Transport for Greater Manchester

Client	**SEMMMS Client Board**
Project	**A6 to Manchester Airport Relief Road**
Subject	**HFAS Briefing Note: SEMMMS8B Local Model Validation Update**

This Note describes the update to the 2009 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 Note describes the model convergence and presents the results of the link flow and journey time validation.

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Originator	Michael Atkinson		Check /
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Contact	HFAS:	E-mail	Tel:
	Michael Atkinson	michael.atkinson@tfgm.com	+44 (0) 161 244 1610
	David Nixon	david.nixon@tfgm.com	+44 (0) 161 244 1400
			+

Issued	Organisation	FAO
	Atkins	Robin Kimber

C O N T E N T S

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1.   **Introduction**

        The Report

1.1   This report describes the validation of the 2009 SEMMMS8B 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). The SEMMMS8B SATURN model is an update of the SEMMMS8 SATURN model, which was used to forecast the effects of the proposed A6 to Manchester Airport Relief Road (design freeze 5). The SEMMMS8B model will provide the basis for an updated set of forecasts (design freeze 6).

        Description of New Relief Road

1.1   The improved 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.

1.2   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.

1.3   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

        SEMMMS8B Update

1.4   The 2009 SEMMMS8B SATURN model has been updated to include the following zone changes;

        •   'Zone 1045' (Finney Green between Wilmslow & Handforth) has been split into two zones (zone 1045 & new zone 1081). The trips assigned to/from this zone have been redistributed as a 50/50 split.

        •   'Zone 1062' (East of Lacy Green, North Wilmslow) has been split into two zones (zone 1062 & new zone 1082). The trips assigned to/from this zone have been redistributed as a 30/70 split.

        •   'Zone 1043' (NW of Poynton) has been split into two zones (zone 1043 & new zone 1083). The trips assigned to/from this zone have been redistributed as a 90/10 split.

        •   'Zone 635' (Disley) has been split into two zones (zone 635 & new zone 1084). The trips assigned to/from this zone have been redistributed as a 50/50 split.

1.5   The following network changes were also included;

        •   Inclusion of Moor Lane between Moor Lane/Jenny Lane & A5102 Chester Road, North of Woodford Aerodrome.

Matrix Input

1.6   The matrices used in this validation exercise were those produced post-matrix estimation for the design freeze 5 forecasting work (SEMMMS8 SATURN model). The only changes being those described in paragraph 1.5 above.

1.7   No attempt has been made to rerun matrix estimation. The objective here is to confirm that the limited changes made to matrices & network, have not significantly altered the outcome of the validation process.

2.   Traffic Flow Validation

Introduction

2.1   This section presents the link flow validation results for the updated SEMMMS8B model. 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.

Network Convergence

2.2   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.

2.3   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.

2.4   Table 2.1 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 2.1 2009 SEMMMS 8B SATURN Model Network Convergence Statistics				
Criterion	Target	AM Peak	Inter Peak	PM Peak
Delta	<1%	0.016%	0.0048%	0.015%
Percentage of links with <2% flow change on final iteration	>99%	99.09	99.51	99.25
Final iteration −1		99.33	99.16	99.02
Final iteration −2		99.40	99.49	99.23
Final iteration −3		99.17	98.92	99.10

Assignment Validation Guidelines

2.5   DMRB Volume 12 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.

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

2.7   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.

2.8   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.

2.9   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

2.10   This section presents the assignment validation results for the sites in the SEMMMS AOI that were used during matrix estimation (ME) in the SEMMMS8 model. 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

2.11   In total, counts on 10 (two-way) cordons and screenlines were used during SEMMMS8 matrix estimation, as described below in Table 2.2.

Table 2.2 Matrix Estimation Cordons and Screenlines		
Cordon/Screenline Number/Name	**Direction**	**Number of Sites**
1 SEMMMS RSI Cordon 1	Inbound	12
	Outbound	13
2 SEMMMS RSI Cordon 2	Inbound	20
	Outbound	20
3 SEMMMS RSI Cordon 3	Inbound	21
	Outbound	21
4 Manchester Airport Cordon	Inbound	5
	Outbound	5
5 Wilmslow Cordon	Westbound	4
	Eastbound	4
6 Stockport – Bramhall Screenline	Westbound	5
	Eastbound	5
7 Romiley - Hazel Grove Screenline	Northbound	7
	Southbound	7
8 Romiley / New Mills Screenline	Westbound	6
	Eastbound	6
9 North-of-Scheme screenline Northbound	Northbound	12
	Southbound	12
10 South-of-Wilmslow Screenline	Northbound	8
	Southbound	8
Total sites	-	201

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

2.12   The validation results for the matrix estimation cordons and screenlines are shown below in Tables 2.3 to 2.5. Results are presented for each of the three time periods for all vehicle types

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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 for both SEMMMS8 and SEMMMS8B 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.

2.13   Table 2.3 compares modelled and observed flows in the AM peak hour. Overall, the comparisons are very good, with 16 out of 20 (two way) cordons/screenlines having a screenline GEH value of less than 4. Cordon number 9, (north of scheme cordon), has the highest GEH value with a figure of 5.1.

2.14   At the site level, approximately 92% of the sites have a GEH value of less than 5, and meet the combined DMRB link flow criteria, which satisfies the DMRB requirements. Largely, there is very little difference between SEMMMS8B and SEMMMS8 results.

Table 2.3   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	SEMMMS8B Screenline GEH	SEMMMS8 Screenline GEH
1	In	12	10,670	10,949	279	2.6%	2.7	2.6
	Out	13	8,606	8,634	28	0.3%	0.3	0.2
2	In	20	17,688	17,324	-364	-2.1%	2.8	3.3
	Out	20	17,087	17,198	111	0.7%	0.8	0.5
3	In	21	14,540	14,689	149	1.0%	1.2	0.9
	Out	21	13,953	14,330	377	2.7%	3.2	3.0
4	In	5	2,642	2,613	-29	-1.1%	0.6	0.6
	Out	5	1,757	1,663	-94	-5.4%	2.3	2.3
5	West	4	3,232	3,151	-81	-2.5%	1.4	0.8
	East	4	3,487	3,217	-270	-7.7%	4.7	5.2
6	West	5	4,458	4,413	-45	-1.0%	0.7	0.8
	East	5	4,312	4,202	-110	-2.65%	1.7	0.9
7	North	7	4,996	5,344	348	7.0%	4.8	3.8
	South	7	3,830	4,009	179	4.7%	2.9	1.7
8	West	6	2,928	2,831	-97	-3.3%	1.8	1.7
	East	6	2,186	2,156	-30	-1.4%	0.6	0.8
9	North	12	13,561	12,978	-583	-4.3%	5.1	4.9
	South	12	13,637	13,387	-250	-1.8%	2.2	2.6
10	North	8	5,140	4,947	-193	-3.8%	2.7	2.6
	South	8	5,470	5,108	-362	-6.6%	5.0	4.9

Notes:

Percentage of <u>all sites</u> with GEH < 5 = 91.5% (SEMMMS8 – 91.2%)
Percentage of <u>all sites</u> meeting DMRB flow criteria = 92.0% (SEMMMS8 – 91.2%)

2.15   Table 2.4 compares modelled and observed screenline crossing flows in the inter-peak hour in PCUs.

2.16   Overall, the comparisons are very good, with 18 out of 20 (two way) cordons/screenlines having a screenline GEH value of less than 4. The notable exception is cordon 10 (south of Wilmslow screenline) having a GEH value of 4.6 & 5.9. 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. Overall, there is very little difference between SEMMMS8B and SEMMMS8 results.

Table 2.4	**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	SEMMMS8B Screenline GEH	SEMMMS8 Screenline GEH
1	In	12	7,164	7,261	97	1.4%	1.1	1.0
	Out	13	7,302	7,155	-147	-2.0%	1.7	2.0
2	In	20	12,069	12,125	56	0.5%	0.5	0.2
	Out	20	11,694	11,817	123	1.1%	1.1	0.5
3	In	21	11,766	11,540	-226	-1.9%	2.1	3.6
	Out	21	12,045	11,845	-200	-1.7%	1.8	2.8
4	In	5	1,734	1,746	12	0.7%	0.3	0.3
	Out	5	1,850	1,820	-30	-1.6%	0.7	0.3
5	West	4	2,395	2,310	-85	-3.6%	1.8	1.1
	East	4	2,396	2,332	-64	-2.7%	1.3	1.1
6	West	5	3,293	3,225	-68	-2.1%	1.2	1.0
	East	5	3,599	3,540	-59	-1.6%	1.0	0.6
7	North	7	3,916	3,877	-39	-1.0%	0.6	1.0
	South	7	3,786	3,769	-17	-0.5%	0.3	4.1
8	West	6	2,151	2,189	38	1.8%	0.8	0.1
	East	6	2,062	2,139	77	3.7%	1.7	1.5
9	North	12	10,383	10,236	-147	-1.4%	1.4	2.2
	South	12	10,262	9,907	-355	-3.5%	3.5	4.3
10	North	8	3,431	3,167	-264	-7.7%	4.6	4.7
	South	8	3,218	2,894	-324	-10.1%	5.9	6.0

Notes:

Percentage of <u>all sites</u> with GEH < 5 = 94.0% (SEMMMS8 – 94.4%)

Percentage of <u>all sites</u> meeting DMRB flow criteria = 95.0% (SEMMMS8 – 94.4%)

2.17   Table 2.5 compares modelled and observed screenline crossing flows in the PM peak hour for all vehicles combined as PCUs.

2.18   In total, 16 out of 20 of the (two way) cordons/screenlines have a GEH value of less than 4. Southbound flows on cordon 7, (Romiley - Hazel Grove screenline), have the highest GEH value, with a figure of 7.7. The observed flows in the northbound direction are reproduced reasonably

well, with a percentage difference between the modelled and observed flows of 4.9% and a cordon GEH value of 3.2.

2.19   At the site level, approximately 90% of the sites have a GEH value of less than 5, with 92% of the sites meeting the combined DMRB link flow criteria. Overall, there is very little difference between SEMMMS8B and SEMMMS8 results. Generally, there is very little difference between SEMMMS8B and SEMMMS8 results.

Table 2.5   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	SEMMMS8B Screenline GEH	SEMMMS8 Screenline GEH
1	In	12	9,263	8,716	-547	-5.9%	5.8	6.1
	Out	13	9,964	10,095	131	1.3%	1.3	1.0
2	In	20	17,598	17,703	105	0.6%	0.8	0.4
	Out	20	16,106	16,359	253	1.6%	2.0	1.6
3	In	21	14,770	15,270	500	3.4%	4.1	3.8
	Out	21	15,629	15,712	83	0.5%	0.7	0.3
4	In	5	1,625	1,638	13	0.8%	0.3	0.4
	Out	5	2,410	2,362	-48	-2.0%	1.0	0.9
5	West	4	3,075	3,103	28	0.9%	0.5	1.6
	East	4	3,330	3,221	-109	-3.3%	1.9	1.9
6	West	5	3,995	3,966	-29	-0.7%	0.5	0.7
	East	5	4,394	4,336	-58	-1.3%	0.9	0.1
7	North	7	4,315	4,526	211	4.9%	3.2	1.7
	South	7	5,657	6,254	597	10.6%	7.7	5.0
8	West	6	2,377	2,424	47	2.0%	1.0	1.0
	East	6	3,591	3,626	35	1.0%	0.6	0.6
9	North	12	12,941	12,960	19	0.2%	0.2	0.7
	South	12	14,077	13,593	-484	-3.4%	4.1	4.3
10	North	8	5,172	5,021	-151	-2.9%	2.1	2.0
	South	8	4,896	4,646	-250	-5.1%	3.6	3.6

Notes:

Percentage of <u>all sites</u> with GEH < 5 = 90.1% (SEMMMS8 – 91.2%)

Percentage of <u>all sites</u> meeting DMRB flow criteria = 91.6% (SEMMMS8 – 92.6%)

Matrix Estimation Motorway Sites

2.20   Table 2.6 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.

2.21   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 100.0% and 95% of the sites meeting the standard in the inter-peak and PM peak hours respectively.

Table 2.6 Link Flow Comparisons for Motorway Counts used During Matrix Estimation (Actual Flows, All Vehicles)								
Time Period	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH < 5	% SEMMMS8B ALL DMRB	% SEMMMS8 All DMRB
AM Peak	40	146,803	143,205	-3,598	-2.5%	87.5	90.0	90.0
Inter Peak	40	108,571	107,422	-1,149	-1.1%	97.5	100.0	97.5
PM Peak	40	144,360	142,581	-1,779	-1.2%	95.0	95.0	95.0

Link Flow Comparisons for All Matrix Estimation Counts

2.22   Table 2.7 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.

2.23   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 95% of sites having a GEH value of less than 5 and 94% meeting the DMRB flow criteria. The PM peak hour has approximately 92% of sites having a GEH value of less than 5 and approximately 93% meeting the DMRB flow criteria

2.24   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 2.7 Link Flow Comparisons for All Matrix Estimation Counts (Actual Flows, All Vehicles)								
Time Period	Number Of Sites	Observed Flow	Modelled Flow	Difference	% Difference	% GEH < 5	% SEMMMS8B ALL DMRB	% SEMMMS8 All DMRB
AM Peak	215	283,915	278,862	-5,053	-1.8%	90.7	91.2	91.2
Inter-Peak	215	211,310	208,418	-2,892	-1.4%	94.0	95.3	94.4
PM Peak	215	280,949	278,788	-2,161	-0.8%	90.7	92.3	92.6

Link Flow Difference Plots

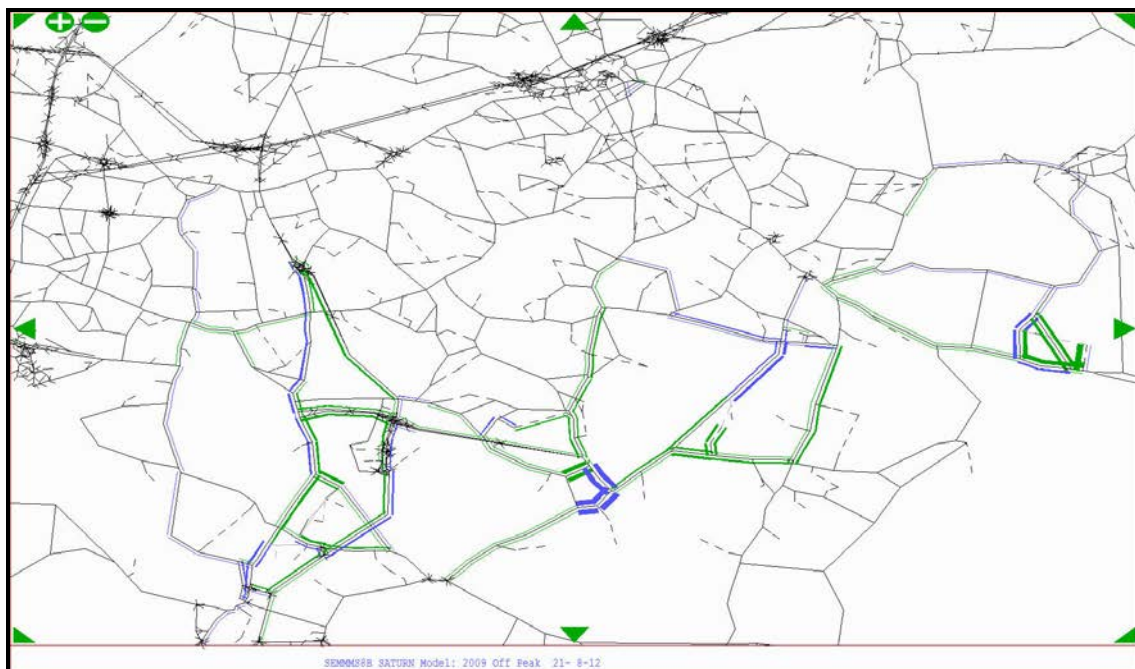2.25   Figure 2.1 below depicts the ***2009 AM Peak Period SEMMMS8B Model*** minus the ***2009 AM Peak Period SEMMMS8 Model*** demand flows (PCUs). The blue flows represent a decrease in demand and the green flows represent an increase in demand.
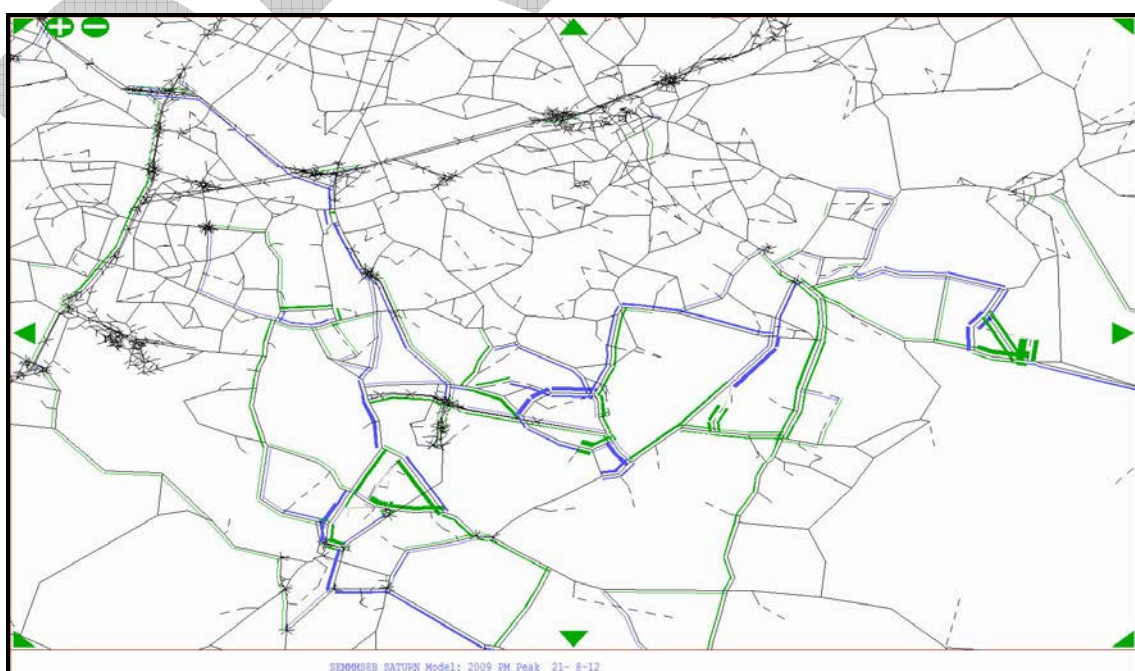
Figure 2.1
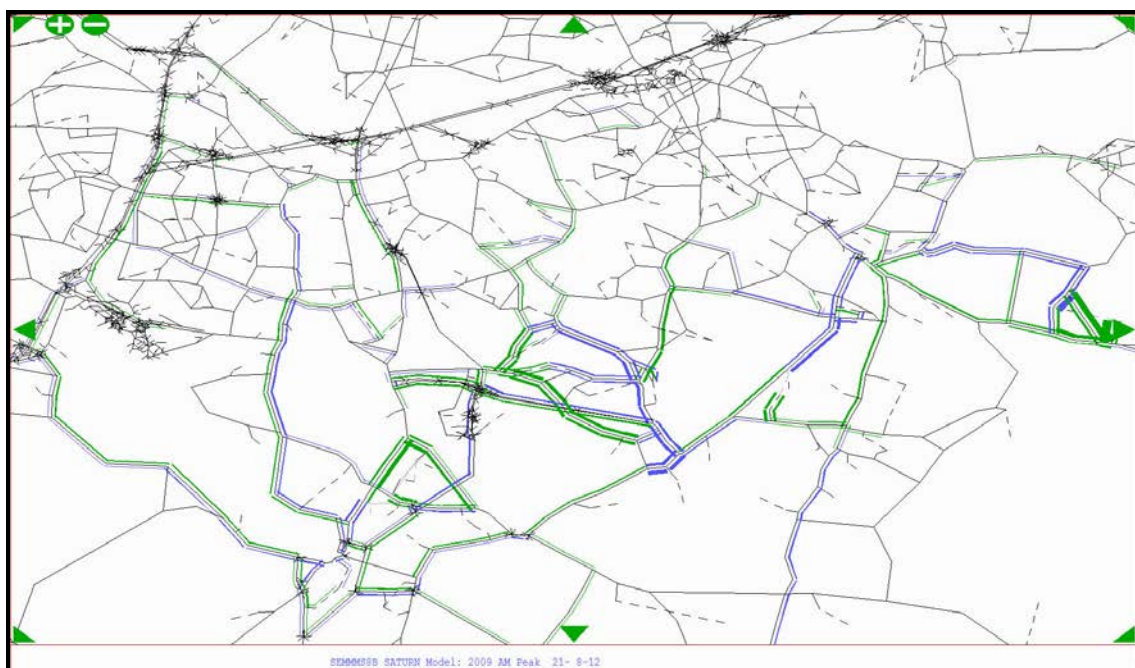
2.26   The updated 2009 SEMMMS8B AM Peak model has seen a small reassignment within the AOI as a result of the network changes. There has been a localised effect with reassignment on adjacent areas to the network changes. The biggest impact has been the introduction of Moor Lane between Jenny Lane & A5102 Chester Road, North of Woodford Aerodrome. Although not shown on Figure 2.1, this has led to an increase of two-way traffic on Moor Lane between Jenny Lane and Grove Lane of around 180 PCUs. There has been a decrease of two-way traffic on A5102 Woodford Rd between Jenny Lane & A5102 Chester Road, North of Woodford Aerodrome of 150 PCUs. There has also been a small localised effect in High Lane with a reassignment from the minor roads to Andrew Lane and the A6. This effect is common to all time periods.

2.27   Figure 2.2 below depicts the ***2009 Inter Peak Period SEMMMS8B Model*** minus the ***2009 Inter Peak Period SEMMM8 Model*** demand flows (PCUs).

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Figure 2.2

2.28   The updated 2009 SEMMMS8B Inter Peak model has seen a small reassignment within the AOI as a result of the network changes. There has been a localised effect with reassignment on adjacent areas to the network changes.

2.29   Figure 2.3 below depicts the *2009 PM Peak Period SEMMMS8B Model* minus the *2009 PM Peak Period SEMMMS8 Model* demand flows (PCUs).

Figure 2.3

2.30   The updated 2009 SEMMMS8B PM Peak model has seen a small reassignment within the AOI as a result of the network changes. There has been a localised effect with reassignment on adjacent areas to the network changes.

3.   Journey Time Validation

Introduction

3.1   Modelled and observed journey times have been compared on a selection of radial and orbital routes within the study area, as shown in Table 3.1 and illustrated in Figure 3.1. 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.

3.2   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.

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

Journey Time Validation Guidelines

3.4   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.

3.5   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.

3.6   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 3.1 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

Journey Time Routes

Drawn By : I Hagyard	Scale : Not applicable	Date : May 2010	
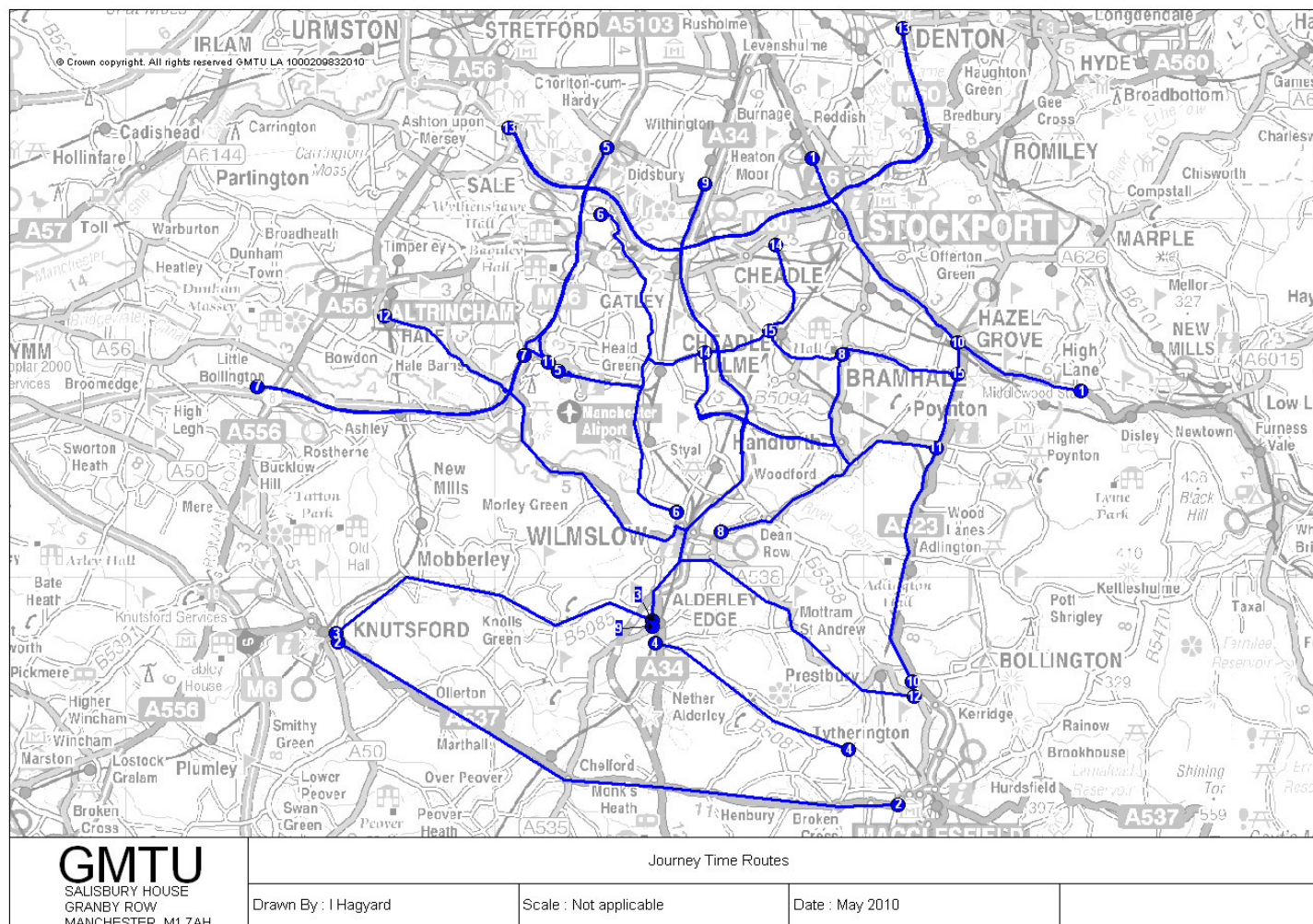
AM Peak Hour Journey Time Validation Results

3.7   Table 3.2 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.

3.8   Considering all of the routes together, the total modelled time is approximately 2.4% 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 3.2 Modelled Versus Observed AM Peak Hour Journey Times (Minutes)							
Route Number	Direction	Observed Time	Modelled Time	Modelled-Observed	% Error	SEMMMS8B DMRB	SEMMMS8 DMRB
1	NW	28.9	28.8	-0.1	0.3%	Y	Y
	SE	22.1	25.3	3.1	14.1%	Y	Y
2	E	22.7	20.7	-2.0	8.9%	Y	Y
	W	21.7	20.2	-1.5	6.8%	Y	Y
3	E	13.8	15.1	1.3	9.4%	Y	Y
	W	13.8	13.5	-0.3	2.3%	Y	Y
4	NW	7.7	7.1	-0.5	7.1%	Y	Y
	SE	7.4	6.8	-0.6	8.7%	Y	Y
5	N	12.3	6.7	-5.6	45.3%	N	N
	S	5.2	6.1	0.9	17.3%	Y	Y
6	N	16.5	16.6	0.1	0.5%	Y	Y
	S	16.6	17.5	0.9	5.4%	Y	Y
7	E	6.7	6.4	-0.3	4.5%	Y	Y
	W	5.2	6.0	0.9	16.9%	Y	Y
8	NE	11.6	11.8	0.3	2.2%	Y	Y
	SW	13.9	21.1	-1.8	12.9%	Y	Y
9	N	24.0	21.8	-2.1	8.9%	Y	Y
	S	24.2	25.0	0.8	3.4%	Y	Y
10	N	16.3	16.2	0.0	0.3%	Y	Y
	S	17.7	16.3	-1.5	8.2%	Y	Y
11	W	24.7	22.2	-2.4	9.8%	Y	Y
	E	23.2	24.3	1.1	4.7%	Y	Y
12	NW	38.9	34.0	-4.9	12.6%	Y	Y
	SE	38.8	36.1	-2.7	7.0%	Y	Y
13	AC	11.2	14.7	3.5	31.4%	N	N
	CW	16.3	14.8	-1.5	9.0%	Y	Y
14	NE	14.6	14.1	-0.5	3.4%	Y	Y
	SW	14.1	14.1	0.0	0.1%	Y	Y
15	E	10.7	13.4	2.8	25.9%	N	N
	W	14.9	15.3	0.4	2.8%	Y	Y
Total		515.4	503.0	-12.4	2.4%		

Number of routes satisfying DMRB Criteria = 27out of 30 (90.0%) (SEMMMS8 – 90.0%)

Inter-Peak Hour Journey Time Validation Results

3.9   Table 3.3 compares modelled and observed journey times in the inter-peak hour along the 30 journey time routes.

3.10   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 0.0% of the observed time, which represents a very good fit.

Table 3.3 Modelled Versus Observed Inter Peak Hour Journey Times (Minutes)						
Route Number	Direction	Observed Time	Modelled Time	Modelled-Observed	% Error	SEMMMS8B DMRB	SEMMMS8 DMRB
1	NW	20.8	23.6	2.8	13.4%	Y	Y
	SE	19.0	20.6	1.5	7.9%	Y	Y
2	E	18.5	19.8	1.3	6.9%	Y	Y
	W	18.0	19.8	1.8	9.7%	Y	Y
3	E	13.2	12.7	-0.5	3.7%	Y	Y
	W	13.1	12.3	-0.8	5.8%	Y	Y
4	NW	7.5	6.6	-0.9	11.7%	Y	Y
	SE	7.2	6.4	-0.8	10.9%	Y	Y
5	N	5.5	5.8	0.3	6.0%	Y	Y
	S	5.0	5.2	0.2	4.6%	Y	Y
6	N	15.5	14.3	-1.2	7.9%	Y	Y
	S	14.6	13.4	-1.2	8.2%	Y	Y
7	E	4.6	4.8	0.2	4.5%	Y	Y
	W	4.8	4.9	0.1	2.5%	Y	Y
8	NE	10.8	10.2	-0.6	5.7%	Y	Y
	SW	11.2	10.3	-1.0	8.5%	Y	Y
9	N	15.8	15.5	-0.3	2.0%	Y	Y
	S	16.4	15.8	-0.6	3.5%	Y	Y
10	N	14.8	14.8	0.0	0.2%	Y	Y
	S	13.4	13.1	-0.3	2.3%	Y	Y
11	W	19.1	17.5	-1.6	8.3%	Y	Y
	E	20.5	18.2	-2.3	11.2%	Y	Y
12	NW	30.3	29.8	-0.5	1.7%	Y	Y
	SE	30.8	31.1	0.3	1.1%	Y	Y
13	AC	9.8	12.0	2.1	21.6%	N	N
	CW	10.4	11.8	1.4	13.4%	Y	Y
14	NE	10.6	10.1	-0.5	4.9%	Y	Y
	SW	10.6	11.1	0.5	4.8%	Y	Y
15	E	9.8	10.3	0.4	4.4%	Y	Y
	W	9.8	9.7	-0.1	0.8%	Y	Y
Total		**411.3**	**411.3**	**-0.1**	**0.0%**		

Number of routes satisfying DMRB Criteria = 29 out of 30 (96.7%) (SEMMMS8 – 96.7%)

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PM Peak Hour Journey Time Validation Results

3.11   Table 3.4 compares modelled and observed journey times in the PM peak hour.

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

3.13   Considering all of the routes together, the total modelled time is approximately 1.6% 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 3.4 Modelled Versus Observed PM Peak Hour Journey Times (Minutes)							
Route Number	Direction	Observed Time	Modelled Time	Modelled-Observed	% Error	SEMMMS8B DMRB	SEMMMS8 DMRB
1	NW	23.0	26.4	3.4	14.6%	Y	Y
	SE	27.7	27.0	-0.7	2.5%	Y	Y
2	E	20.1	20.1	0.0	0.0%	Y	Y
	W	19.5	20.2	0.7	3.6%	Y	Y
3	E	13.2	14.9	1.7	13.1%	Y	Y
	W	13.3	13.5	0.3	2.1%	Y	Y
4	NW	7.4	7.1	-0.3	3.8%	Y	Y
	SE	7.1	6.8	-0.3	4.5%	Y	Y
5	N	7.9	6.6	-1.3	16.4%	N	N
	S	6.1	6.2	0.2	2.9%	Y	Y
6	N	17.2	16.1	-1.1	6.4%	Y	Y
	S	16.5	15.2	-1.3	7.7%	Y	Y
7	E	5.6	5.5	-0.1	2.2%	Y	Y
	W	6.6	6.6	0.0	0.3%	Y	Y
8	NE	13.2	11.7	-1.5	11.4%	Y	Y
	SW	13.1	11.9	-1.2	9.4%	Y	Y
9	N	21.6	20.5	-1.2	5.4%	Y	Y
	S	21.2	22.0	0.8	3.8%	Y	Y
10	N	18.0	19.6	1.6	8.8%	Y	Y
	S	14.0	14.0	0.0	0.2%	Y	Y
11	W	21.2	19.3	-1.9	8.8%	Y	Y
	E	27.8	23.8	-4.0	14.4%	Y	Y
12	NW	32.5	32.5	0.0	0.1%	Y	Y
	SE	37.5	35.5	-2.1	5.5%	Y	Y
13	AC	16.1	15.8	-0.3	2.0%	Y	Y
	CW	11.5	13.8	2.3	19.9%	N	N
14	NE	14.8	13.5	-1.4	9.2%	Y	Y
	SW	13.8	14.1	0.3	2.2%	Y	Y
15	E	13.7	12.6	-1.2	8.6%	Y	Y
	W	11.1	11.7	0.6	5.4%	Y	Y
Total		492.5	484.5	-8.0	1.6%		

Number of routes satisfying DMRB Criteria = 28 out of 30 (93.3%) (SEMMMS8 – 93.3%)

Conclusions of Journey Time Validation

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

3.15   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.

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4. Conclusions

9.1 The SEMMMS SATURN model (SEMMMS8B) has been built to inform the development of the business case for the proposed 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 SEMMMS8B 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.

9.5 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.

9.6 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%, 95% and 92% respectively.

9.7 Ten cordons and screenlines were formed for the link flow validation within the AOI.

9.8 Considering the 10 ME cordon and screenlines together, the percentage with screenline GEH values less than 4 is 80% in the AM peak, 85% in the inter-peak and 80% in the PM peak. In the PM peak period two of the screenlines are marginal with a screenline GEH of 4.1. These figures confirm that the model meets DMRB criteria (GEH<4 for nearly all of the sites).

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

9.10 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.

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

9.12   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.

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