4 Matrix Build

4.1 Methodology

The highway matrix has been built from three components:

- Observed matrix (based on RSI surveys);
- Synthetic matrix (based on land-use information); and
- Trafficmaster matrix (based on Trafficmaster origin-destination data).

A brief overview of the matrix development is presented in this section, full details can be found in Appendix C.

4.2 Observed Matrix

The observed matrix has been developed using the 2015 origin-destination surveys described in xxxxx plus the set of RSIs undertaken around Birkenhead in 2009 (described in section xxx). To provide a complete set of movements in the buffer area, RSIs are also included from surveys undertaken in the Liverpool City Region. Any gaps in the RSI cordon have been infilled based on an assignment of the synthetic matrix.

The RSI data has been expanded to traffic counts to be representative of traffic flows in 2015.

The individual site matrices have been transposed, and return trip times have been calibrated using local data sources.

The RSI data-set has been compiled using ERICA, which is the DfT recommended and approved software for the purpose of matrix building using RSI records. This software allows for the building of large matrices with multiple observed RSI cordons and contains a technique for the identification and removal of 'wiggly' trips, i.e. those that make several crossings of the same cordon boundary. ERICA also contains processes for identifying and removing trips that will have been observed at more than one cordon boundary.

4.3 Synthetic Matrix

The LCRTM synthetic matrix has been converted to the WTM zoning system for use in the WTM model.

The purpose of the synthetic matrix is to provide a complete representation of demand to, from and within the LCRTM Study Area. This is used in two ways, firstly to strengthen the observed matrices and secondly to infill any areas where observed data is not available. Within LCRTM, land use information e.g. numbers of housing and jobs are used in conjunction with observed trip rates to synthesise travel demand. The matrices are calibrated to meet the trip distribution from Census Travel To Work data (commute trips), and mean trip lengths from the Merseyside Countywide Household Travel Survey.

4.4 TrafficMaster Matrix

The LCRTM Trafficmaster matrix has been converted to the WTM zoning system for use in the WTM model.

Trafficmaster data is provided by the DfT as individual trip records in the Trafficmaster zoning system for a 12 month period. Trip data has been extracted from the data-set, and has been converted to an annual average weekday. This data has then been expanded to LCRTM RSI matrix totals for inter-sector movements and LCRTM synthetic matrix totals for intra-sector movements. The trip data has been profiled using the synthetic matrix trip purposes; and trip length distributions to produce segmented trip matrices by time period. The LCRTM sector movements are consistent with the Wirral sectors as described in Section 5.1.

4.5 Prior Matrix

A prior matrix, which has been taken forward into model calibration has been produced by combining the different matrices described above:

- Firstly, the RSI matrices have been merged with the Trafficmaster matrices to produce a final observed matrix; and thenThe observed and synthetic matrices have then been merged at a sector level using the following weightings:
- Inter Zonal Sectors: 90% (Observed) : 10% (Synthetic)
- Intra Zonal Sectors: 100% (Synthetic)

For model assignment, the trip purpose matrices have been aggregated into the following (five) user classes (UC):

- UC1 - Car Commute
- UC2 - Car Other
- UC3 - Car Employers Business
- UC4 - LGV
- UC5 - OGV

Prior matrix totals are presented in Table 4.1 and corresponding trip purpose splits are shown in Table 4.2.

Table 4.1: Summary of matrix totals (PCUs)

User Class	AM Peak Hour (08:00 to 09:00)	Average IP Hour (10:00 to 16:00)	PM Peak Hour (17:00 to 18:00)
UC1 - Car Commute	277,521	64,580	225,182
UC2 - Car Other	329,078	364,305	384,470
UC3 - Car Employers Business	28,983	24,597	37,409
UC4 - LGV	47,165	44,017	43,479
UC5 - OGV	27,186	28,088	18,129
Total	**709,934**	**525,588**	**708,669**

Table 4.2: Trip Purpose Splits

User Class	AM Peak Hour (08:00 to 09:00)	Average IP Hour (10:00 to 16:00)	PM Peak Hour (17:00 to 18:00)
UC1 - Car Commute	39%	12%	32%
UC2 - Car Other	46%	69%	54%
UC3 - Car Employers Business	4%	5%	5%
UC4 - LGV	7%	8%	6%
UC5 - OGV	4%	5%	3%
Total	**100%**	**100%**	**100%**

5 Model Calibration

5.1 Overview

Model calibration has been carried out to improve the correlation between observed and modelled traffic conditions. Cordons and screenlines applied in model calibration are shown in Figure 5.1 and Figure 5.2.

Four calibration cordons have been defined that capture traffic movements across the model simulation area.

- Cordons 1 and 2 are based on the RSI cordons that were defined to capture traffic movements entering / leaving the Birkenhead and north-east Wirral area.
- The third calibration cordon covers West Wirral; and
- The fourth cordon has been constructed to calibrate traffic flows entering / leaving south-east Wirral.

Nine screenlines have been constructed with the following objectives:

1. To calibrate traffic flows crossing the River Mersey and Wirral Docklands;
2. To calibrate traffic flows crossing between cordons; and
3. To calibrate traffic flows in the buffer area of the model.

The cordons and screenlines are defined as follows:

Cordons

- 1 – Birkenhead Inner
- 2 – Birkenhead Outer
- 3 – Wirral South-East
- 4 – West of M53

Screenlines

- 5 – River Crossings
- 6 – Wirral Dock Crossings
- 7 – North of Kingsway Tunnel
- 8 – Birkenhead Town Centre South
- 9 – Mid-Wirral East to West
- 10 – Mid-Wirral North to South
- 11 – Hoylake to West Kirby
- 12 – West Kirby
- 13 - Heswall

Figure 5.1: Calibration Cordons for Matrix Calibration

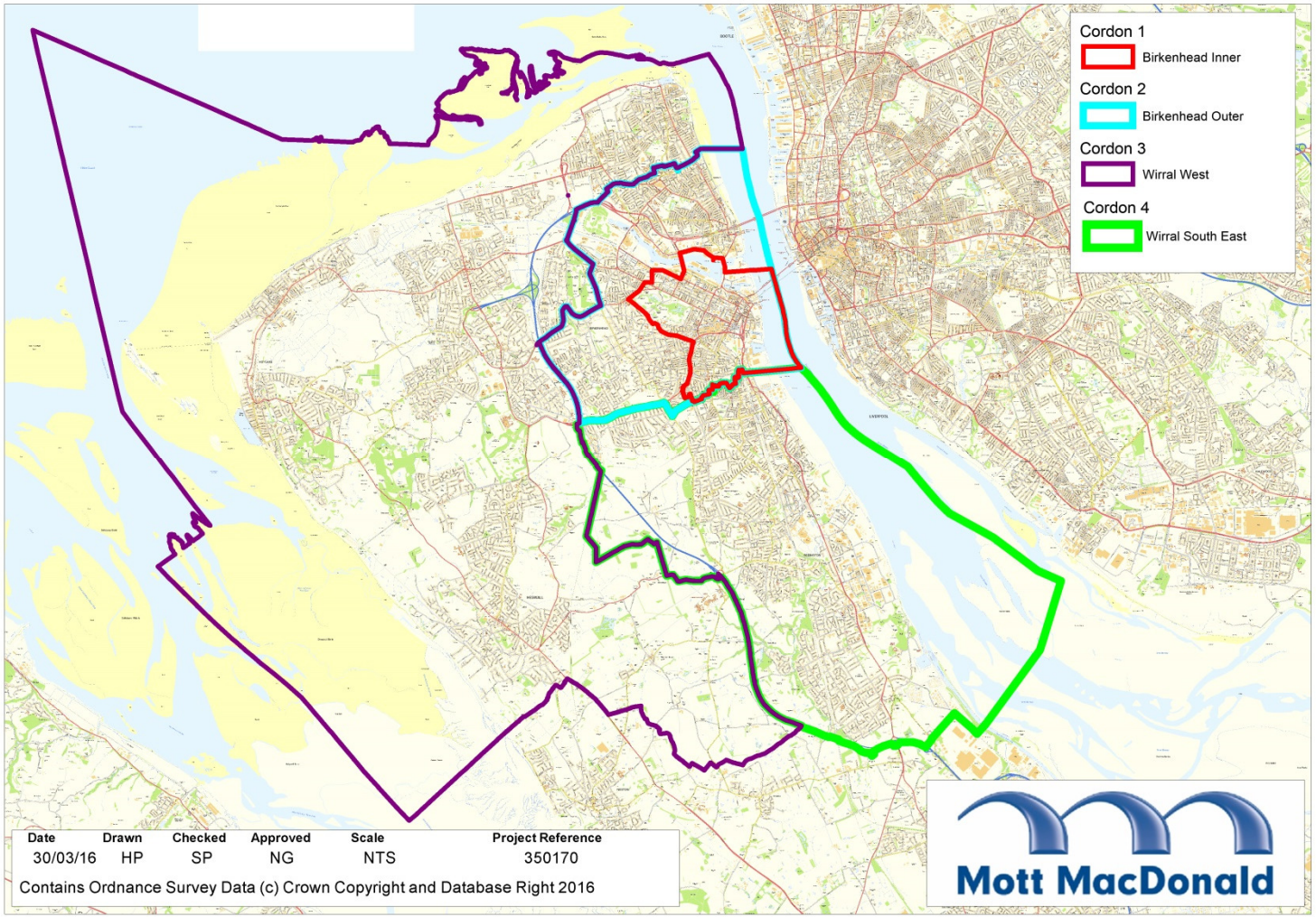
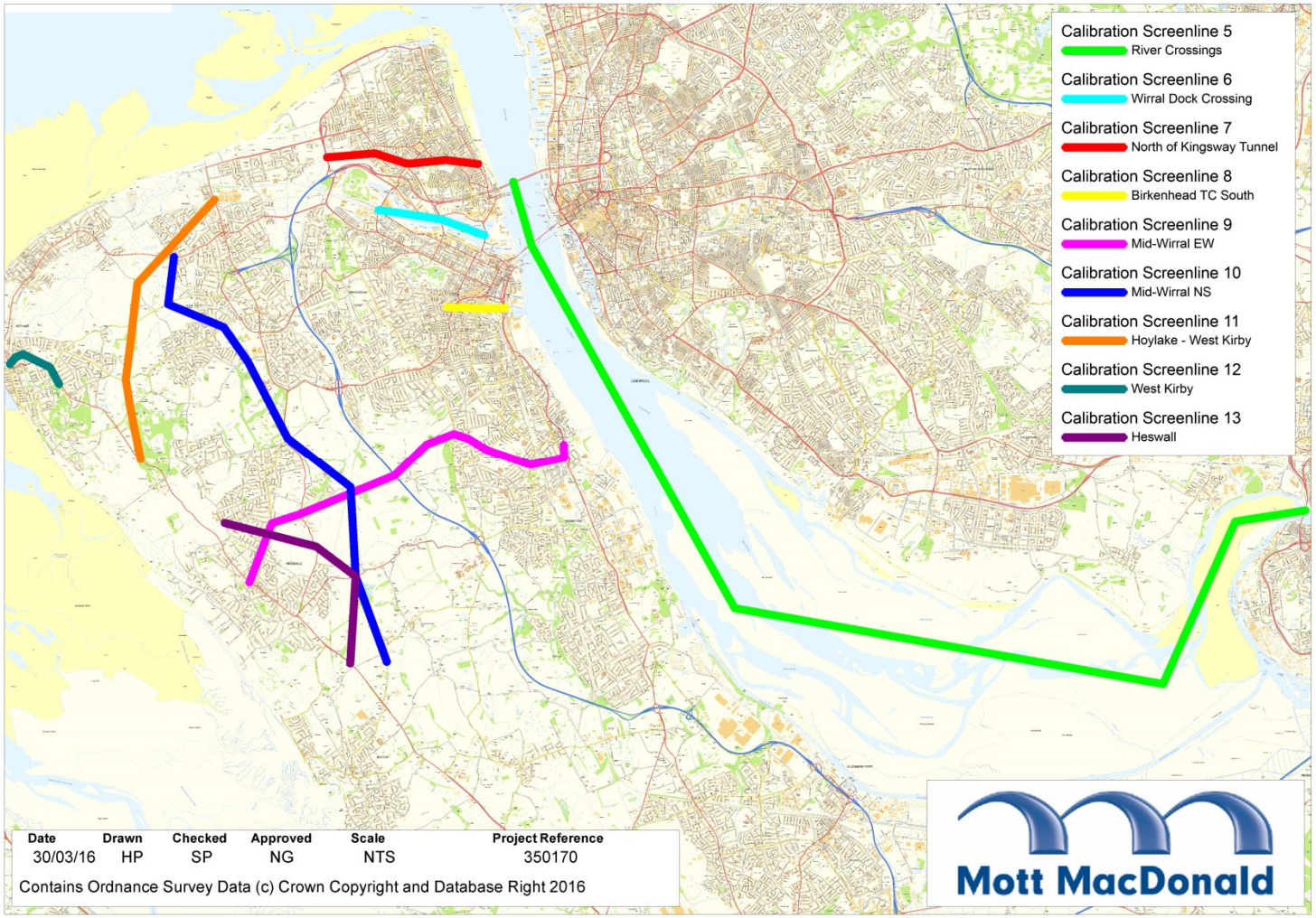


Figure 5.2: Calibration Screenlines for Matrix Calibration



5.2 Model Assignment Convergence

Model convergence checks have been carried out to ascertain the stability of the model assignment results. This has been done by observing the flow difference of subsequent iterations within the model assignment as a measure of model stability.

The stopping criteria for the assignment/simulation loops in SATURN, as specified in TAG Unit M3.1 is for the percentage of links with flow changing by less than 1% (denoted as %FLOWS) to be greater than 98% on four consecutive iterations. Even though this guideline is used to show that the model is stable, a truer measure is the duality gap (delta, d, %GAP) which represents the percentage difference between the minimum cost routes and the chosen routes summed across the network. TAG Unit M3.1 recommends that delta and %GAP should be less than 0.1%. Reference should be made to Table 5.1.

Table 5.1: Summary of Convergence Measures and Base Model Acceptable Values

Measure of Convergence	Base Model Acceptable Values
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P)<1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2)<1%	Four consecutive iterations greater than 98%

Source: Table 4, TAG UNIT M3.1 Highway Assignment Modelling, October 2013

Model convergence statistics are presented in Appendix D for the final iterations of the AM, IP and PM models. From reference to the statistics, it is evident that the model convergence criteria have been achieved for all time periods.

- The "%FLOWS" values are higher than 98% in the final four assignment loops for all models
- "%GAP" values of 0.016%, 0.0042% and 0.014% have been achieved for the AM, IP and PM models respectively.

5.3 Change in the Matrix due to Matrix Estimation

Table 5.2 presents the change in matrix totals due to matrix estimation. Further detail on the matrix changes is presented in Appendix J.

Table 5.2: Matrix Total Comparison

	Prior ME Matrix	Post ME Matrix	Difference	Percentage Difference (%)
AM Peak	709,934	730,127	20,194	2.8%
Inter Peak	525,588	536,472	10,885	2.1%
PM Peak	708,669	720,710	12,041	1.7%

5.4 Traffic Flow Calibration / Validation Criteria

Table 5.3 shows the DfT Transport Analysis Guidance (TAG) validation criteria for cordons and screenlines, and Table 5.4 shows the TAG validation criteria for individual link flow comparisons.

Table 5.3: Cordon / Screenline Validation - TAG Criteria

Criteria	Acceptability Guideline
Differences between modelled flows and counts should be less than 5% of the counts	All or nearly all screenlines

Source: Table 1, TAG UNIT M3.1 Highway Assignment Modelling, October 2013

Table 5.4: Individual Link Flow Validation – TAG Criteria

Criteria	Description of Criteria	Acceptability Guideline
1	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	> 85% of cases
	Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	> 85% of cases
	Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	> 85% of cases
2	GEH < 5 for individual flows	> 85% of cases

Source: Table 2, TAG UNIT M3.1 Highway Assignment Modelling, October 2013

5.5 Traffic Flow Calibration - Summary

Traffic flows have been compared for each individual count site location and also collectively through the formation of cordons and screenlines. In total, 194 link counts have been compared, across 26 directional cordons / screenlines.

The individual link flow summary shows that all time periods exceed the TAG threshold (GEH < 5), with the AM, IP, and PM achieving a flow calibration of 94% (183 links), 98% (191 links) and 97% (188 links), respectively.

When compared to the TAG flow difference criteria, all time periods also exceed the recommended 85% threshold, with the AM, IP and PM modelled hours achieving a flow calibration of 95% (184 links), 99% (192 links) and 97% (188 links), respectively. Reference should be made to Table 5.5.

The cordon / screenline summary shows that all time periods achieve a good correspondence to TAG flow difference criteria (less than 5%) with the AM, IP and PM achieving 96% (25), 100% (26), and 92% (24), respectively. Reference should be made to Table 5.6.

Table 5.5: Individual Link Flow Calibration - Summary

		TAG GEH<5 criteria		TAG flow difference criteria	
Time Period	Total Counts	Number of counts	Percentage	Number of counts	Percentage
AM Peak	194	183	94%	184	95%
Inter Peak	194	191	98%	192	99%
PM Peak	194	188	97%	188	97%

Table 5.6: Calibration Cordon Flow - Summary

		TAG GEH<4 criteria		TAG flow difference <5% criteria	
Time Period	Total Cordons	Number of cordons	Percentage	Number of cordons	Percentage
AM Peak	26	26	100%	25	96%
Inter Peak	26	26	100%	26	100%
PM Peak	26	25	96%	24	92%

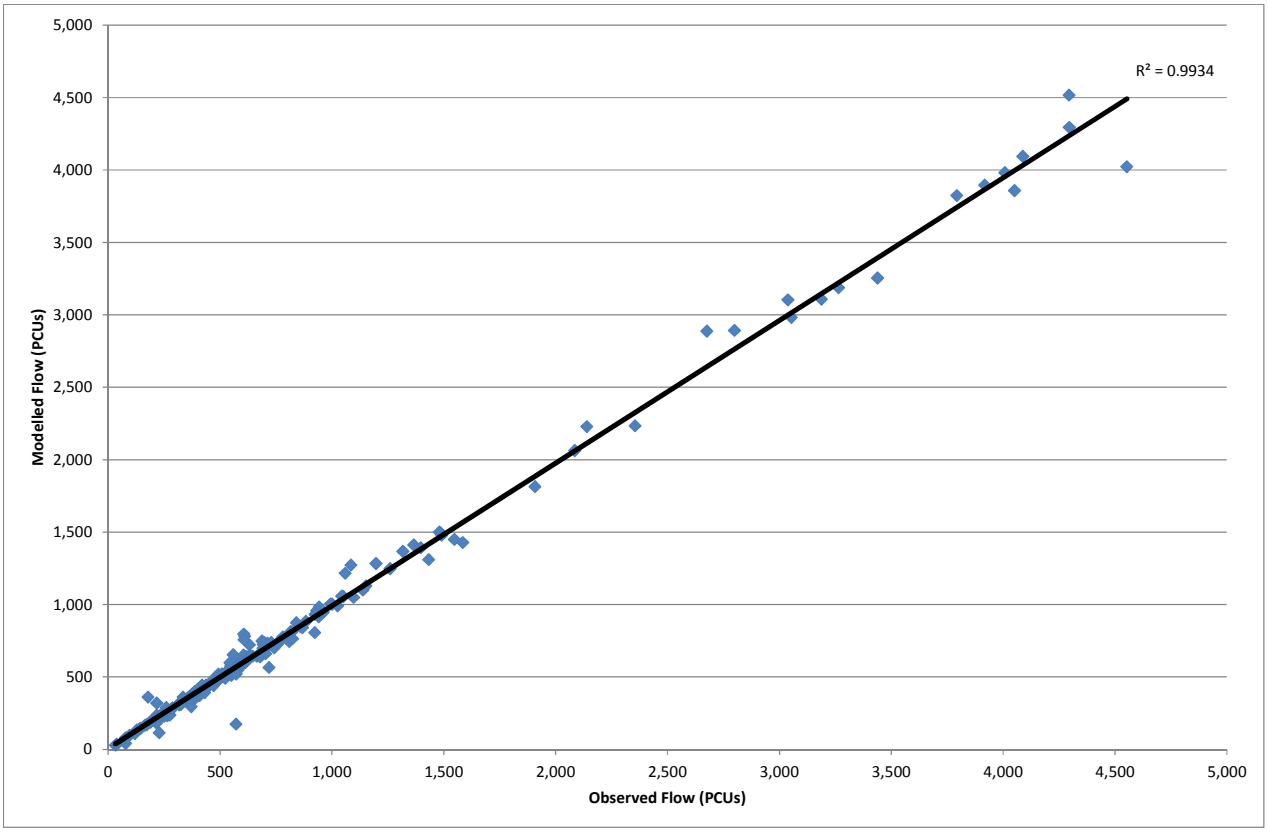
5.6 Traffic Flow Calibration by Time Period

5.6.1 AM Peak Hour

A summary comparison of cordon / screenline traffic flows is presented in Table 5.7. The AM peak hour results show that 96% (25) of cordons by direction achieve TAG flow calibration criteria (flow difference < 5%).

Reference should be made to Figure 5.3 which shows a correlation between observed and modelled calibration counts, for the AM peak hour. The R^2 value is 0.99.

Figure 5.3: Correlation between Observed and Modelled Flows - AM Peak Hour

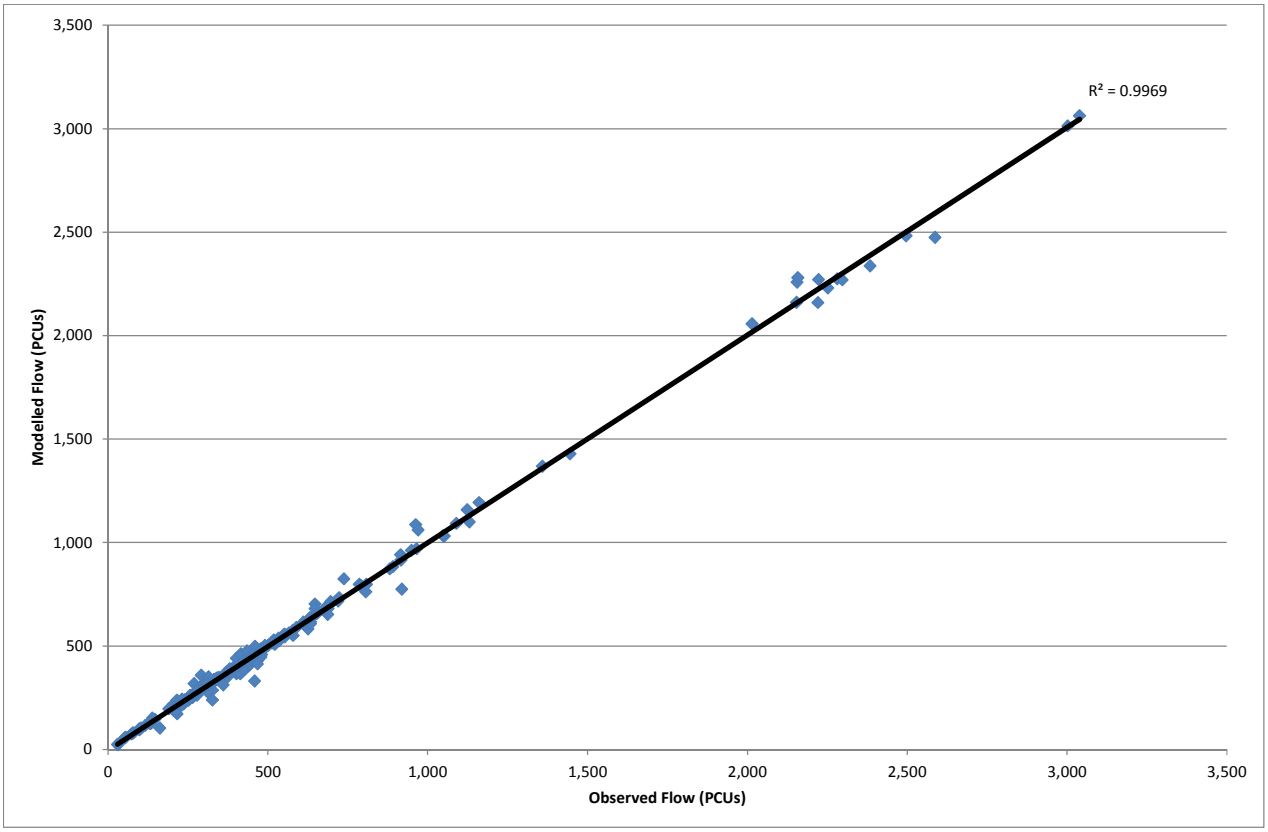


5.6.2 Average Inter Peak Hour

A summary comparison of cordon / screenline traffic flows is presented in Table 5.8. The Average IP hour results show that 100% (26) of cordons by direction achieve TAG flow calibration criteria (flow difference < 5%).

Reference should be made to Figure 5.4 which shows a correlation between observed and modelled calibration counts, for the Average IP hour. The R^2 value is 0.99.

Figure 5.4: Correlation between Observed and Modelled Flows – Average IP Peak Hour



5.6.3 PM Peak Hour

A summary comparison of cordon / screenline traffic flows is presented in Table 5.9. The PM peak hour results show that 92% (24) of cordons by direction achieve TAG flow calibration criteria (flow difference < 5%).

Reference should be made to Figure 5.5 which shows a correlation between observed and modelled calibration counts, for the PM peak hour. The R^2 value is 0.99.

Figure 5.5: Correlation between Observed and Modelled Flows –PM Peak Hour

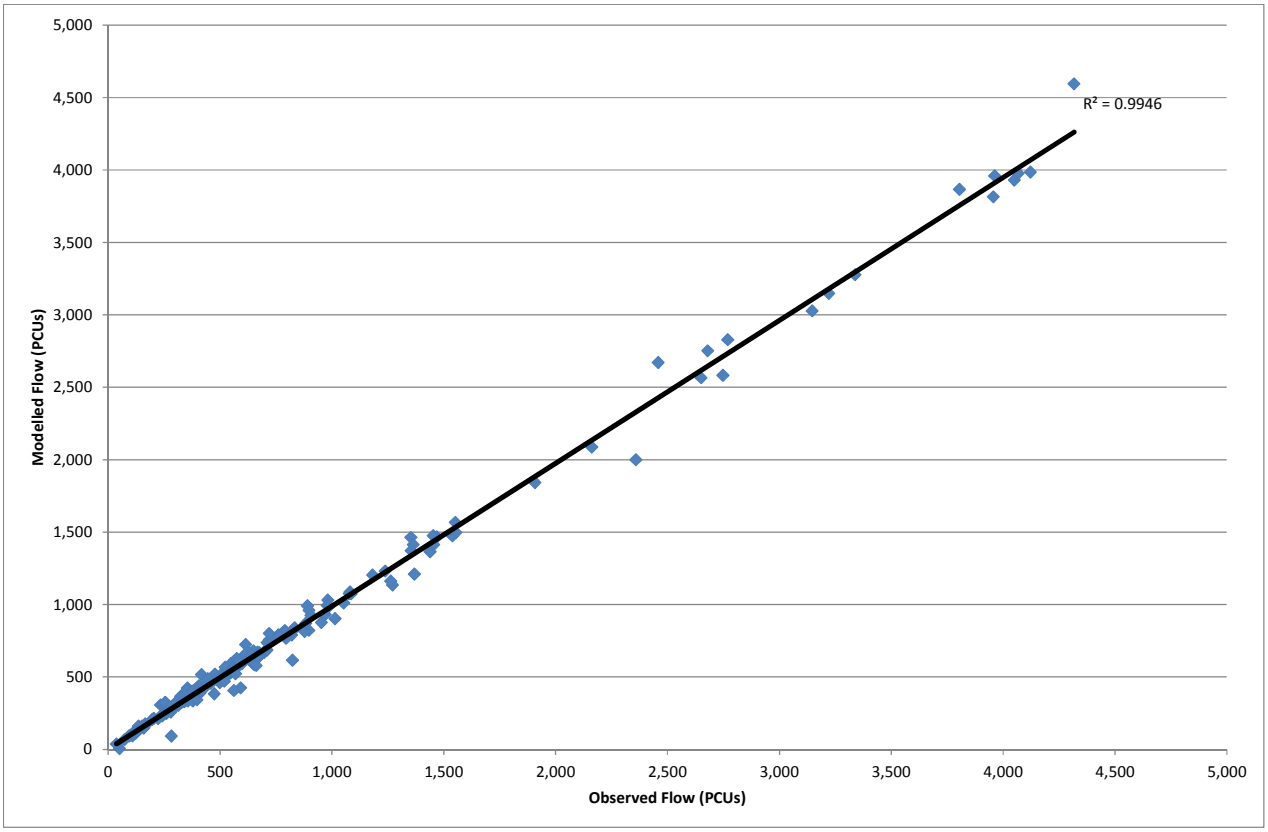


Table 5.7: Cordon Summary Table – AM Peak Hour

	Cordon / Screenline		Observed Flow (PCUs)				Modelled Flow (PCUs)				Comparison (PCUs)		Criteria
		Dir	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	Flow<5%
1	Birkenhead Inner	Dir 1(IB)	8,828	1,088	404	10,320	9,027	1,076	332	10,435	114	1.1%	✓
		Dir 2 (OB)	5,794	844	367	7,005	5,964	859	298	7,120	115	1.6%	✓
2	Birkenhead Outer	Dir 1 (IB)	12,204	1,391	1,113	14,708	11,972	1,389	1,059	14,420	-288	-2.0%	✓
		Dir 2 (OB)	9,949	1,152	865	11,966	9,860	1,255	1,008	12,123	157	1.3%	✓
3	Wirral - West of M53	Dir 1 (IB)	8,447	1,041	607	10,095	8,408	1,040	616	10,064	-31	-0.3%	✓
		Dir 2 (OB)	11,025	1,062	563	12,650	10,943	1,158	635	12,737	86	0.7%	✓
4	Wirral South East	Dir 1 (IB)	6,213	708	416	7,336	6,176	758	315	7,249	-87	-1.2%	✓
		Dir 2 (OB)	7,112	755	448	8,315	7,154	777	419	8,350	35	0.4%	✓
5	River Crossings	Dir 1 (IB)	7,573	700	755	9,028	7,545	862	808	9,215	188	2.1%	✓
		Dir 2 (OB)	5,155	856	1,391	7,401	5,219	877	1,294	7,390	-11	-0.1%	✓
6	Wirral Dock Crossings	Dir 1 (IB)	1,217	206	164	1,587	1,215	202	160	1,576	-11	-0.7%	✓
		Dir 2 (OB)	2,120	330	128	2,578	2,113	321	126	2,560	-18	-0.7%	✓
7	North of Kingsway Tunnel	Dir 1 (IB)	3,688	430	239	4,357	3,623	403	184	4,211	-146	-3.3%	✓
		Dir 2 (OB)	2,757	321	205	3,283	2,744	324	185	3,253	-30	-0.9%	✓
8	Birkenhead TC South	Dir 1 (IB)	3,756	464	176	4,396	3,754	464	154	4,371	-25	-0.6%	✓
		Dir 2 (OB)	1,975	294	104	2,373	2,024	317	101	2,441	68	2.9%	✓
9	Mid-Wirral EW	Dir 1 (IB)	6,722	864	913	8,499	6,970	852	871	8,694	194	2.3%	✓
		Dir 2 (OB)	7,578	981	1,059	9,618	7,419	949	972	9,340	-278	-2.9%	✓
10	Mid-Wirral NS	Dir 1 (IB)	4,880	508	223	5,611	4,865	522	135	5,522	-89	-1.6%	✓
		Dir 2 (OB)	3,500	393	228	4,121	3,428	378	116	3,923	-199	-4.8%	✓
11	Hoylake to West Kirby	Dir 1 (IB)	3,181	355	197	3,733	3,173	355	173	3,701	-32	-0.9%	✓
		Dir 2 (OB)	6,060	676	371	7,108	6,049	658	328	7,034	-74	-1.0%	✓
12	West Kirby	Dir 1 (IB)	1,619	188	123	1,929	1,503	159	98	1,760	-170	-8.8%	×
		Dir 2 (OB)	1,406	161	101	1,669	1,421	152	94	1,667	-2	-0.1%	✓
13	Heswall	Dir 1 (IB)	2,402	268	146	2,816	2,406	260	76	2,742	-74	-2.6%	✓
		Dir 2 (OB)	1,781	199	109	2,090	1,765	195	56	2,016	-74	-3.5%	✓

Table 5.8: Cordon Summary Table – Average IP Hour

Cordon / Screenline			Observed Flow (PCUs)				Modelled Flow (PCUs)				Comparison (PCUs)		Criteria
		Dir	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	Flow<5%
1	Birkenhead Inner	Dir 1(IB)	4,808	820	376	6,005	4,857	802	335	5,994	-11	-0.2%	✓
		Dir 2 (OB)	4,935	827	385	6,147	4,987	813	349	6,148	2	0.0%	✓
2	Birkenhead Outer	Dir 1 (IB)	7,324	1,102	880	9,305	7,313	1,107	978	9,398	93	1.0%	✓
		Dir 2 (OB)	7,484	1,118	925	9,527	7,373	1,075	984	9,431	-96	-1.0%	✓
3	Wirral - West of M53	Dir 1 (IB)	6,706	864	610	8,180	6,769	855	621	8,246	66	0.8%	✓
		Dir 2 (OB)	6,638	876	636	8,150	6,514	892	686	8,091	-59	-0.7%	✓
4	Wirral South East	Dir 1 (IB)	4,307	611	404	5,321	4,413	617	385	5,416	95	1.8%	✓
		Dir 2 (OB)	4,313	608	418	5,339	4,335	628	384	5,346	8	0.1%	✓
5	River Crossings	Dir 1 (IB)	3,461	660	1,113	5,234	3,469	659	1,113	5,240	6	0.1%	✓
		Dir 2 (OB)	3,358	607	1,122	5,087	3,386	605	1,119	5,111	23	0.5%	✓
6	Wirral Dock Crossings	Dir 1 (IB)	1,241	221	164	1,625	1,231	218	165	1,614	-11	-0.7%	✓
		Dir 2 (OB)	1,136	212	150	1,498	1,136	212	152	1,500	2	0.1%	✓
7	North of Kingsway Tunnel	Dir 1 (IB)	2,447	359	239	3,044	2,441	354	236	3,032	-13	-0.4%	✓
		Dir 2 (OB)	2,530	370	229	3,129	2,450	360	197	3,007	-122	-3.9%	✓
8	Birkenhead TC South	Dir 1 (IB)	2,251	308	119	2,678	2,251	309	147	2,708	30	1.1%	✓
		Dir 2 (OB)	2,108	290	121	2,520	2,109	290	153	2,552	33	1.3%	✓
9	Mid-Wirral EW	Dir 1 (IB)	4,647	643	853	6,144	4,625	636	804	6,064	-79	-1.3%	✓
		Dir 2 (OB)	4,696	652	874	6,222	4,645	625	795	6,064	-158	-2.5%	✓
10	Mid-Wirral NS	Dir 1 (IB)	2,739	359	220	3,317	2,762	362	169	3,293	-24	-0.7%	✓
		Dir 2 (OB)	2,826	363	213	3,402	2,803	364	143	3,311	-91	-2.7%	✓
11	Hoylake to West Kirby	Dir 1 (IB)	2,019	279	185	2,483	2,016	260	201	2,477	-6	-0.3%	✓
		Dir 2 (OB)	4,038	557	370	4,964	4,036	523	375	4,934	-30	-0.6%	✓
12	West Kirby	Dir 1 (IB)	1,097	162	124	1,384	1,091	155	108	1,355	-29	-2.1%	✓
		Dir 2 (OB)	1,053	154	116	1,323	1,057	144	111	1,311	-12	-0.9%	✓
13	Heswall	Dir 1 (IB)	1,603	220	144	1,967	1,605	217	79	1,900	-66	-3.4%	✓
		Dir 2 (OB)	1,376	186	117	1,678	1,379	185	69	1,633	-45	-2.7%	✓

Table 5.9: Cordon Summary Table – PM Peak Hour

	Cordon / Screenline		Observed Flow (PCUs)				Modelled Flow (PCUs)				Comparison (PCUs)		Criteria
		Dir	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	Flow<5%
1	Birkenhead Inner	Dir 1(IB)	6,193	538	133	6,864	6,258	593	98	6,949	85	1.2%	✓
		Dir 2 (OB)	8,983	696	111	9,790	9,032	771	86	9,890	100	1.0%	✓
2	Birkenhead Outer	Dir 1 (IB)	10,596	895	400	11,891	10,829	985	449	12,262	371	3.1%	✓
		Dir 2 (OB)	13,074	1,070	492	14,636	12,346	1,134	421	13,901	-734	-5.0%	✓
3	Wirral - West of M53	Dir 1 (IB)	11,681	860	231	12,771	11,466	867	258	12,591	-181	-1.4%	✓
		Dir 2 (OB)	8,859	740	224	9,823	8,617	699	219	9,535	-288	-2.9%	✓
4	Wirral South East	Dir 1 (IB)	7,480	636	128	8,244	7,446	686	118	8,250	6	0.1%	✓
		Dir 2 (OB)	6,570	516	200	7,286	6,575	528	138	7,241	-45	-0.6%	✓
5	River Crossings	Dir 1 (IB)	6,298	624	462	7,384	6,229	634	427	7,290	-94	-1.3%	✓
		Dir 2 (OB)	6,875	480	448	7,804	6,981	576	451	8,008	205	2.6%	✓
6	Wirral Dock Crossings	Dir 1 (IB)	2,076	166	39	2,280	2,067	152	48	2,267	-14	-0.6%	✓
		Dir 2 (OB)	1,248	128	39	1,415	1,377	133	34	1,543	128	9.1%	×
7	North of Kingsway Tunnel	Dir 1 (IB)	3,044	246	80	3,370	2,925	229	83	3,237	-132	-3.9%	✓
		Dir 2 (OB)	4,339	353	103	4,795	4,339	349	115	4,802	7	0.2%	✓
8	Birkenhead TC South	Dir 1 (IB)	2,476	292	63	2,832	2,488	283	63	2,835	3	0.1%	✓
		Dir 2 (OB)	3,850	422	70	4,343	3,765	392	67	4,224	-119	-2.7%	✓
9	Mid-Wirral EW	Dir 1 (IB)	7,991	904	617	9,513	7,947	885	581	9,413	-99	-1.0%	✓
		Dir 2 (OB)	6,991	744	461	8,197	6,914	746	434	8,094	-103	-1.3%	✓
10	Mid-Wirral NS	Dir 1 (IB)	3,570	293	100	3,963	3,662	264	58	3,984	21	0.5%	✓
		Dir 2 (OB)	4,854	383	99	5,337	4,645	370	40	5,055	-281	-5.3%	×
11	Hoylake to West Kirby	Dir 1 (IB)	2,678	212	64	2,954	2,730	194	53	2,977	23	0.8%	✓
		Dir 2 (OB)	5,866	465	136	6,467	5,913	448	108	6,469	3	0.0%	✓
12	West Kirby	Dir 1 (IB)	1,389	109	40	1,539	1,382	107	41	1,529	-9	-0.6%	✓
		Dir 2 (OB)	1,428	112	40	1,580	1,397	97	29	1,523	-57	-3.6%	✓
13	Heswall	Dir 1 (IB)	2,116	168	51	2,335	2,125	160	26	2,312	-22	-1.0%	✓
		Dir 2 (OB)	2,121	168	46	2,335	2,130	170	25	2,325	-10	-0.4%	✓

6 Model Validation

6.1 Independent Traffic Flow Validation

An independent traffic flow validation has been undertaken utilising available traffic counts that have not been included in model calibration.

A total of 20 link counts have been included in the data-set. Table 6.1 shows a validation summary comparison for individual links. Figure 6.1 shows the location of the validation sites and Appendix H presents the results.

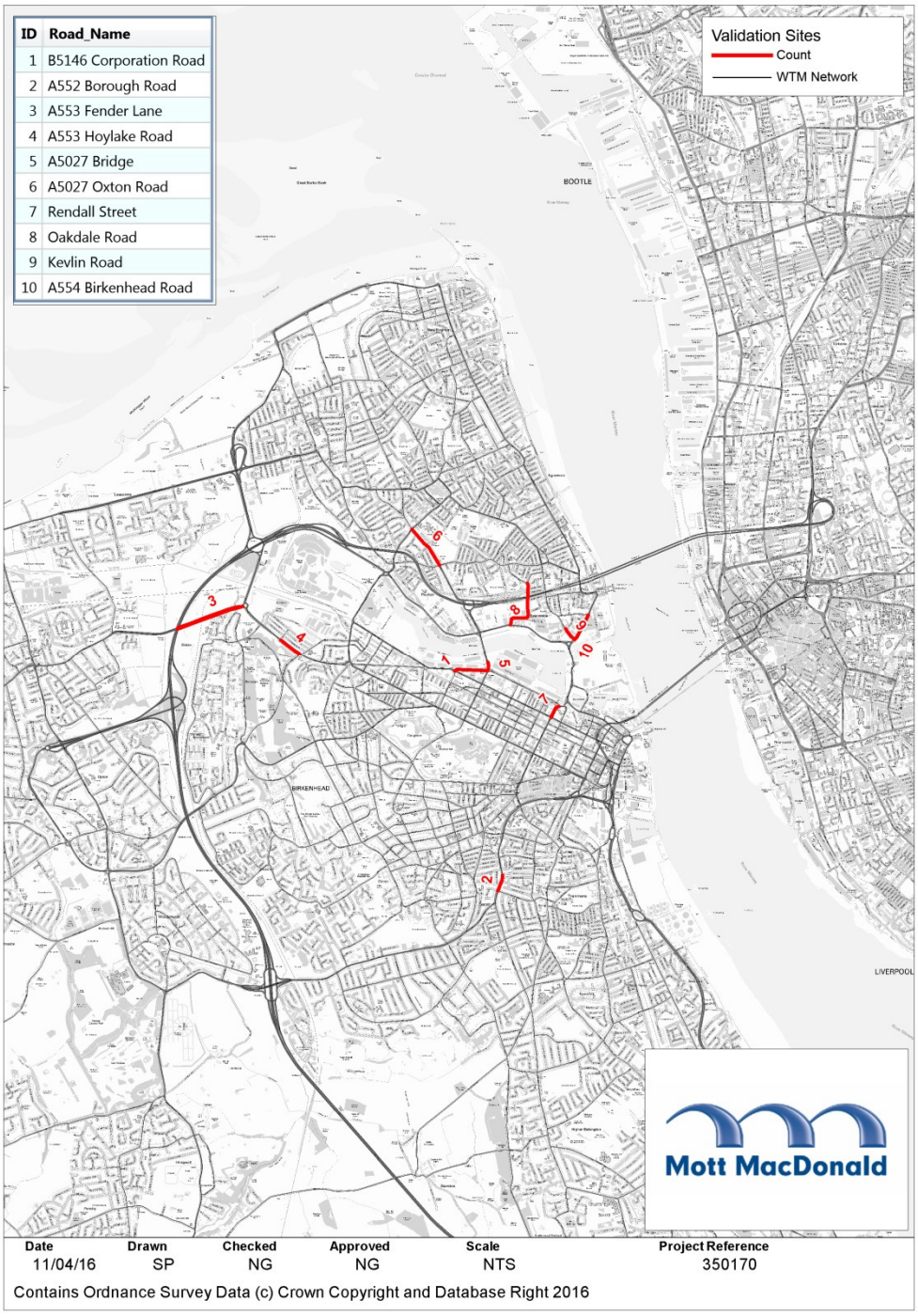
Comparison between observed and modelled flows using the TAG GEH less than 5 criteria show that the validation result is 75% (15 links) for AM and IP, and 70% (14 links) in the PM. When compared to the TAG flow difference criteria, the AM, IP and PM time periods achieve a validation result of 70% (14 links), 85% (17 links) and 75% (15 links).

It is evident that the results are close to the TAG recommendation that 85% of all link comparisons should exceed the specified criteria.

Table 6.1: Link Flow Validation Summary

		TAG GEH<5 criteria		TAG flow difference criteria	
Time Period	Total Counts	Number of counts	Percentage	Time Period	Total Counts
AM Peak	20	15	75%	14	70%
Inter Peak	20	15	75%	17	85%
PM Peak	20	14	70%	15	75%

Figure 6.1: Validation Sites



6.2 Journey Time Validation

Journey time routes have been defined to compare observed and modelled journey times along the key routes throughout the model study area. Reference should be made to Figure 6.2 which shows the location of journey time routes.

The sixteen routes (two-way directional routes) are listed below;

- 1 - A551 Leasowe Road to Hamilton Square (A551 / B5145 / A5088 / A5030);
- 2 - Grove Road to A553 Park Road North (A5027);
- 3 - A554 Kings Parade to A552 Borough Road (A554 / A5029);
- 4 - A553 Fender Lane to A552 Argyle Street (A553);
- 5 - A554 Tower Road to A41 New Chester Road (A554 / A41);
- 6 - Nocturum Avenue to A5027 Duke Street (A5027);
- 7 - M53 J5 to A59 Scotland Road (M53 / A59 / Kingsway Tunnel);
- 8 - M53 J5 to A552 Singleton Avenue (M53 / B5161);
- 9 - M53 J5 to Byrom Street (A41 / Queensway Tunnel);
- 10 - M53 J3 to Byrom Street (A552);
- 11 - Borough Road corridor (from Broadway to Conway Street);
- 12 - Church Road corridor (from Broadway to Conway Street);
- 13 - Hoylake Road between A554/ A553 Roundabout to A540 Telegraph Road / B5140 Caldy Road
- 14 - Arrowe Park Road between A551 / A553 Roundabout and M53 Junction 3
- 15 - Saughall Massie Road between A540 Hilbre View / B5130 Black Horse Hill and A5027 / A551 Roundabout
- 16 - Frankby Road between B5192 Black Horse Hill / B5139 Frankby Road to M53 Junction 2A

The overall journey time route validation performance is shown in Table 6.2.

Comparisons between observed and modelled journey times using the TAG time difference criteria (within 15% or 1 min if higher) show that the each time period achieves 100% (32 routes) validation. TAG recommends that 85% of compared routes should validate according to this criterion.

Table 6.2: Journey Time Validation Summary

		TAG Time difference criteria (within 15% or 1 minute)	
Time Period	Total Routes	Number of Routes	Percentage
AM Peak	32	32	100%
Inter Peak	32	32	100%
PM Peak	32	32	100%

Reference should be made to Table 6.3 to Table 6.5 which shows journey time results by time period.

Figure 6.2: Location of Journey Time Routes

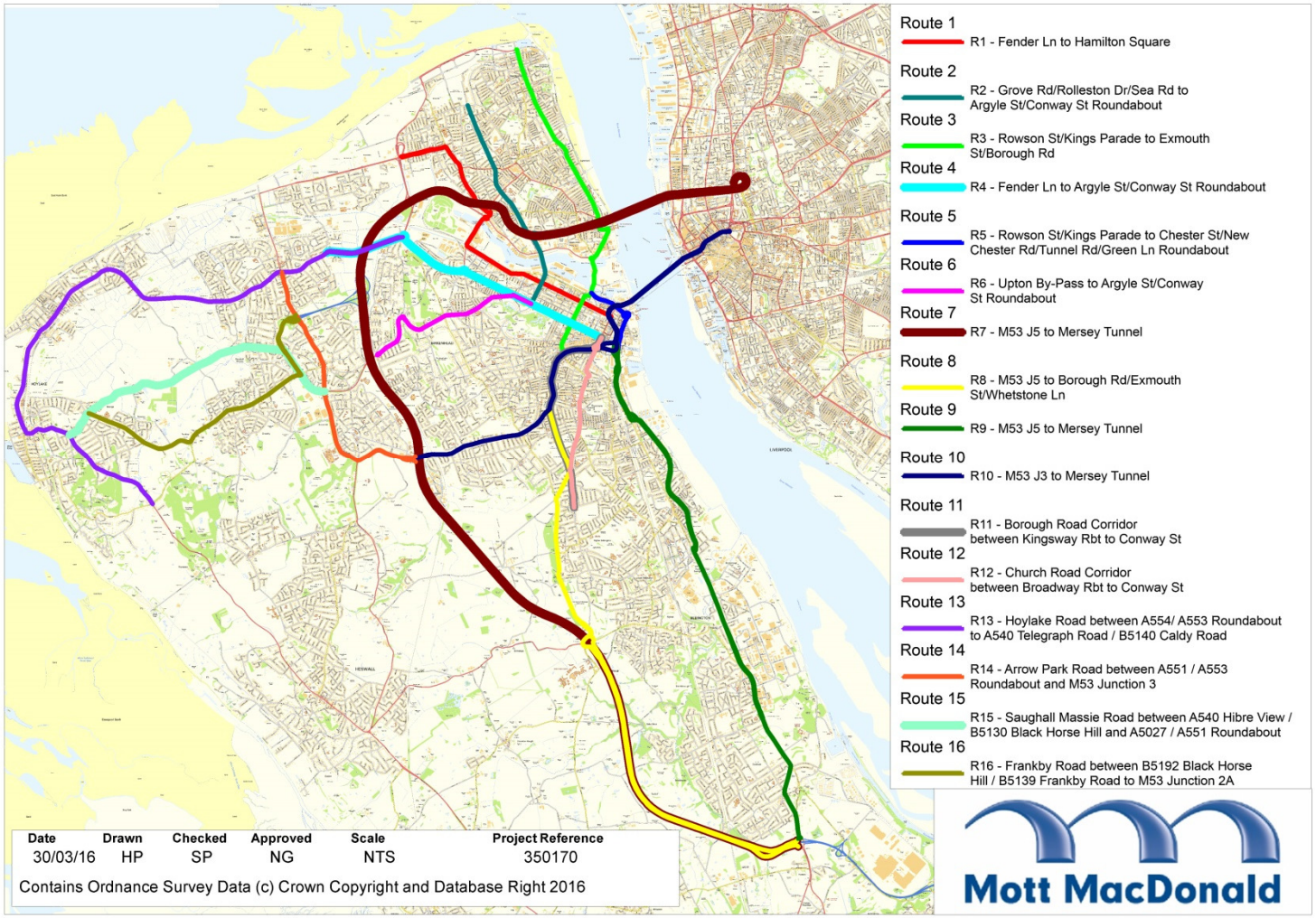


Table 6.3: Journey Time Validation – Route Summary - AM Peak Hour

	Route Name	Dir	Observed (mins)	Modelled (mins)	Difference (mins)	Percentage Difference	Validation within 15%
1	A551 Leasowe Road to Hamilton Square	EB	14.1	12.7	1.4	10%	Pass
		WB	11.5	11.5	0.0	0%	Pass
2	Grove Road to A553 Park Road North	SB	11.7	10.2	1.5	13%	Pass
		NB	11.6	10.0	1.6	14%	Pass
3	A554 Kings Parade to A552 Borough Rd	SB	15.0	13.8	1.2	8%	Pass
		NB	14.2	13.2	0.9	7%	Pass
4	A553 Fender Lane to A552 Argyle Street	EB	11.9	12.0	-0.1	-1%	Pass
		WB	10.8	11.1	-0.3	-3%	Pass
5	A554 Tower Road to A41 New Chester Road	SB	3.5	3.8	-0.3	-9%	Pass
		NB	3.7	3.9	-0.3	-7%	Pass
6	Nocturum Avenue to A5027 Duke Street	EB	8.1	6.9	1.2	15%	Pass
		WB	7.1	6.8	0.3	4%	Pass
7	M53 J5 to A59 Scotland Road	NEB	19.6	20.3	-0.6	-3%	Pass
		SWB	20.0	20.3	-0.2	-1%	Pass
8	M53 J5 to A552 Singleton Avenue	NB	13.2	13.7	-0.5	-4%	Pass
		SB	15.4	14.8	0.6	4%	Pass
9	M53 J5 to Byrom Street Roundabout	NEB	23.3	23.6	-0.4	-2%	Pass
		SWB	19.6	21.5	-1.9	-10%	Pass
10	M53 J3 to Byrom Street Roundabout	NEB	18.6	17.8	0.7	4%	Pass
		SWB	15.6	16.0	-0.5	-3%	Pass
11	Borough Road Corridor	NB	9.8	9.3	0.5	5%	Pass
		SB	8.1	8.0	0.1	1%	Pass
12	Church Road Corridor	NB	7.6	7.1	0.5	7%	Pass
		SB	6.8	6.2	0.6	10%	Pass
13	Hoylake Road	NB	21.4	19.6	1.8	9%	Pass
		SB	21.5	19.1	2.4	11%	Pass
14	Arrowe Park Road	WB	12.9	12.4	0.6	4%	Pass

	Route Name	Dir	Observed (mins)	Modelled (mins)	Difference (mins)	Percentage Difference	Validation within 15%
		EB	12.7	12.1	0.6	4%	Pass
15	Saughall Massie Road	EB	9.3	8.5	0.9	10%	Pass
		WB	9.5	8.8	0.8	8%	Pass
16	Frankby Road	EB	10.3	10.3	0.0	0%	Pass
		WB	10.6	10.2	0.4	3%	Pass

Table 6.4: Journey Time Validation – Route Summary – Average IP Hour

	Route Name	Dir	Observed (mins)	Modelled (mins)	Difference (mins)	Percentage Difference	Validation within 15%
1	A551 Leasowe Road to Hamilton Square	EB	11.3	10.5	0.8	7%	Pass
		WB	10.9	10.5	0.4	3%	Pass
2	Grove Road to A553 Park Road North	SB	9.2	9.3	-0.1	-1%	Pass
		NB	9.1	9.4	-0.3	-3%	Pass
3	A554 Kings Parade to A552 Borough Rd	SB	14.3	13.5	0.8	5%	Pass
		NB	13.9	13.3	0.6	5%	Pass
4	A553 Fender Lane to A552 Argyle Street	EB	11.2	11.5	-0.3	-3%	Pass
		WB	11.1	11.3	-0.2	-2%	Pass
5	A554 Tower Road to A41 New Chester Road	SB	3.2	3.5	-0.2	-7%	Pass
		NB	3.3	3.7	-0.4	-13%	Pass
6	Nocturum Avenue to A5027 Duke Street	EB	7.1	6.3	0.9	12%	Pass
		WB	6.8	6.6	0.2	4%	Pass
7	M53 J5 to A59 Scotland Road	NEB	17.2	17.8	-0.6	-4%	Pass
		SWB	16.8	17.9	-1.1	-7%	Pass
8	M53 J5 to A552 Singleton Avenue	NB	11.6	11.8	-0.2	-1%	Pass
		SB	11.2	11.2	0.0	0%	Pass
9	M53 J5 to Byrom Street Roundabout	NEB	20.4	20.4	0.0	0%	Pass
		SWB	19.2	20.5	-1.3	-7%	Pass
10	M53 J3 to Byrom Street Roundabout	NEB	15.2	15.6	-0.3	-2%	Pass
		SWB	15.0	15.2	-0.2	-1%	Pass
11	Borough Road Corridor	NB	7.7	8.0	-0.3	-5%	Pass
		SB	7.3	7.5	-0.3	-4%	Pass
12	Church Road Corridor	NB	6.0	6.0	0.1	1%	Pass
		SB	5.9	5.8	0.2	3%	Pass
13	Hoylake Road	NB	20.3	18.2	2.1	10%	Pass
		SB	19.9	18.1	1.8	9%	Pass
14	Arrowe Park Road	WB	11.2	11.1	0.1	1%	Pass
		EB	10.5	10.4	0.1	1%	Pass

	Route Name	Dir	Observed (mins)	Modelled (mins)	Difference (mins)	Percentage Difference	Validation within 15%
15	Saughall Massie Road	EB	7.7	7.2	0.5	6%	Pass
		WB	8.0	7.7	0.3	4%	Pass
16	Frankby Road	EB	9.1	8.6	0.5	6%	Pass
		WB	9.2	9.0	0.2	2%	Pass

Table 6.5: Journey Time Validation – Route Summary - PM Peak Hour

	Route Name	Dir	Observed (mins)	Modelled (mins)	Difference (mins)	Percentage Difference	Validation within 15%
1	A551 Leasowe Road to Hamilton Square	EB	11.2	10.1	1.1	9%	Pass
		WB	13.2	12.3	1.0	7%	Pass
2	Grove Road to A553 Park Road North	SB	9.6	9.6	0.0	0%	Pass
		NB	11.0	10.5	0.5	4%	Pass
3	A554 Kings Parade to A552 Borough Rd	SB	15.0	13.8	1.2	8%	Pass
		NB	14.8	13.7	1.1	7%	Pass
4	A553 Fender Lane to A552 Argyle Street	EB	12.7	12.7	0.0	0%	Pass
		WB	12.9	12.1	0.8	6%	Pass
5	A554 Tower Road to A41 New Chester Road	SB	3.6	4.0	-0.4	-10%	Pass
		NB	3.9	4.2	-0.3	-9%	Pass
6	Nocturum Avenue to A5027 Duke Street	EB	7.3	6.3	1.0	14%	Pass
		WB	8.1	7.5	0.6	7%	Pass
7	M53 J5 to A59 Scotland Road	NEB	20.2	19.3	0.9	5%	Pass
		SWB	19.9	20.1	-0.3	-1%	Pass
8	M53 J5 to A552 Singleton Avenue	NB	13.4	13.0	0.3	2%	Pass
		SB	11.9	12.2	-0.4	-3%	Pass
9	M53 J5 to Byrom Street Roundabout	NEB	22.7	21.1	1.6	7%	Pass
		SWB	20.9	22.6	-1.8	-8%	Pass
10	M53 J3 to Byrom Street Roundabout	NEB	18.4	16.9	1.5	8%	Pass
		SWB	16.5	16.4	0.1	1%	Pass
11	Borough Road Corridor	NB	8.3	8.3	0.1	1%	Pass
		SB	8.2	7.9	0.3	4%	Pass
12	Church Road Corridor	NB	6.6	6.2	0.4	6%	Pass
		SB	6.6	6.3	0.3	4%	Pass
13	Hoylake Road	NB	21.1	20.8	0.3	1%	Pass
		SB	19.6	17.8	1.7	9%	Pass
14	Arrowe Park Road	WB	13.0	12.1	0.9	7%	Pass
		EB	13.3	12.0	1.3	10%	Pass

	Route Name	Dir	Observed (mins)	Modelled (mins)	Difference (mins)	Percentage Difference	Validation within 15%
15	Saughall Massie Road	EB	7.8	7.3	0.6	7%	Pass
		WB	9.5	9.2	0.3	3%	Pass
16	Frankby Road	EB	10.3	9.0	1.2	12%	Pass
		WB	10.2	10.4	-0.2	-2%	Pass

7 Conclusion

An update and extension of the East Wirral Traffic Model has been undertaken to extend the detailed model area over the entire Wirral district. The new Wirral Traffic Model now provides a good representation of observed traffic conditions for a 2015 base year over the entire district.

The traffic flow calibration results for all time periods show that the model exceeds the TAG recommended threshold of 85% of links achieving a flow difference of GEH less than 5. The results achieved for the AM, IP and PM time periods are 94%, 98% and 97%, respectively.

The calibration cordon / screenline summary shows that all time periods achieve a good correspondence to TAG flow difference criteria (less than 5%) with the AM, IP and PM achieving 96%, 100%, and 92%, respectively.

Comparison of journey times, for the AM, IP and PM time periods, show that the model achieves a 100% match against TAG time difference criteria for all time periods (within 15% or 1 minute if higher).

The validation summary shows the AM, IP and PM time periods achieve a 75%, 75% and 70% match against the TAG flow difference threshold (GEH < 5). There is a lack of suitable count data available for validation. Therefore, we would suggest that the commission of a new set of traffic counts is considered to improve this aspect of the model.

The 2015 base year model performance demonstrates that the model is a suitable platform for the development of future year traffic models to support the following requirements:

- prediction of future congestion levels and the subsequent impact on network operation;
- detailed assessment of highway impacts associated with proposed land use developments and transport policy changes; and also
- to assess the impacts of major highway improvement schemes.

The model has been calibrated across set of cordons and screenlines which cover Wirral district. However for more detailed model applications we would recommend that localised calibration and validation is considered, with the collection of additional data to support this activity and as consistent with good modelling practice.

Appendices

Appendix A. Traffic Survey Commission

Table A.1: ATC Traffic Survey Commission (2015)

ATC Count Ref	Existing Ref	Road Name	Survey Type	Month	Year	Commission
1	22	A554 Bayswater Road	ATC	July	2015	Wirral - WTM
2	23	A551 Leasowe Road	ATC	June	2015	Wirral - WTM
3	1	A554 near M53 Junction 1	ATC	July	2015	Wirral - WTM
4	0	A551 Pasture Road	ATC	June	2015	Wirral - WTM
5	2	A553 Fender Lane	ATC	June	2015	Wirral - WTM
6	12	Eastham Rake	ATC	July	2015	Wirral - WTM
7	13	A41 New Chester Road	ATC	July	2015	Wirral - WTM
8	0	A551 Barnston Road	ATC	June	2015	Wirral - WTM
9	0	B5138 Pensby Road	ATC	June	2015	Wirral - WTM
10	0	Irby Road	ATC	June	2015	Wirral - WTM
11	21	A540 Telegraph Road	ATC	July	2015	Wirral - WTM
12	19	B5140 Montgomery Hill	ATC	July	2015	Wirral - WTM
13	20	B5139 Frankby Road	ATC	July	2015	Wirral - WTM
14	18	B5192 Saugall Massie Road	ATC	June	2015	Wirral - WTM
15	17	A553 Hoylake Road	ATC	July	2015	Wirral - WTM
16	0	A553 Birkenhead Road	ATC	June	2015	Wirral - WTM
17	0	A553 Market Street	ATC	July	2015	Wirral - WTM
18	0	A540 Meols Drive	ATC	July	2015	Wirral - WTM
19	0	A540 Meols Drive	ATC	July	2015	Wirral - WTM
20	0	Orrysdale Road	ATC	July	2015	Wirral - WTM
21	0	Darmonds Green	ATC	June	2015	Wirral - WTM
22	0	B5139 Black Horse Hill	ATC	July	2015	Wirral - WTM
23	0	A540 Column Road	ATC	July	2015	Wirral - WTM
24	211	A41 New Chester Road	ATC	June	2015	Wirral - WTM
25	210	B5149 Old Chester Road	ATC	July	2015	Wirral - WTM
26	225	Derby Road	ATC	July	2015	Wirral - WTM
27	208	A552 Borough Road	ATC	June	2015	Wirral - WTM
28	206	Park Road South	ATC	July	2015	Wirral - WTM
29	205	A5027 Park Road North	ATC	July	2015	Wirral - WTM
30	204	A553 Laird Street	ATC	July	2015	Wirral - WTM
31	203	A5030 Beaufort Road	ATC	July	2015	Wirral - WTM
32	202	A5027 Duke Street	ATC	June	2015	Wirral - WTM

ATC Count Ref	Existing Ref	Road Name	Survey Type	Month	Year	Commission
33	201	A554 Tower Road	ATC	June	2015	Wirral - WTM
34	212	A554 Seabank Road	ATC	June	2015	Wirral - WTM
35	213	B5143 Rake Lane	ATC	June	2015	Wirral - WTM
36	216	A551 Wallasey Village	ATC	June	2015	Wirral - WTM
37	217	A5139 Wallasey Dock Link Road	ATC	June	2015	Wirral - WTM
38	226	A5088 Wallasey Bridge Road	ATC	July	2015	Wirral - WTM
39	16	A554	ATC	June	2015	Wirral - WTM
40	218	A553 Hoylake Road	ATC	June	2015	Wirral - WTM
41	219	A5027 Upton Bypass	ATC	July	2015	Wirral - WTM
42	221	A552 Woodchurch Road	ATC	July	2015	Wirral - WTM
43	222	B5151 Storeton Road	ATC	July	2015	Wirral - WTM
44	223	Borough Road	ATC	June	2015	Wirral - WTM
45	209	B5148 Church Road	ATC	July	2015	Wirral - WTM
46	0	A5137 Brimstage Road	ATC	July	2015	Wirral - WTM
47	0	B5151 Mount Road (Clatterbridge)	ATC	June	2015	Wirral - WTM
48	0	A41 New Chester Road	ATC	June	2015	Wirral - WTM
49	0	A540 Chester High Road	ATC	June	2015	Wirral - WTM
50	0	Station Road	ATC	July	2015	Wirral - WTM
51	0	A540 Chester Road	ATC	June	2015	Wirral - WTM
52	0	B5137 Brimstage Road	ATC	July	2015	Wirral - WTM
53	0	Heron Road	ATC	June	2015	Wirral - WTM
54	0	Station Road (Hoylake)	ATC	June	2015	Wirral - WTM
55	0	B5133 Hooton Road	ATC	July	2015	Wirral - WTM
56	0	B5151 Birkenhead Road	ATC	July	2015	Wirral - WTM

Table A.2: RSI Traffic Survey Commission

RSI Ref	Road Name	Description
1	A551 Upton Road	north of Junction 2a
2	A5027 Upton By Pass	west of Junction 2a
3	A551 Moreton Road	south of Junction 2a
4	A552 Woodchurch Road	Woodchurch Road / Arrowe Park Road
5	Station Road	near M53 Bridge
6	A5137 Brimstage Road	near Junction 4

RSI Ref	Road Name	Description
8	B5137 Brimstage Road	near Junction 4
9	Kingsway Tunnel	Toll booths
10	Queensway Tunnel	Toll booths

Appendix B. Network Development

B.1 Simulation Network Coding

The simulation area has all junctions coded in explicit detail, this includes junction type, number of approach lanes, priority rules etc., so that delay at junctions by individual turning movement can be modelled and there is some junction interaction, e.g. the effect of blocking back of traffic can be modelled. The assumption is that in the simulation area, the effect of junctions is the key determinant on assignment.

B.2 Junction Coding

With a large number of junctions in a model it is impractical to calculate a unique saturation flow for each individual movement at each junction. Instead, sensitivity analysis of the different parameters can be conducted, and a set of standard values adopted. However at individual locations this aspect was reviewed, where necessary, during model calibration.

B.2.1 Priority Junctions

Standard saturation flows for movements at priority junctions have been developed, which take into account the approach width, turning radii and visibility on each arm of a junction, with the saturation flow for each individual movement being calculated separately. These have been calculated based on information included in TRRL Report SR 810 and TRRL Report LR 942:

Table B.1 details the saturation flows which were adopted at priority junctions in the simulation network. This table only applies to unopposed major arm traffic movements, minor arm and major arm opposed movement saturation flows are shown in Table B.2.

Table B.1: Priority Junction - Saturation Flows (PCU / hr) for major arm unopposed movements

Nearside/Offside	Approach Width	Entry Width	Downhill/Uphill	Gradient	Turning Proportion	Turning Radius	Movement	Left Turn	Straight	Right Turn
								Sat Flow		
N	3.5	3.5	0	0	1	20		1828		
N	3.5	3.5	0	0	1	40		1894		
N	3.5	3.5	0	0	0.5	20		1894	1894	
N	3.5	3.5	0	0	0.5	40		1929	1929	
N	3.5	3.5	0	0	0.5	20		1894		1894
N	3.5	3.5	0	0	0.5	40		1929		1929
N	3.5	3.5	0	0	0.333	20		1917	1917	1917
N	3.5	3.5	0	0	0.333	40		1941	1941	1941
N	3.5	3.5	0	0	0	0.1			1965	
O	3.5	3.5	0	0	0	0.1			2105	
O	3.5	3.5	0	0	0.5	20			2029	2029
O	3.5	3.5	0	0	0.5	40			2066	2066
O	3.5	3.5	0	0	1	20				1958
O	3.5	3.5	0	0	1	40				2029

Table B.2: Priority Junction - Saturation Flows (PCU / hr) for opposed movements

Minor Arm			Major Arm Opposed
Left	Ahead	Right	Right
721	721	574	721

B.2.2 Signalised Junctions

B.2.2.1 Saturation Flows

The saturation flows (PCUs) in Table B.3 were adopted at signalised junctions. The values displayed in Table B.3 are per movement per full lane. Saturation flows are based on the relationships included in TRRL Report RR67.

Table B.3: Saturation flows at signalised junctions (PCU / hr)

Left	Ahead & Left	Ahead	Ahead & Right	Right
1800	1900	1950	1900	1850

Note that standard values for lane width, entry width, turning proportion and turning radii have been adopted. No gradient has been assumed.

B.2.2.2 Signal Staging and Timings

Signal timings and staging were provided by Wirral Council. At each junction signal staging was coded as indicated on the signal staging plans provided. At complex junctions some simplifications were required to represent the junction in SATURN.

The majority of the traffic signal timing information contained only minimum and maximum green times. In the case of VA, MOVA and SCOOT operated signals, stage lengths can differ from cycle to cycle. A standard approach of using the maximum signal timing was adopted, where model assignments indicated that this approach was not providing the observed level of delay (from TrafficMaster) the signal timings were adjusted.

B.2.3 Roundabout Coding

B.2.3.1 Signalised Roundabouts

These were coded as a series of nodes, interspersed with priority junctions if required and the CLF plans provided in the signal timing information were used.

B.2.3.2 Non-signalised Roundabouts

Non-signalised roundabouts, if greater than 28m in diameter, were coded as a series of priority junctions. This allows for lane gains/drops on the circulating carriageway, and is preferable when modelling non-circular roundabouts as different link lengths can be modelled on the circulating carriageway between different approaches.

Roundabouts with a diameter of less than 28m were modelled as single nodes (SATURN Junction Type 2).

Table B.4 shows the saturation flows adopted at all non-signalised roundabouts, whether coded as single node roundabouts or ‘exploded’ priority node roundabouts. These saturation flows are applied to entry links.

Table B.4: Roundabout – Saturation Flows (PCU/hr)

		E			
V	I	3.5 (1)	7.0 (2)	10.5 (3)	14.0 (4)
3.5 (1)	10	1060	1561	1715	1790
	20	1060	1740	2061	2248
	30	1060	1833	2275	2561
	40	1060	1889	2420	2790
7.0 (2)	10		2121	2621	2776
	20		2121	2801	3121
	30		2121	2893	3335
	40		2121	2950	3481
10.5 (3)	10			3182	3682
	20			3182	3861
	30			3182	3954
	40			3182	4010
14.0 (4)	10				4242
	20				4242
	30				4242
	40				4242

Where:
E = entry width (meters)*
V = approach width (m)*
I = average effective flare length (m)

*The number in brackets represents the typical number of lanes at an entry/approach of the respective width.

Circulating saturation flows on 'exploded' roundabouts are coded as per major arm priority links. Saturation flows were calculated based on formulas included in, TRRL Report SR 810 and TRRL Report LR 942.

B.3 Cruise Speeds

The cruise speeds represent the speed at which traffic travels on the link in the absence of any junction delay. A correspondence was developed between the Wirral and TrafficMaster networks and the mid-link TrafficMaster speed for each time period was extracted from the TrafficMaster dataset.

B.4 Pedestrian Crossings

Pedestrian crossings of key significance in relation to traffic flow delay have been accounted for in the development of the highway network.

B.5 Banned Links / Turns

Banned links and turns have been defined by specific vehicle type (e.g. OGV) in the turn restriction card of the SATURN network coding deck. Restrictions applicable to all movements have been accounted for directly in the simulation junction coding.

B.6 Height and Weight Restrictions

Height and weight restrictions are included in the model using turn or link based restrictions. Height and weight restrictions were taken as applying to OGVs only.

B.7 Bus Routes

Bus route and frequency is required particularly in the simulation area in order that the model will recognise the contribution made by buses to total traffic flows on links and at junctions.

Information on the number of buses travelling along each model link in each model time period was extracted from LCRTM and applied as a preload in the SATURN assignment.

B.8 Buffer Network Coding

In the buffer area the representation of the road network in the traffic model is link based with the network described by it links characteristics. Junctions are not specifically modelled; however the form of flow delay curve includes an allowance for junction delays.

B.8.1 Requirements

Each link in the SATURN buffer area requires the following coded characteristics:

- A node
- B node
- Link type or capacity index
- Free flow speed or time
- Link Capacity
- Direction (1 way or 2 way)
- Link Length
- Speed at capacity
- Power (n)

All of the above attributes, except the last two, have been coded throughout the model using readily available data sources. The link type has been taken from the LCRTM model.

Link Type or Capacity Index reflects the road characteristics in terms of road type, road standard, level of development and speed limit. The capacity index is used to allocate an appropriate flow delay curve to each link. They reflect the road type, capacity, free flow speed and characteristics.

Free flow speed has been applied; this has been based on the speed limit of the link.

Link length has been obtained from the GIS network; care has been taken to ensure the link length properly represents the alignment of the link.

Link capacity, is based on the number of lanes, road type and standard, and level of development.

Speed at capacity and Power (n) are generated subsequently to reflect appropriate link speed flow relationships for each link, as defined by the capacity index.

B.8.2 Flow Delay Curves

Flow delay curves are used to relate the number of vehicles along a particular type of link with average speed. These were used throughout the buffer area of the network. These flow delay relationships are based on COBA. In SATURN the flow delay relationship is defined by the free flow speed, speed at capacity and the shape of the relationship which is determined by the power function.

It is not possible to define separate speed flow curves for OGVs as such in SATURN. However it is possible to specify a different maximum speed limit for OGVs by Capacity Index using the CLICKS parameter. This at least ensures that on a lightly trafficked link OGVs are not travelling at a speed in excess of their permitted maximum.

The speed flow curves used in are shown in Table B.5.

Table B.5: Flow Delay Curve Definitions

LinkType	Description	S0 (kph)	S Min (kph)	Capacity (PCUs)	N
1	4-lane rural motorway	116	45	9320	3.42
2	3-lane rural motorway	116	45	6990	3.42
3	2-lane rural motorway	112	45	4660	3.2
4	3-lane rural dual carriageway	109	45	6299	3.01
5	2-lane rural dual carriageway	105	45	4199	2.8
6	Wide rural single carriageway	91	45	1687	2.17
7	Standard rural single carriageway	87	45	1328	2.04
8	Poor rural single carriageway	67	45	1328	0.99
101	Good Suburban Dual carriageway	78	35	3540	2.78
102	Typical Suburban Dual Carriageway	71	35	3540	2.46
103	Poor Suburban Dual Carriageway	58	35	3540	1.4
104	Good Suburban Single carriageway	68	25	1680	3.95

LinkType	Description	S0 (kph)	S Min (kph)	Capacity (PCUs)	N
105	Typical Suburban Single Carriageway	61	25	1680	4.28
106	Poor Suburban Single Carriageway	48	25	1680	2.25
201	Urban Non-Central Good	54	25	896	1.67
202	Urban Non-Central Typical	49	25	896	1.56
203	Urban Non-Central Poor	45	25	896	1.48
204	Urban Central Good	37	15	896	1.83
205	Urban Central Typical	34	15	896	1.73
206	Urban Central Poor	29	15	896	1.55
301	Small Town Light	63	30	1344	2.38
302	Small Town Medium	57	30	1344	1.94
303	Small Town Heavy	46	30	1344	1.06
401	Slip Roads - On Slip	30	30	9999	1
402	Slip Roads - Off Slip	30	30	9999	1
403	Roundabouts ICD <= 30m	30	30	9999	1
404	Roundabouts ICD <= 100m	30	30	9999	1
405	Roundabouts ICD > 100m	30	30	9999	1
406	External Links	30	30	9999	1
407	Zone Connectors	30	30	9999	1

Appendix C. Matrix Build

C.1 Observed Matrix

The observed matrix has been developed using the 2015 origin-destination surveys plus a set of RSIs undertaken around Birkenhead in 2009. To provide a complete set of movements in the buffer area, RSIs are also included from surveys undertaken in the Liverpool City Region.

C.1.1 Segmentation

The observed highway matrices are built at time period level by purpose and direction.

Table C.1: Observed Highway Matrix Time Periods

ID	Description	Time period
1	AM Peak Period	0700-1000 hrs.
2	Inter Peak Period	1000-1600 hrs.
3	PM Peak Period	1600-1900 hrs.
4	Off Peak Period	1900-0700 hrs.

Table C.2: Observed Highway Matrix Purposes

ID	Purpose	Direction
1	Home Based Commute	From Home, To Home
2	Home Based Education	From Home, To Home
3	Home Based Shopping	From Home, To Home
4	Home Based Other	From Home, To Home
5	Home Based Employer's Business	From Home, To Home
6	Non Home Based Employer's Business	Non Home Based
7	Non Home Based Other	Non Home Based

C.1.2 RSI Transposition

RSI records are generally only captured in one direction. In order to create a full matrix these are transposed to create a proxy of travel in the reverse direction. To create the transposed records:

- the origin and destinations have been switched;
- trips from home have been converted to trips to home and vice versa;
- trip purpose remains the same; and
- trip time has been adjusted based on trip chain information from the Merseyside Countywide Household Travel Survey (CWS). .

The trip time calculation examined the trip chaining in the CWS to establish the propensity to make further trips whilst on a particular trip. The analysis stepped through each stage in a person's trip chain, which was defined as a sequence of trips that started with a From Home trip and ended with a To Home trip, with

Non Home Based trips between. The analysis examined the sequence of trips within the chain that followed, split by trip purpose, direction and travel hour.

The transposed records were combined with the RSI records to form the complete set of OD data for matrix building.

C.1.3 RSI Expansion

The RSI records and transposed records represent only a sample of people travelling through each survey point. Therefore, to produce a matrix containing a full representation of trips, interview records are expanded to match traffic counts i.e. each interview is assumed to be equivalent to a number of trips not just the one trip that has been captured in the surveys.

This is a two stage process, where firstly records are expanded to the control MCC counts and secondly to the ATC count at the survey site.

Finally, a set of adjustment factors are applied to the RSI records to account for gaps in the RSI cordon, postcard bias and non-surveyed RSI data.

C.1.3.1 Gaps in RSI Cordon

The observed matrix build is carried out on a sector cordon basis. RSIs have not been carried out at every location that crosses the cordon boundaries. To ensure the observed matrix accurately reflects the traffic flow across each cordon an infilling exercise has been carried out. This has been done in two ways:

- Factoring RSI records at a suitable site to the value of the count on any links that cross the cordon where we do not have an RSI site;
- Creating a synthetic RSI for any gaps in the cordon using select link analysis of an assignment of the 2012 LCRTM model factored to 2015 traffic counts.

C.1.3.2 Postcard Bias Factor

It is widely acknowledged that the return rate of postcard forms varies significantly between different travel purposes, potentially leading to skewing of the RSI data. A postcard bias factor has been produced for each site that adjusts the purpose split of postcard records to reflect that of the interview records by time period. This calculation only uses RSI records where there are interview and postcard records in the same time period.

C.1.3.3 Infill Factor

RSI data is not always present for every half hour time/vehicle type, particularly for LGV/OGV. To ensure the total flow across cordons is represented it is necessary to produce additional factors. To address this issue factors have been produced at time period level that compare the total ATC count at each site per

time period to the ATC count used in the expansion factor process for the time period. The factor of these two values has then been applied.

C.1.4 Expansion Factor Analysis

Table C.3 presents the final expansion factors. It is recommended that expansion factors are less than 10, which is the case for 96% of our records indicating that a good sample of records were collected. It is often difficult to obtain a high sample of LGVs and OGVs, but the below table indicates that the RSI data contained a good sample of these vehicles.

Table C.3: Expansion Factor Ranges

Range	CAR	LGV	OGV	Total
<1	75%	75%	70%	74%
<2	11%	9%	8%	10%
<5	8%	8%	9%	8%
<10	3%	4%	6%	4%
<15	1%	2%	2%	1%
<20	1%	1%	1%	1%
<30	1%	1%	1%	1%
<40	0%	0%	1%	0%
<50	0%	0%	0%	0%
>=50	0%	1%	1%	0%

C.1.5 Observed Matrix Build Set-Up

The RSI data provides a wealth of information on travel patterns, but there is the potential for trips to be observed at more than one survey location. The Visual -TM ERICA program has been used to remove these instances of double-counting.

In order to carry out the RSI data expansion to counts and the full build of the observed trip matrix, it is necessary to prepare a set of parameter files for use in ERICA.

Firstly the zone-cordon system needs to be defined in ERICA in terms of 'screenline segments'. These segments are the boundaries between individual cordons. Each RSI site is therefore defined as sitting on a specific screenline segment. When ERICA seeks to capture movements between cordons, it groups sites by their screenline segment.

There are five main parameter files required by ERICA of:

- SECPAT;
- STASEG;
- ERCODM;
- Column Position; and

- Label.

Each of these files is described below.

C.1.5.1 SECPAT

The SECPAT file is used to define the relationship of zones to sectors. This is a list of the model sectors with their respective zones alongside them.

C.1.5.2 STASEG

The STASEG file is essentially a list of every individual RSI site that is input to ERICA, the screenline segment it sits on, and the file location of the RSI data for each site.

Each site also has a station variance factor that is used as a weighting to signify the significance of the records contained in the RSI input file. The greater the variance applied, the less weight the records in the file will carry in the ERICA process. For example a synthesised site will have a greater site variance than a fully observed site.

C.1.5.3 ERCODM

The ERCODM file is key to the matrix building process in ERICA as it is used to identify which screenline segments should be used to select the trips making up cordon crossing movements. Each sector-to-sector movement is listed individually, and alongside it the screenline segments that ERICA should extract trips from. ERICA uses the screenline segments in the ERCODM file to match sector-to-sector movements to the RSI input files listed in the STASEG file.

Each sector should be completely bounded by screenline segments, and each RSI site should have one of these segments associated with it. Each sector-to-sector movement has a positive and a negative set of segments associated with it. The purpose of this is to eliminate 'wiggly' trips, those trips which cross the cordon more than once at different sites and are therefore picked up as multiple trips. For instance if a trip from sector 1 to sector 2 is identified in the matrix build as crossing in the opposite direction, it is assumed that this trip must have to cross the screenline segment in the 'correct' direction twice in order to get to its destination. The total 'negative' trips for an i, j pair are therefore subtracted from the 'positive' trips for that i, j pair.

An example of how the ERCODM file should look is given below:

O sector	D sector	Pos/Neg	Cordon no	Factor			
1	2	P	1	1	12	16	2
1	2	N	1	1	11	15	1
1	3	P	1	1	12	16	2
1	3	N	1	1	11	15	1
1	4	P	1	1	12	16	2
1	4	N	1	1	11	15	1
1	5	P	1	1	12	16	2
1	5	N	1	1	11	15	1
1	6	P	1	1	12	16	2
1	6	N	1	1	11	15	1
1	7	P	1	1	12	16	2
1	7	N	1	1	11	15	1
1	8	P	1	1	12	16	2
1	8	N	1	1	11	15	1
1	9	P	1	1	12	16	2

In this case all the trips passing from sector 1 to sector 2 are being drawn from sites on screenline segments 12, 16 and 2. Trips passing from sector 1 to sector 2 passing through other segments are not included. This acts to prevent double counting, as in many cases trips from sector X to sector Y will pass through numerous segments. Any trips with an origin in sector 1 and a destination in sector 2 that pass through screenline segments 11, 15 or 1 will be counted as negative (or 'wiggly') trips and subtracted from the total.

In most instances there are two ways to specify the screenline segments used to travel between two sectors:

- leaving the Origin sector
- entering the Destination sector

In order to include as much RSI data as possible two Ercodm files are defined ('A' and 'B'), relating to each of the above options.

C.1.5.4 Column Position

The Column Position file specifies which columns in the RSI input spreadsheets represent required values for use in the ERICA expansion process. Different DEF files can be used if RSI inputs are formatted differently; the WTM input RSI spreadsheets are in uniform formats. The above DEF file is therefore named alongside each individual RSI spreadsheet input in the STASEG file.

C.1.5.5 Label

Like the Column Position file, the Label file is only used for the expansion process in ERICA. It defines the vehicle types and time periods that are used in the RSI and MCC data.

C.1.6 Observed Trip Matrix Build

The matrix build function in ERICA takes all the input RSI records, synthesised records and parameter files, and builds matrices in binary format to a specification entered by the user. This specification for WTM is that vehicle (rather than occupants) matrices are built by:

- time period;
- vehicle type (Car/LGV/OGV); and
- purpose.

When the initial matrix was built a positive and a negative trip matrix was produced. The purpose of this is to eliminate the 'wiggly' trips that cross cordons more than once. The negative trips are subtracted from the positive trips; any cells that become negative due to this process are set to zero and the negative trips are subtracted from the remaining matrix cells within that sector.

As discussed above two ERCODM files are used in the WTM matrix build to reflect the fact that sector-to-sector movements often have more than one set of observations to draw trips from. The two resulting matrices are built and saved separately, then merged together.

C.1.7 Observed Matrix Merge

The final step in producing the observed trip matrices is the merging of the two separate ERCODM matrices, files 'A' and 'B'.

This takes the form of a variance weighted merge. Each cell in an ERICA matrix contains a variance dependent on the size of the expansion factor for each record and the station variance factor in the Staseg file. The larger the variance the less reliable a trip is deemed. The merge uses the variance as a weight to calculate the average number of trips. Where an observed zero flow estimate exists an average variance is calculated:

- Matrix A – an average of all variances for each origin zone
- Matrix B – an average of all variances for each destination zone

The variance weighted merge process is expressed as:

$$f_m = \frac{f_1 I_2 + f_2 I_1}{I_1 + I_2}$$

Where:

f_m = merged flow estimate

f_i = flow estimate from source *i*

I_i = index of dispersion for source *i* trip estimate; defined as variance divided by trip estimate

The Index of dispersion is defined as:

$$I = \frac{v}{f}$$

where:

I = Index of Dispersion

v = variance for *ij* flow estimate

f = flow estimate for origin *i* to destination *j*

C.2 Synthetic Matrix

The LCRTM synthetic matrix has been converted to the WTM zoning system for use in the WTM model.

The correspondences between LCRTM and WTM zones have been developed using Address Base. All WTM zones have been created by splitting LCRTM zones. The following classifications are used:

- Production trips: Residential Units
- Attraction trips:
  - Commute + EB - Employment Units
  - Shopping - Retail Units
  - Education - School Locations
  - Other - Leisure Units
- Non Home Based (NHB) trips:
  - NHB EB - commercial units (these will be used for both origins and destinations)
  - NHB Other - an average of all attraction proportions (as these trips can be to/from anywhere - these will be used for Origins, leisure units will be used for destinations)
- LGV/OGV: commercial units (these will be used for both origins and destinations)

A set of factors are then created based on the number of units in each WTM zone and the corresponding LCRTM zone. These are applied to the each zone LCRTM matrix to convert to the WTM zone system.

The purpose of the synthetic matrix is to provide a complete representation of demand to, from and within the LCRTM Study Area. This is used in two ways, firstly to strengthen the observed matrices and secondly to infill any areas where observed data is not available. Land use information e.g. numbers of housing and jobs are used in conjunction with observed trip rates to synthesise travel demand.

The development of the LCRTM synthetic matrix is described below.

C.2.1 Calculation of Productions and Attractions

Productions (where trips are generated) and attractions (where trips are attracted to) are calculated through the following steps:

- Home Based Productions calculated from Households * Trip Rate
- Attractions calculated from ABI/pupil numbers (study area) and TEMPRO (buffer and external area)
- Attractions constrained to production totals
- NHB Productions calculated based on constrained Home Based Attractions * propensity for NHB trips
- NHB Attractions calculated based on constraining the Attractions to NHB production totals

Trip rates and the propensity to make NHB trips are derived from the CWS. Data from the 2008, 2010 and 2013 CWS has been combined to increase the number of records available for these calculations.

Trip productions are calculated for the study and buffer area; trip attractions are calculated for the entire model area.

C.2.2 Distribution

Productions and attractions provide details of the total number of trips to and from each zone. The distribution process links the two to determine how many trips travel between each zone. The distribution has been undertaken in two ways:

i) Using the proportions from the Census 2011 Travel to Work data-set for commute trips.
ii) Using a standard gravity model which uses the travel cost between each zone combined with the productions and attractions to determine the number of trips between each zone for Other and Business purposes. This process is calibrated to an observed mean trip cost to ensure the distribution is realistic.

C.2.2.1 Census Travel to Work Distribution

The Census Travel to Work data is aggregated to LCRTM zone level. The proportion of trips travelling between each LCRTM zone has been calculated and used to distribute the LCRTM productions and attractions.

C.2.2.2 Gravity Model

The trip cost between each zone has been calculated using an assignment of the 2012 LCRTM model and the model has been calibrated to an average trip time from the National Travel Survey (NTS).

C.2.3 Conversion to Origin-Destination Format

The LCRTM observed matrices have been produced in Origin-Destination format and this is the format to be used in assignment, therefore the synthetic matrices have been converted from 24 hour Production-Attraction (PA) format to time period based Origin-Destination (OD) matrices using locally adjusted NTS tour proportions (retaining information on the trip direction).

C.3 TrafficMaster Matrix

The LCRTM TrafficMaster matrix has been converted to the WTM zoning system for use in the WTM model.

TrafficMaster (TM) data is provided by the DfT as individual trip records in the Trafficmaster zoning system for a 12 month period. Each record represents a journey between ignition-on and ignition-off of a tracked vehicle. TM GPS data is available from mainly vehicles belonging to TM customers who are primarily high mileage private drivers and company car drivers. There are now more than 60,000 of these drivers across the country, and taken over a full year, these tracked vehicles provide a large volume of trip making.

Although it is known that TM customers are primarily company car drivers and a small proportion of private customers, the methodology describes here assumes that TM data provides a random sample of journey making for all car trip purposes. This is the key assumption and simplification in this methodology.

The development of the LCRTM TM matrix is detailed below.

C.3.1 Conversion to LCRTM zoning system

The TM zoning system is provided with MapInfo files that allow mapping to be made to LCRTM zoning system. This is done by overlapping the two zoning systems and applying the following simple rules:

- If TM zone is more than 90% inside LCRTM zone, then assign all of zone trips to that LCRTM zone. Otherwise split TM zone between corresponding LCRTM zones according to area of overlap.
- If TM zone is larger than LCRTM zone, split the TM zone to LCRTM zones according to area proportions in the overlaps.

C.3.2 Annual weekday trip totals

The next step involves aggregation of TM records into total annual weekday trips by TM vehicle types and by TM time periods. This step yields matrices for each time period for the following vehicle types:

- Car (all purposes)
- LGV
- OGV

In order to convert these annual TM matrices to average weekday, these matrices are divided by 260. These values then represent average trips recorded for each weekday for each time period and for each vehicle type. As they do not represent actual total trips made for each day, expansion to total observed or estimated daily trips is required. This is described further below.

The average weekday (all purpose) car matrices form the basis for expansion to (and creation of) purpose-specific car travel matrices.

C.3.3 Creation of (all purpose) weekday trip matrices

The next stage in this process is to factor up recorded TM daily matrix values to observed trip counts within the LCRTM Study Area. This is based on the following sources of information:

- sector-sector RSI observation by vehicle type
- synthetic matrix

More specifically the scaling follows the following rules:

- Inter-sector: All within the Study Area. Factor TM movements to RSI observed totals
- Inter-sector: All Study Area-External. Factor TM movements to RSI observed totals
- Inter-sector: All External-External. Factor to synthetic matrix totals
- Intra-sector: Factor to synthetic totals

This stage yields TM matrices with levels of traffic broadly in line with Study Area traffic levels.

C.3.4 Creation of purpose-specific matrices

In order to create purpose-specific car matrices, use is made of journey purpose splits and trip length distributions from the synthetic matrix.

Trips purpose matrices are obtained by factoring all-purpose matrices with trip purpose proportions from the synthetic matrix. This preserves the matrix totals.

These purpose-specific matrices are then forced to adopt the synthetic matrix trip length distribution for each car purpose (using TLD ratios between TM matrices and synthetic matrices). This process is, of course constrained to the existing total number of trips.

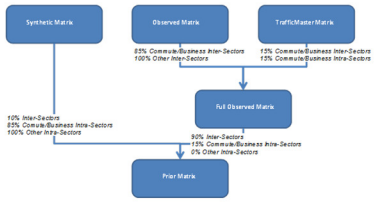
The outcome from this stage is a set of purpose-specific TM matrices that have the same TLDs as the synthetic matrix.

C.4 Matrix Merge

The three matrices are merged based on their relative strengths and weaknesses. There are well established processes for merging synthetic and observed matrices using 90% of the observed matrix and 10% of the synthetic matrix as set out in DMRB 12.1.1.8. There is no guidance on how to include TM matrices, therefore 15% of the TM matrices have been used based on the cell coverage of this matrix.

Figure C.1 provides details of the HY merge process.

Figure C.1: Matrix Merge



Appendix D. Model Assignment Statistics

Table D.1: AM Peak Hour - Model Convergence Statistics (Table 1)

LOOP	Ass.	Sim.	A/S Step	%FLOWS	%DELAYS	%V.I.	%GAP
26	0.0195/50	0.002/ 7	1.000/	1	99.5	99.8	0.00055
27	0.0177/50	0.002/ 7	1.000/	1	99.7	99.7	0.0005
28	0.0130/50	0.001/ 7	1.000/	1	99.6	99.7	0.00045
29	0.0121/50	0.002/ 7	1.000/	1	99.7	99.8	0.00041

Table D.2: AM Peak Hour - Model Convergence Statistics (Table 2)

LOOP	ASS-HRS	CHANGE	SIM-HRS	SIM-KMS	GEHBAR	AAD	RAAD	XMSD	SAD	RSAD
26	418198.5	-0.001	11880.3	472133.7	0.006	0.113	0.018	0.053	0.012	0.19
27	418209.3	0.003	11881.2	472125.8	0.005	0.101	0.016	0.059	0.013	0.201
28	418210.8	0	11879.3	472120.9	0.005	0.105	0.017	0.052	0.014	0.219
29	418192.2	-0.004	11880.9	472113.2	0.005	0.104	0.016	0.059	0.013	0.195

Table D3: Average IP Hour - Model Convergence Statistics (Table 1)

LOOP	Ass.	Sim.	A/S Step	%FLOWS	%DELAYS	%V.I.	%GAP
22	0.0044/50	0.000/ 7	1.000/	1	99.6	99.9	0.00036
23	0.0034/50	0.000/ 7	1.000/	1	99.7	99.9	0.00031
24	0.0033/50	0.000/ 7	1.000/	1	99.7	99.9	0.00023
25	0.0025/50	0.000/ 7	1.000/	1	99.7	99.9	0.00019

Table D.4: Average IP Hour - Model Convergence Statistics (Table 2)

LOOP	ASS-HRS	CHANGE	SIM-HRS	SIM-KMS	GEHBAR	AAD	RAAD	XMSD	SAD	RSAD
22	252204.1	-0.005	7849.1	326888.8	0.006	0.119	0.025	0.075	0.009	0.176
23	252206.8	0.001	7849	326885.8	0.005	0.098	0.021	0.054	0.008	0.153
24	252223.6	0.007	7849.7	326875.5	0.006	0.104	0.022	0.06	0.008	0.163
25	252215.5	-0.003	7848.7	326882	0.005	0.096	0.02	0.053	0.009	0.18

Table D.5: PM Peak Hour - Model Convergence Statistics (Table 1)

LOOP	Ass.	Sim.	A/S Step	%FLOWS	%DELAYS	%V.I.	%GAP
22	0.0161/50	0.005/ 7	1.000/	1	99.5	99.7	0.00065
23	0.0177/50	0.005/ 7	1.000/	1	99.5	99.7	0.00059
24	0.0164/50	0.005/ 7	1.000/	1	99.5	99.7	0.00052
25	0.0151/50	0.005/ 7	1.000/	1	99.6	99.7	0.0005

Table D.6: PM Peak Hour - Model Convergence Statistics (Table 2)

LOOP	ASS-HRS	CHANGE	SIM-HRS	SIM-KMS	GEHBAR	AAD	RAAD	XMSD	SAD	RSAD
22	440587.8	-0.004	11864.3	452252.2	0.007	0.13	0.02	0.07	0.11	1.68
23	440588.3	0	11863.6	452253.1	0.006	0.11	0.02	0.07	0.11	1.71
24	440586	-0.001	11863.6	452252.7	0.005	0.1	0.02	0.07	0.11	1.65
25	440576.1	-0.002	11863.5	452252.2	0.005	0.1	0.02	0.09	0.11	1.69

Appendix E. Flow Calibration AM

Table E.1: Cordon 1 Birkenhead Inner Results – AM

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Inbound	1	Queensway Mersey Tunnel	1,042	156	0	**1,198**	1,113	169	0	**1,282**	84	7%	2.40
	2	A554 Tower Road	878	131	43	**1,052**	881	133	41	**1,055**	3	0%	0.10
	3	A5027 Duke Street	526	127	66	**719**	532	119	67	**718**	-1	0%	0.03
	4	A5030 Beaufort Road	478	56	18	**551**	476	29	6	**511**	-40	-7%	1.74
	5	A553 Laird Street	356	54	4	**414**	354	54	3	**411**	-2	-1%	0.12
	6	A5027 Park Road North	525	47	13	**585**	520	48	24	**592**	7	1%	0.28
	7	Ashville Road	422	52	38	**512**	424	51	38	**513**	1	0%	0.03
	8	Park Road South	493	39	13	**546**	508	45	13	**566**	20	4%	0.86
	9	Oxton Road	467	35	6	**507**	477	22	3	**503**	-4	-1%	0.19
	10	A552 Borough Road	688	73	48	**809**	672	77	7	**755**	-53	-7%	1.91
	11	Derby Road	481	59	41	**581**	480	58	9	**548**	-33	-6%	1.40
	12	B5148 Church Road	542	55	14	**610**	680	81	21	**782**	172	28%	6.51
	13	B5149 Old Chester Road	627	57	3	**688**	691	55	3	**750**	62	9%	2.30
	14	A41 New Chester Road	1,304	148	97	**1,549**	1,218	133	97	**1,449**	-100	-6%	2.58
INBOUND TOTAL			**8,828**	**1,088**	**404**	**10,320**	**9,027**	**1,076**	**332**	**10,435**	**114**	**1%**	**1.12**
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Outbound	1	Queensway Mersey Tunnel	1,984	155	0	**2,139**	2,030	197	0	**2,228**	88	4%	1.89
	2	A554 Tower Road	495	79	73	**647**	496	76	70	**643**	-4	-1%	0.17
	3	A5027 Duke Street	333	88	81	**502**	324	87	80	**490**	-11	-2%	0.51
	4	A5030 Beaufort Road	161	60	10	**231**	160	60	10	**230**	-1	0%	0.05
	5	A553 Laird Street	224	46	19	**289**	222	42	23	**286**	-3	-1%	0.17
	6	A5027 Park Road North	231	41	6	**279**	231	31	6	**268**	-10	-4%	0.62
	7	Ashville Road	203	25	38	**266**	200	25	7	**232**	-34	-13%	2.15
	8	Park Road South	194	31	10	**235**	194	20	6	**219**	-16	-7%	1.05
	9	Oxton Road	117	40	8	**164**	118	40	7	**165**	1	1%	0.07
	10	A552 Borough Road	368	49	4	**421**	392	49	4	**445**	24	6%	1.17
	11	Derby Road	201	25	25	**251**	203	20	5	**228**	-23	-9%	1.47
	12	B5148 Church Road	194	20	5	**218**	282	30	7	**319**	101	46%	6.17
	13	B5149 Old Chester Road	264	35	17	**317**	266	35	5	**307**	-10	-3%	0.57
	14	A41 New Chester Road	825	152	68	**1,045**	846	146	66	**1,058**	13	1%	0.40
			Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
OUTBOUND TOTAL			**5,794**	**844**	**367**	**7,005**	**5,964**	**859**	**298**	**7,120**	**115**	**2%**	**1.37**
2-WAY TOTAL			**14,622**	**1,932**	**771**	**17,325**	**14,991**	**1,935**	**630**	**17,555**	**230**	**1%**	**1.74**

Table E.2: Cordon 2 Birkenhead Outer Results - AM

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Inbound	1	Kingsway Mersey Tunnel	1,205	245	458	**1,908**	1,204	251	358	**1,813**	-95	-5%	2.20
	2	A554 Seabank Road	439	42	12	**494**	466	42	12	**520**	26	5%	1.16
	3	B5143 Rake Lane	232	27	18	**277**	194	24	19	**236**	-41	-15%	2.53
	4	Seaview Road	305	37	41	**383**	306	29	7	**342**	-41	-11%	2.15
	5	Belvidere Road	329	40	40	**410**	335	37	0	**372**	-38	-9%	1.94
	6	A551 Wallasey Road	593	84	17	**693**	598	83	17	**697**	4	1%	0.16
	7	A59 (East of M53 J1)	1,970	230	154	**2,355**	1,729	224	280	**2,233**	-122	-5%	2.54
	8	A5139 Dock Road	1,043	112	105	**1,260**	1,015	129	104	**1,248**	-13	-1%	0.36
	9	A553 Hoylake Road	740	86	58	**884**	769	86	28	**883**	-1	0%	0.03
	10	A5027 Upton Road	535	13	3	**550**	529	23	28	**581**	31	6%	1.30
	11	A552 Woodchurch Road	1,261	147	79	**1,487**	1,278	137	78	**1,493**	6	0%	0.17
	12	B5151 Storeton Road	537	45	14	**596**	540	45	13	**598**	2	0%	0.09
	13	Borough Road	443	36	2	**481**	447	31	2	**480**	-1	0%	0.05
	14	B5148 Church Road	642	41	11	**693**	652	59	14	**725**	32	5%	1.20
	15	B5149 Old Chester Road	627	57	3	**688**	691	55	3	**750**	62	9%	2.30
	16	A41 New Chester Road	1,304	148	97	**1,549**	1,218	133	97	**1,449**	-100	-6%	2.58
INBOUND TOTAL			**12,204**	**1,391**	**1,113**	**14,708**	**11,972**	**1,389**	**1,059**	**14,420**	**-288**	**-2%**	**2.39**

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Outbound	1	Kingsway Mersey Tunnel	2,397	149	254	**2,800**	2,309	271	314	**2,893**	93	3%	1.75
	2	A554 Seabank Road	270	60	6	**336**	270	58	33	**360**	25	7%	1.31
	3	B5143 Rake Lane	178	21	14	**213**	178	24	14	**216**	3	1%	0.18
	4	Seaview Road	285	35	52	**372**	284	7	3	**294**	-77	-21%	4.23
	5	Belvidere Road	159	19	38	**217**	159	19	5	**183**	-34	-16%	2.41
	6	A551 Wallasey Road	446	64	9	**519**	444	64	9	**516**	-3	-1%	0.13
	7	A59 (East of M53 J1)	887	104	70	**1,060**	874	110	232	**1,215**	156	15%	4.61
	8	A5139 Dock Road	607	155	202	**963**	593	150	203	**946**	-17	-2%	0.54
	9	A553 Hoylake Road	486	57	38	**581**	483	57	34	**573**	-8	-1%	0.34
	10	A5027 Upton Road	708	65	9	**783**	695	65	11	**771**	-12	-1%	0.42
	11	A552 Woodchurch Road	1,192	115	60	**1,367**	1,233	118	59	**1,411**	44	3%	1.18
	12	B5151 Storeton Road	610	51	5	**666**	585	53	4	**641**	-25	-4%	0.97
	13	Borough Road	368	28	8	**404**	372	35	8	**415**	11	3%	0.56
	14	B5148 Church Road	267	44	14	**325**	271	44	8	**323**	-2	-1%	0.12
	15	B5149 Old Chester Road	264	35	17	**317**	266	35	5	**307**	-10	-3%	0.57
	16	A41 New Chester Road	825	152	68	**1,045**	846	146	66	**1,058**	13	1%	0.40
			Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
OUTBOUND TOTAL			**9,949**	**1,152**	**865**	**11,966**	**9,860**	**1,255**	**1,008**	**12,123**	**157**	**1%**	**1.43**
2-WAY TOTAL			**22,154**	**2,543**	**1,978**	**26,675**	**21,832**	**2,644**	**2,067**	**26,543**	**-131**	**0%**	**0.81**

Table E.3: Cordon 3 Wirral West of M53 Results – AM

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Inbound	1	A554 Bayswater Road	656	77	51	**784**	644	80	50	**774**	-11	-1%	0.39
	2	A551 Leasowe Road	774	90	61	**925**	687	76	42	**805**	-119	-13%	4.06
	3	A554	832	97	65	**994**	822	100	81	**1,003**	9	1%	0.29
	4	A553 Hoylake Road	388	63	13	**465**	387	63	24	**474**	9	2%	0.42
	5	A551 Upton Road	687	73	63	**823**	682	69	60	**811**	-12	-2%	0.43
	6	A5027 Upton By-Pass	598	73	42	**713**	620	72	41	**733**	20	3%	0.73
	7	A551 Upton Road	333	51	21	**405**	329	51	21	**401**	-4	-1%	0.19
	8	A5027 Upton Road	788	92	62	**942**	793	81	42	**915**	-26	-3%	0.87
	9	A552 Woodchurch Road	951	119	84	**1,153**	954	118	57	**1,129**	-24	-2%	0.71
	10	Station Road	180	23	14	**218**	214	22	0	**236**	18	8%	1.19
	11	A5137 Brimstage Road	181	32	25	**238**	181	32	25	**238**	-1	0%	0.04
	12	B5151 Clatterbridge Road	497	50	13	**560**	499	72	83	**654**	94	17%	3.82
	13	B5136 Thornton Commom Road	528	79	14	**620**	543	82	14	**639**	19	3%	0.75
	14	Raby Mere Road	71	7	2	**79**	72	7	1	**80**	1	1%	0.06
	15	Hooton Road	296	35	23	**353**	297	25	20	**342**	-12	-3%	0.62
	16	Birkenhead Road	218	25	17	**261**	219	34	16	**269**	9	3%	0.54
	17	Chester High Road	470	55	37	**561**	467	55	39	**561**	0	0%	0.00
INBOUND TOTAL			**8,447**	**1,041**	**607**	**10,095**	**8,408**	**1,040**	**616**	**10,064**	**-31**	**0%**	**0.31**

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Outbound	1	A554 Bayswater Road	513	60	40	**613**	511	59	39	**609**	-5	-1%	0.19
	2	A551 Leasowe Road	633	74	50	**757**	615	72	38	**725**	-32	-4%	1.18
	3	A554	1,170	137	92	**1,399**	1,162	139	91	**1,392**	-7	0%	0.17
	4	A553 Hoylake Road	631	84	15	**730**	634	84	15	**733**	2	0%	0.08
	5	A551 Upton Road	920	101	64	**1,086**	942	159	172	**1,272**	186	17%	5.43
	6	A5027 Upton By-Pass	1,384	78	29	**1,491**	1,351	100	27	**1,478**	-13	-1%	0.34
	7	A551 Upton Road	520	39	22	**581**	486	42	25	**554**	-27	-5%	1.13
	8	A5027 Upton Road	678	79	53	**810**	672	54	19	**745**	-65	-8%	2.33
	9	A552 Woodchurch Road	935	55	37	**1,027**	887	67	37	**991**	-36	-4%	1.13
	10	Station Road	507	30	8	**545**	535	63	0	**597**	53	10%	2.21
	11	A5137 Brimstage Road	528	26	15	**569**	507	18	15	**539**	-30	-5%	1.27
	12	B5151 Clatterbridge Road	837	84	22	**943**	846	95	41	**982**	38	4%	1.24
	13	B5136 Thornton Commom Road	306	46	8	**361**	307	46	8	**361**	0	0%	0.02
	14	Raby Mere Road	126	13	3	**142**	126	13	3	**142**	0	0%	0.04
	15	Hooton Road	344	40	27	**412**	351	35	8	**394**	-18	-4%	0.87
	16	Birkenhead Road	218	25	17	**260**	228	25	36	**290**	30	11%	1.79
	17	Chester High Road	774	90	61	**925**	785	88	61	**933**	8	1%	0.25
			Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
OUTBOUND TOTAL			**11,025**	**1,062**	**563**	**12,650**	**10,943**	**1,158**	**635**	**12,737**	**86**	**1%**	**0.77**
2-WAY TOTAL			**19,472**	**2,103**	**1,170**	**22,746**	**19,352**	**2,198**	**1,251**	**22,801**	**55**	**0%**	**0.37**

Table E.4: Cordon 4 Wirral South East Results – AM

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Inbound	1	A41 New Chester Road	825	152	68	**1,045**	846	146	66	**1,058**	13	1%	0.40
	2	B5149 Old Chester Road	264	35	17	**317**	266	35	5	**307**	-10	-3%	0.57
	3	B5148 Church Road	267	44	14	**325**	271	44	8	**323**	-2	-1%	0.12
	4	Borough Road	368	28	8	**404**	372	35	8	**415**	11	3%	0.56
	5	B5151 Storeton Road	610	51	5	**666**	585	53	4	**641**	-25	-4%	0.97
	6	Station Road	507	30	8	**545**	535	63	0	**597**	53	10%	2.21
	7	B5151 Mount Road	561	57	14	**632**	621	82	20	**722**	91	14%	3.49
	8	B5137 Brimstage Road	987	83	27	**1,098**	961	73	16	**1,050**	-48	-4%	1.47
	9	B5136 Thornton Commom Road	306	46	8	**361**	307	46	8	**361**	0	0%	0.02
	10	Raby Hall Road	126	13	3	**142**	126	13	3	**142**	0	0%	0.04
	11	Eastham Rake	86	9	2	**97**	86	9	2	**97**	0	0%	0.05
	12	A41 New Chester Road	1,198	150	237	**1,585**	1,099	152	176	**1,427**	-158	-10%	4.07
	13	B5132 Rivacre Road	107	11	3	**120**	101	7	0	**108**	-13	-10%	1.18
INBOUND TOTAL			**6,213**	**708**	**416**	**7,336**	**6,176**	**758**	**315**	**7,249**	**-87**	**-1%**	**1.01**

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Outbound	1	A41 New Chester Road	1,304	148	97	**1,549**	1,218	133	97	**1,449**	-100	-6%	2.58
	2	B5149 Old Chester Road	627	57	3	**688**	691	55	3	**750**	62	9%	2.30
	3	B5148 Church Road	642	41	11	**693**	652	59	14	**725**	32	5%	1.20
	4	Borough Road	443	36	2	**481**	447	31	2	**480**	-1	0%	0.05
	5	B5151 Storeton Road	537	45	14	**596**	540	45	13	**598**	2	0%	0.09
	6	Station Road	180	23	14	**218**	214	22	0	**236**	18	8%	1.19
	7	B5151 Mount Road	763	77	20	**860**	747	79	20	**845**	-14	-2%	0.50
	8	B5137 Brimstage Road	744	64	34	**842**	761	84	29	**874**	31	4%	1.07
	9	B5136 Thornton Commom Road	528	79	14	**620**	543	82	14	**639**	19	3%	0.75
	10	Raby Hall Road	71	7	2	**79**	72	7	1	**80**	1	1%	0.06
	11	Eastham Rake	115	12	3	**129**	120	12	2	**134**	5	4%	0.41
	11	A41 New Chester Road	1,089	159	233	**1,481**	1,115	162	224	**1,501**	20	1%	0.53
	12	B5132 Rivacre Road	70	7	2	**79**	35	5	0	**40**	-39	-49%	5.03
			Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
OUTBOUND TOTAL			**7,112**	**755**	**448**	**8,315**	**7,154**	**777**	**419**	**8,350**	**35**	**0%**	**0.38**
2-WAY TOTAL			**13,325**	**1,462**	**864**	**15,651**	**13,330**	**1,535**	**734**	**15,599**	**-52**	**0%**	**0.42**

Appendix F. Flow Calibration IP

Table F.1: Cordon 1 Birkenhead Inner Results – IP

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Inbound	1	Queensway Mersey Tunnel	572	117	0	**689**	564	117	0	**681**	-8	-1%	0.31
	2	A554 Tower Road	464	92	56	**612**	466	92	57	**615**	3	1%	0.13
	3	A5027 Duke Street	290	78	85	**453**	291	78	85	**454**	2	0%	0.07
	4	A5030 Beaufort Road	149	37	30	**216**	149	21	2	**171**	-45	-21%	3.24
	5	A553 Laird Street	332	47	17	**396**	329	47	18	**395**	-1	0%	0.07
	6	A5027 Park Road North	258	38	7	**302**	257	37	21	**316**	14	5%	0.78
	7	Ashville Road	202	30	32	**265**	200	28	22	**250**	-15	-6%	0.92
	8	Park Road South	269	26	8	**303**	286	30	8	**324**	22	7%	1.23
	9	Oxton Road	280	33	7	**320**	280	33	7	**320**	0	0%	0.02
	10	A552 Borough Road	473	62	14	**549**	475	63	15	**553**	3	1%	0.15
	11	Derby Road	259	39	29	**326**	254	26	7	**286**	-40	-12%	2.30
	12	B5148 Church Road	237	26	6	**270**	280	31	7	**318**	49	18%	2.84
	13	B5149 Old Chester Road	287	44	8	**339**	288	44	8	**341**	2	1%	0.11
	14	A41 New Chester Road	736	152	78	**965**	738	154	78	**970**	4	0%	0.14
INBOUND TOTAL			**4,808**	**820**	**376**	**6,005**	**4,857**	**802**	**335**	**5,994**	**-11**	**0%**	**0.15**
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Outbound	1	Queensway Mersey Tunnel	645	141	0	**786**	654	144	0	**798**	12	2%	0.43
	2	A554 Tower Road	548	99	74	**720**	544	99	74	**717**	-3	0%	0.12
	3	A5027 Duke Street	287	78	80	**445**	276	75	80	**431**	-13	-3%	0.63
	4	A5030 Beaufort Road	181	38	19	**238**	186	38	7	**231**	-7	-3%	0.47
	5	A553 Laird Street	328	48	15	**391**	328	48	18	**393**	2	1%	0.11
	6	A5027 Park Road North	276	32	9	**317**	277	32	18	**327**	11	3%	0.60
	7	Ashville Road	212	32	35	**279**	213	32	16	**262**	-17	-6%	1.03
	8	Park Road South	307	20	6	**333**	307	20	6	**333**	0	0%	0.00
	9	Oxton Road	259	26	5	**290**	259	26	5	**290**	0	0%	0.01
	10	A552 Borough Road	401	60	20	**481**	398	60	20	**477**	-4	-1%	0.16
	11	Derby Road	250	37	25	**313**	243	27	6	**276**	-37	-12%	2.13
	12	B5148 Church Road	257	28	7	**292**	317	33	8	**357**	66	23%	3.65
	13	B5149 Old Chester Road	315	53	5	**372**	314	53	5	**372**	0	0%	0.01
	14	A41 New Chester Road	670	136	86	**891**	671	126	86	**883**	-8	-1%	0.28
			Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
OUTBOUND TOTAL			**4,935**	**827**	**385**	**6,147**	**4,987**	**813**	**349**	**6,148**	**2**	**0%**	**0.02**
2-WAY TOTAL			**9,743**	**1,647**	**761**	**12,152**	**9,844**	**1,615**	**684**	**12,142**	**-10**	**0%**	**0.09**

Table F.2: Cordon 2 Birkenhead Outer Results - IP

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Inbound	1	Kingsway Mersey Tunnel	896	160	304	**1,359**	904	160	303	**1,368**	8	1%	0.23
	2	A554 Seabank Road	286	36	10	**332**	288	36	14	**338**	6	2%	0.35
	3	B5143 Rake Lane	186	28	23	**237**	168	28	23	**219**	-18	-8%	1.19
	4	Seaview Road	302	45	40	**387**	302	45	33	**379**	-7	-2%	0.38
	5	Belvidere Road	180	27	24	**230**	180	27	9	**216**	-14	-6%	0.95
	6	A551 Wallasey Road	435	53	12	**500**	435	53	12	**500**	0	0%	0.01
	7	A59 (East of M53 J1)	755	115	93	**963**	748	115	224	**1,086**	124	13%	3.87
	8	A5139 Dock Road	524	124	143	**791**	525	125	143	**792**	2	0%	0.06
	9	A553 Hoylake Road	488	74	59	**621**	487	74	41	**602**	-19	-3%	0.75
	10	A5027 Upton Road	431	44	13	**488**	435	44	17	**496**	8	2%	0.34
	11	A552 Woodchurch Road	893	103	56	**1,052**	877	103	50	**1,030**	-21	-2%	0.66
	12	B5151 Storeton Road	424	44	10	**478**	426	44	16	**485**	8	2%	0.35
	13	Borough Road	247	27	5	**279**	255	26	5	**286**	7	2%	0.39
	14	B5148 Church Road	255	28	3	**286**	257	28	4	**289**	3	1%	0.21
	15	B5149 Old Chester Road	287	44	8	**339**	288	44	8	**341**	2	1%	0.11
	16	A41 New Chester Road	736	152	78	**965**	738	154	78	**970**	4	0%	0.14
INBOUND TOTAL			**7,324**	**1,102**	**880**	**9,305**	**7,313**	**1,107**	**978**	**9,398**	**93**	**1%**	**0.96**

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Outbound	1	Kingsway Mersey Tunnel	936	165	344	**1,445**	924	162	343	**1,428**	-17	-1%	0.45
	2	A554 Seabank Road	324	47	11	**381**	322	47	19	**388**	7	2%	0.38
	3	B5143 Rake Lane	210	32	25	**268**	213	32	25	**270**	3	1%	0.16
	4	Seaview Road	364	54	40	**459**	265	25	40	**330**	-129	-28%	6.47
	5	Belvidere Road	172	26	24	**221**	172	26	6	**204**	-17	-8%	1.15
	6	A551 Wallasey Road	363	45	10	**418**	360	45	10	**416**	-2	0%	0.10
	7	A59 (East of M53 J1)	761	116	93	**970**	766	116	178	**1,060**	90	9%	2.84
	8	A5139 Dock Road	614	130	138	**882**	605	129	138	**872**	-10	-1%	0.34
	9	A553 Hoylake Road	435	66	52	**553**	436	66	42	**543**	-10	-2%	0.41
	10	A5027 Upton Road	398	34	4	**436**	397	34	4	**435**	-1	0%	0.04
	11	A552 Woodchurch Road	917	105	68	**1,090**	920	105	68	**1,093**	3	0%	0.08
	12	B5151 Storeton Road	471	44	11	**526**	465	44	9	**518**	-8	-2%	0.36
	13	Borough Road	255	31	4	**290**	255	31	4	**290**	0	0%	0.02
	14	B5148 Church Road	281	36	9	**326**	287	34	8	**329**	3	1%	0.16
	15	B5149 Old Chester Road	315	53	5	**372**	314	53	5	**372**	0	0%	0.01
	16	A41 New Chester Road	670	136	86	**891**	671	126	86	**883**	-8	-1%	0.28
			Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
OUTBOUND TOTAL			**7,484**	**1,118**	**925**	**9,527**	**7,373**	**1,075**	**984**	**9,431**	**-96**	**-1%**	**0.98**
2-WAY TOTAL			**14,808**	**2,220**	**1,804**	**18,832**	**14,686**	**2,182**	**1,961**	**18,829**	**-3**	**0%**	**0.02**

Table F.3: Cordon 3 Wirral West of M53 Results – IP

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Inbound	1	A554 Bayswater Road	409	61	49	**519**	419	61	49	**529**	10	2%	0.43
	2	A551 Leasowe Road	498	75	60	**633**	496	59	60	**616**	-18	-3%	0.71
	3	A554	722	108	86	**917**	720	108	86	**914**	-2	0%	0.07
	4	A553 Hoylake Road	473	58	22	**553**	472	58	27	**557**	3	1%	0.13
	5	A551 Upton Road	509	72	66	**647**	506	72	124	**703**	56	9%	2.14
	6	A5027 Upton By-Pass	594	61	41	**697**	612	61	41	**714**	17	2%	0.65
	7	A551 Upton Road	284	34	24	**343**	282	34	24	**339**	-3	-1%	0.18
	8	A5027 Upton Road	541	81	65	**688**	564	70	18	**652**	-36	-5%	1.37
	9	A552 Woodchurch Road	811	78	60	**950**	822	79	60	**961**	12	1%	0.37
	10	Station Road	181	16	7	**204**	197	21	0	**218**	13	6%	0.91
	11	A5137 Brimstage Road	294	29	21	**344**	294	29	21	**344**	0	0%	0.02
	12	B5151 Clatterbridge Road	354	38	9	**401**	354	53	33	**440**	39	10%	1.90
	13	B5136 Thornton Commom Road	212	32	8	**252**	212	32	8	**252**	0	0%	0.01
	14	Raby Mere Road	91	10	2	**104**	91	10	2	**103**	0	0%	0.02
	15	Hooton Road	182	27	22	**232**	182	26	8	**216**	-16	-7%	1.08
	16	Birkenhead Road	103	15	12	**131**	103	15	7	**125**	-6	-5%	0.54
	17	Chester High Road	446	67	53	**566**	443	67	53	**563**	-2	0%	0.10
INBOUND TOTAL			**6,706**	**864**	**610**	**8,180**	**6,769**	**855**	**621**	**8,246**	**66**	**1%**	**0.73**

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Outbound	1	A554 Bayswater Road	502	76	61	**638**	502	76	61	**639**	1	0%	0.04
	2	A551 Leasowe Road	456	69	55	**579**	456	69	26	**551**	-29	-5%	1.20
	3	A554	721	108	86	**916**	731	108	102	**941**	25	3%	0.82
	4	A553 Hoylake Road	418	53	20	**491**	419	53	31	**503**	11	2%	0.51
	5	A551 Upton Road	507	68	74	**648**	473	68	139	**680**	32	5%	1.24
	6	A5027 Upton By-Pass	598	72	54	**723**	595	72	67	**733**	10	1%	0.37
	7	A551 Upton Road	272	29	20	**321**	278	29	20	**326**	5	2%	0.27
	8	A5027 Upton Road	492	74	59	**626**	481	68	34	**582**	-43	-7%	1.77
	9	A552 Woodchurch Road	783	77	60	**919**	657	78	40	**774**	-145	-16%	4.99
	10	Station Road	186	22	8	**216**	214	24	0	**237**	21	10%	1.40
	11	A5137 Brimstage Road	274	32	23	**328**	276	32	13	**321**	-7	-2%	0.38
	12	B5151 Clatterbridge Road	367	40	10	**416**	368	47	48	**462**	46	11%	2.19
	13	B5136 Thornton Commom Road	201	30	8	**240**	201	30	8	**239**	-1	0%	0.04
	14	Raby Mere Road	68	8	2	**78**	68	8	2	**78**	0	0%	0.02
	15	Hooton Road	171	26	21	**218**	171	26	21	**218**	1	0%	0.04
	16	Birkenhead Road	109	16	13	**139**	110	27	13	**150**	12	8%	0.97
	17	Chester High Road	513	78	63	**654**	516	78	62	**656**	2	0%	0.09
			Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
OUTBOUND TOTAL			**6,638**	**876**	**636**	**8,150**	**6,514**	**892**	**686**	**8,091**	**-59**	**-1%**	**0.65**
2-WAY TOTAL			**13,344**	**1,740**	**1,246**	**16,330**	**13,283**	**1,747**	**1,307**	**16,337**	**7**	**0%**	**0.06**

Table F.4: Cordon 4 Wirral South East Results – IP

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Inbound	1	A41 New Chester Road	670	136	86	**891**	671	126	86	**883**	-8	-1%	0.28
	2	B5149 Old Chester Road	315	53	5	**372**	314	53	5	**372**	0	0%	0.01
	3	B5148 Church Road	281	36	9	**326**	287	34	8	**329**	3	1%	0.16
	4	Borough Road	255	31	4	**290**	255	31	4	**290**	0	0%	0.02
	5	B5151 Storeton Road	471	44	11	**526**	465	44	9	**518**	-8	-2%	0.36
	6	Station Road	186	22	8	**216**	214	24	0	**237**	21	10%	1.40
	7	B5151 Mount Road	412	45	11	**467**	419	45	17	**481**	13	3%	0.61
	8	B5137 Brimstage Road	630	71	36	**738**	707	82	35	**824**	86	12%	3.08
	9	B5136 Thornton Commom Road	201	30	8	**240**	201	30	8	**239**	-1	0%	0.04
	10	Raby Hall Road	68	8	2	**78**	68	8	2	**78**	0	0%	0.02
	11	Eastham Rake	65	7	2	**73**	65	7	2	**74**	1	1%	0.08
	12	A41 New Chester Road	705	123	221	**1,049**	699	123	211	**1,033**	-16	-2%	0.50
	13	B5132 Rivacre Road	49	5	1	**55**	49	10	0	**59**	4	7%	0.53
INBOUND TOTAL			**4,307**	**611**	**404**	**5,321**	**4,413**	**617**	**385**	**5,416**	**95**	**2%**	**1.30**

			Observed Flow (PCUs)				Modelled Flow (PCUs)				DMRB (1) GEH Validation (Total PCUs)		
Direction	Cordon Pt	Road Name	Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
Outbound	1	A41 New Chester Road	736	152	78	**965**	738	154	78	**970**	4	0%	0.14
	2	B5149 Old Chester Road	287	44	8	**339**	288	44	8	**341**	2	1%	0.11
	3	B5148 Church Road	255	28	3	**286**	257	28	4	**289**	3	1%	0.21
	4	Borough Road	247	27	5	**279**	255	26	5	**286**	7	2%	0.39
	5	B5151 Storeton Road	424	44	10	**478**	426	44	16	**485**	8	2%	0.35
	6	Station Road	181	16	7	**204**	197	21	0	**218**	13	6%	0.91
	7	B5151 Mount Road	420	46	11	**477**	415	46	11	**471**	-6	-1%	0.28
	8	B5137 Brimstage Road	594	63	35	**692**	594	67	35	**696**	4	1%	0.16
	9	B5136 Thornton Commom Road	212	32	8	**252**	212	32	8	**252**	0	0%	0.01
	10	Raby Hall Road	91	10	2	**104**	91	10	2	**103**	0	0%	0.02
	11	Eastham Rake	70	8	2	**80**	70	8	2	**80**	0	0%	0.03
	11	A41 New Chester Road	748	136	247	**1,131**	747	136	216	**1,100**	-31	-3%	0.92
	12	B5132 Rivacre Road	46	5	1	**52**	45	10	0	**55**	3	6%	0.44
			Car	LGV	OGV	Total	Car	LGV	OGV	Total	Diff	% Diff	GEH
OUTBOUND TOTAL			**4,313**	**608**	**418**	**5,339**	**4,335**	**628**	**384**	**5,346**	**8**	**0%**	**0.11**
2-WAY TOTAL			**8,619**	**1,219**	**822**	**10,660**	**8,748**	**1,245**	**770**	**10,763**	**103**	**1%**	**0.99**