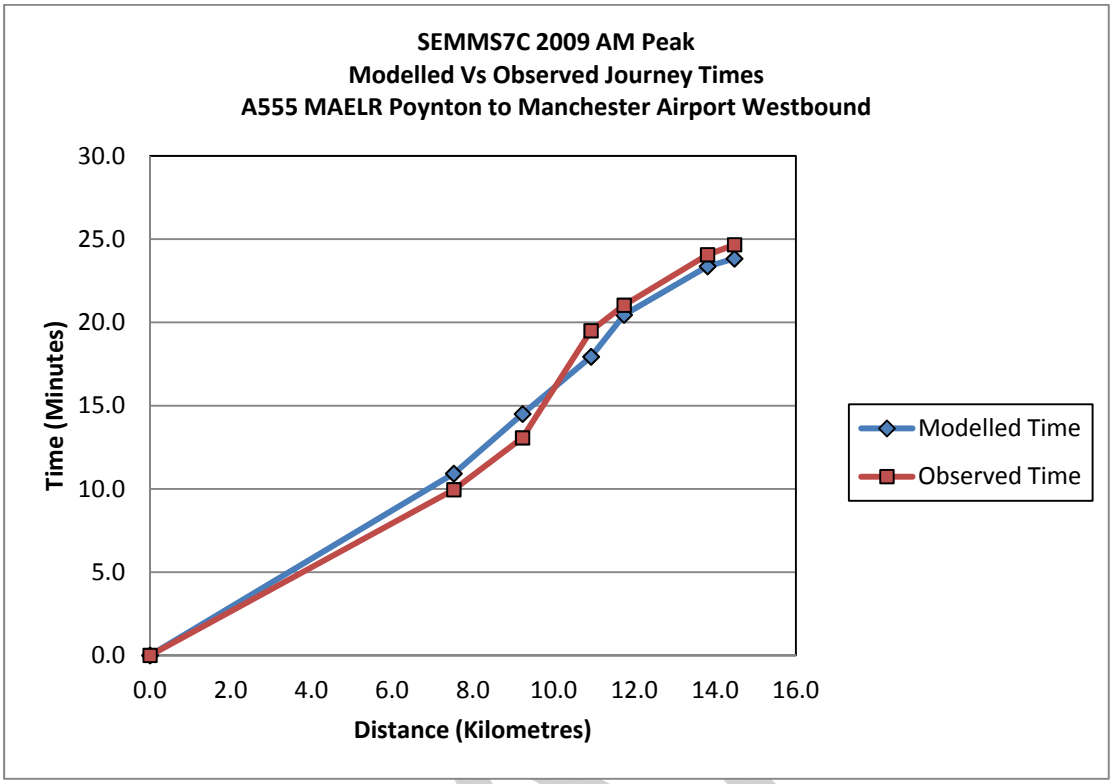

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A5102 Bramhall to Wilmslow Southwest bound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

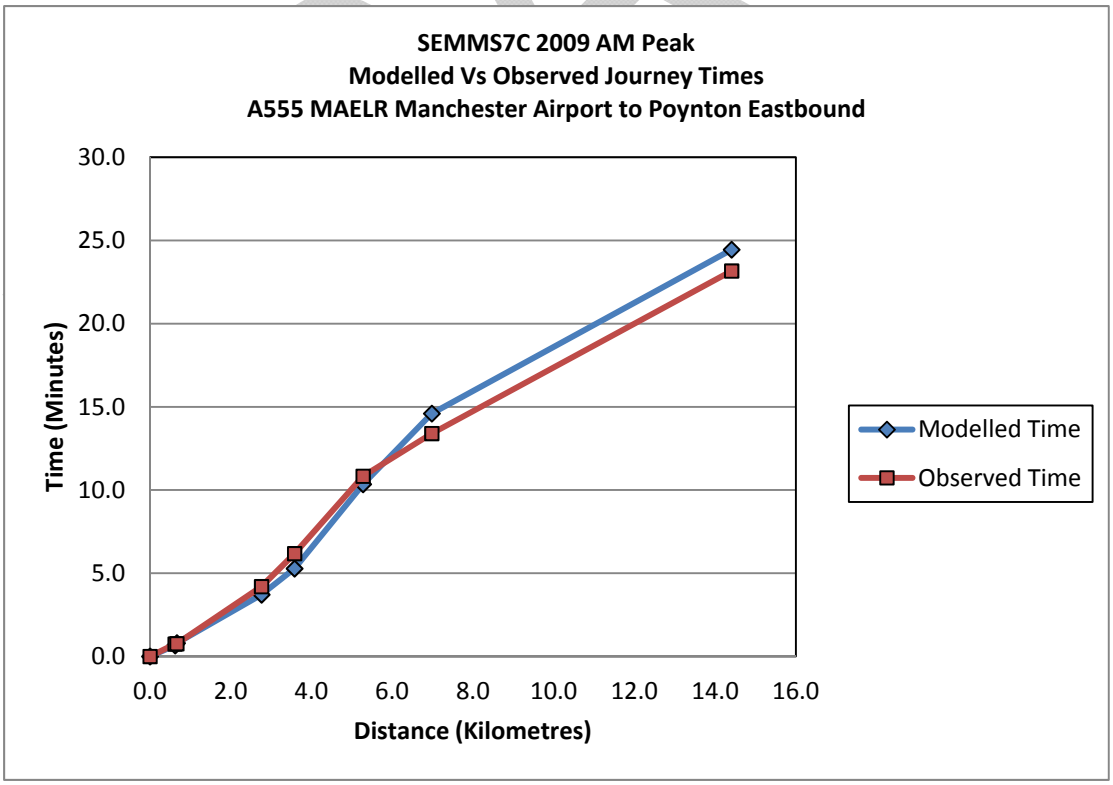

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A34 Alderley Edge to East Didsbury Northbound
Time (Minutes)
Distance (Kilometres)
Modelled Time
Observed Time

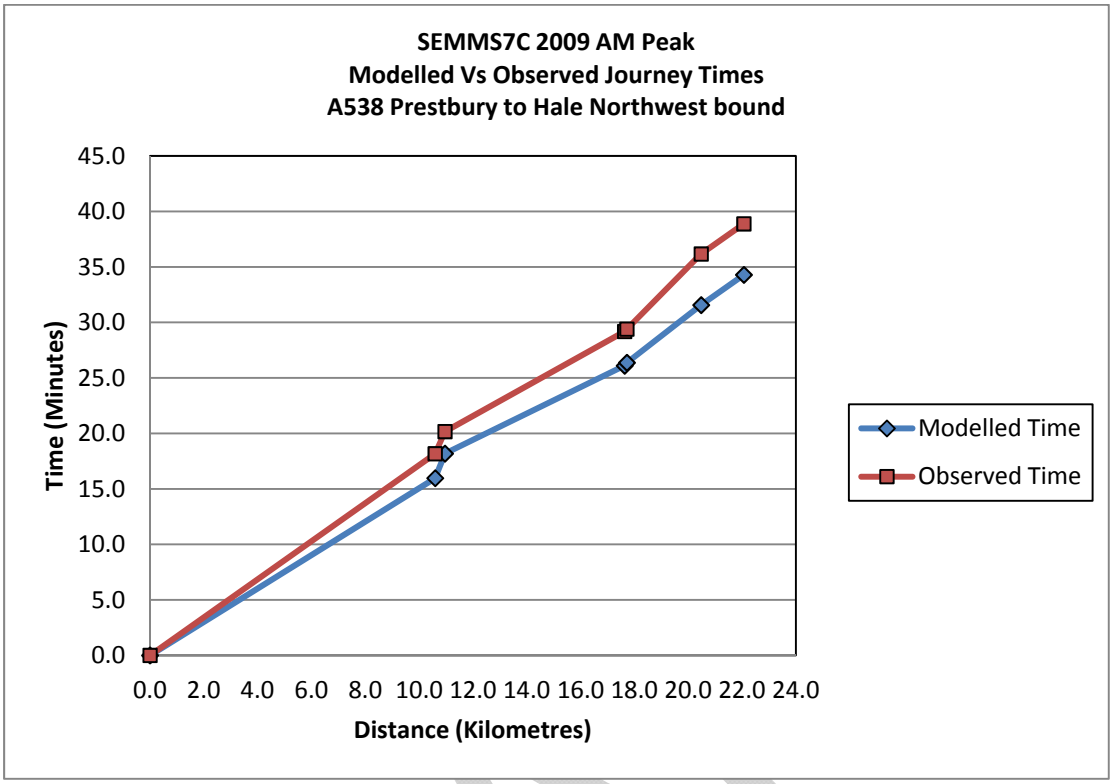

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A34 East Didsbury to Alderley Edge Southbound
Time (Minutes)
Distance (Kilometres)
Modelled Time
Observed Time

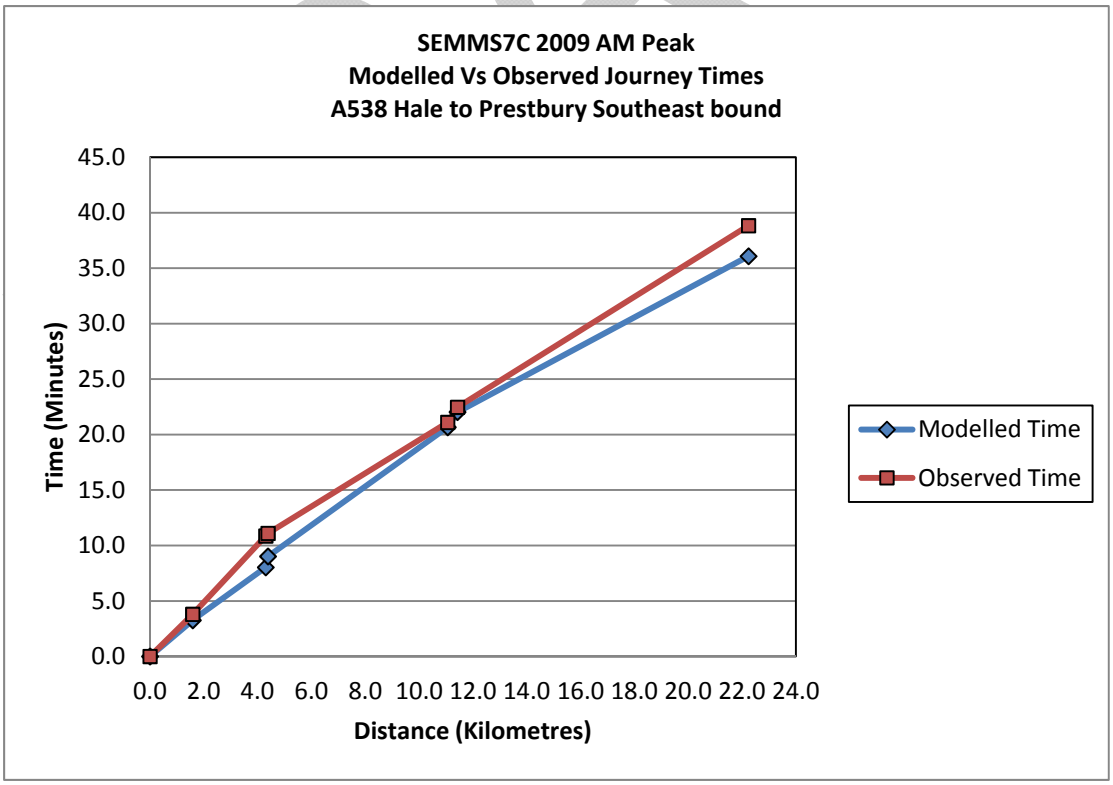

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A523 Prestbury to Hazel Grove Northbound
Time (Minutes)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

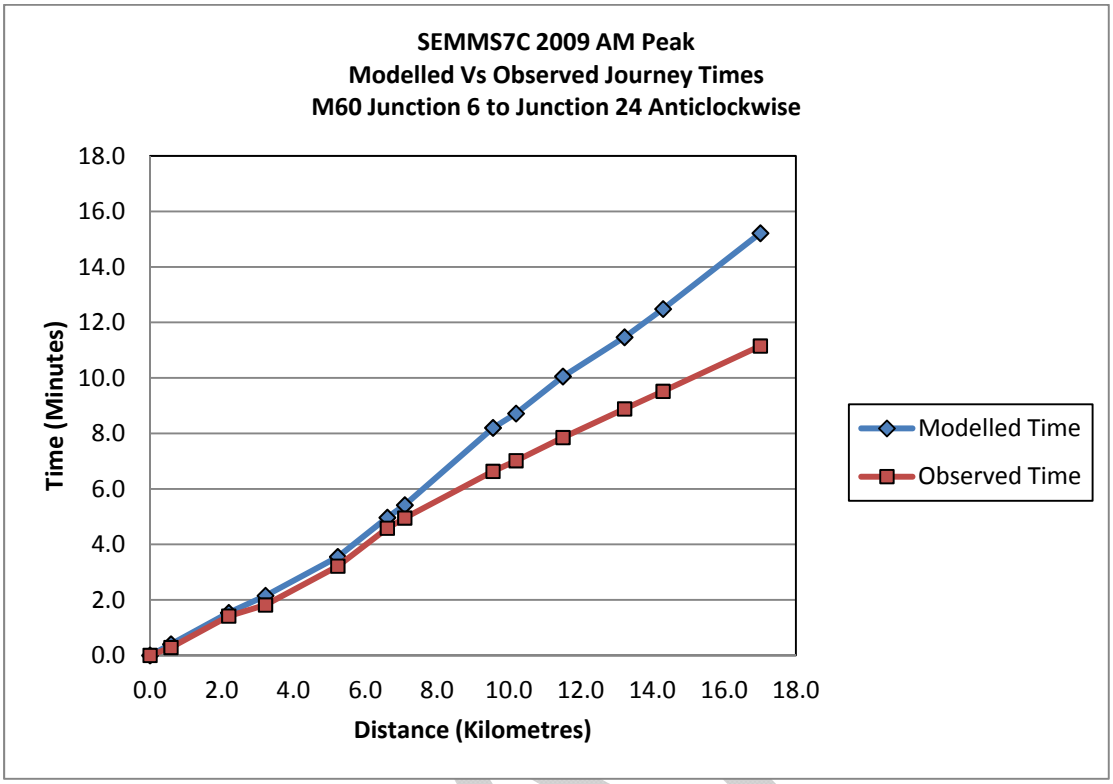

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A523 Hazel Grove to Prestbury Southbound
Time (Minutes)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

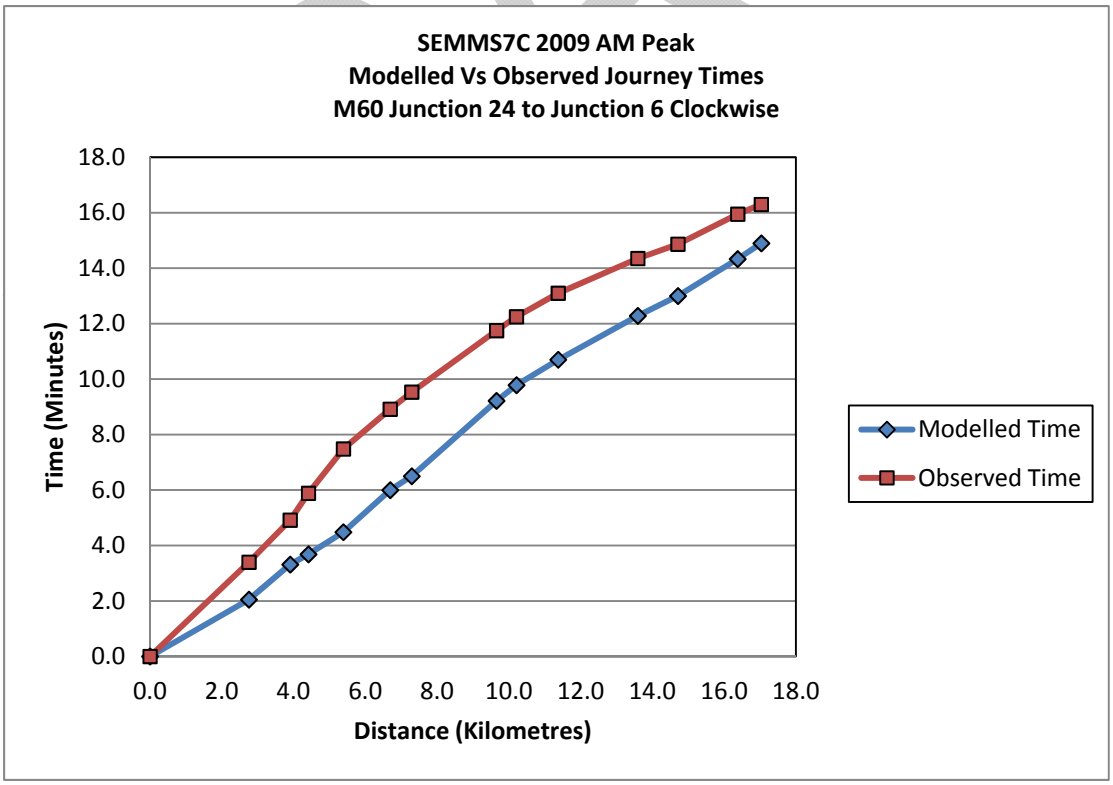

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A555 MAELR Poynton to Manchester Airport Westbound
Time (Minutes)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Distance (Kilometres)
Modelled Time
Observed Time

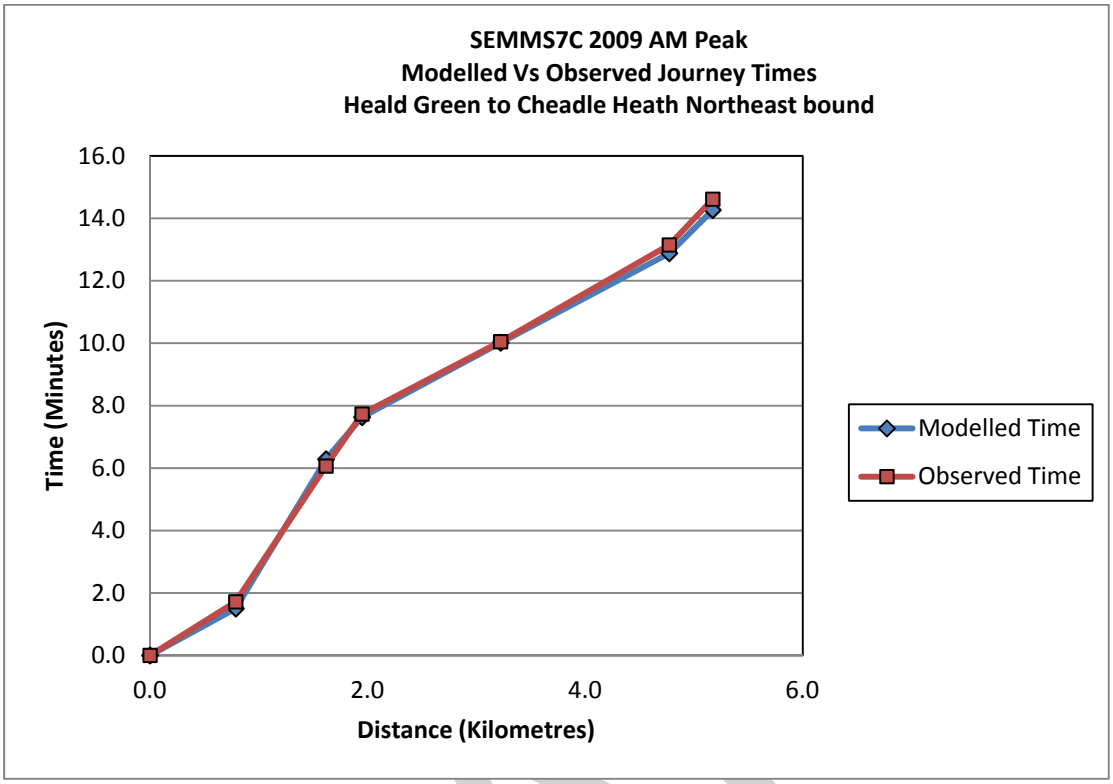

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A555 MAELR Manchester Airport to Poynton Eastbound
Time (Minutes)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Distance (Kilometres)
Modelled Time
Observed Time

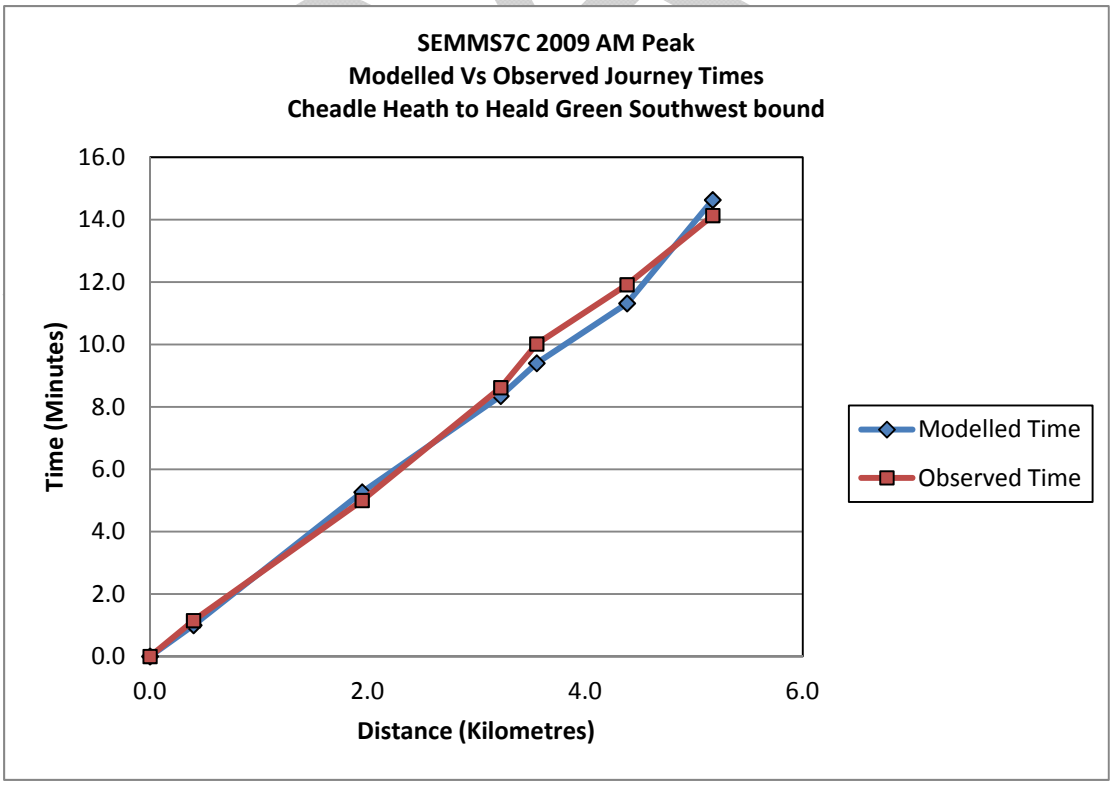

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A538 Prestbury to Hale Northwest bound
Time (Minutes)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0
Distance (Kilometres)
Modelled Time
Observed Time

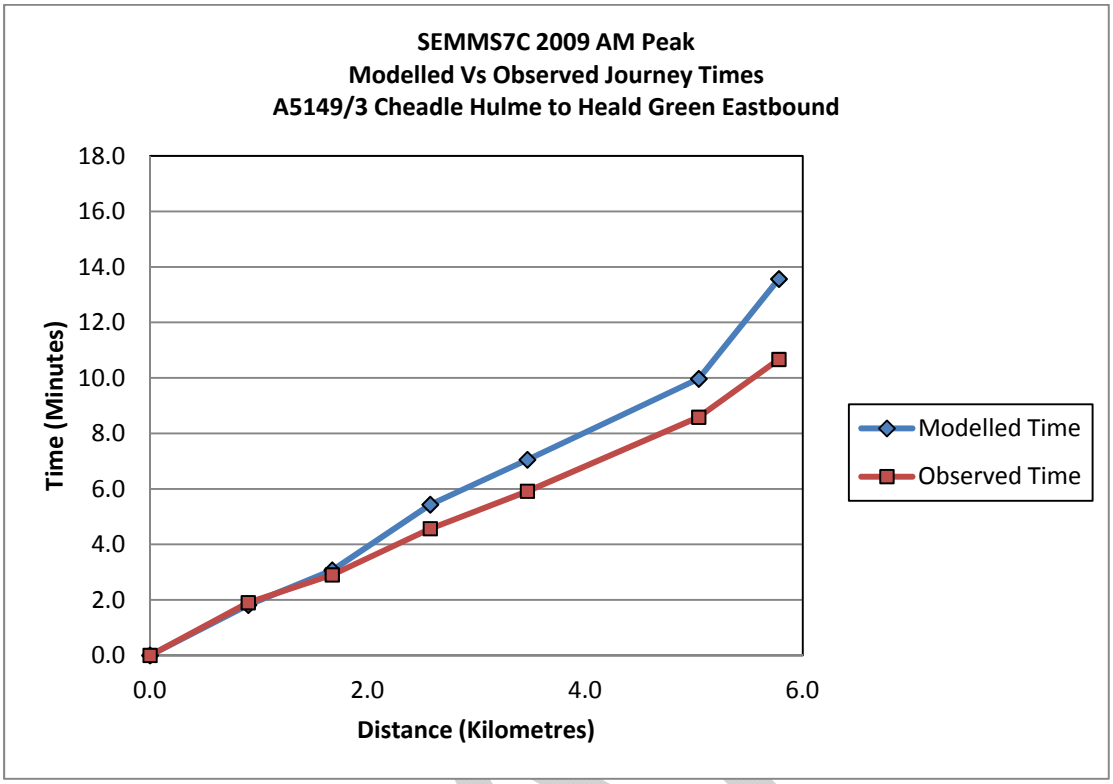

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A538 Hale to Prestbury Southeast bound
Time (Minutes)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0
Distance (Kilometres)
Modelled Time
Observed Time

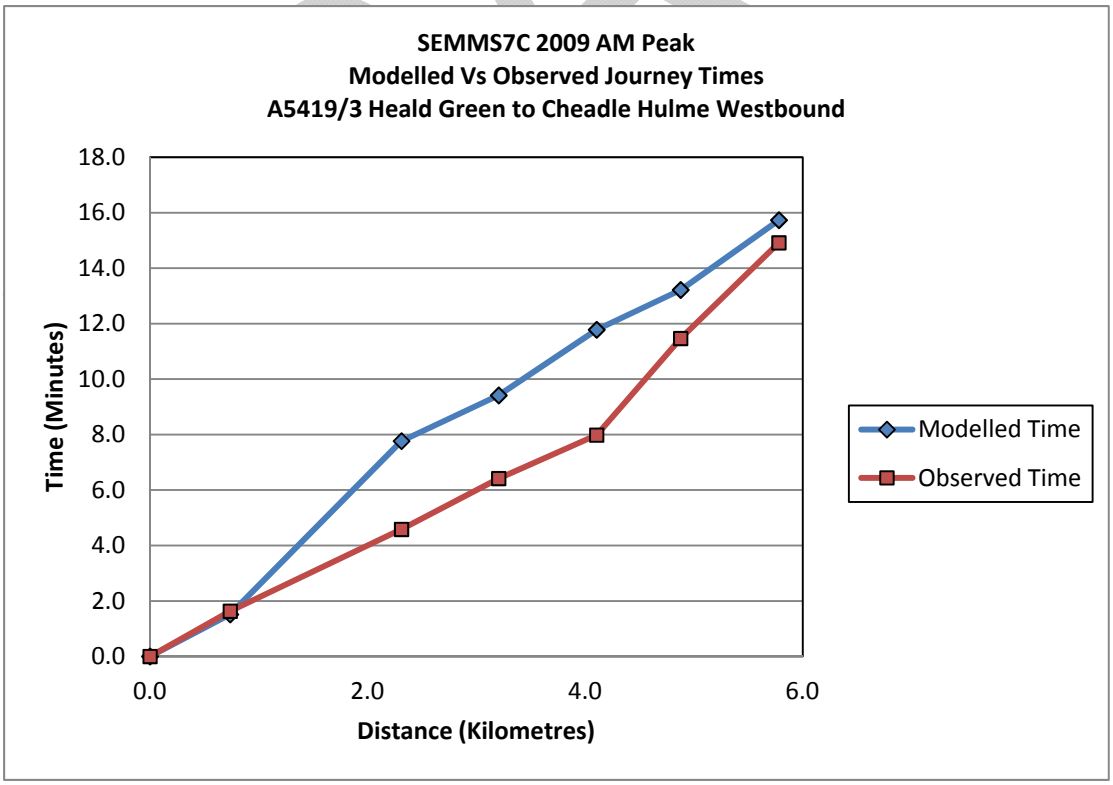

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
M60 Junction 6 to Junction 24 Anticlockwise
Time (Minutes)
Distance (Kilometres)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Modelled Time
Observed Time

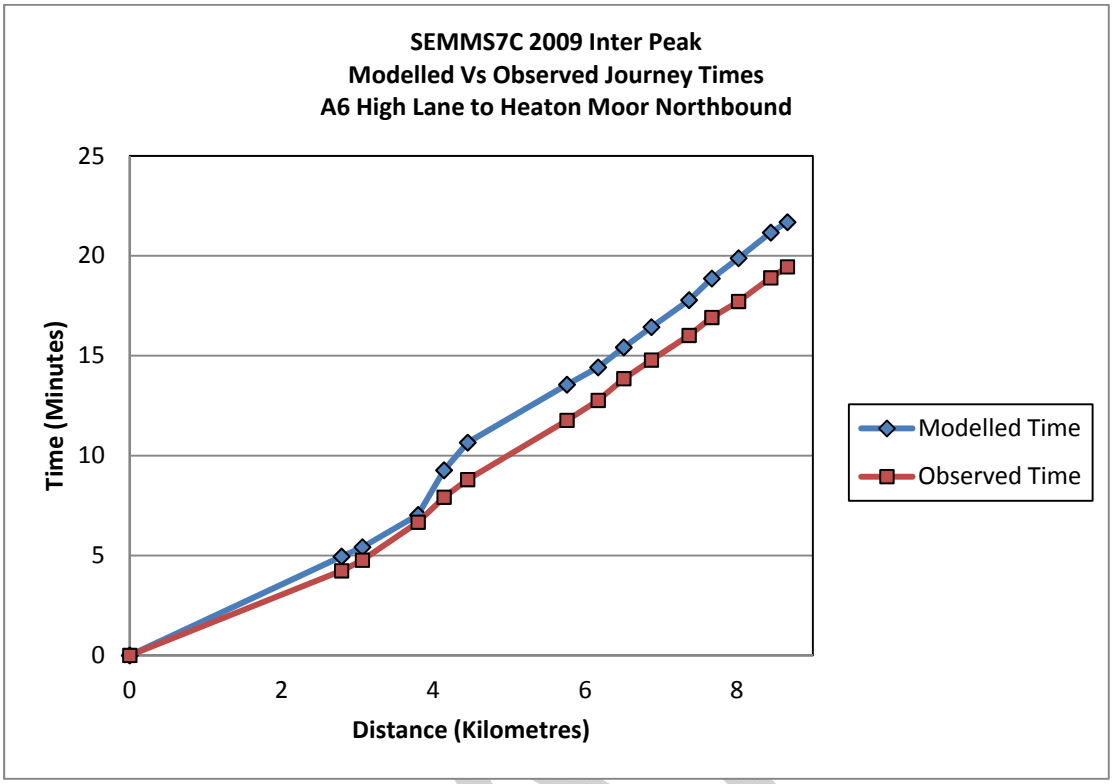

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
M60 Junction 24 to Junction 6 Clockwise
Time (Minutes)
Distance (Kilometres)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Modelled Time
Observed Time

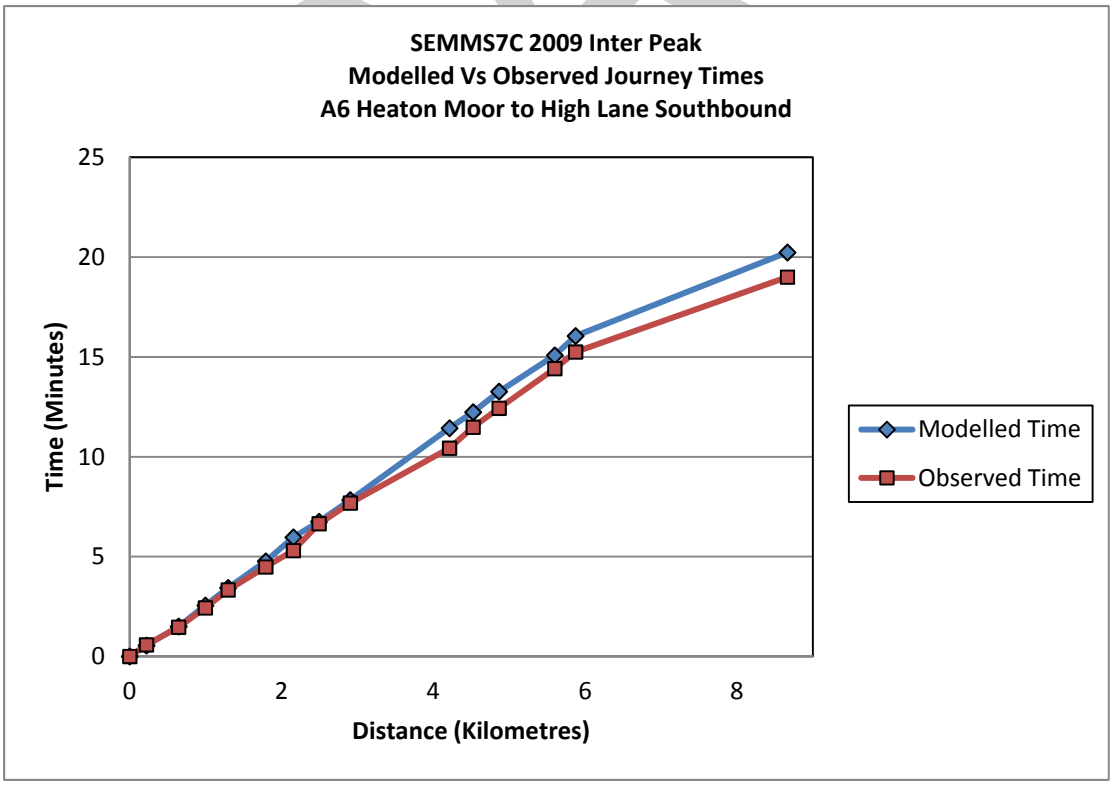

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
Heald Green to Cheadle Heath Northeast bound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

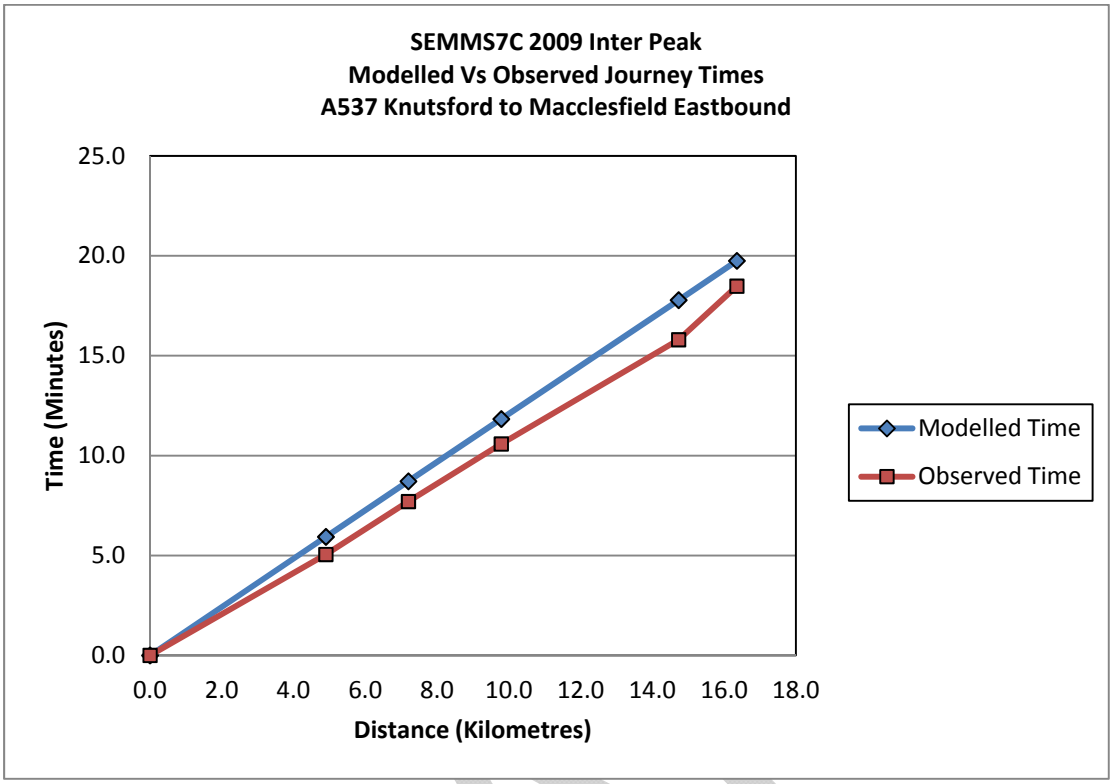

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
Cheadle Heath to Heald Green Southwest bound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

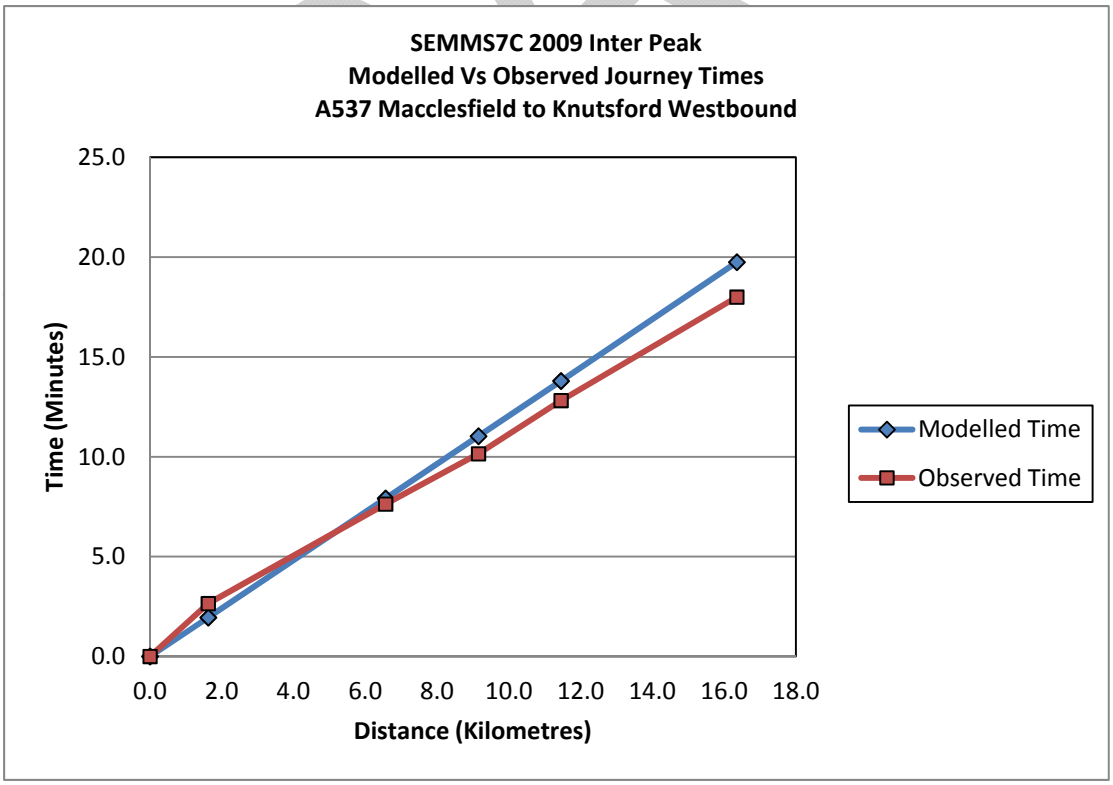

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A5149/3 Cheadle Hulme to Heald Green Eastbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

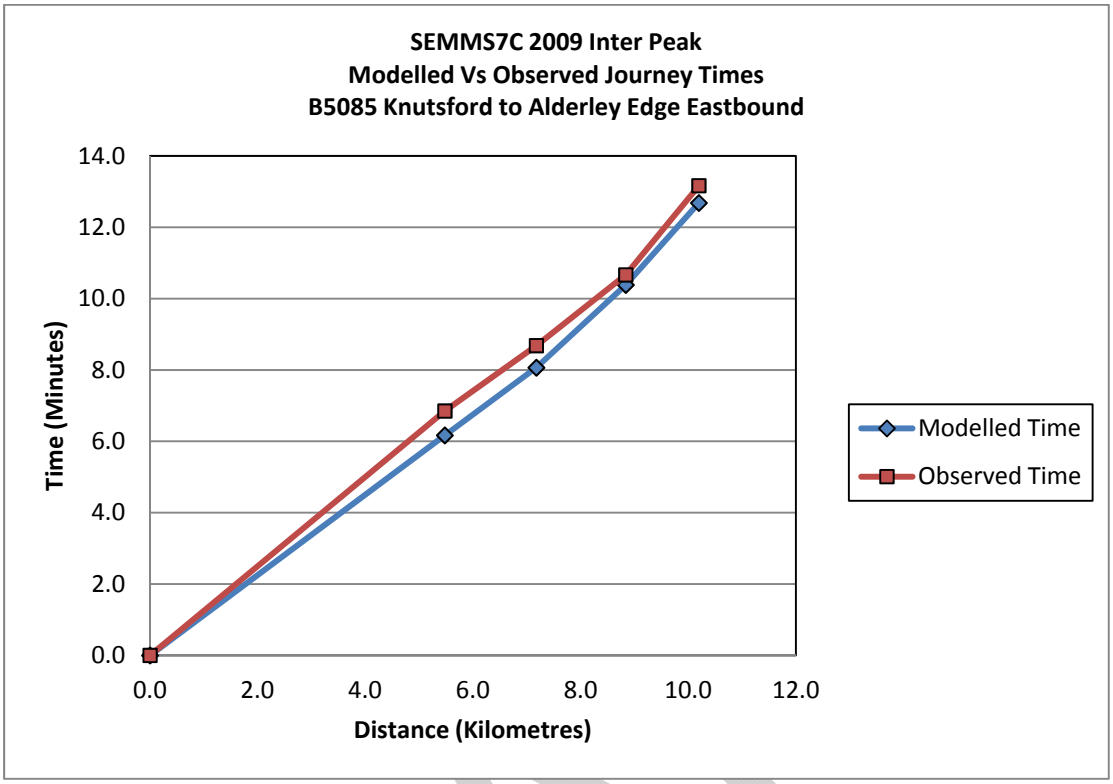

SEMMS7C 2009 AM Peak
Modelled Vs Observed Journey Times
A5419/3 Heald Green to Cheadle Hulme Westbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

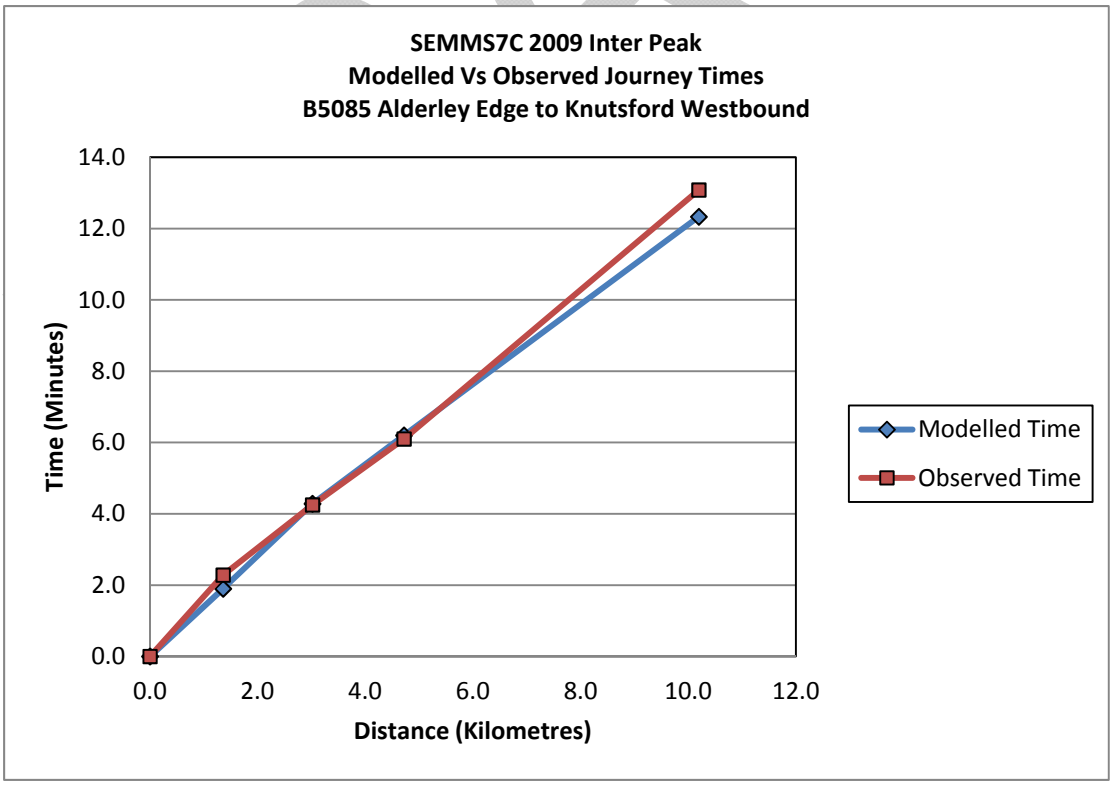

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A6 High Lane to Heaton Moor Northbound
Time (Minutes)
0
5
10
15
20
25
0
2
4
6
8
Distance (Kilometres)
Modelled Time
Observed Time

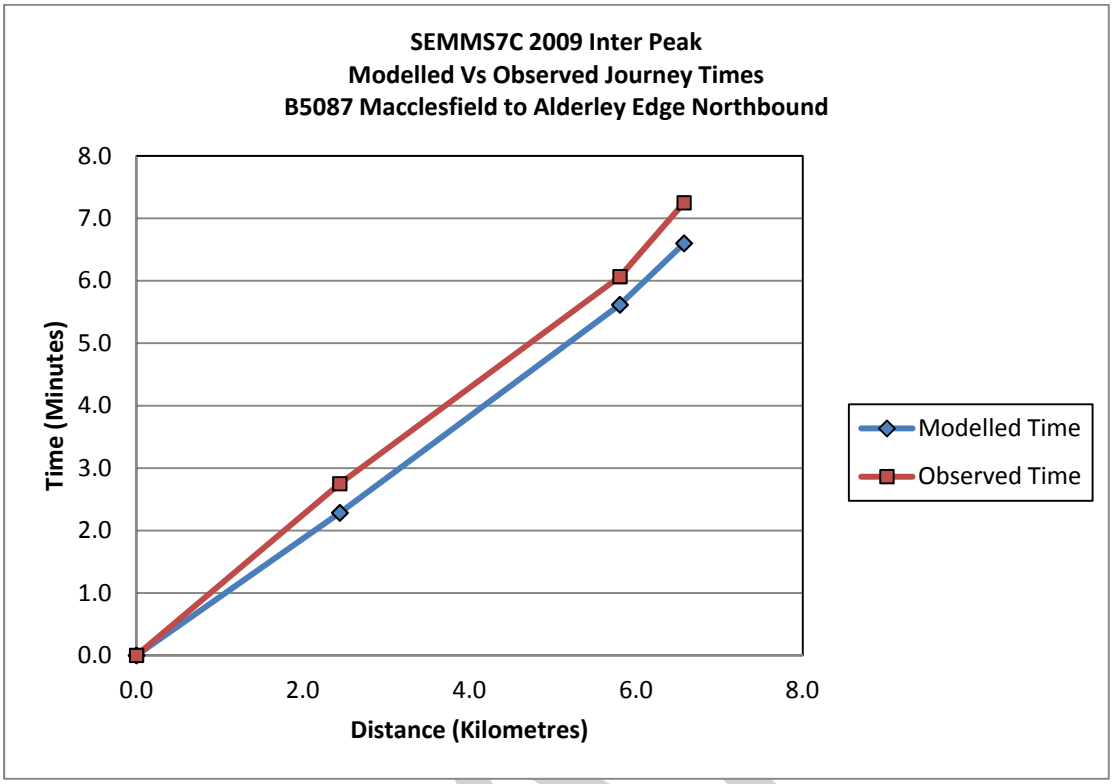

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A6 Heaton Moor to High Lane Southbound
Time (Minutes)
0
5
10
15
20
25
0
2
4
6
8
Distance (Kilometres)
Modelled Time
Observed Time

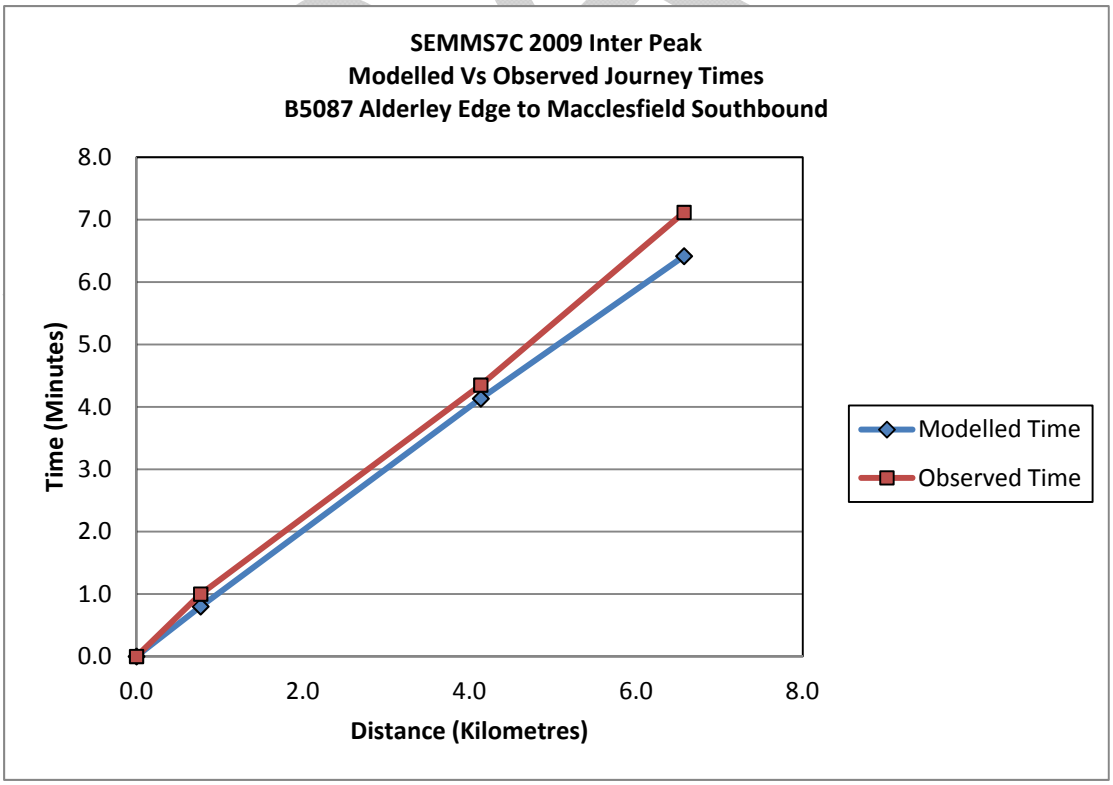

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A537 Knutsford to Macclesfield Eastbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0
Distance (Kilometres)
Modelled Time
Observed Time

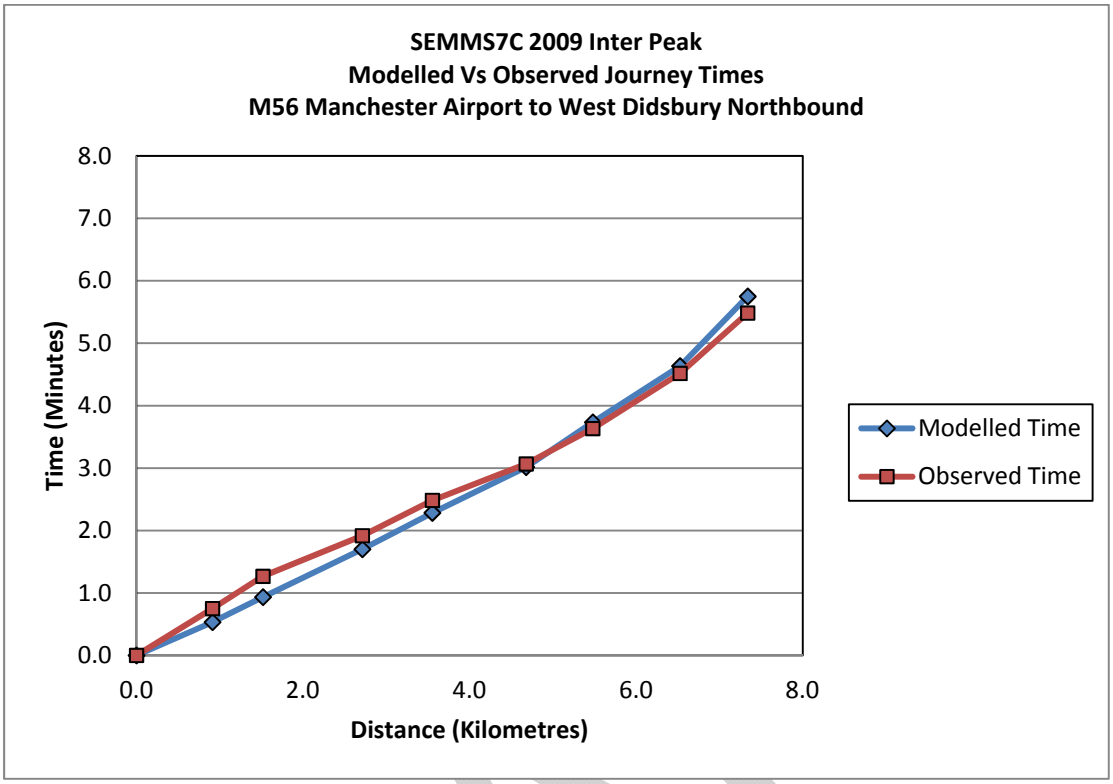

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A537 Macclesfield to Knutsford Westbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0
Distance (Kilometres)
Modelled Time
Observed Time

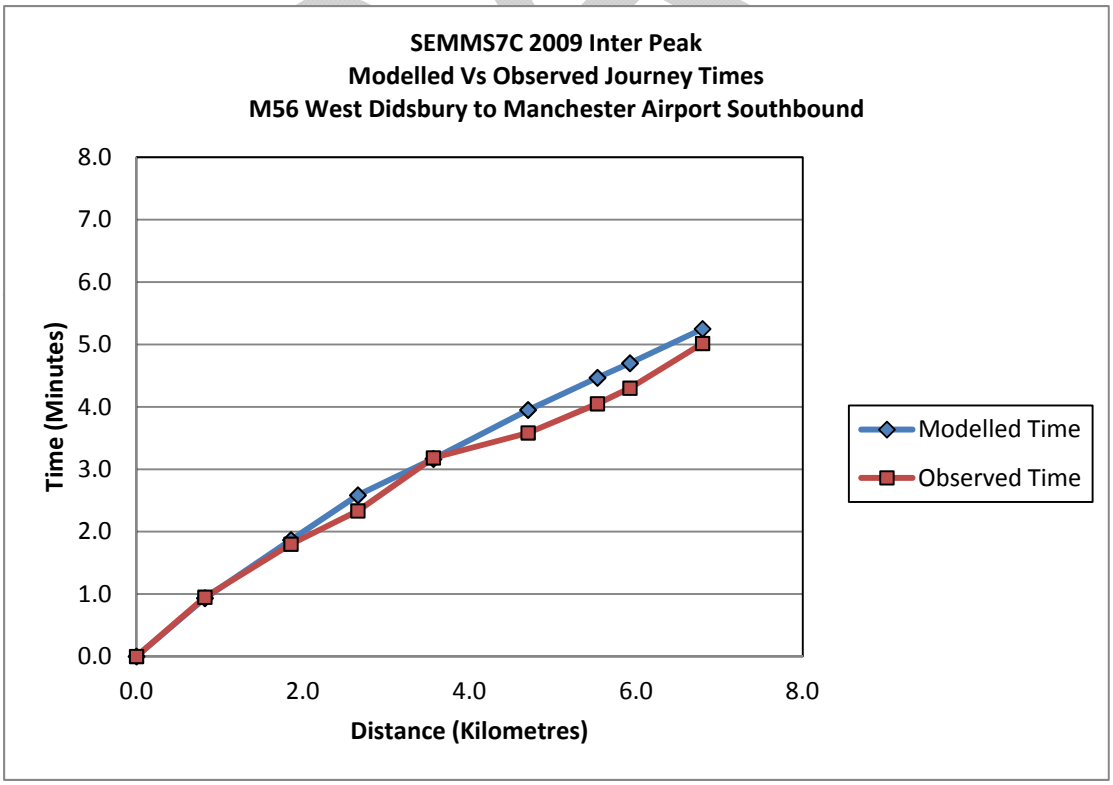

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
B5085 Knutsford to Alderley Edge Eastbound
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

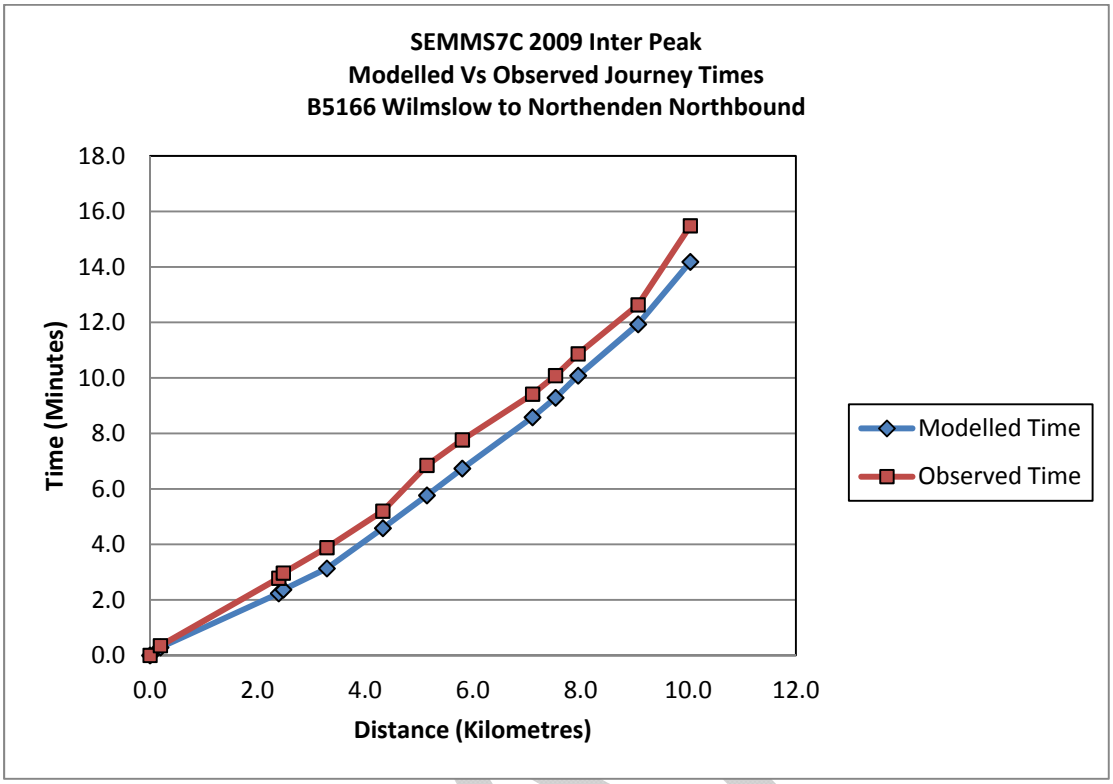

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
B5085 Alderley Edge to Knutsford Westbound
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

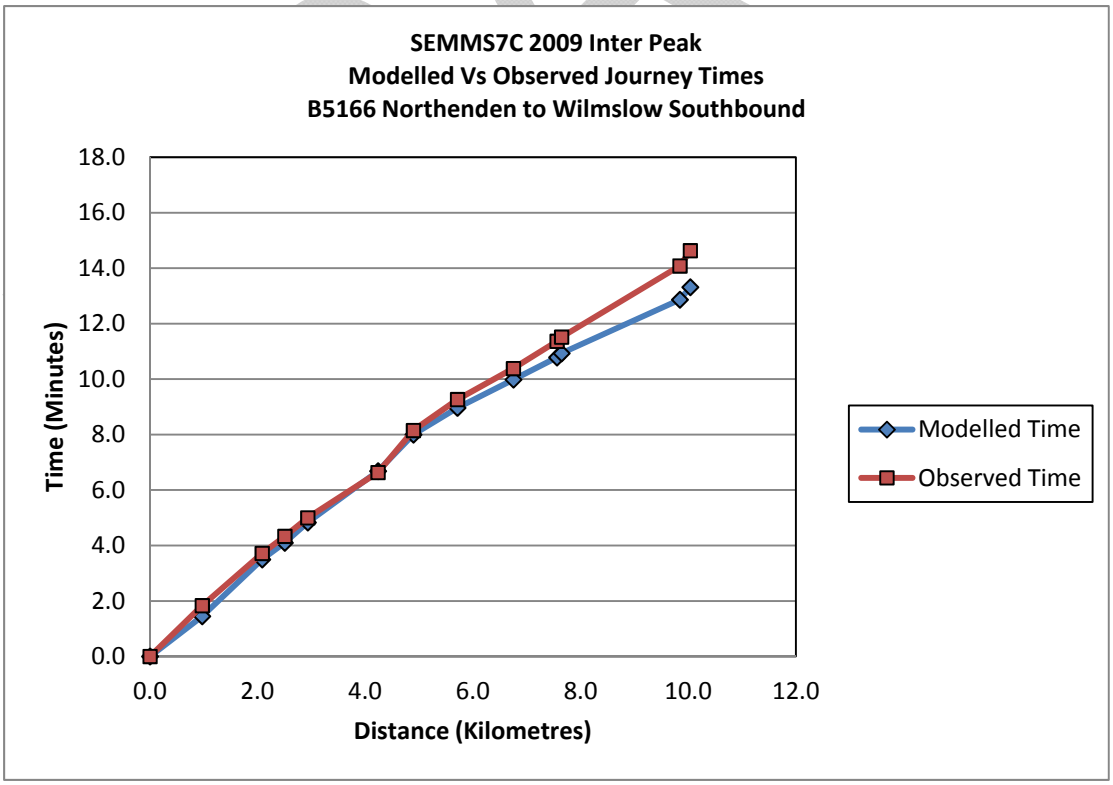

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
B5087 Macclesfield to Alderley Edge Northbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

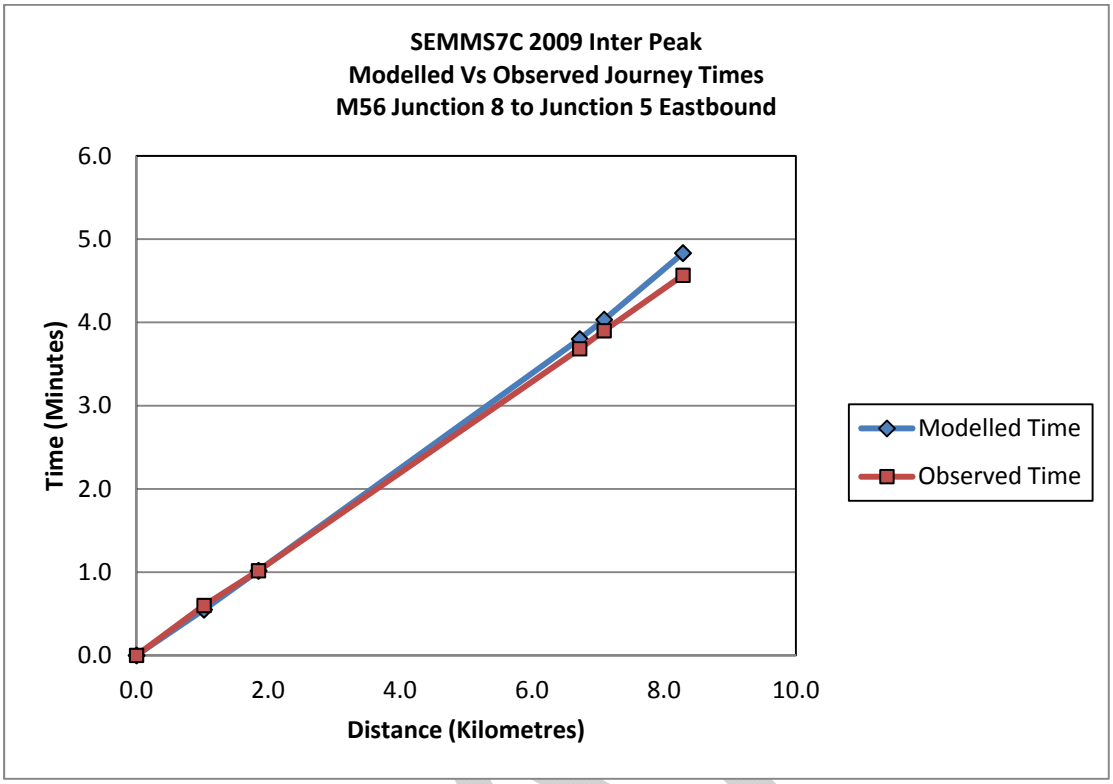

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
B5087 Alderley Edge to Macclesfield Southbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

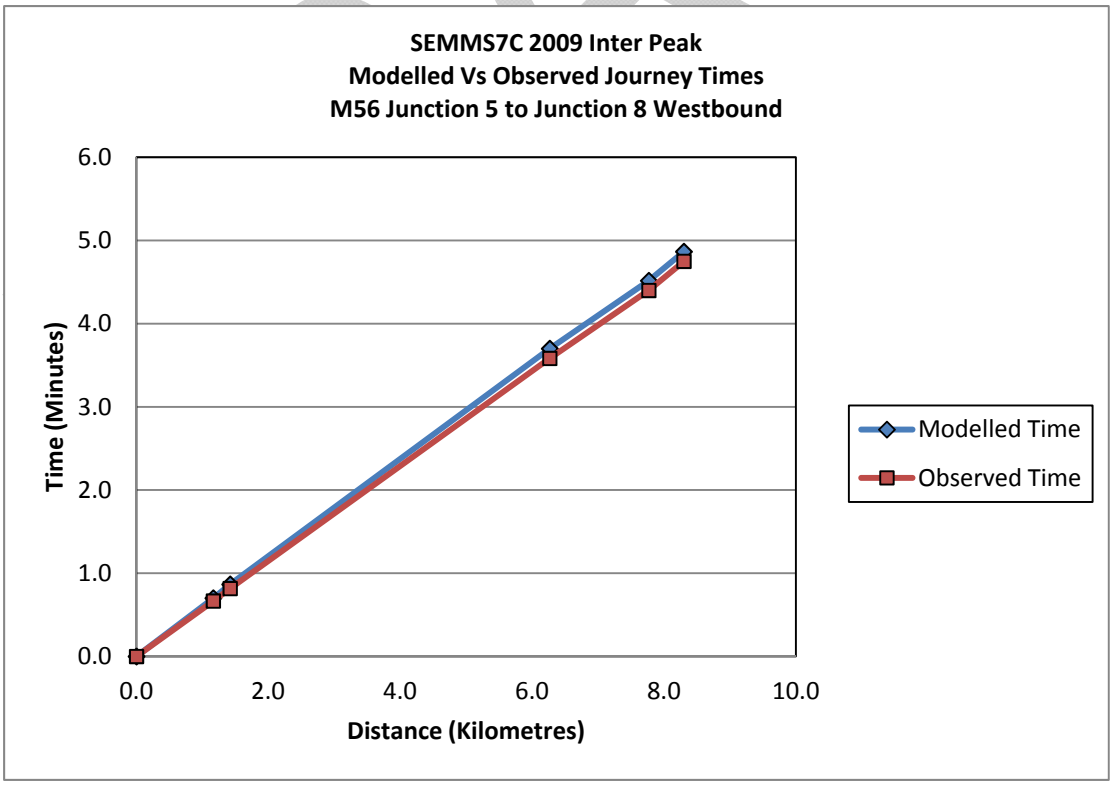

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
M56 Manchester Airport to West Didsbury Northbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

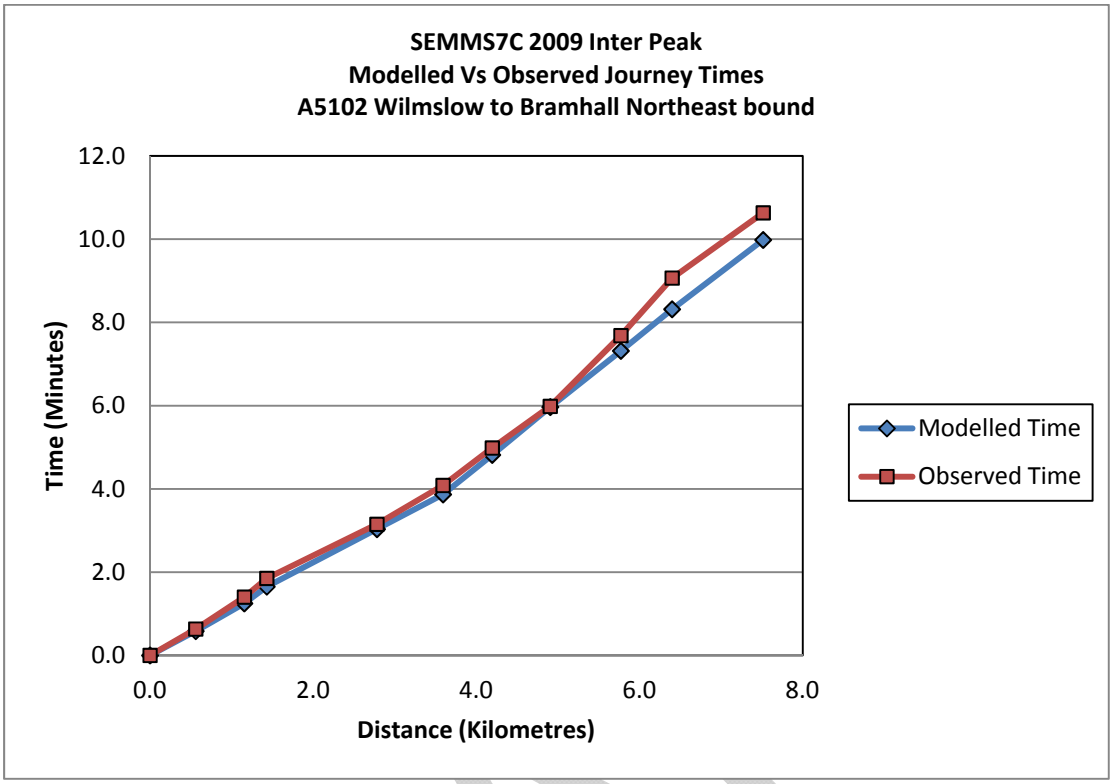

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
M56 West Didsbury to Manchester Airport Southbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

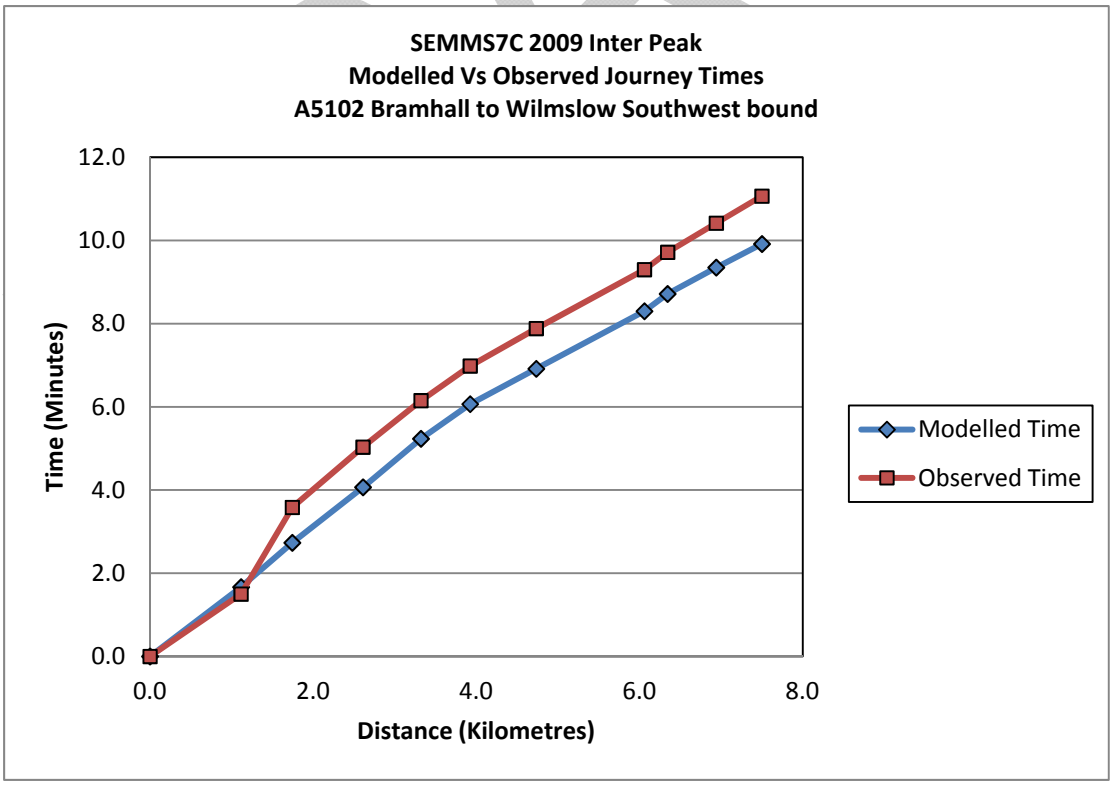

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
B5166 Wilmslow to Northenden Northbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

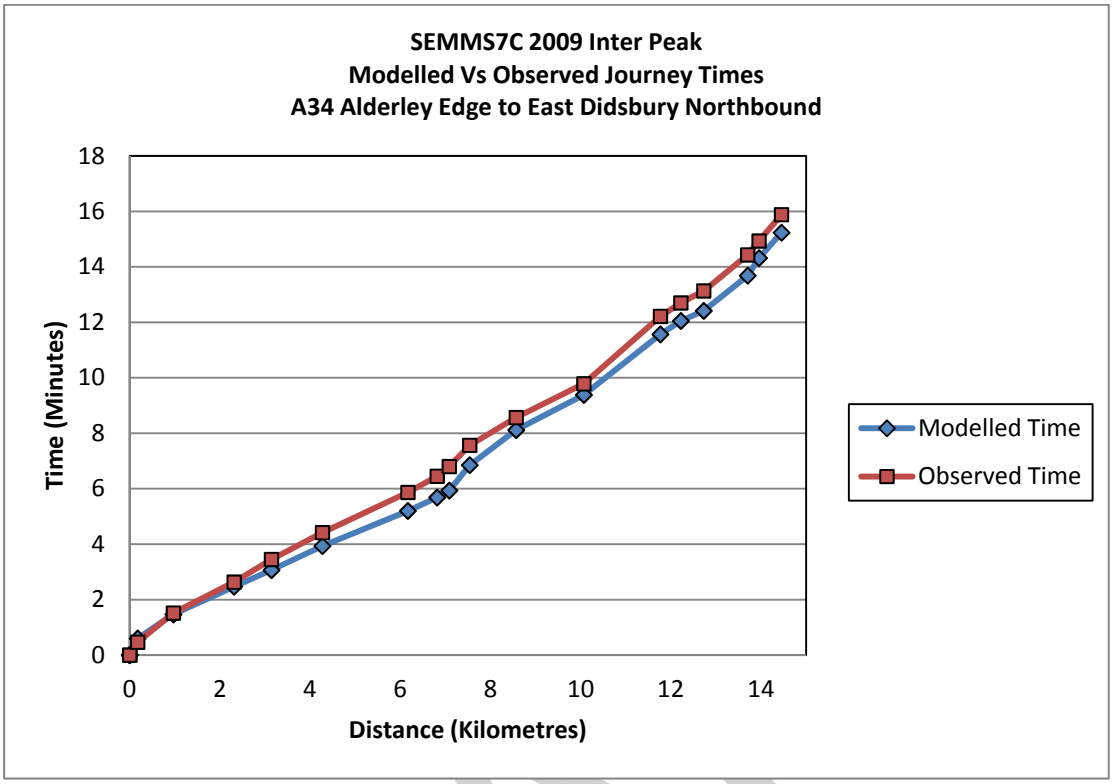

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
B5166 Northenden to Wilmslow Southbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

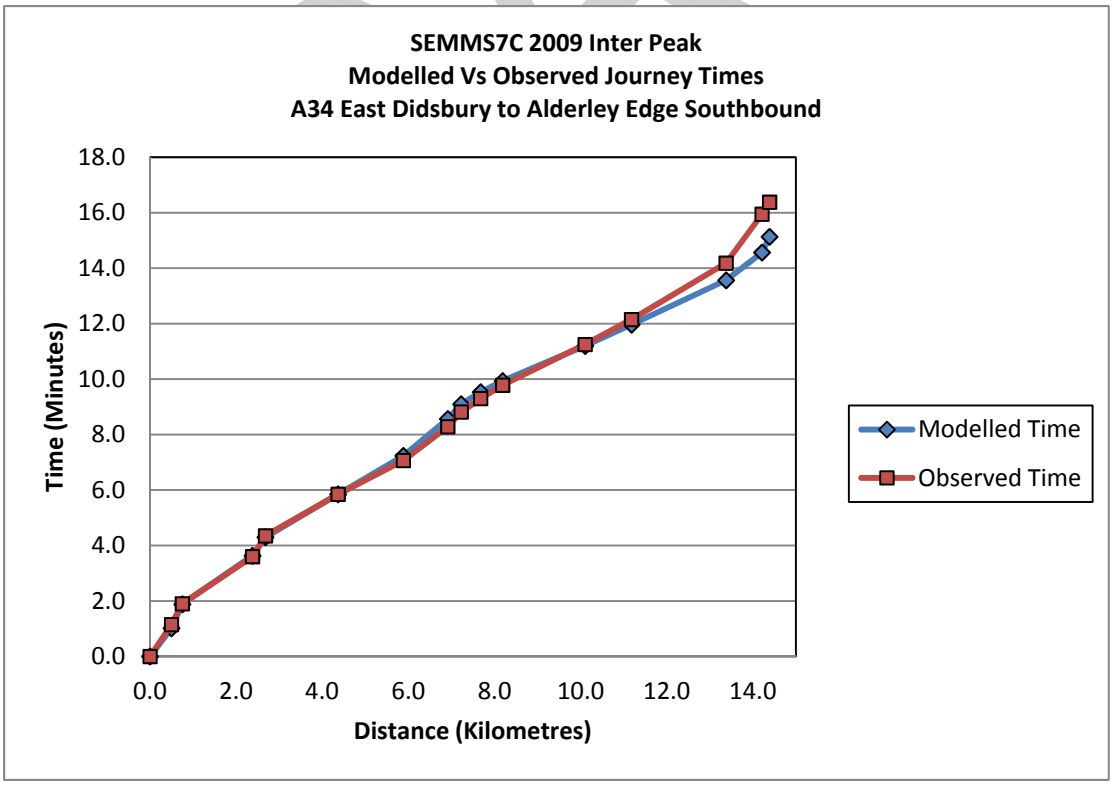

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
M56 Junction 8 to Junction 5 Eastbound
Time (Minutes)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
Distance (Kilometres)
Modelled Time
Observed Time

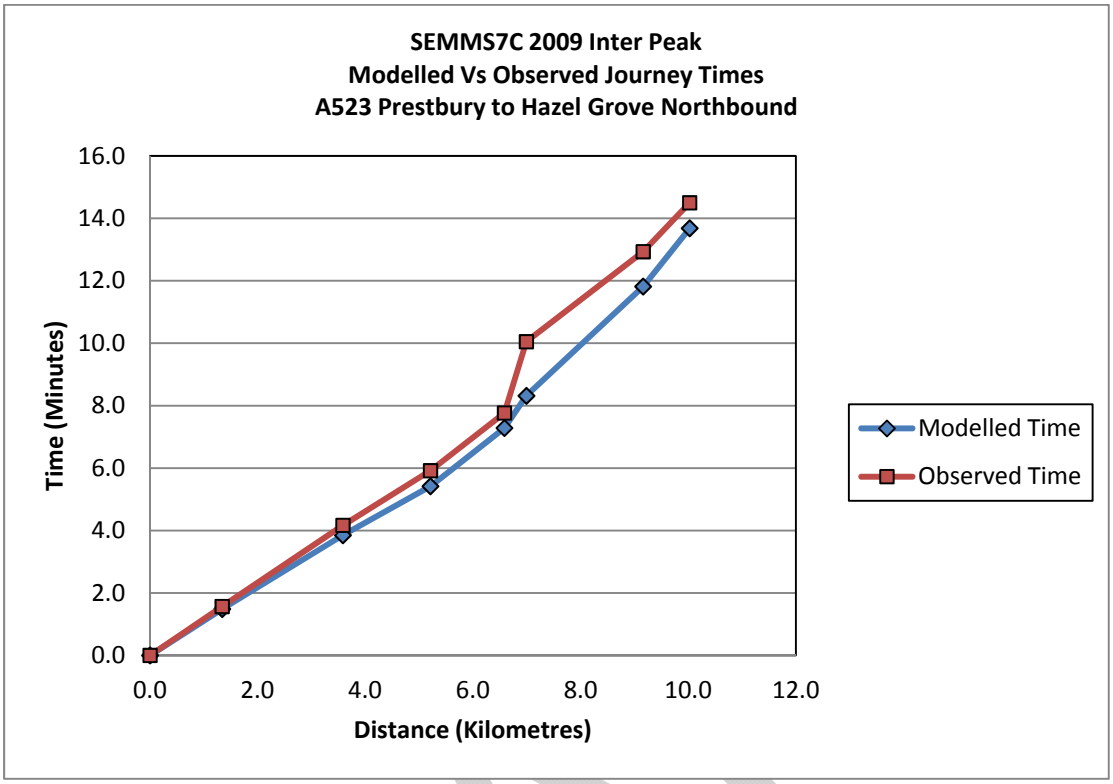

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
M56 Junction 5 to Junction 8 Westbound
Time (Minutes)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
Distance (Kilometres)
Modelled Time
Observed Time

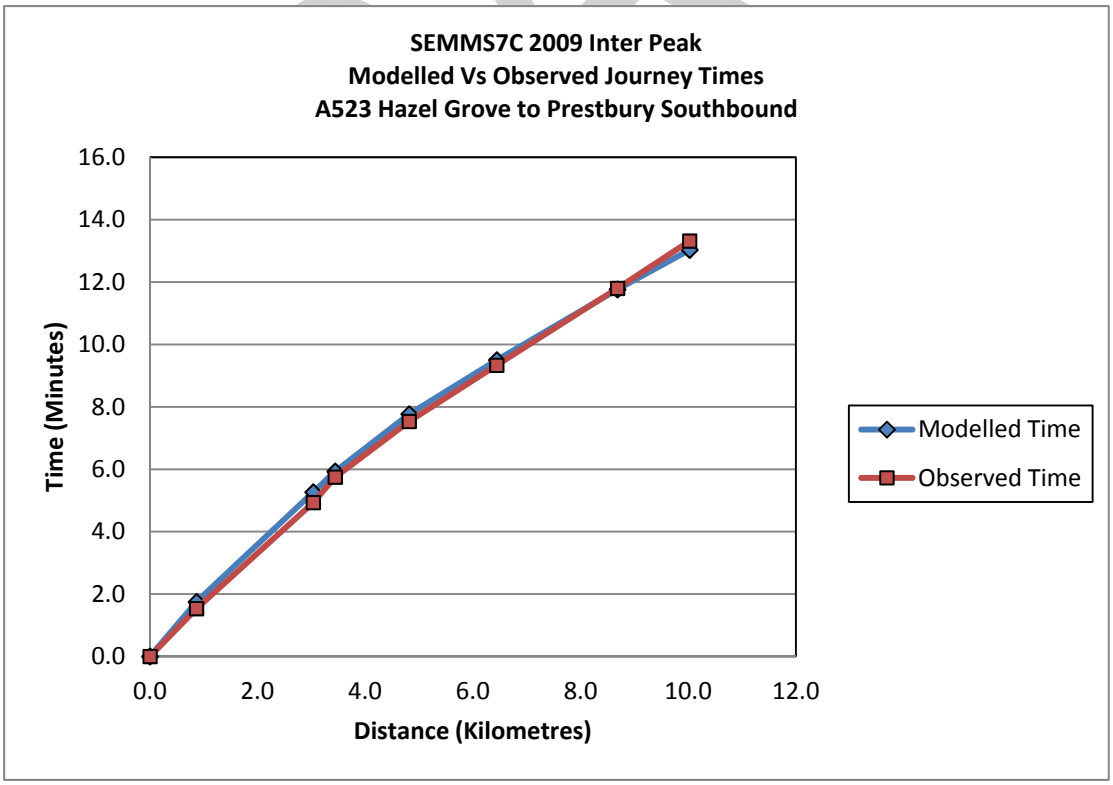

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A5102 Wilmslow to Bramhall Northeast bound
Time (Minutes)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

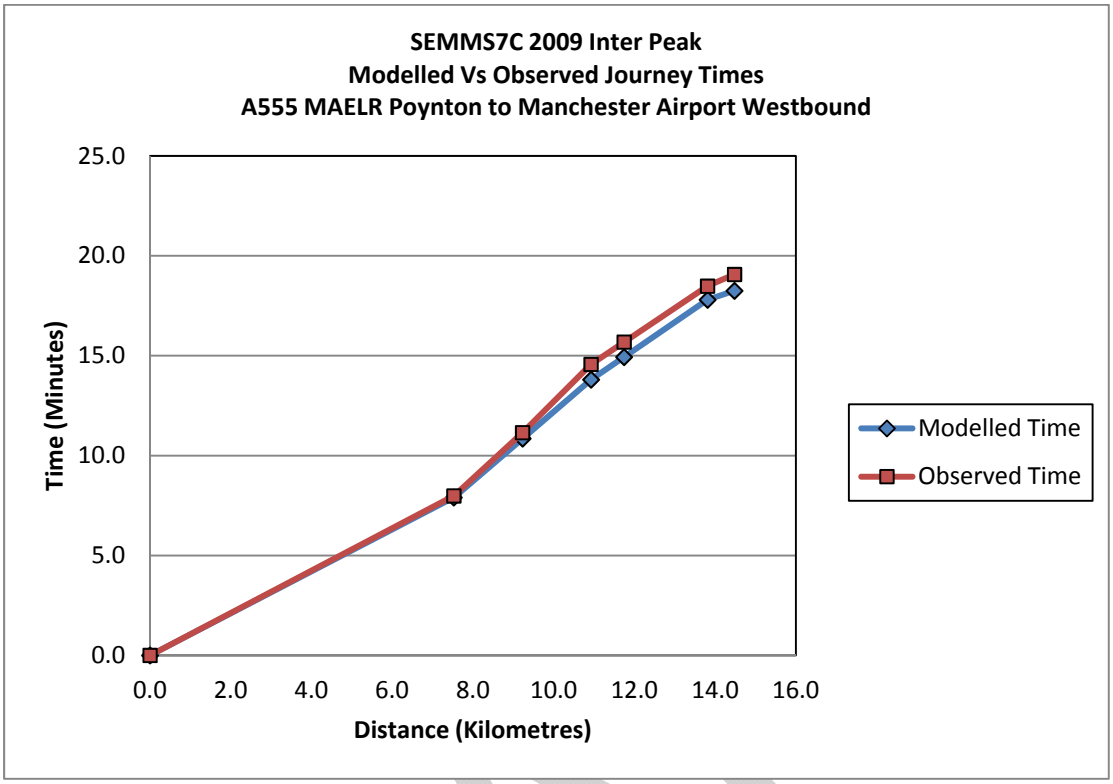

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A5102 Bramhall to Wilmslow Southwest bound
Time (Minutes)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

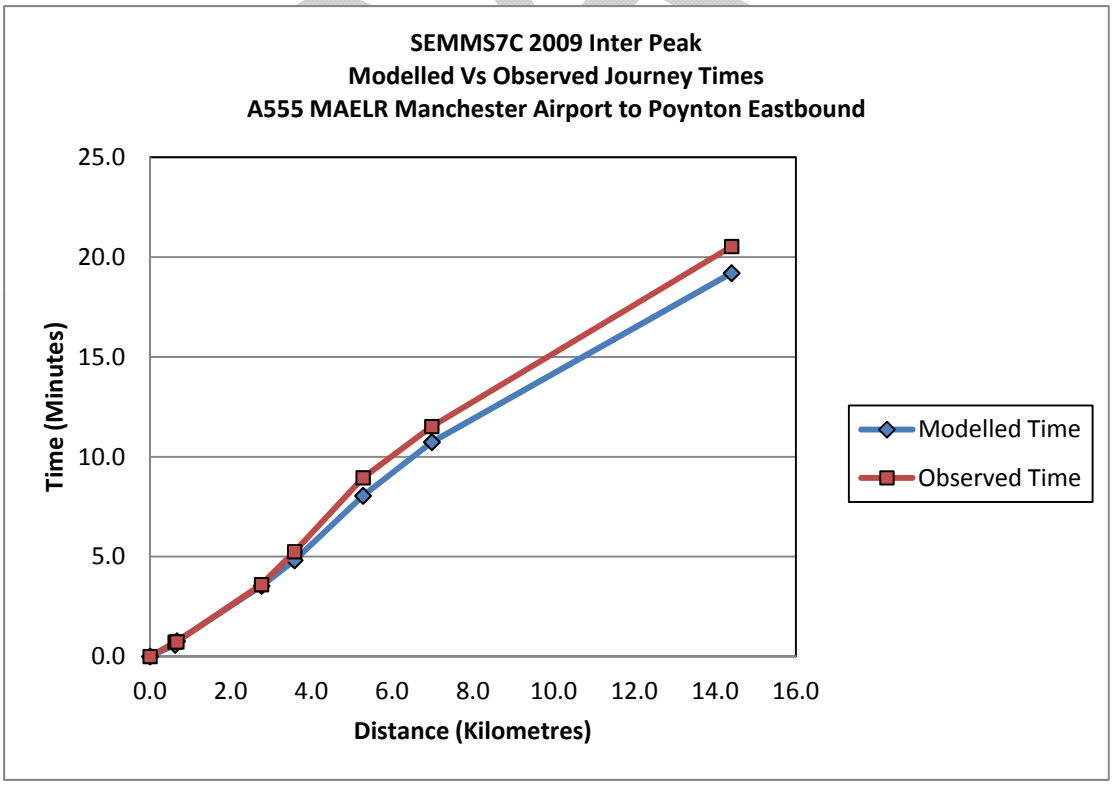

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A34 Alderley Edge to East Didsbury Northbound
Time (Minutes)
Distance (Kilometres)
Modelled Time
Observed Time

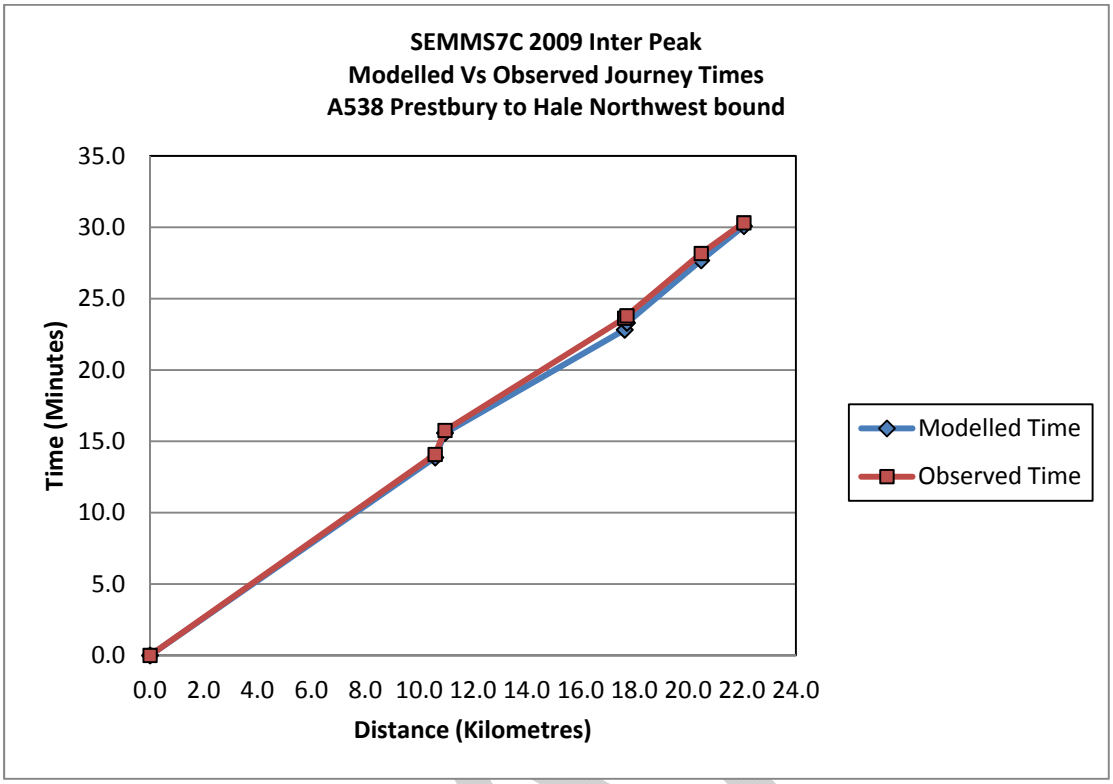

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A34 East Didsbury to Alderley Edge Southbound
Time (Minutes)
Distance (Kilometres)
Modelled Time
Observed Time

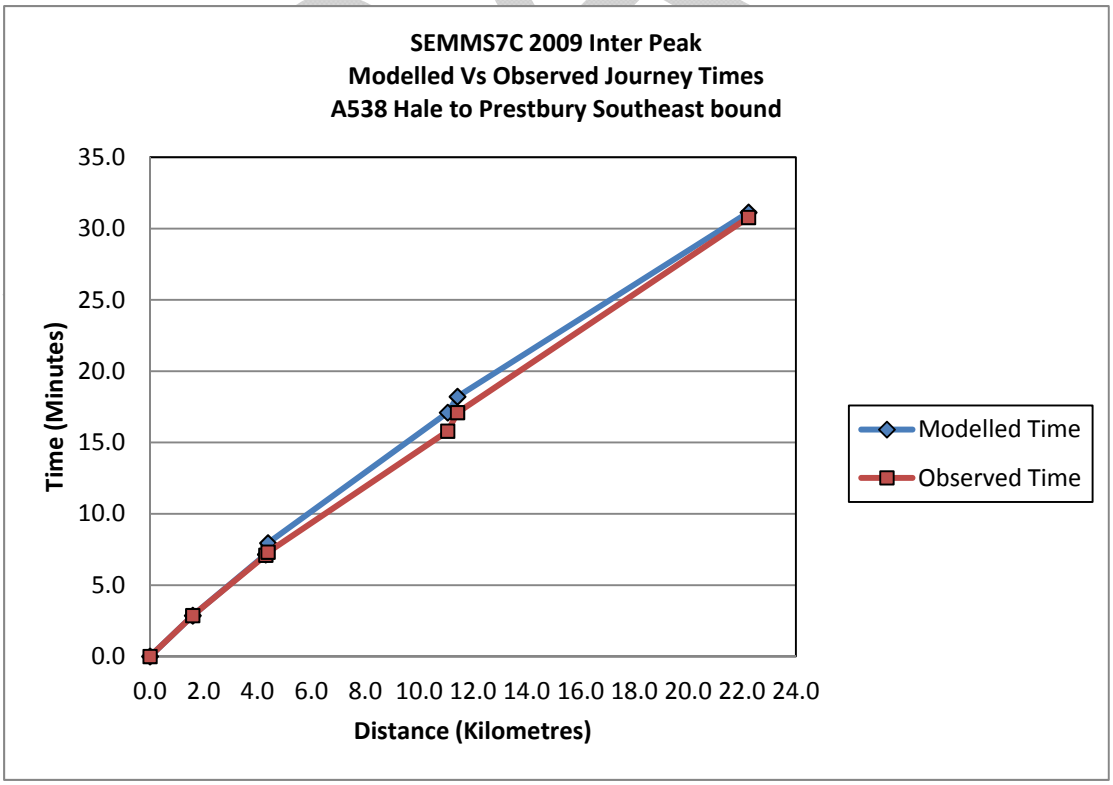

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A523 Prestbury to Hazel Grove Northbound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

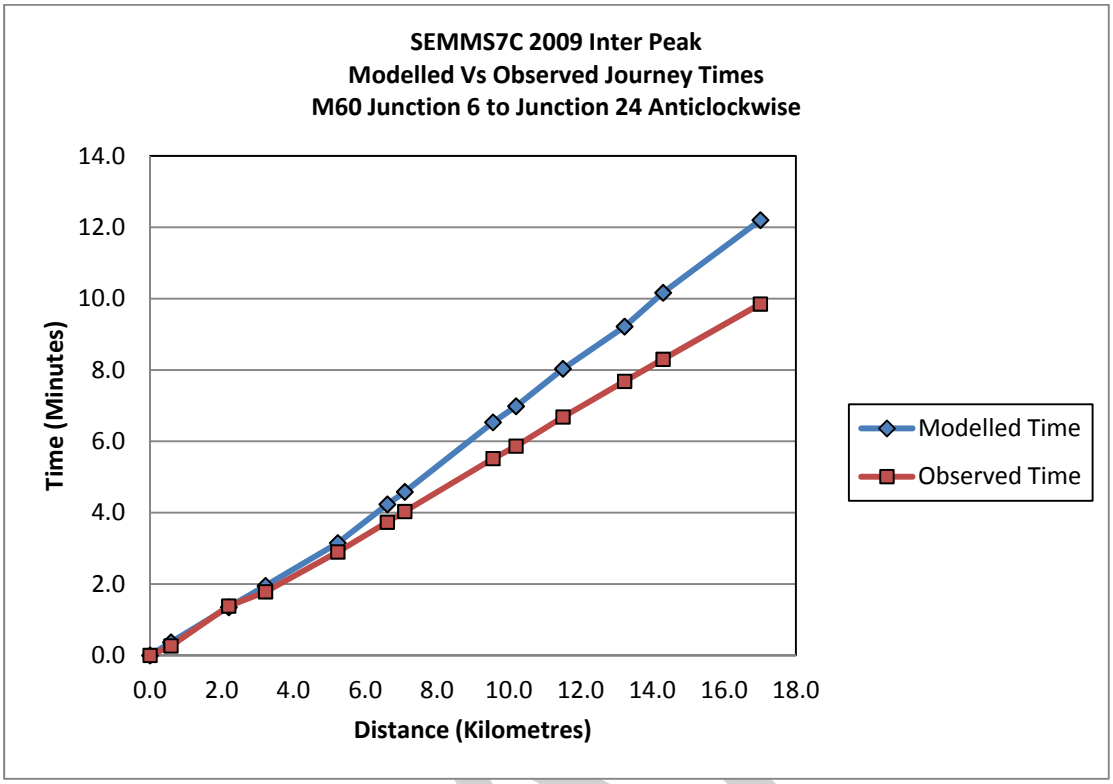

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A523 Hazel Grove to Prestbury Southbound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

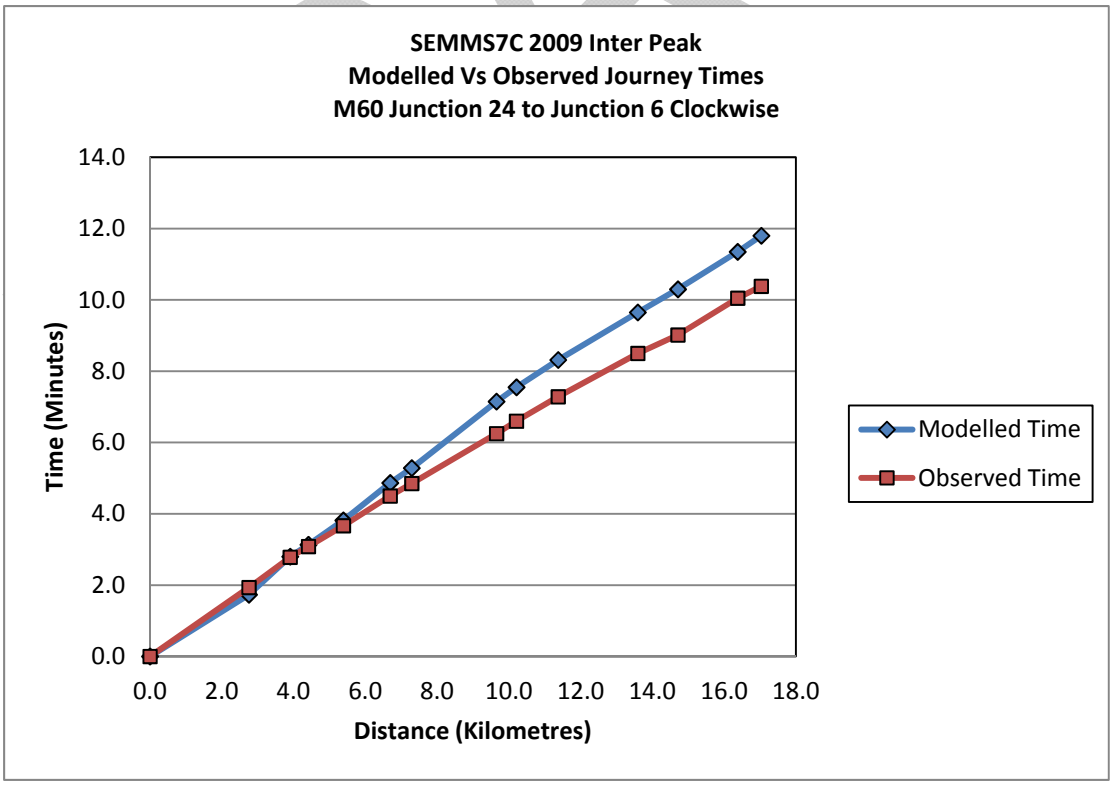

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A555 MAELR Poynton to Manchester Airport Westbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0
Distance (Kilometres)
Modelled Time
Observed Time

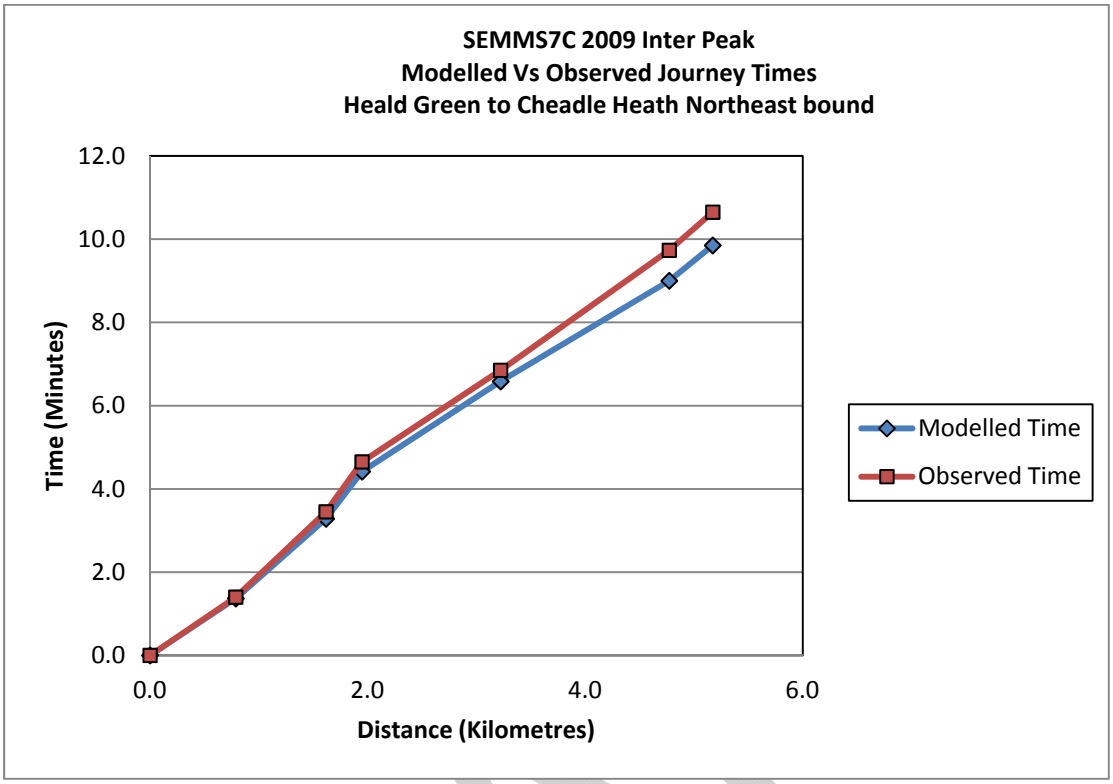

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A555 MAELR Manchester Airport to Poynton Eastbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0
Distance (Kilometres)
Modelled Time
Observed Time

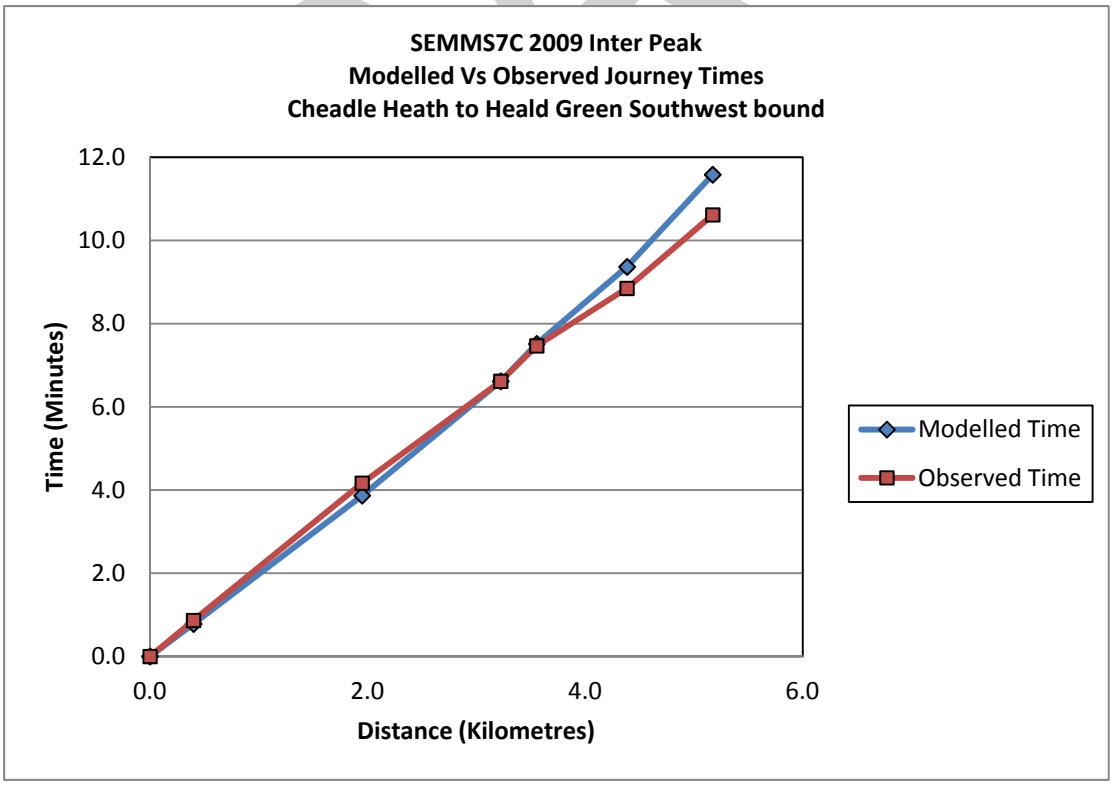

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A538 Prestbury to Hale Northwest bound
Time (Minutes)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0
Distance (Kilometres)
Modelled Time
Observed Time

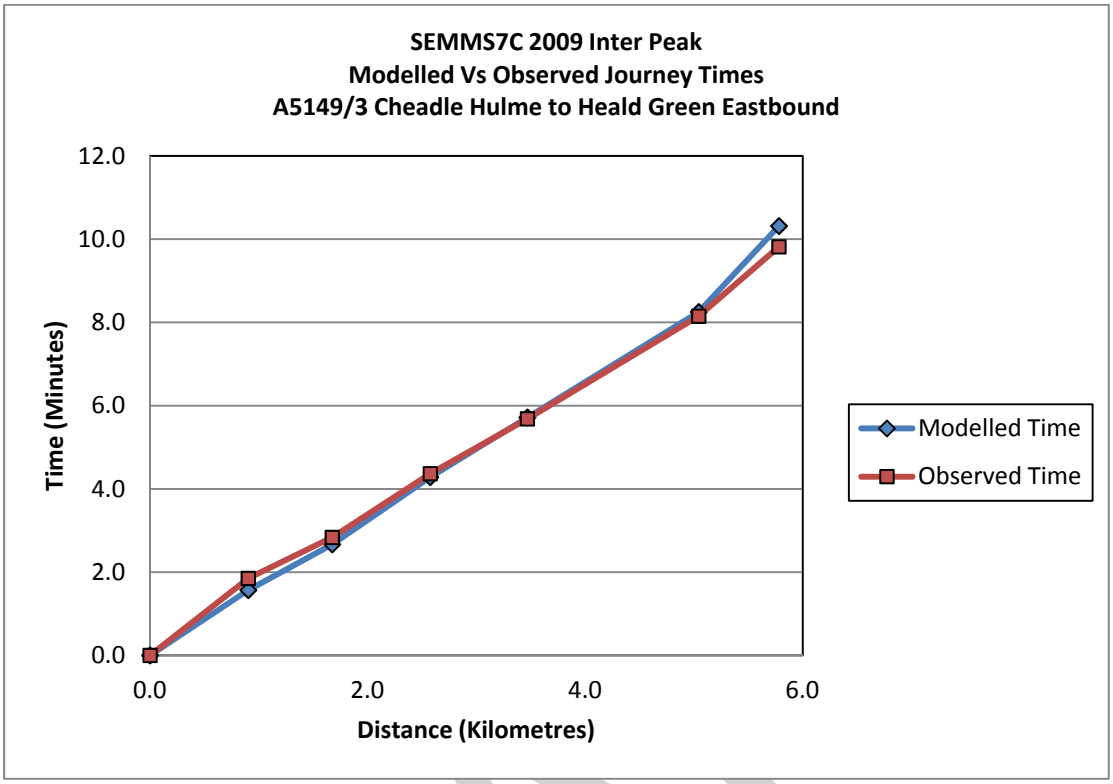

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A538 Hale to Prestbury Southeast bound
Time (Minutes)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0
Distance (Kilometres)
Modelled Time
Observed Time

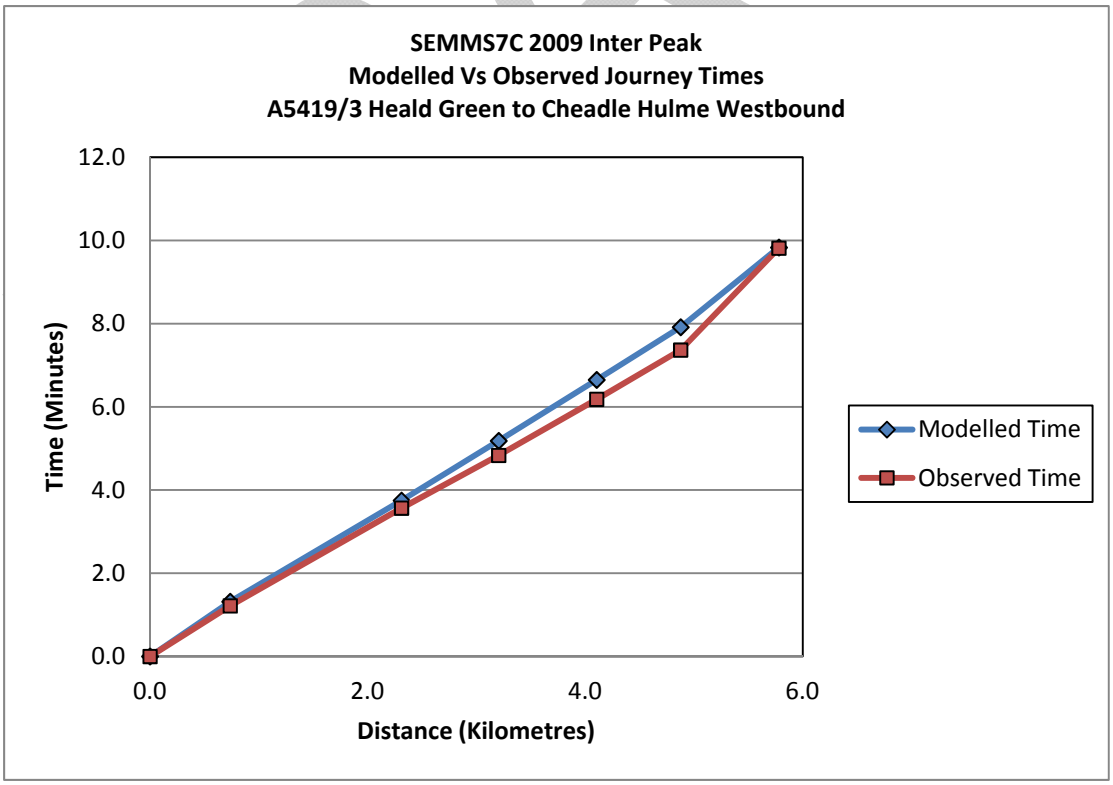

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
M60 Junction 6 to Junction 24 Anticlockwise
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0
Distance (Kilometres)
Modelled Time
Observed Time

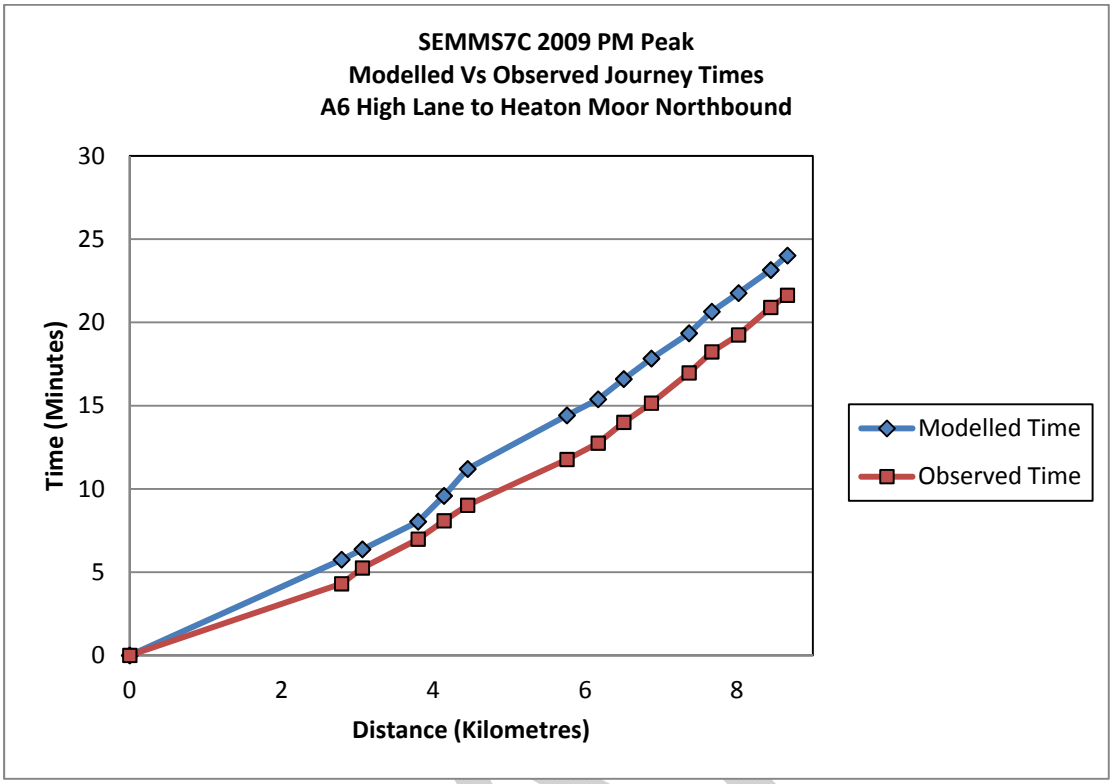

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
M60 Junction 24 to Junction 6 Clockwise
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0
Distance (Kilometres)
Modelled Time
Observed Time

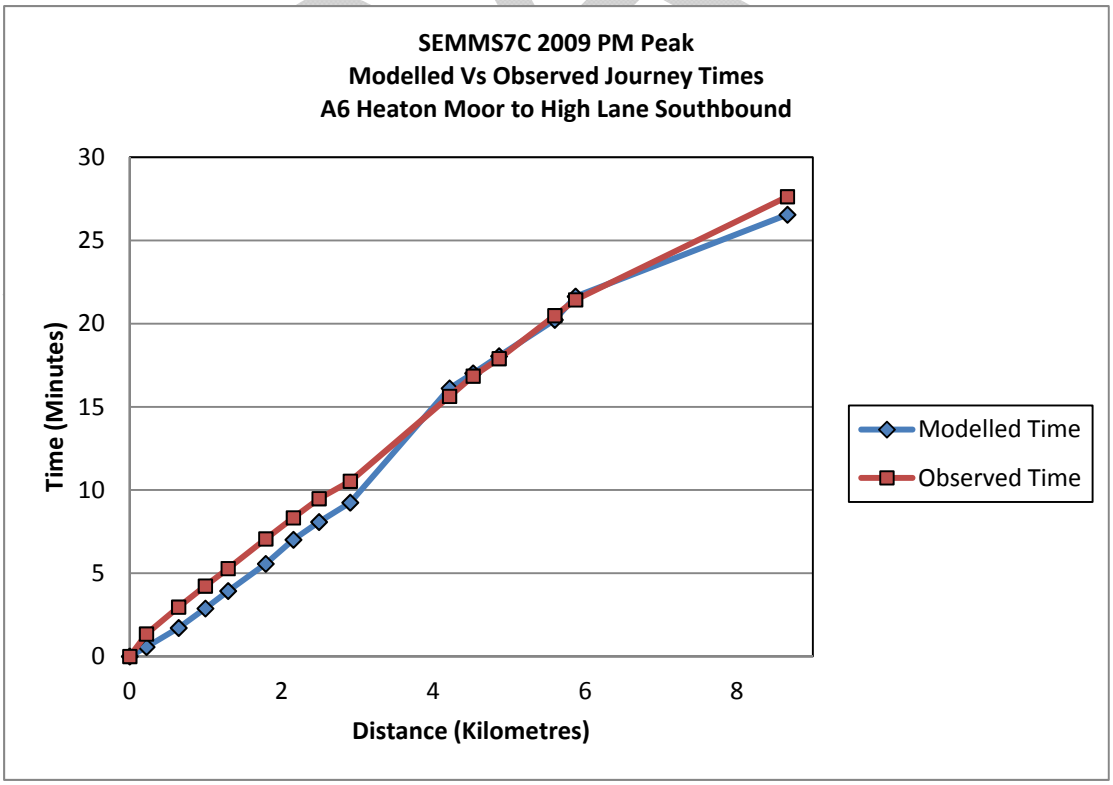

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
Heald Green to Cheadle Heath Northeast bound
Time (Minutes)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

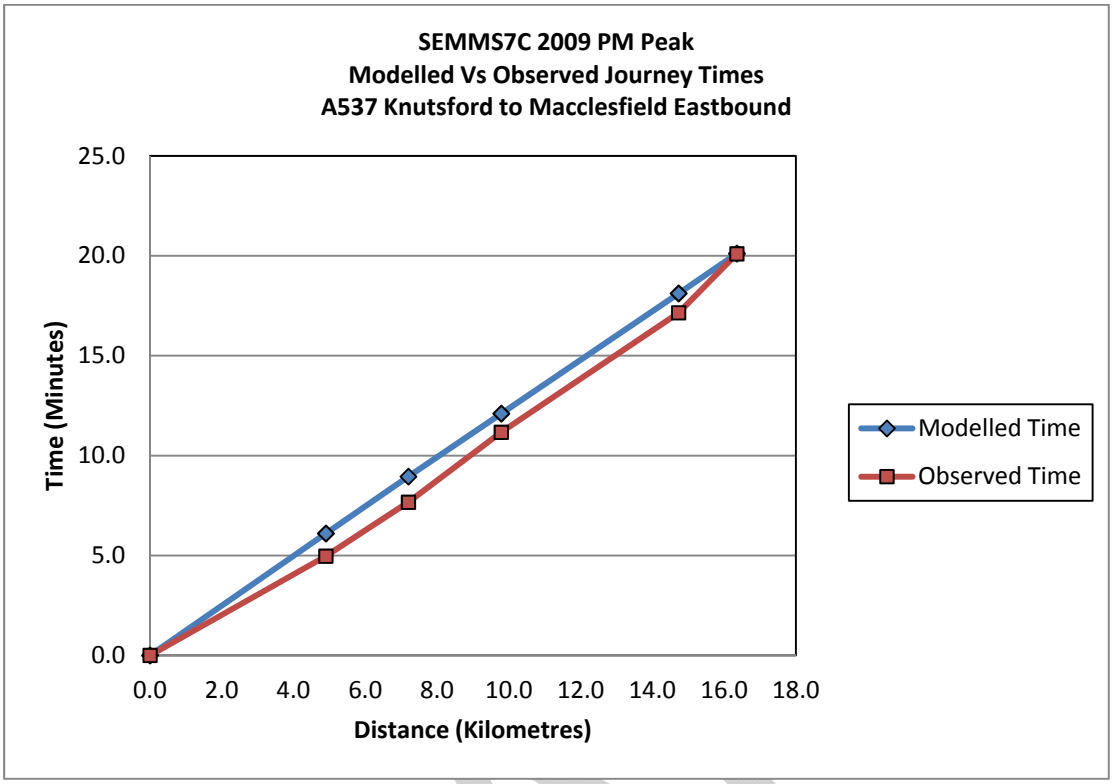

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
Cheadle Heath to Heald Green Southwest bound
Time (Minutes)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

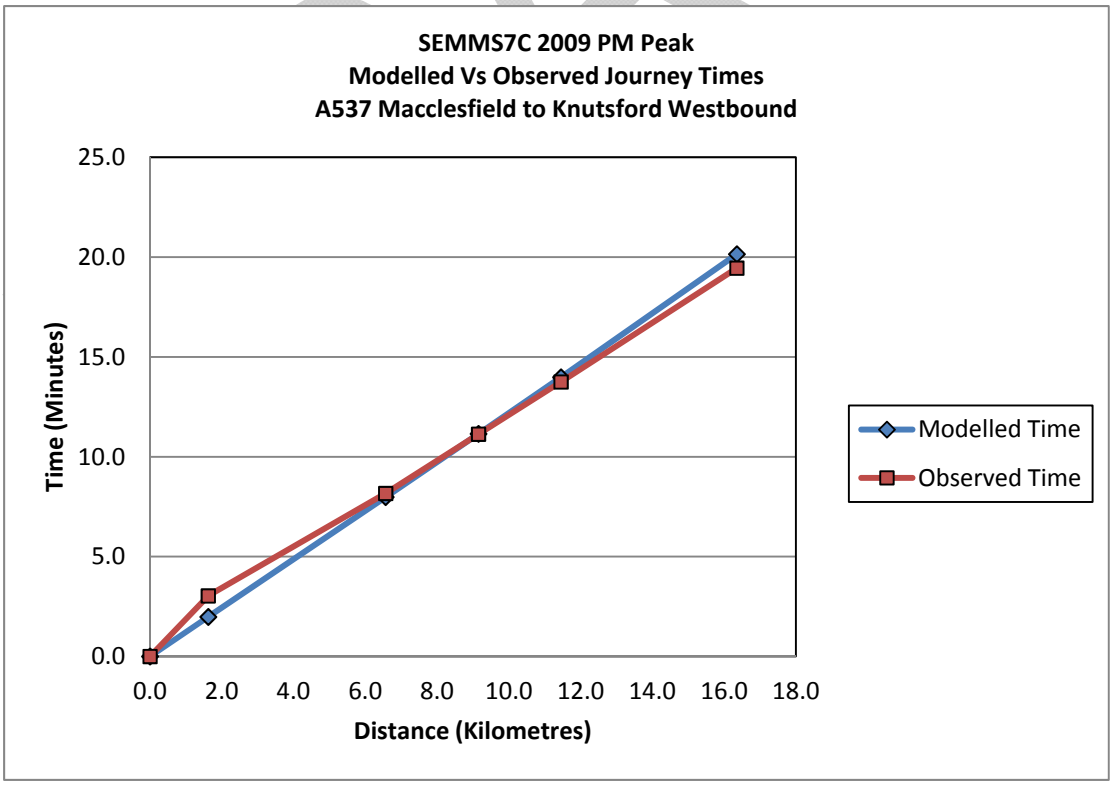

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A5149/3 Cheadle Hulme to Heald Green Eastbound
Time (Minutes)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

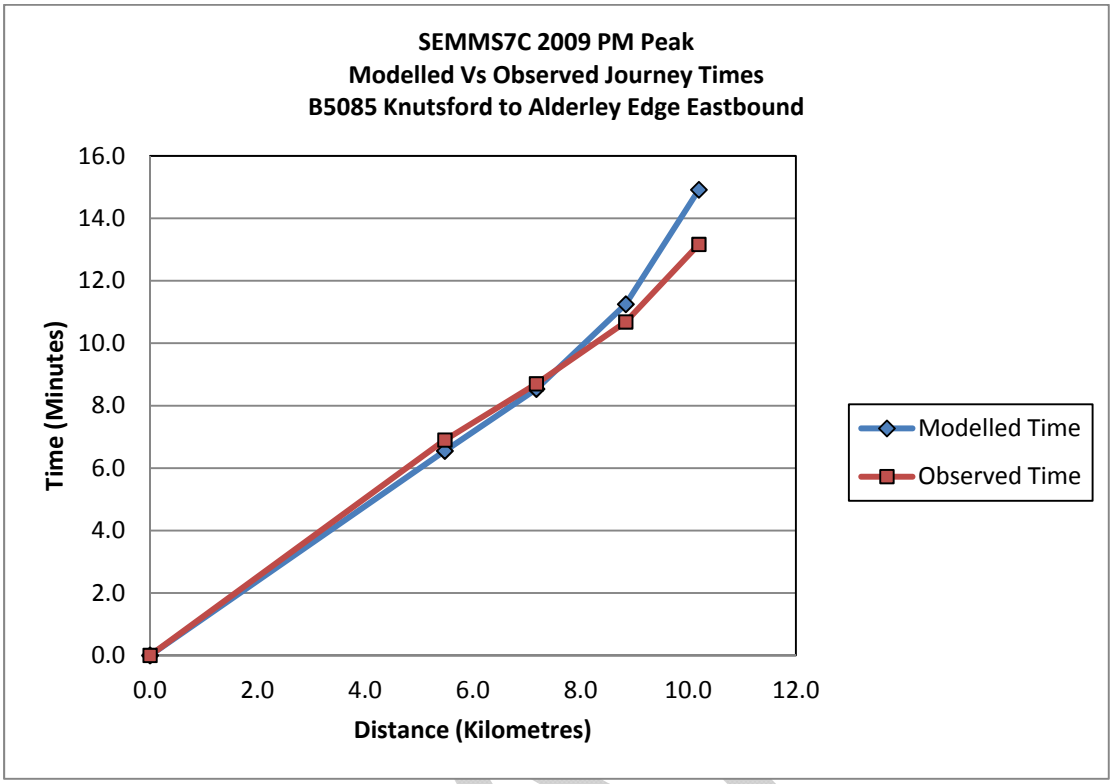

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A5419/3 Heald Green to Cheadle Hulme Westbound
Time (Minutes)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

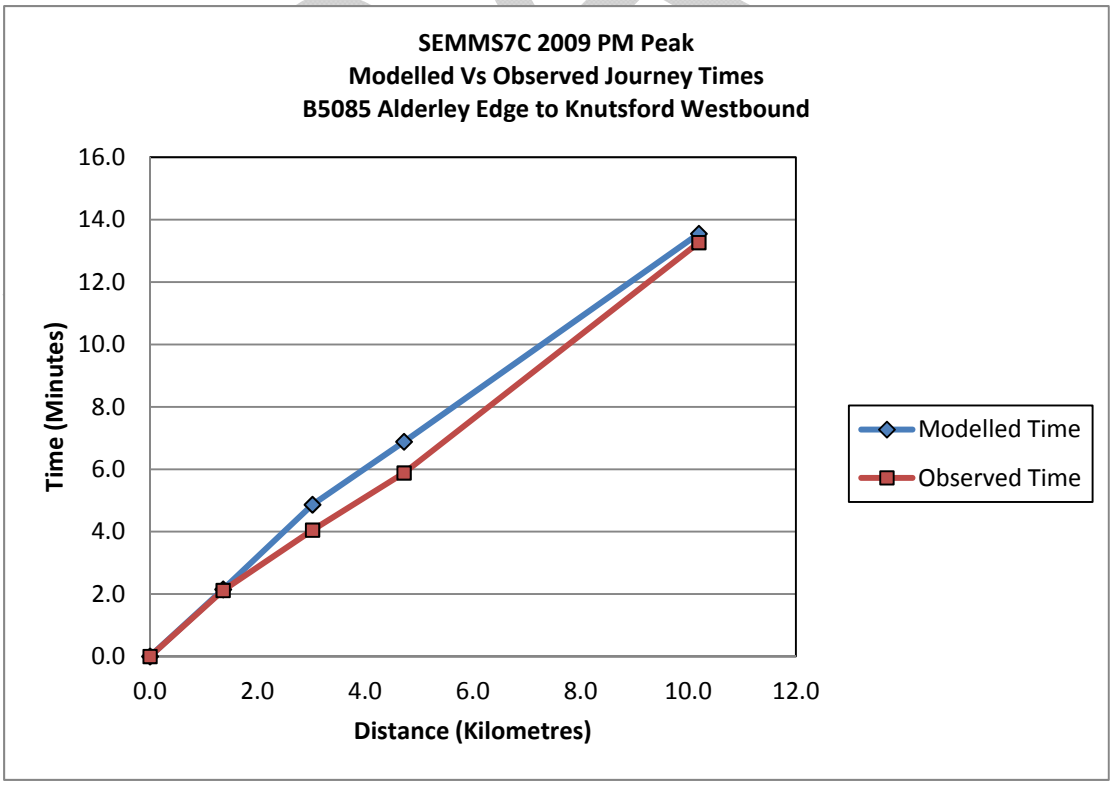

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A6 High Lane to Heaton Moor Northbound
Time (Minutes)
0
5
10
15
20
25
30
0
2
4
6
8
Distance (Kilometres)
Modelled Time
Observed Time

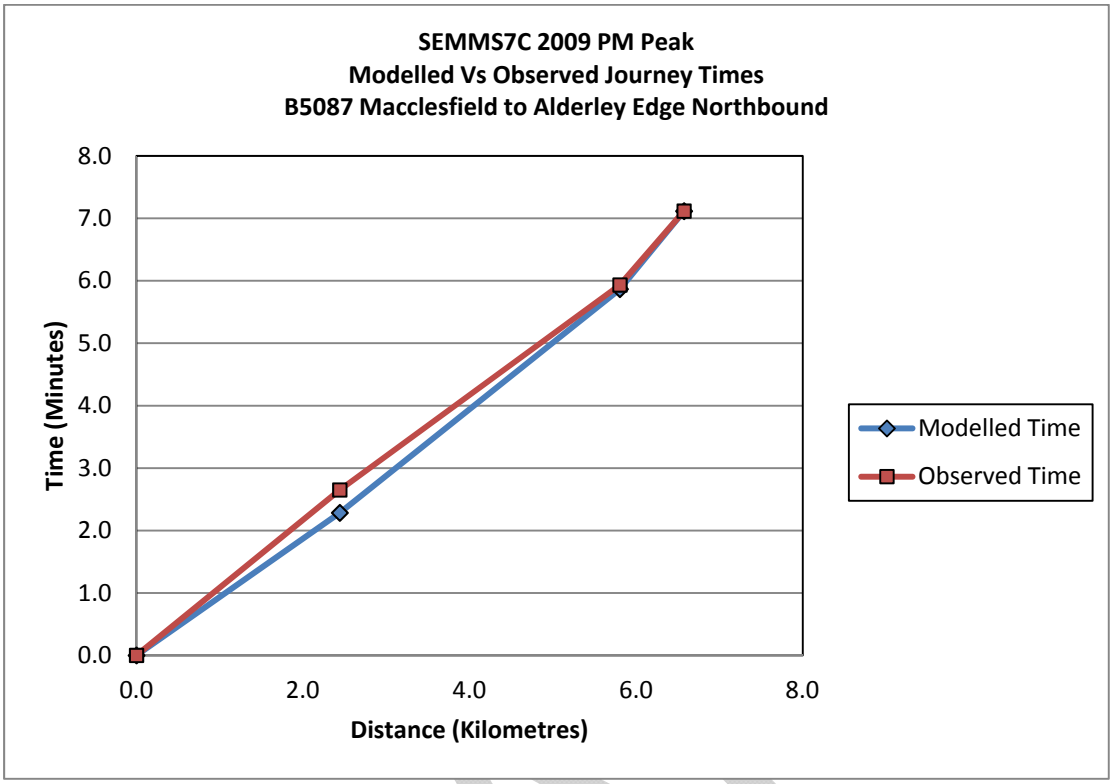

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A6 Heaton Moor to High Lane Southbound
Time (Minutes)
0
5
10
15
20
25
30
0
2
4
6
8
Distance (Kilometres)
Modelled Time
Observed Time

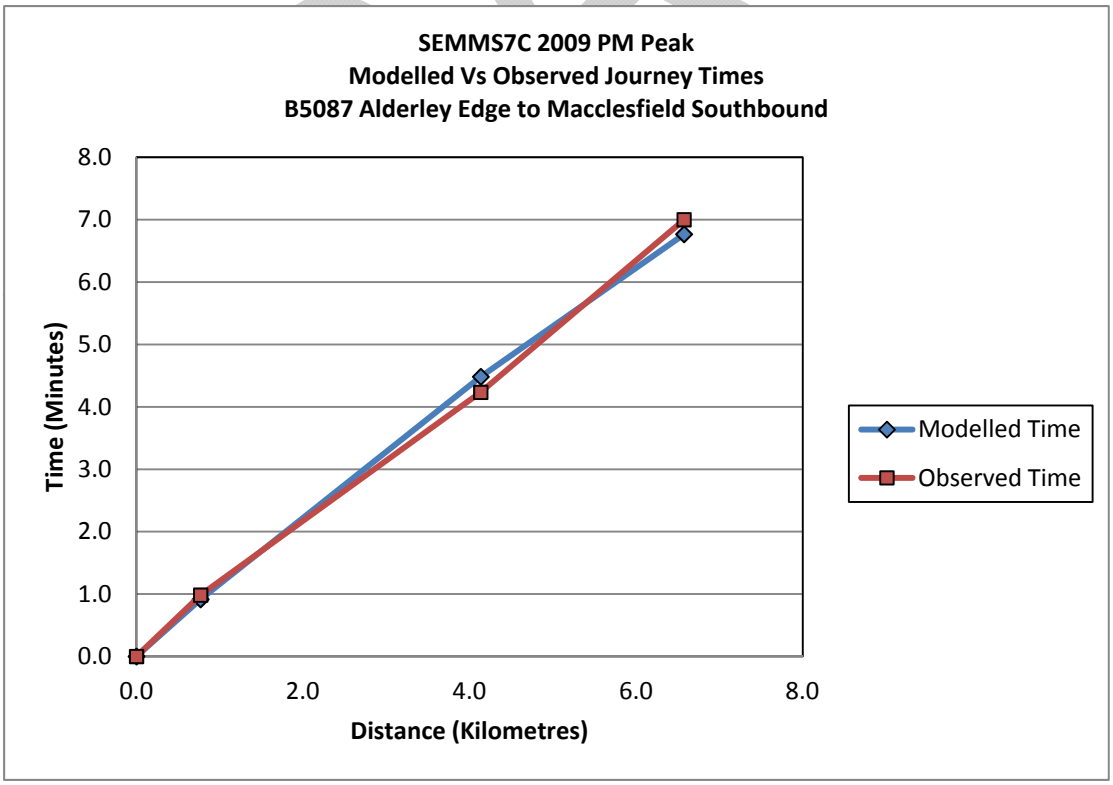

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A537 Knutsford to Macclesfield Eastbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Distance (Kilometres)
Modelled Time
Observed Time

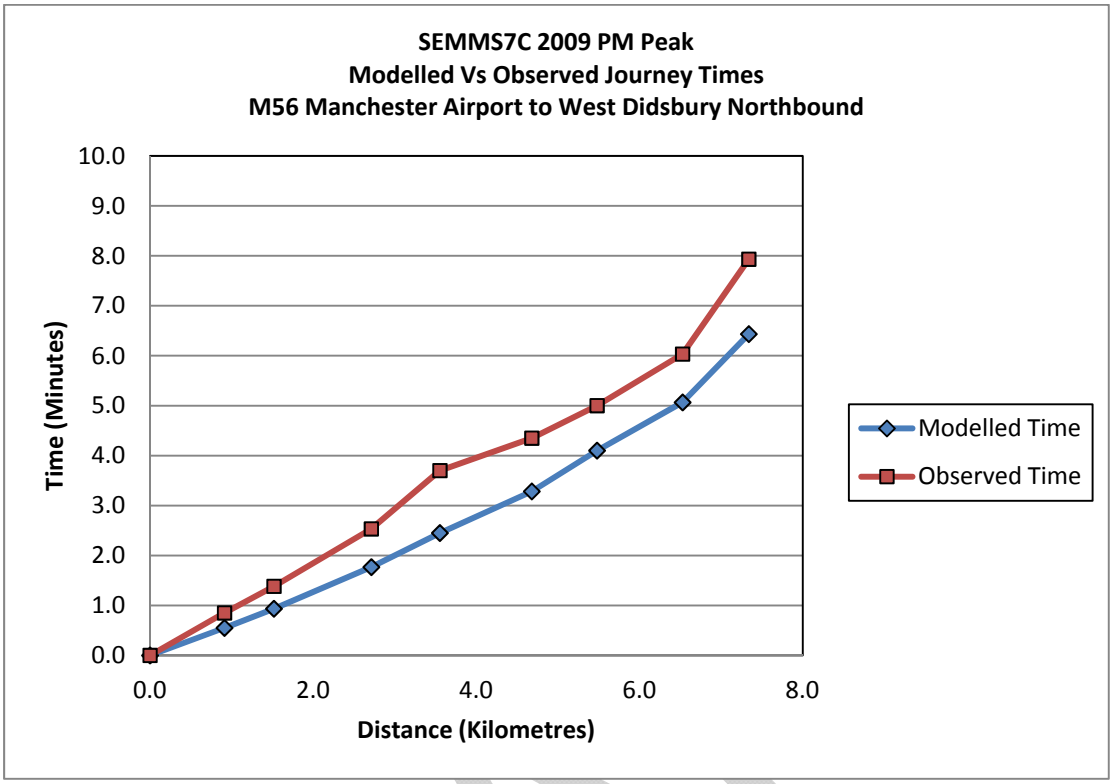

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A537 Macclesfield to Knutsford Westbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Distance (Kilometres)
Modelled Time
Observed Time

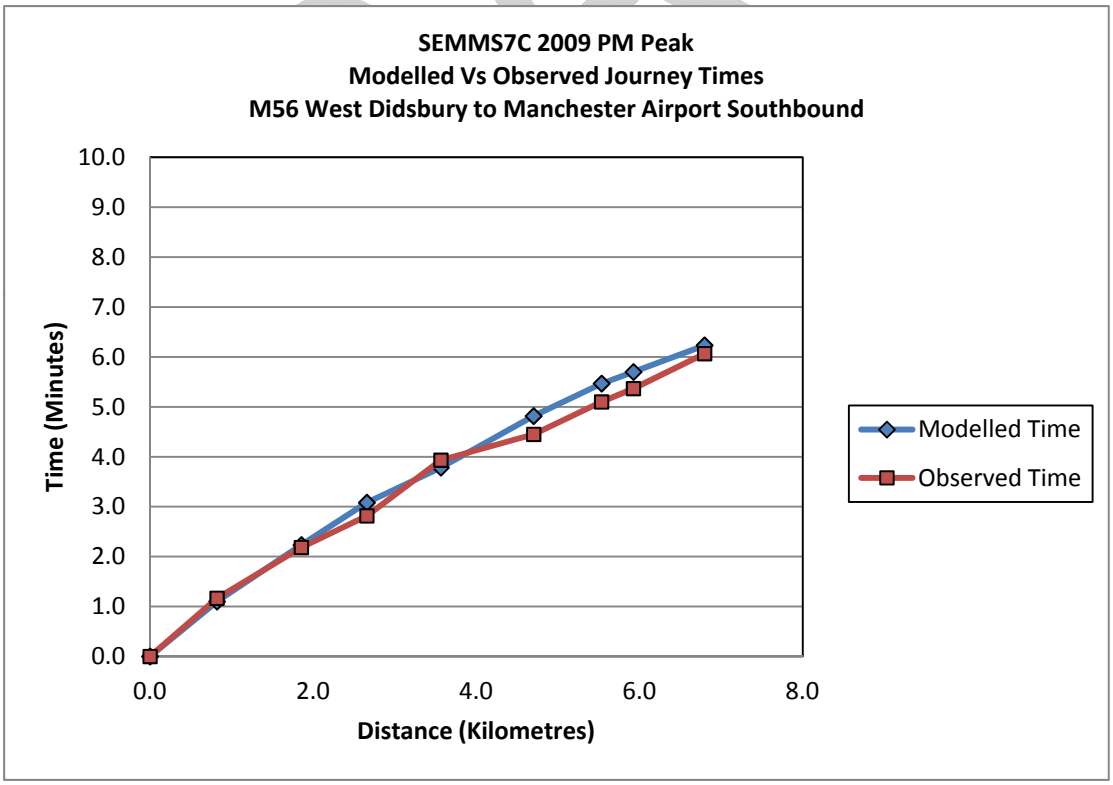

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
B5085 Knutsford to Alderley Edge Eastbound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

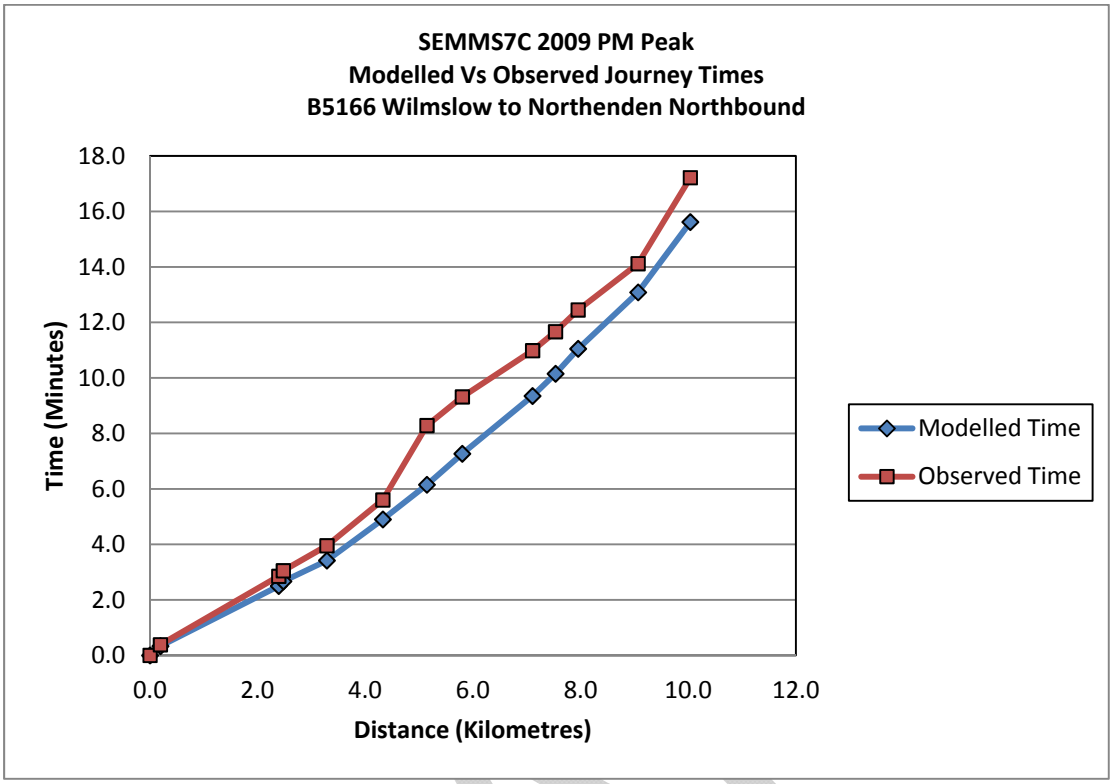

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
B5085 Alderley Edge to Knutsford Westbound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

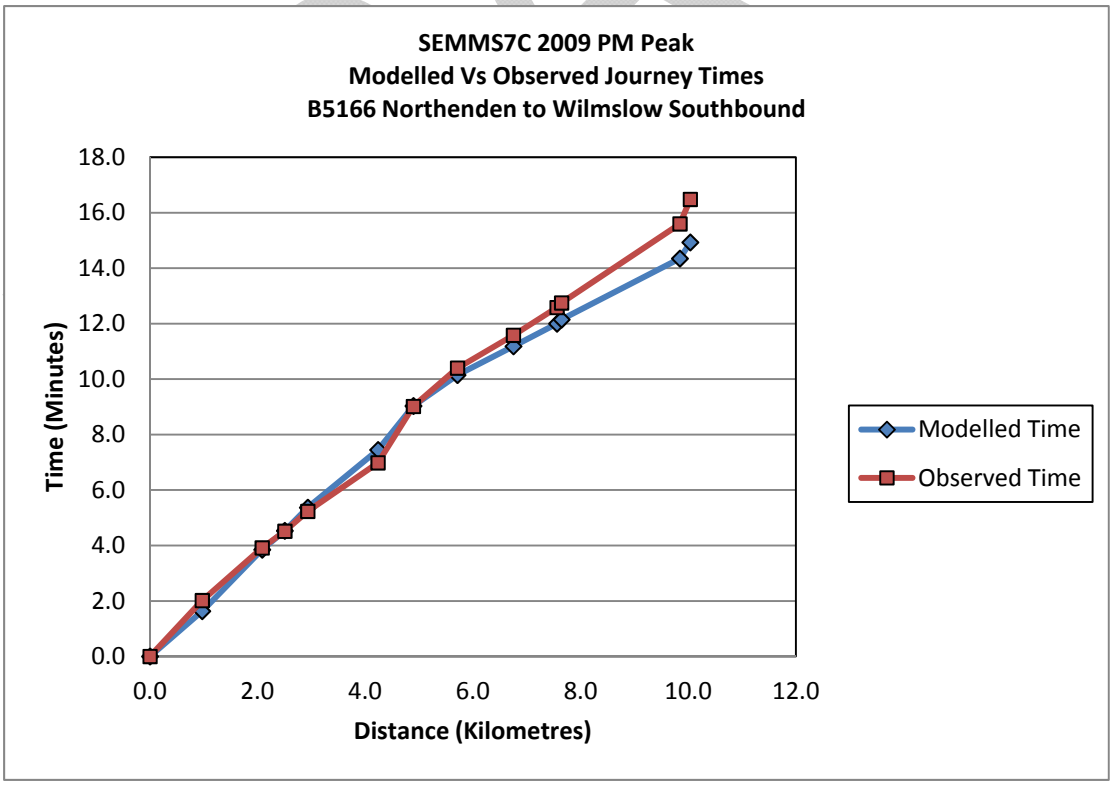

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
B5087 Macclesfield to Alderley Edge Northbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

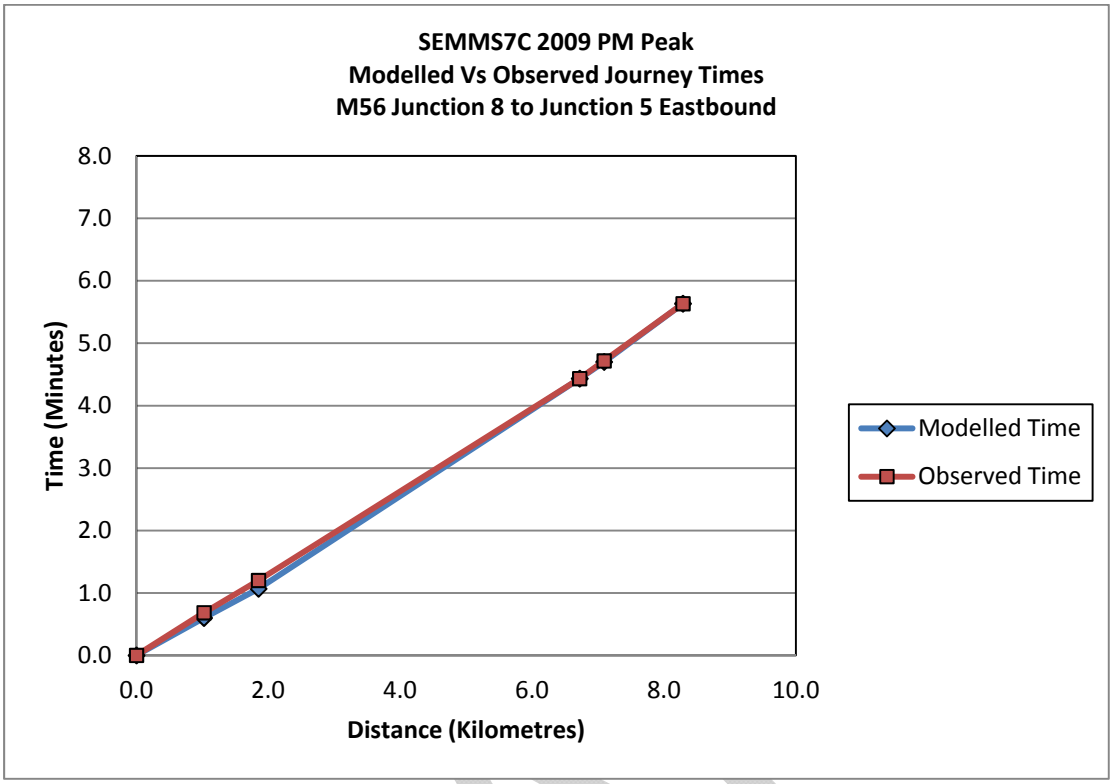

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
B5087 Alderley Edge to Macclesfield Southbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

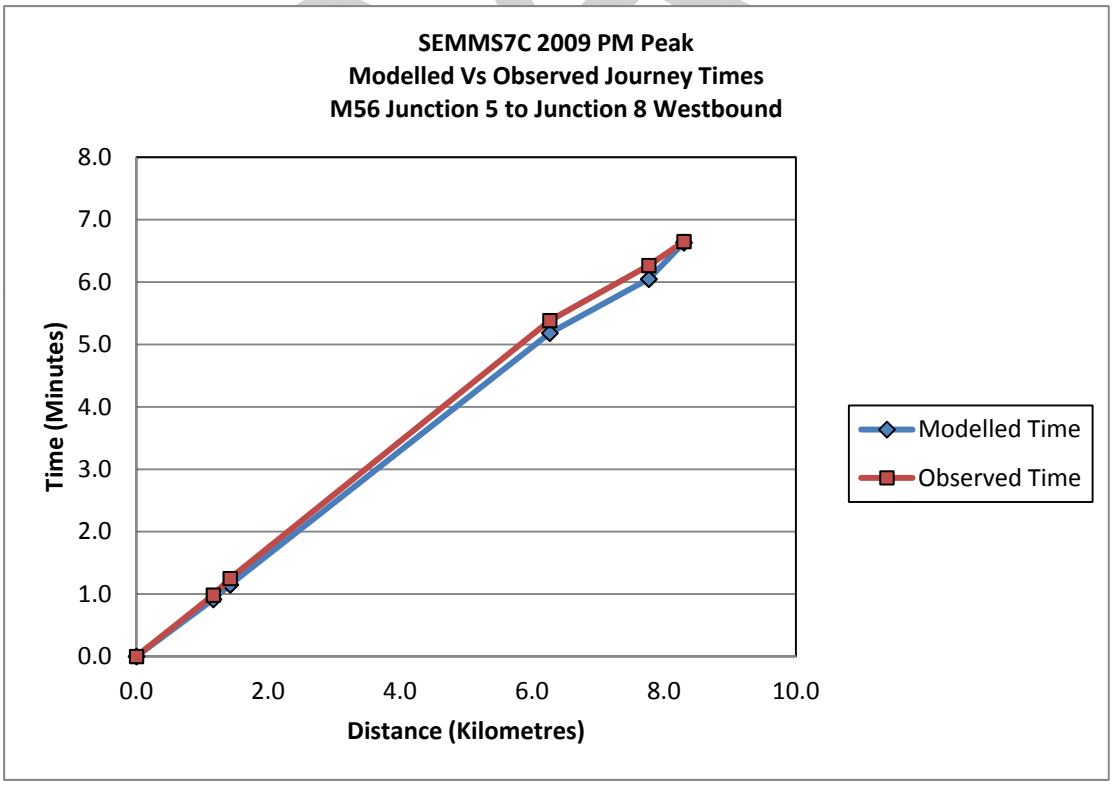

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
M56 Manchester Airport to West Didsbury Northbound
Time (Minutes)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

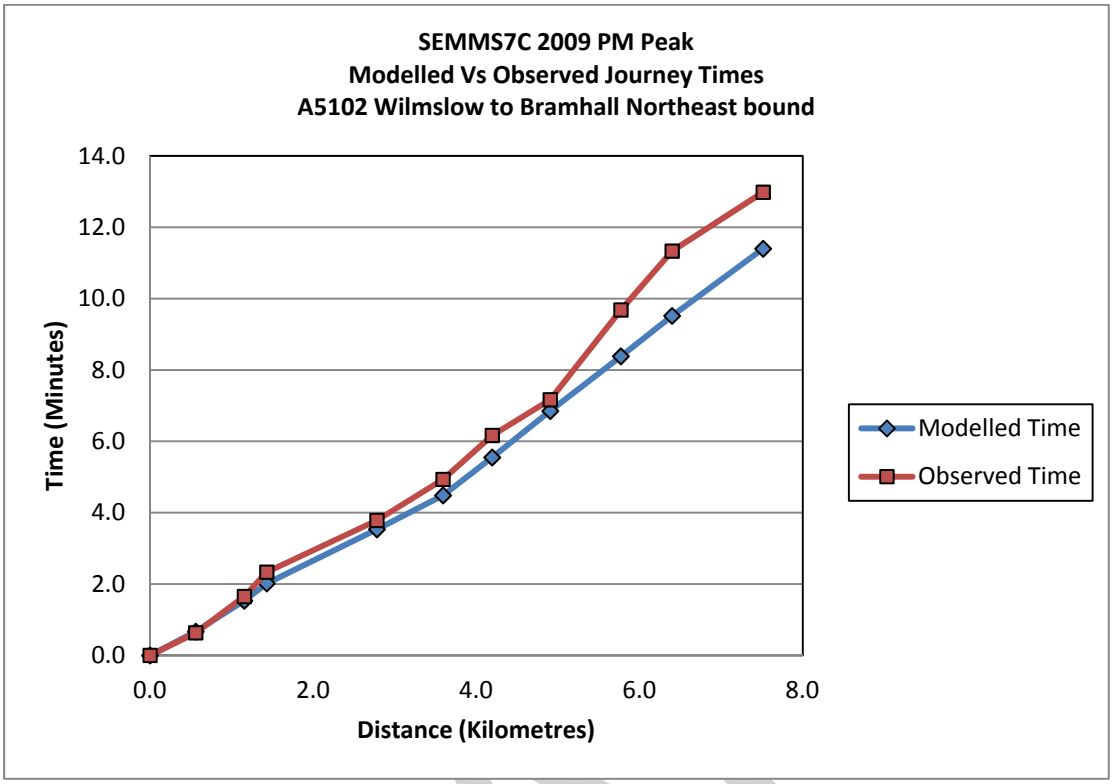

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
M56 West Didsbury to Manchester Airport Southbound
Time (Minutes)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

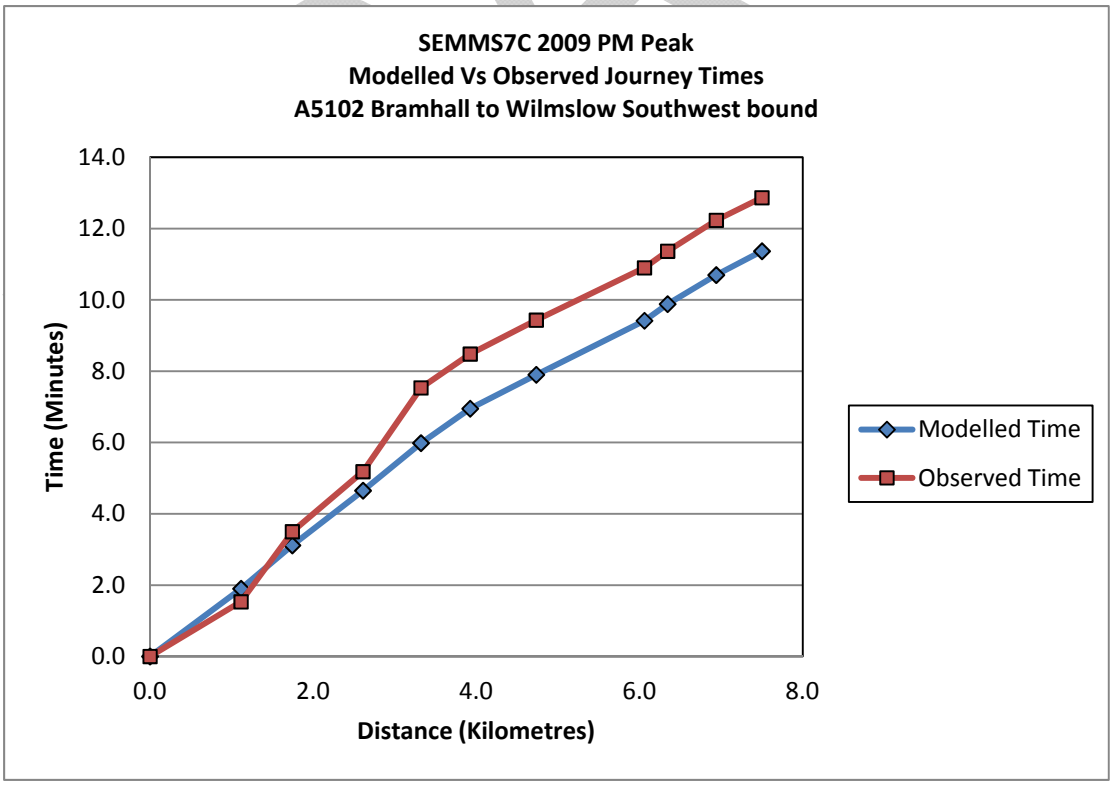

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
B5166 Wilmslow to Northenden Northbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

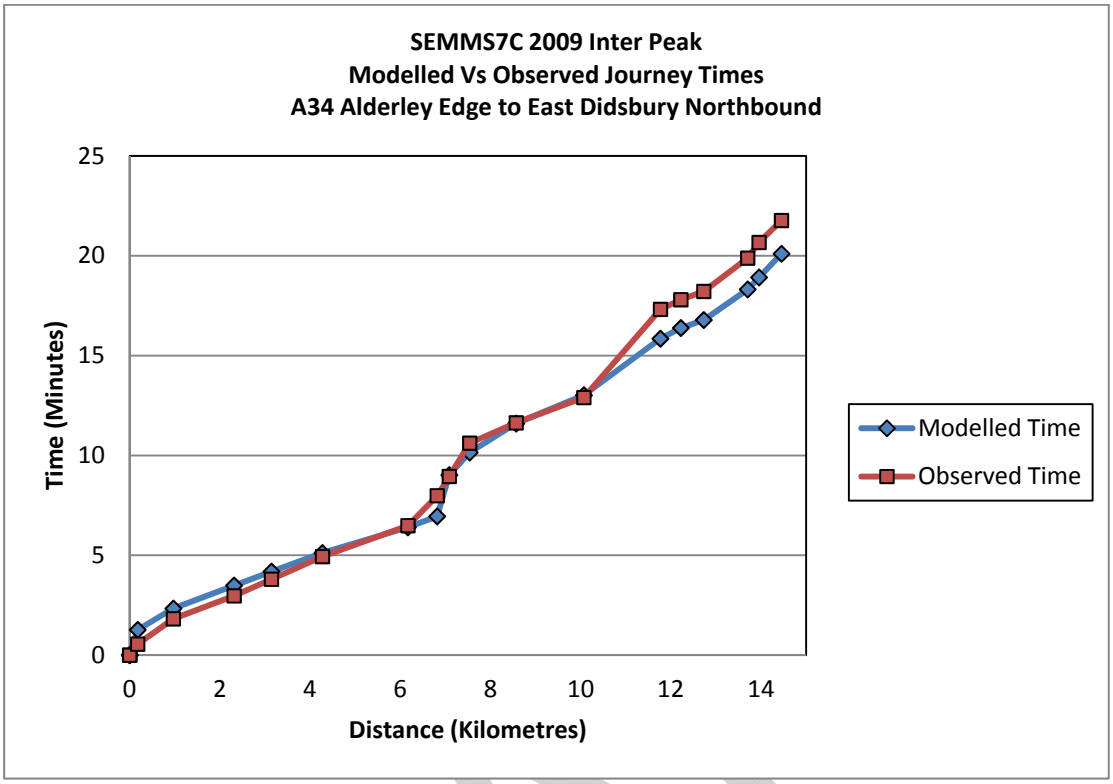

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
B5166 Northenden to Wilmslow Southbound
Time (Minutes)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

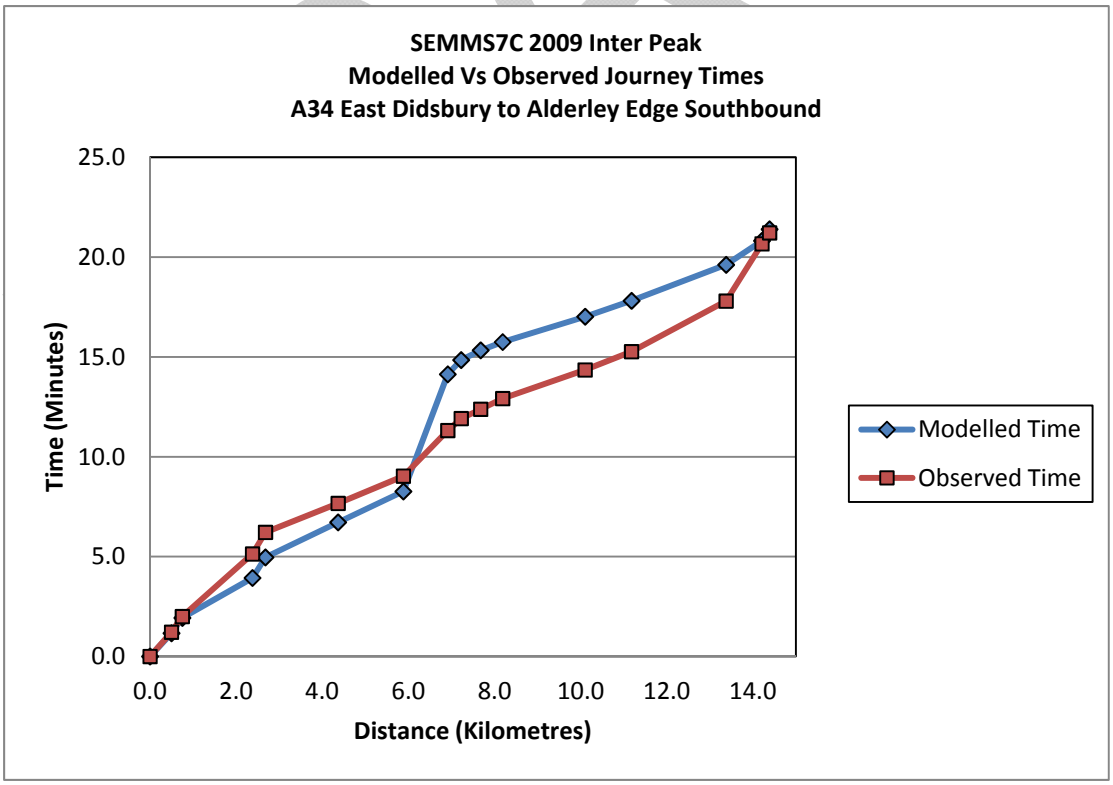

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
M56 Junction 8 to Junction 5 Eastbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
Distance (Kilometres)
Modelled Time
Observed Time

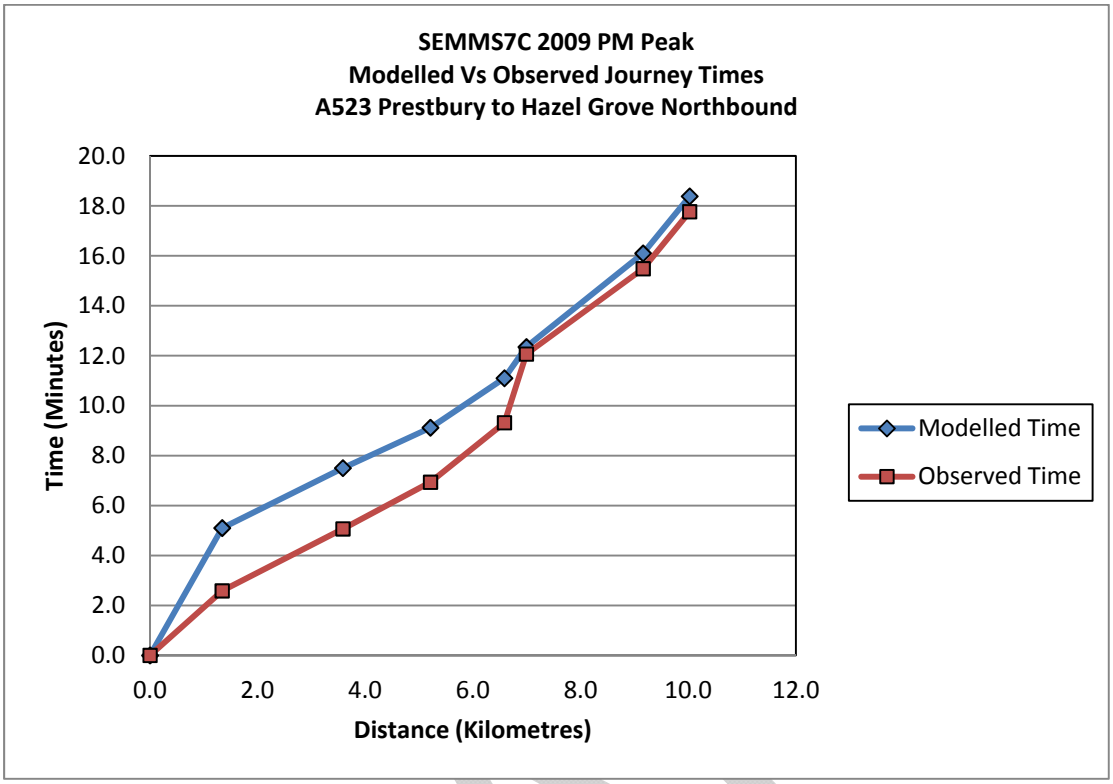

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
M56 Junction 5 to Junction 8 Westbound
Time (Minutes)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
Distance (Kilometres)
Modelled Time
Observed Time

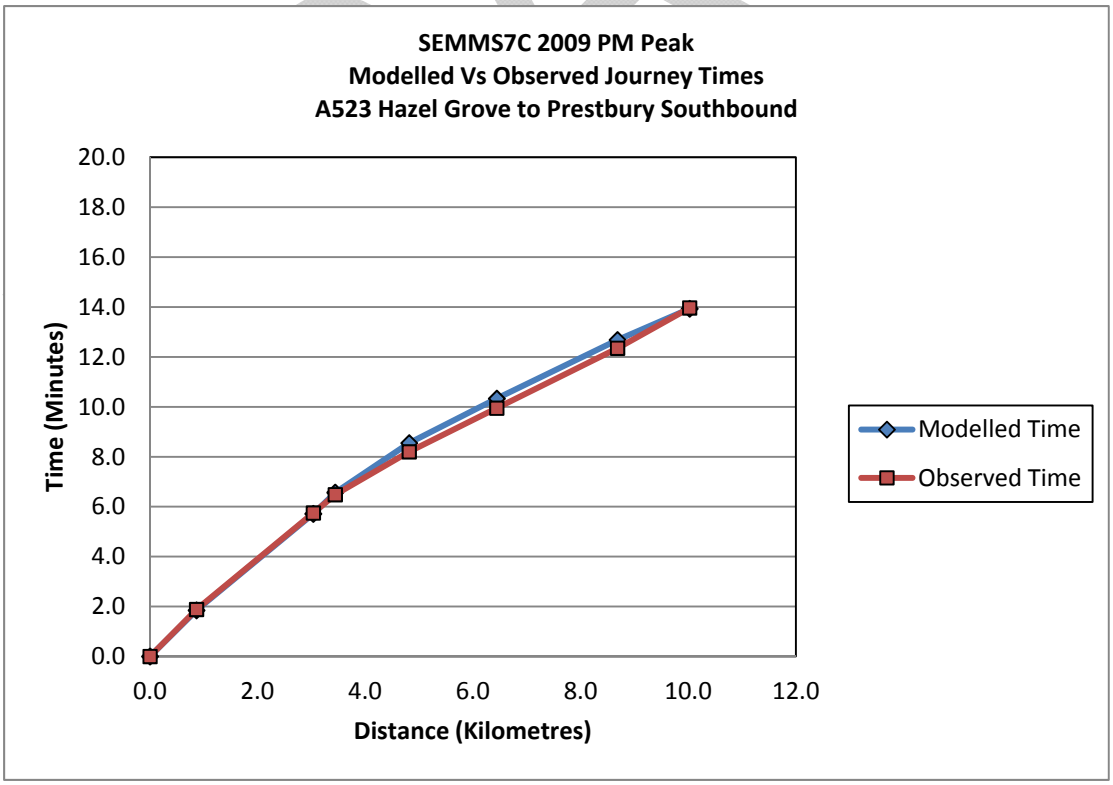

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A5102 Wilmslow to Bramhall Northeast bound
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

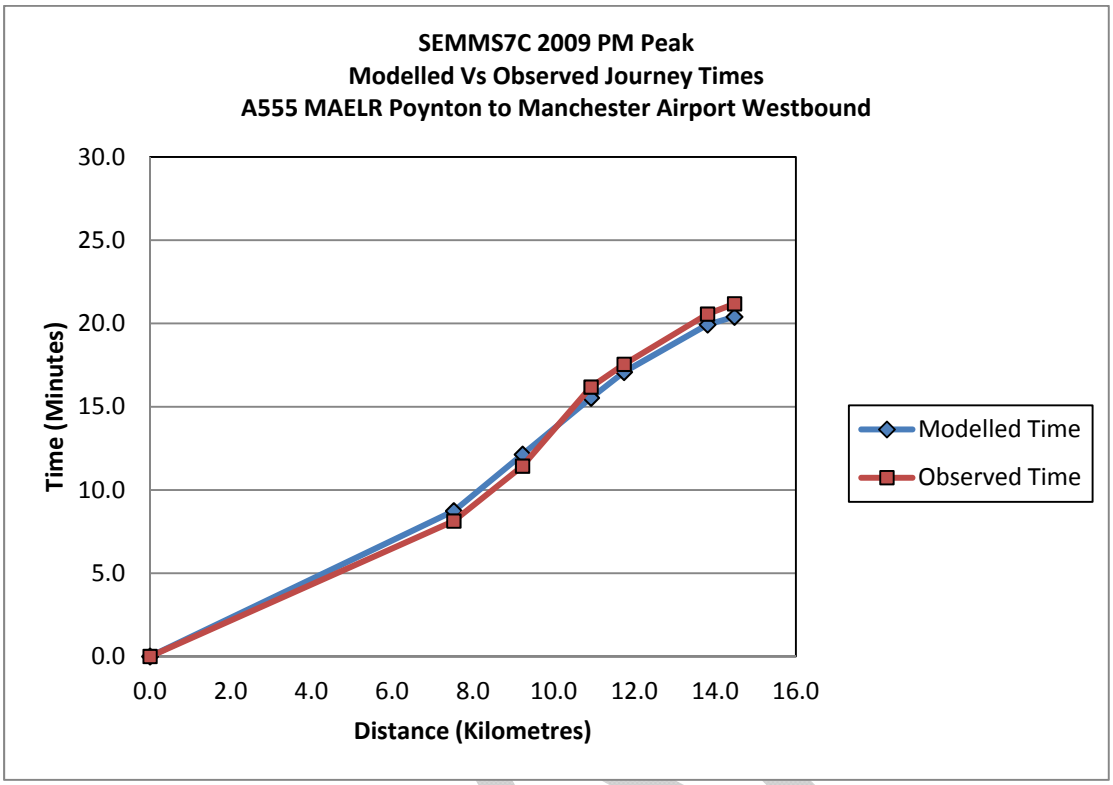

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A5102 Bramhall to Wilmslow Southwest bound
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
Distance (Kilometres)
Modelled Time
Observed Time

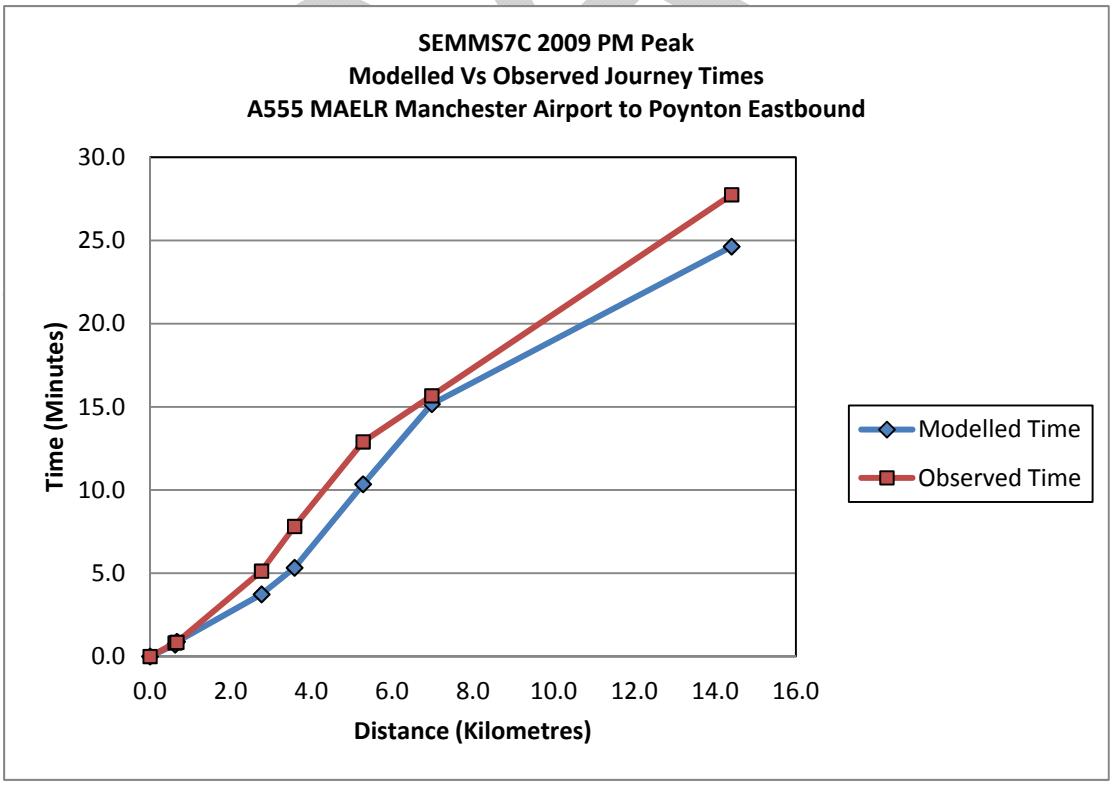

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A34 Alderley Edge to East Didsbury Northbound
Time (Minutes)
25
20
15
10
5
0
0
2
4
6
8
10
12
14
Distance (Kilometres)
Modelled Time
Observed Time

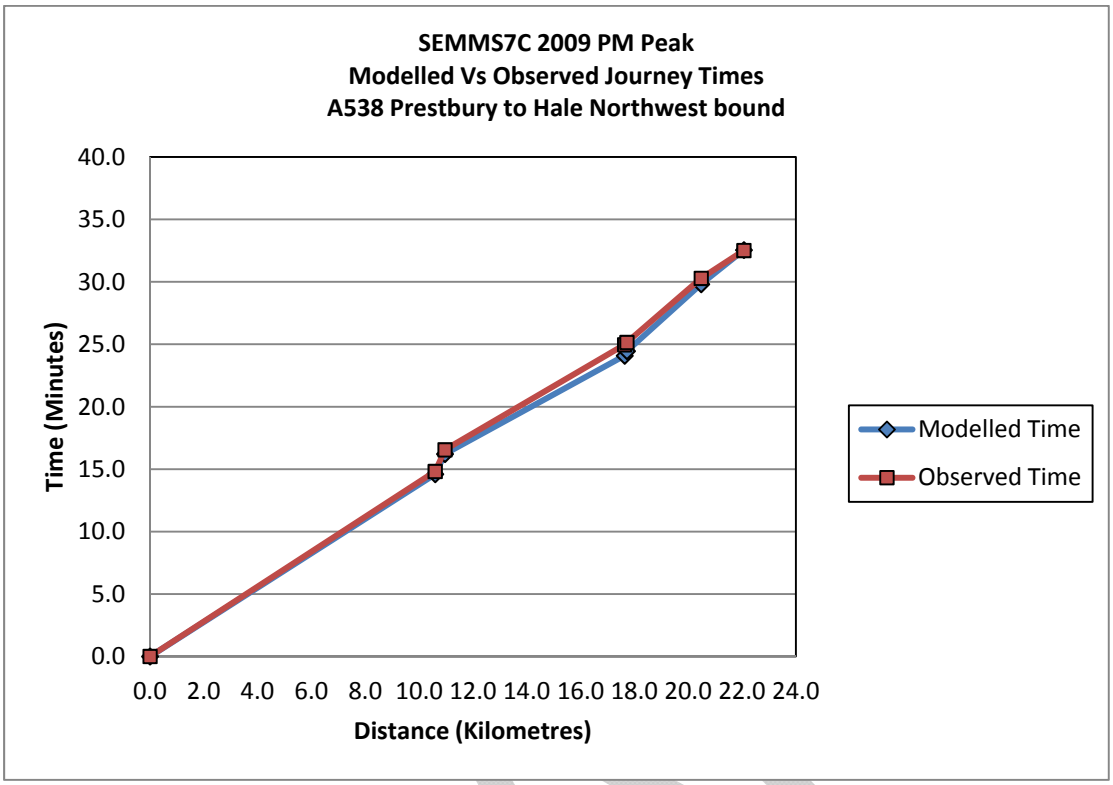

SEMMS7C 2009 Inter Peak
Modelled Vs Observed Journey Times
A34 East Didsbury to Alderley Edge Southbound
Time (Minutes)
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Distance (Kilometres)
Modelled Time
Observed Time

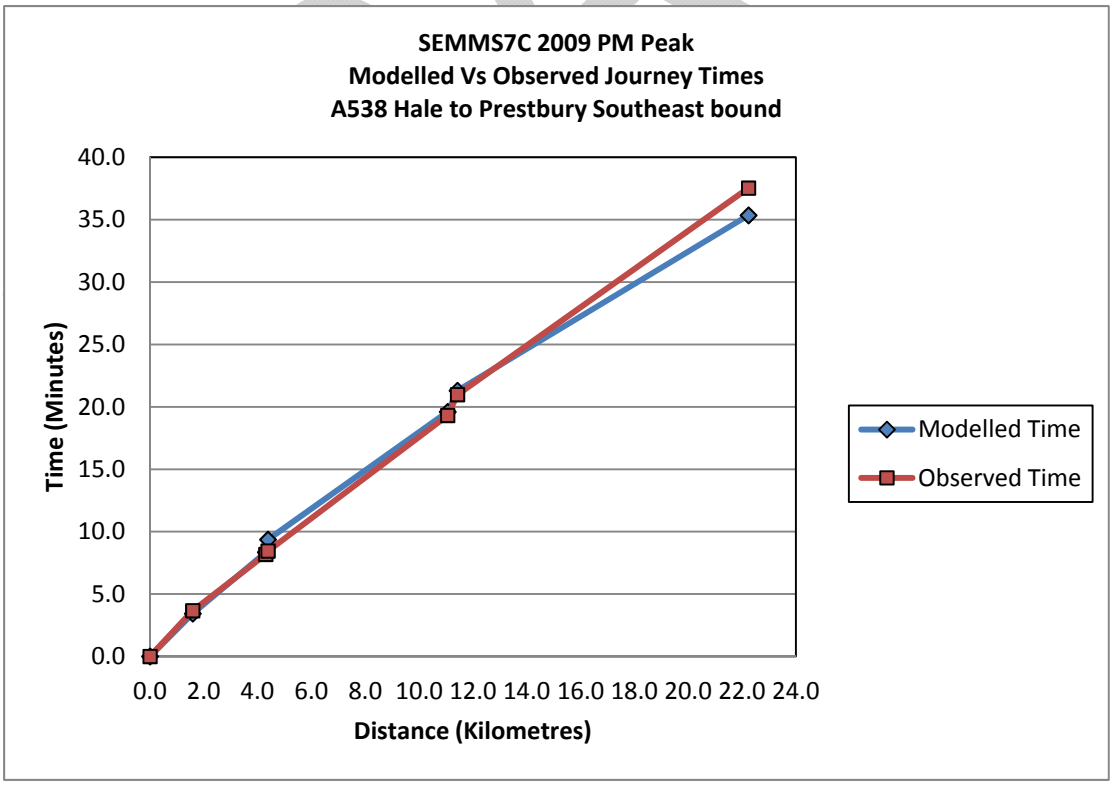

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A523 Prestbury to Hazel Grove Northbound
Time (Minutes)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

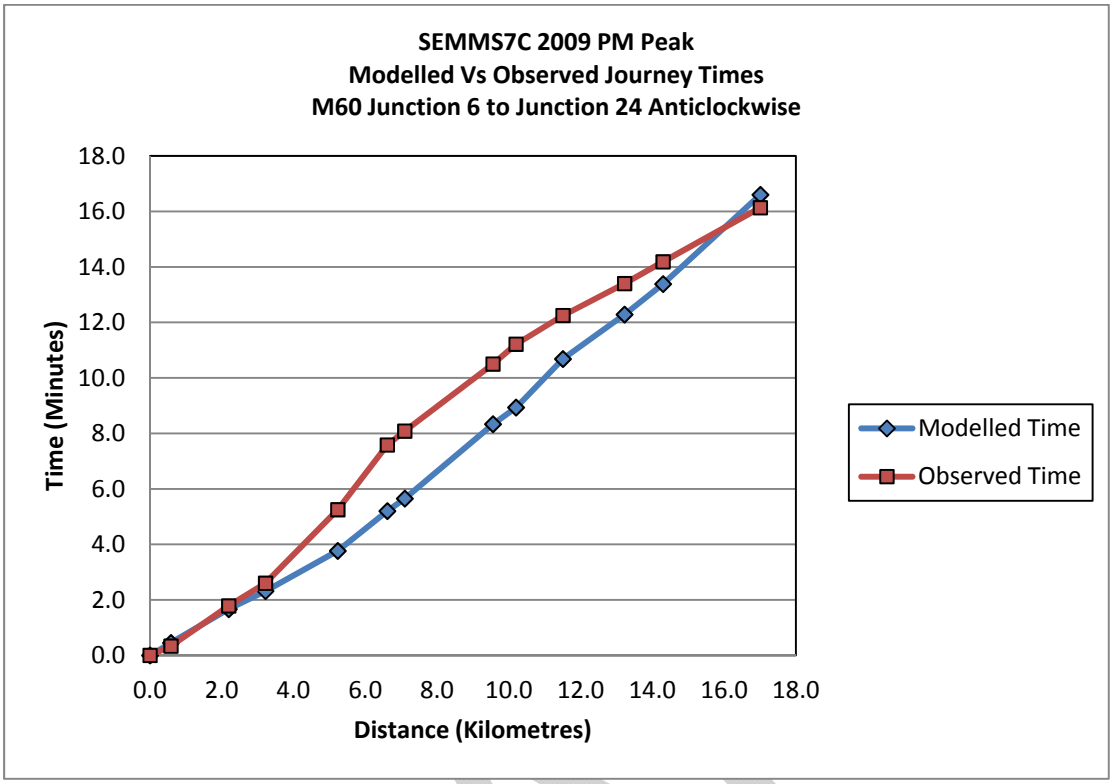

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A523 Hazel Grove to Prestbury Southbound
Time (Minutes)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (Kilometres)
Modelled Time
Observed Time

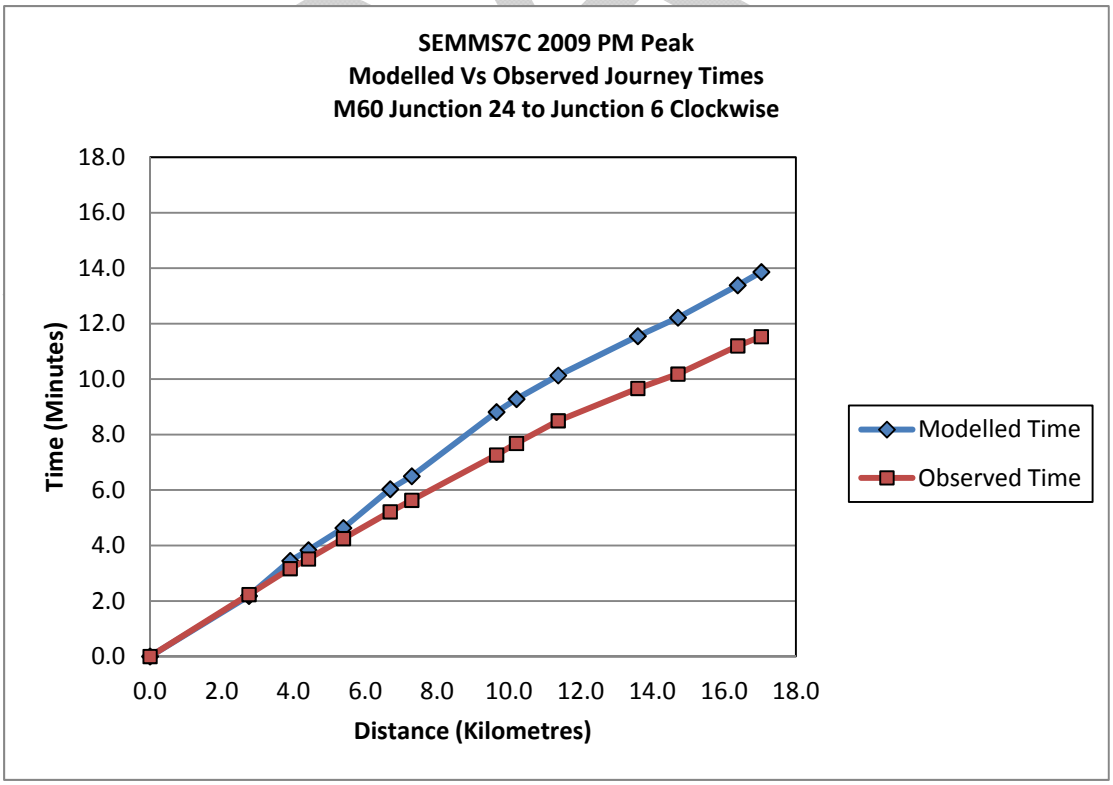

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A555 MAELR Poynton to Manchester Airport Westbound
Time (Minutes)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0
Distance (Kilometres)
Modelled Time
Observed Time

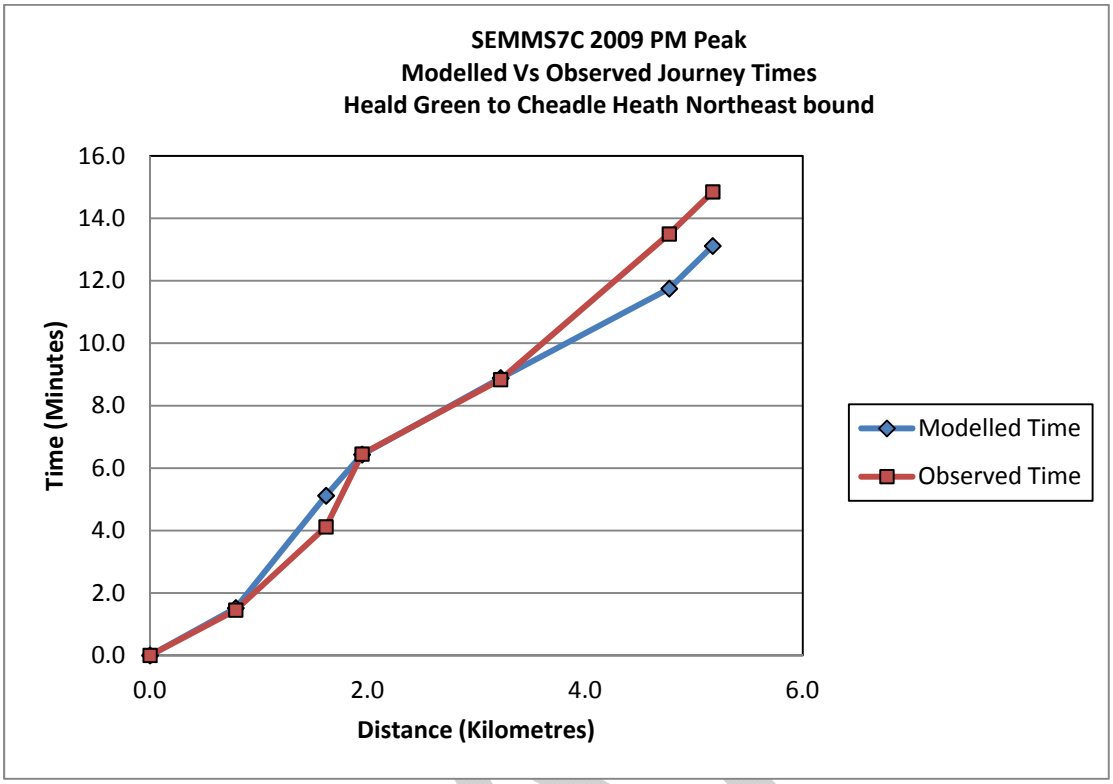

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A555 MAELR Manchester Airport to Poynton Eastbound
Time (Minutes)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0
Distance (Kilometres)
Modelled Time
Observed Time

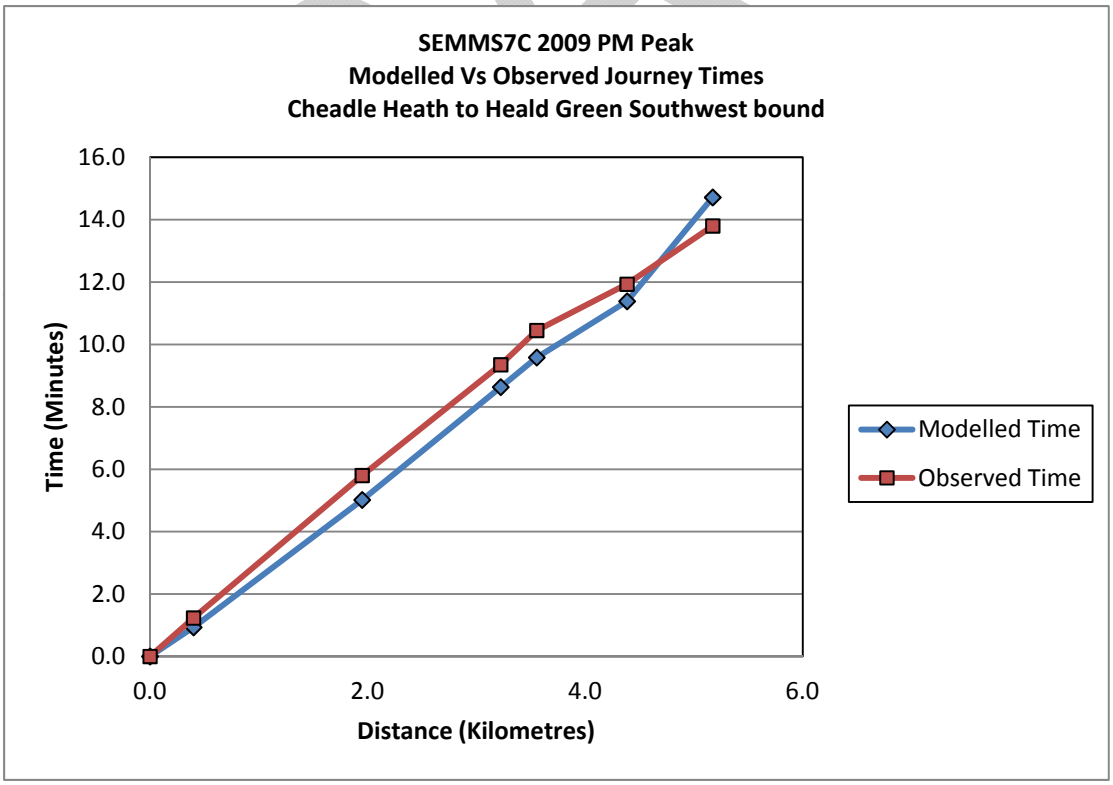

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A538 Prestbury to Hale Northwest bound
Time (Minutes)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0
Distance (Kilometres)
Modelled Time
Observed Time

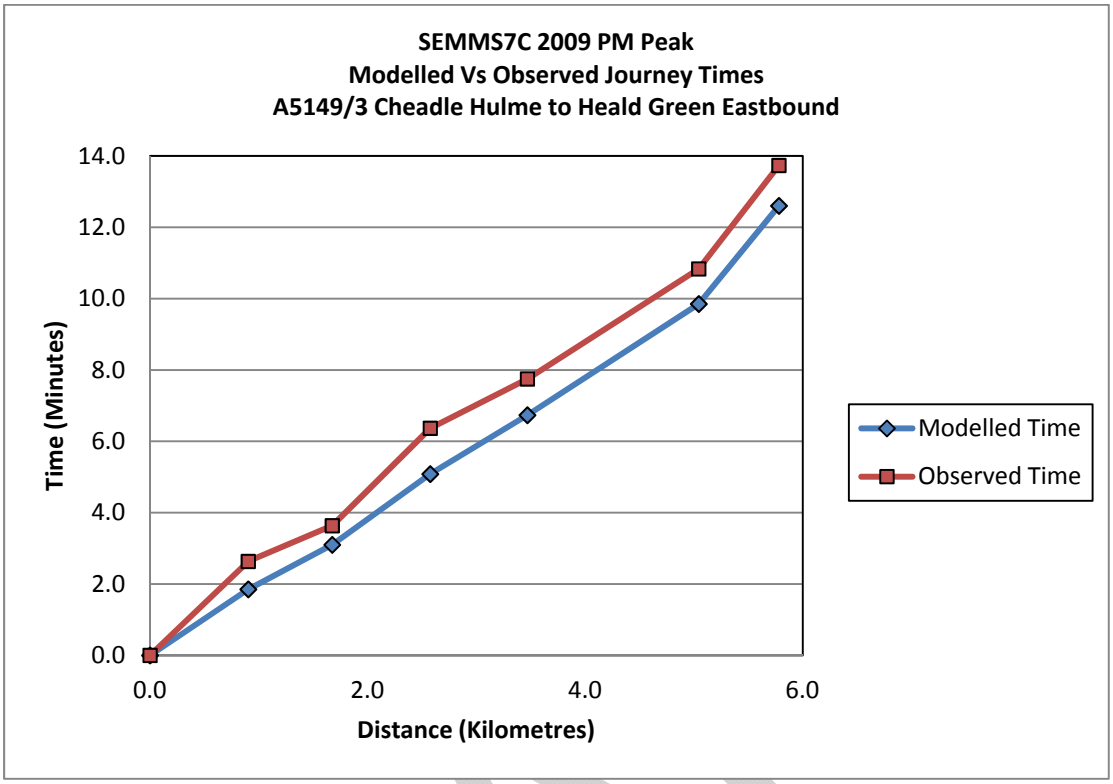

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A538 Hale to Prestbury Southeast bound
Time (Minutes)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0
Distance (Kilometres)
Modelled Time
Observed Time

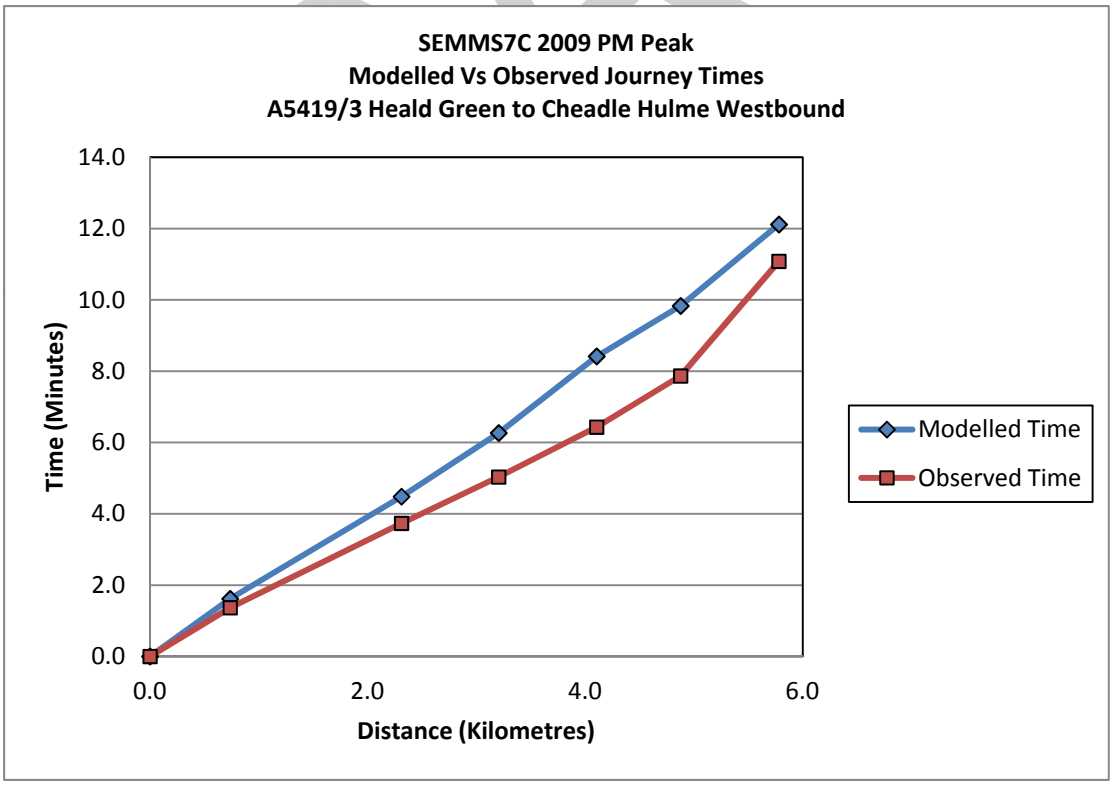

SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
M60 Junction 6 to Junction 24 Anticlockwise
Time (Minutes)
Distance (Kilometres)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Modelled Time
Observed Time


SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
M60 Junction 24 to Junction 6 Clockwise
Time (Minutes)
Distance (Kilometres)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Modelled Time
Observed Time


SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
Heald Green to Cheadle Heath Northeast bound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time


SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
Cheadle Heath to Heald Green Southwest bound
Time (Minutes)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time


SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A5149/3 Cheadle Hulme to Heald Green Eastbound
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time


SEMMS7C 2009 PM Peak
Modelled Vs Observed Journey Times
A5419/3 Heald Green to Cheadle Hulme Westbound
Time (Minutes)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
2.0
4.0
6.0
Distance (Kilometres)
Modelled Time
Observed Time

Appendix 10 Filenames

Networks

AM Peak	S7C_09PC_N21_5UCMEv4.dat
	S7C_09PC_N21_5UCMEv4.ufc
	S7C_09PC_N21_5UCMEv4.ufs
Inter-Peak	S7C_09OC_N21_5UCMEv4.dat
	S7C_09OC_N21_5UCMEv4.ufc
	S7C_09OC_N21_5UCMEv4.ufs
PM Peak	S7C_09EC_N21_5UCMEv4.dat
	S7C_09EC_N21_5UCMEv4.ufc
	S7C_09EC_N21_5UCMEv4.ufs

Matrices

AM Peak	S7C_09PC_5UCMEv4.ufm
Inter Peak	S7C_09OC_5UCMEv4.ufm
PM Peak	S7C_09EC_5UCMEv4.ufm

Counts (All Greater Manchester)

AM Peak	counts.110913.0800-0900.cars.f.txt
	counts.110913.0800-0900.lgvs.f.txt
	counts.110913.0800-0900.ogvs.f.txt
	counts.110913.0800-0900.pcus.f.txt
	counts.110913.0800-0900.cars.f.txt
	counts.110913.0800-0900.vehpcus.f.me2.txt
Inter-Peak	counts.110913.1000-1600.cars.f.txt
	counts.110913.1000-1600.lgvs.f.txt
	counts.110913.1000-1600.ogvs.f.txt
	counts.110913.1000-1600.pcus.f.txt
	counts.110913.1000-1600.cars.f.txt
	counts.110913.1000-1600.vehpcus.f.me2.txt
PM Peak	counts.110913.1700-1800.cars.f.txt
	counts.110913.1700-1800.lgvs.f.txt
	counts.110913.1700-1800.ogvs.f.txt
	counts.110913.1700-1800.pcus.f.txt

counts.110913.1700-1800.cars.f.txt
counts.110913.1700-1800.vehpcus.f.me2.txt

Counts (Area of Influence)

AM Peak	counts.110918.0800-0900.cars.f.txt
	counts.110918.0800-0900.lgvs.f.txt
	counts.110918.0800-0900.ogvs.f.txt
	counts.110918.0800-0900.pcus.f.txt
	counts.110918.0800-0900.cars.f.txt
	counts.110918.0800-0900.vehpcus.f.me2.txt
Inter-Peak	counts.110918.1000-1600.cars.f.txt
	counts.110918.1000-1600.lgvs.f.txt
	counts.110918.1000-1600.ogvs.f.txt
	counts.110918.1000-1600.pcus.f.txt
	counts.110918.1000-1600.cars.f.txt
	counts.110918.1000-1600.vehpcus.f.me2.txt
PM Peak	counts.110918.1700-1800.cars.f.txt
	counts.110918.1700-1800.lgvs.f.txt
	counts.110918.1700-1800.ogvs.f.txt
	counts.110918.1700-1800.pcus.f.txt
	counts.110918.1700-1800.cars.f.txt
	counts.110918.1700-1800.vehpcus.f.me2.txt