

6. TRANSPORT MODEL VALIDATION

6.1 INTRODUCTION

The reference case model can be validated by comparing the results of the modelling with results obtained in the surveys. The three main areas for comparison are as follows:

- Comparison between the modelled link volumes and count data
- Comparison between the modelled and surveyed journey times on particular routes (road traffic)
- Comparison between modelled and surveyed rail boarding and alighting volumes.

A further level of detail may be assessed using select link analysis.

6.2 TRAFFIC ASSIGNMENT VALIDATION

6.2.1 Traffic Assignment Model Runs

The assignment procedure is the same for the four modelled time periods.

Only one assignment run is carried out for the public transport segment using a line based method. For the other demand segments, which represent motorised road traffic, the equilibrium method has been applied.

After this first step the external road traffic matrices have to be modified to ensure that total traffic flows are modelled for local sections of the motorway network. The original matrix does not include information about through traffic on the motorway system. In particular, this is the case for through movements on the M1 and the A42. Two steps were necessary to overcome this problem:

- the modelled volumes were projected to the observed volumes on the links using ATC data for the M1 and the A42, and
- a balancing algorithm adapted the resulting matrix of external traffic to minimise the deviations from the observed volumes at the RSI sites.

A second assignment was carried out for private transport producing updated journey times from the speed flow curves incorporated into the equilibrium procedure. These modified journey times plus the public transport journey times were used to re-run the demand model using impedances reflecting loaded network conditions.

The whole process of assignment and balancing was repeated until the results were stable and acceptable. At the same time: -

- the calibration was made by checking the assignment results against the available survey data
- the network was checked and coding errors were removed.

The calibration process was based on the ATC data collected at the RSI sites.

6.2.2 Traffic Count Screenline Validation

In order to confirm that the model is acceptable for the purpose of forecasting, a two stage process of comparing modelled volumes and observed counts can be undertaken.

In the first stage a useful comparison can be made at sites where data has been used in the calibration process. These counts were made at the RSI sites (as illustrated in figure 2.3). The matrices were generated by a combination of the synthetic demand model (which is based on structural data) and observed data from the RSIs. Therefore the role of the RSI data in the calibration process is somewhat different from that in a more conventional transport model. The ATC counts at these sites would typically be used in the expansion process from the sample movements to full matrix totals. This would effectively prevent their use in validation, since by default the modelled flows would be closely tied to the observed. In this case the modelled flows were less intrinsically linked, since the RSI data provided the input for only the external to internal and through (external to external) traffic. Although this external traffic is significant in amount particularly at the A453 RSI site, it was still possible to make a useful comparison.

The second stage involved making comparisons at a number of independent sites which had not been used in the calibration process. Data was supplied by Nottinghamshire County Council for a number of sites where data were available for the year 2000. This data was adjusted using the factors outlined in section 2.3.31 to ensure that the data was consistent with the model base.

Counts for the non-interview direction at RSI sites may also be considered independent along with data from various manual counts at key junctions undertaken as part of the A453 MMS surveys.

Tables 6.1 – 6.6 give a comparison between the assignment results from the model and the ATC data from the RSI sites for the am peak, interpeak am, pm peak periods. This comparison has been presented as absolute differences and percentage differences.

This has been supplemented by an additional column, where GEH statistics are listed. The GEH statistic is a Chi-Squared statistical test that incorporates both relative and absolute differences.

The criteria for model acceptability for *scheme appraisal purposes* outlined in DMRB Vol 12 are listed in Appendix C1. These are taken from the Design Manual for Roads and Bridges (DMRB), and should be regarded as rather onerous and unnecessarily rigorous for a strategy development study.

When considering assignment validation comparisons it is important to recognise that traffic counts are not absolute but subject to uncertainty. The longer the count period the less the uncertainty. For ATC count periods above 2 weeks a 95% confidence interval of at least $\pm 10\%$ would be usual, for "snapshot" one day manual counts an interval of $\pm 20\%$ or more should be recognised. These ranges would be widened by any adjustment to match the model base.

The following notes apply to each table 6.1 to 6.6

KEY	Western screenline = A609, B5010, A52, A6005 Southern screenline = A453, Nottingham Road(Gotham), A60, A606, A46 Derby Road corridor =B5010, A52, A6005 A453 corridor = A453, Nottingham Road (Gotham) South eastern corridor=A60, A606, A46 Inbound = towards Nottingham Outbound = away from Nottingham
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Table 6.1 Comparison of Assigned Flows and Traffic Counts – RSI Sites

AM Peak Inbound (Survey Direction) Comparison

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A609	1099	928	-171	-16%	5.37
Ilkeston Rd corridor					
B5010	642	613	-29	-5%	1.16
A52	2160	2308	148	7%	3.13
A6005	1487	1468	-19	-1%	0.49
Derby Rd corridor	4289	4389	100	2%	1.52
Western Screenline	5388	5317	-71	-1%	0.97
A453	1114	1134	20	2%	0.60
Nottingham Road,Gotham	586	470	-116	-20%	5.05
A453 corridor	1700	1604	-96	-6%	2.36
A60	1080	989	-91	-8%	2.83
A606	373	287	-86	-23%	4.73
A46	1064	1335	271	25%	7.82
South eastern corridor	2517	2611	94	4%	1.86
Southern Screenline	4217	4215	-2	0%	0.03
A52 (Gamston)	1300	1090	-210	-16%	6.07
A 6514 (Middleton Boulevard)	2815	2777	-38	-1%	0.72

Table 6.2 Comparison of Assigned Flows and Traffic Counts – RSI Sites

AM Peak Outbound (Non-survey Direction) Comparison

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A609	700	559	-141	-20%	5.62
Ilkeston Rd corridor					
B5010	479	559	80	17%	3.51
A52	2316	2257	-59	-3%	1.23
A6005	1021	1173	152	15%	4.59
Derby Rd corridor	3816	3989	173	5%	2.77
Western Screenline	4516	4548	32	1%	0.48
A453	1082	1046	-36	-3%	1.10
Nottingham Road,Gotham	281	234	-47	-17%	2.93
A453 corridor	1363	1280	-83	-6%	2.28
A60	735	530	-205	-28%	8.15
A606	309	232	-77	-25%	4.68
A46	1715	1970	255	15%	5.94
South eastern corridor	2759	2732	-27	-1%	0.52
Southern Screenline	4122	4012	-110	-3%	1.72
A52 (Gamston)	905	777	-128	-14%	4.41
A 6514 (Middleton Boulevard)	2037	2165	128	6%	2.79

Table 6.3 Comparison of Assigned Flows and Traffic Counts – RSI Sites

Interpeak Inbound (Survey Direction) Comparison

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A609	599	554	-45	-8%	1.87
Ilkeston Rd corridor					
B5010	453	403	-50	-11%	2.42
A52	1263	1450	187	15%	5.08
A6005	908	890	-18	-2%	0.60
Derby Rd corridor	2624	2743	119	5%	2.30
Western Screenline	3223	3297	74	2%	1.30
A453	848	848	0	0%	0.00
Nottingham Road, Gotham	181	156	-25	-14%	1.93
A453 corridor	1029	1004	-25	-2%	0.78
A60	390	406	16	4%	0.80
A606	202	177	-25	-12%	1.82
A46	628	695	67	11%	2.61
South eastern corridor	1220	1278	58	5%	1.64
Southern Screenline	2249	2282	33	1%	0.69
A52 (Gamston)	785	747	-38	-5%	1.37
A 6514 (Middleton Boulevard)	1700	1945	245	14%	5.74

Table 6.4 Comparison of Assigned Flows and Traffic Counts – RSI Sites

Interpeak Outbound (Non-survey Direction) Comparison

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A609	526	552	26	5%	1.12
Ilkeston Rd corridor					
B5010	410	382	-28	-7%	1.41
A52	1358	1507	149	11%	3.94
A6005	908	912	4	0%	0.13
Derby Rd corridor	2676	2801	125	5%	2.39
Western Screenline	3202	3353	151	5%	2.64
A453	763	783	20	3%	0.72
Nottingham Road, Gotham	167	149	-18	-11%	1.43
A453 corridor	930	932	2	0%	0.07
A60	390	415	25	6%	1.25
A606	192	175	-17	-9%	1.25
A46	599	627	28	5%	1.13
South eastern corridor	1181	1217	36	3%	1.04
Southern Screenline	2111	2149	38	2%	0.82
A52 (Gamston)	836	748	-88	-11%	3.13
A 6514 (Middleton Boulevard)	1717	1975	258	15%	6.00

Table 6.5 Comparison of Assigned Flows and Traffic Counts – RSI Sites

PM Peak Inbound (Survey Direction) Comparison

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A609	868	724	-144	-17%	5.10
Ilkeston Rd corridor					
B5010	615	604	-11	-2%	0.45
A52	2045	2071	26	1%	0.57
A6005	1328	1439	111	8%	2.98
Derby Rd corridor	3988	4114	126	3%	1.98
Western Screenline	4856	4838	-18	0%	0.26
A453	1120	1170	50	4%	1.48
Nottingham Road, Gotham	349	270	-79	-23%	4.49
A453 corridor	1469	1440	-29	-2%	0.76
A60	735	659	-76	-10%	2.88
A606	359	299	-60	-17%	3.31
A46	1579	1955	376	24%	8.94
South eastern corridor	2673	2913	240	9%	4.54
Southern Screenline	4142	4353	211	5%	3.24
A52 (Gamston)	972	927	-45	-5%	1.46
A 6514 (Middleton Boulevard)	2239	2337	98	4%	2.05

Table 6.6 Road Traffic assigned Flows and Counts

PM Peak Outbound (Non-survey Direction) Comparison

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A609	1008	866	-142	-14%	4.64
Ilkeston Rd corridor					
B5010	594	608	14	2%	0.57
A52	2244	2389	145	6%	3.01
A6005	1424	1465	41	3%	1.08
Derby Rd corridor	4262	4462	200	5%	3.03
Western Screenline	5270	5328	58	1%	0.80
A453	1169	1224	55	5%	1.59
Nottingham Road, Gotham	401	454	53	13%	2.56
A453 corridor	1570	1678	108	7%	2.68
A60	1009	999	-10	-1%	0.32
A606	375	345	-30	-8%	1.58
A46	1002	1244	242	24%	7.22
South eastern corridor	2386	2588	202	8%	4.05
Southern Screenline	3956	4266	310	8%	4.83
A52 (Gamston)	1477	1233	-244	-17%	6.63
A 6514 (Middleton Boulevard)	2820	2698	-122	-4%	2.32

The following conclusions can be drawn from these tables.

- The model meets all DMRB criteria for screenlines for all time periods and directions
- For the majority of links the model meets all DMRB criteria for all time periods and directions
- A few individual links fall outside the criteria suggested by DMRB. Although these are not felt to be significant, the key differences are outlined below

AM Peak

Inbound

- The A609 is 1% outside the limit and the GEH marginally over 5, but peripheral to the study area so acceptable
- The A46 exceeds the desired percentage by 10% and GEH over 5, however the screenline total is ok. Slight underassignments on the A60 and A606 are balanced by overassignment on the A46
- The A52 Gamston site is slightly over the desired values, but very small differences.

Outbound

- The A609 is again just over the limits but peripheral to the study area
- The A60, A606 and A46 are all just over the desirable values individually, although the screenline is well within. As such felt to be acceptable.

Interpeak

Inbound and Outbound

- Only one link outside the limit in both directions (A6514) and the difference is small, so considered unimportant.

PM Peak

Inbound and Outbound

- The A609 just over the individual link percentage difference, and GEH so close to 5 as to be unimportant.
- The A46 exceeds the percentage and GEH criteria due to overassignment, in part offset by the A60 underassignment. No adverse affects on the A453 and A52 (Derby Road) alternative routes, which are both slightly overassigned as well. Therefore the difference is felt to be acceptable for the models purpose.
- The A52 at Gamston is only marginally outside the criteria for the outbound direction, and as such is felt to be acceptable.

6.2.3 Motorway Sites Validation

A further set of tables 6.7 to 6.9 give a comparison between the assignment results from the model and the ATC data from sites on the M1 and various roads around junction 23a,24 and 24a of the M1.

These sites show a slightly more variable pattern than the calibration sites, and the main conclusions may be summarised as follows:.

AM Peak

- The links in the immediate study area around Junctions 23a and 24 of the M1 generally show good levels of validation within the DMRB criteria, including the A42 approach to Junction 23a.
- Traffic on the A50 approach to junction 24 is less well validated. This route includes a high proportion of NW to SE traffic that is more difficult to model in the context of the A453. Most origins and destinations are well outside the modelled area.
- Other sites more distant from the study area (around junction 29 of the M1 for example) are of much less importance this study. The surveys showed very little traffic from the M1 north of Nottingham using the A453 approach to Nottingham.
- Similarly very little traffic on the A6 north of Kegworth is destined for Nottingham on the A453 and as such this link is underassigned.

Interpeak

- A similar picture to the AM peak can be seen in the interpeak, although A50 traffic approaching Junction 24 is within the DMRB limits.
- Motorway traffic is generally much more closely matched than in the AM peak

PM peak

- Again a very similar pattern to the AM peak with slightly higher differences on the M1 near near to Junction 25.
- The A42 shows a particularly good validation in both directions.

Table 6.7 Comparison of Assigned Flows and Traffic Counts - Motorway Sites - AM Peak

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A42 (Southwest of M1 J23a) Northeastbound	2084	2231	147	7%	3.16
A6 JCT 24 M1 North of Kegworth	874	1103	229	26%	7.28
A50 Slip M1 J24A	2565	3516	951	37%	17.25
A42 (Southwest of M1 J23a) Southwestbound	2113	2270	157	7%	3.35
A6 JCT 24 M1 North of Kegworth	1010	1119	109	11%	3.34
A50 Slip M1 J24A	3074	3330	256	8%	4.52
M1 J23A-23	4730	4697	-33	-1%	0.48
M1 J23-23A	4095	4038	-57	-1%	0.89
M1 J24A-25	4909	4836	-73	-1%	1.05
M1 J25-24A	6049	5324	-725	-12%	9.61
M1 J27-26	5544	4556	-988	-18%	13.90
M1 J26-27	4383	3974	-409	-9%	6.33
M1 J29-28	5663	4040	-1623	-29%	23.30
M1 J28-29	4746	2732	-2014	-42%	32.94
M1 J30-29	5024	4039	-985	-20%	14.63
M1 J29-30	4470	2734	-1736	-39%	28.93

Table 6.8 Comparison of Assigned Flows and Traffic Counts - Motorway Sites – Interpeak

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A42 (Southwest of M1 J23a) Northeastbound	1764	1760	-4	0%	0.10
A6 JCT 24 M1 North of Kegworth	535	393	-142	-27%	6.59
A50 Slip M1 J24A	1618	1458	-160	-10%	4.08
A42 (Southwest of M1 J23a) Southwestbound	1744	1754	10	1%	0.24
A6 JCT 24 M1 North of Kegworth	492	435	-57	-12%	2.65
A50 Slip M1 J24A	1264	1286	22	2%	0.62
M1 J23A-23	2783	2732	-51	-2%	0.97
M1 J23-23A	2733	2644	-89	-3%	1.72
M1 J24A-25	3225	4061	836	26%	13.85
M1 J25-24A	3374	4063	689	20%	11.30
M1 J27-26	3176	3442	266	8%	4.62
M1 J26-27	3163	3440	277	9%	4.82
M1 J29-28	3345	2548	-797	-24%	14.68
M1 J28-29	3208	2520	-688	-21%	12.86
M1 J30-29	3197	2547	-650	-20%	12.13
M1 J29-30	3032	2525	-507	-17%	9.62

Table 6.9 Comparison of Assigned Flows and Traffic Counts - Motorway Sites - PM Peak

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A42 (Southwest of M1 J23a) Northeastbound	2499	2536	37	1%	0.74
A6 JCT 24 M1 North of Kegworth	1107	939	-168	-15%	5.25
A50 Slip M1 J24A	3088	3215	127	4%	2.26
A42 (Southwest of M1 J23a) Southwestbound	2301	2324	23	1%	0.48
A6 JCT 24 M1 North of Kegworth	873	1220	347	40%	10.73
A50 Slip M1 J24A	2267	3780	1513	67%	27.52
M1 J23A-23	4422	4374	-48	-1%	0.72
M1 J23-23A	4720	4545	-175	-4%	2.57
M1 J24A-25	5830	5424	-406	-7%	5.41
M1 J25-24A	5162	5191	29	1%	0.40
M1 J27-26	4503	4033	-470	-10%	7.19
M1 J26-27	4801	4701	-100	-2%	1.45
M1 J29-28	4942	3257	-1685	-34%	26.32
M1 J28-29	5717	3973	-1744	-31%	25.06
M1 J30-29	4597	3179	-1418	-31%	22.74
M1 J29-30	5240	3870	-1370	-26%	20.30

6.2.4 Validation with Independent Counts

As outlined in 4.4.2 the second stage of comparison involves the comparison of modelled traffic flows and independently collected counts at a number of sites across the study area, and at selected sites outside it. The data was collected by Nottingham City Council and Nottinghamshire County Council. Table 6.10 to 6.12 give the comparisons for these sites.

Table 6.10 Comparison of Assigned Flows and Traffic Counts - Independent Sites - AM Peak

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A6200 Derby Rd West of A6130 Lenton Blvd Eastbound	816	1595	779	95%	22.44
A6200 Derby Rd West of A6130 Lenton Blvd Westbound	1076	1030	-46	-4%	1.42
A6005 Abbey Bridge Southwest of A6130 Lenton Blvd Northeast bound	749	1004	255	34%	8.61
A6005 Abbey Bridge Southwest of A6130 Lenton Blvd Southwest bound	941	1096	155	16%	4.86
A6005 Bye Pass Road, Chilwell (inbound)	1640	1307	-333	-20%	8.67
A6005 Bye Pass Road, Chilwell (outbound)	723	592	-131	-18%	5.11
A453 Queens Dr Southwest of Castle Bridge Rd (inbound)	1304	1654	350	27%	9.10
A453 Queens Dr Southwest of Castle Bridge Rd (outbound)	1130	882	-248	-22%	7.82
Kirk lane, Ruddington (eastbound)	335	490	155	46%	7.63
Kirk lane, Ruddington (westbound)	391	315	-76	-19%	4.05
A453 Ratcliffe on Soar (Eastbound)	1061	1060	-1	0%	0.03
A453 Ratcliffe on Soar (Westbound)	1016	1018	2	0%	0.06
Woodborough Rd northeast of A60 Huntingdon St (Southwest bound)	663	580	-83	-13%	3.33
Woodborough Rd northeast of A60 Huntingdon St (Northeast bound)	290	336	46	16%	2.60
St Ann's Well Rd North of Bath St (Inbound)	442	565	123	28%	5.48
St Ann's Well Rd North of Bath St (Outbound)	362	676	314	87%	13.78

Table 6.11 Comparison of Assigned Flows and Traffic Counts - Independent Sites – Interpeak

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A6200 Derby Rd West of A6130 Lenton Blvd Eastbound	624	925	301	48%	10.82
A6200 Derby Rd West of A6130 Lenton Blvd Westbound	883	901	18	2%	0.60
A6005 Abbey Bridge Southwest of A6130 Lenton Blvd Northeast bound	633	792	159	25%	5.96
A6005 Abbey Bridge Southwest of A6130 Lenton Blvd Southwest bound	791	920	129	16%	4.41
A6005 Bye Pass Road, Chilwell (inbound)	780	657	-123	-16%	4.59
A6005 Bye Pass Road, Chilwell (outbound)	700	698	-2	0%	0.08
A453 Queens Dr Southwest of Castle Bridge Rd(inbound)	1003	642	-361	-36%	12.59
A453 Queens Dr Southwest of Castle Bridge Rd(outbound)	1043	794	-249	-24%	8.22
Kirk lane, Ruddington(eastbound)	211	116	-95	-45%	7.43
Kirk lane, Ruddington(westbound)	241	89	-152	-63%	11.83
A453 Ratcliffe on Soar (Eastbound)	725	847	122	17%	4.35
A453 Ratcliffe on Soar (Westbound)	790	776	-14	-2%	0.50
Woodborough Rd northeast of A60 Huntingdon St (Southwest bound)	400	359	-41	-10%	2.10
Woodborough Rd northeast of A60 Huntingdon St (Northeast bound)	378	422	44	12%	2.20
St Ann's Well Rd North of Bath St (Inbound)	250	250	0	0%	0.00
St Ann's Well Rd North of Bath St (Outbound)	351	468	117	33%	5.78

Table 6.12 Comparison of Assigned Flows and Traffic Counts - Independent Site - PM Peak

Site	Observed Count	Modelled Flow	Difference	% Difference	GEH
A6200 Derby Rd West of A6130 Lenton Blvd Eastbound	836	1201	365	44%	11.44
A6200 Derby Rd West of A6130 Lenton Blvd Westbound	1159	1397	238	21%	6.66
A6005 Abbey Bridge Southwest of A6130 Lenton Blvd Northeast bound	868	800	-68	-8%	2.35
A6005 Abbey Bridge Southwest of A6130 Lenton Blvd Southwest bound	1090	1225	135	12%	3.97
A6005 Bye Pass Road, Chilwell (inbound)	1038	898	-140	-13%	4.50
A6005 Bye Pass Road, Chilwell (outbound)	1371	1005	-366	-27%	10.62
A453 Queens Dr Southwest of Castle Bridge Rd(inbound)	1175	755	-420	-36%	13.52
A453 Queens Dr Southwest of Castle Bridge Rd(outbound)	1506	1337	-169	-11%	4.48
Kirk lane, Ruddington(eastbound)	390	485	95	24%	4.54
Kirk lane, Ruddington(westbound)	483	412	-71	-15%	3.36
A453 Ratcliffe on Soar (Eastbound)	1028	1137	109	11%	3.31
A453 Ratcliffe on Soar (Westbound)	1021	1196	175	17%	5.26
Woodborough Rd northeast of A60 Huntingdon St (Southwest bound)	435	430	-5	-1%	0.24
Woodborough Rd northeast of A60 Huntingdon St (Northeast bound)	820	678	-142	-17%	5.19
St Ann's Well Rd North of Bath St (Inbound)	291	294	3	1%	0.18
St Ann's Well Rd North of Bath St (Outbound)	705	980	275	39%	9.47

These independent sites also show a mixed picture.

AM peak

Inbound and outbound

- Flows on the A453 are comfortably within the DMRB limits, (almost zero)
- Flows on Derby Road, the A6005 Abbey Bridge and A453 Queens Drive all exceed observed counts, however this may be caused by incompatibility between counts outside and inside the ring road.
- Kirk Lane at Ruddington appears to be overassigned with high percentage differences and GEH values, however absolute differences are smaller, only just outside the DMRB guidelines.

Interpeak

Inbound and outbound

- Validation is generally much better than in the AM peak, with many links within the DMRB guidelines
- Kirk Lane Ruddington is a low flow road , where limits are only just exceeded.

PM peak

Inbound and Outbound

- Again modelled flows in both directions on the A6200 Derby Road exceed observed values
- The important outbound flow on the A453 Queens Drive is however within DMRB criteria.
- The A453 site at Ratcliffe on Soar only marginally exceeds the guidelines, and is considered to be acceptable
- Although peripheral to the study, sites on the east side of the City centre are within or very close to the DMRB criteria.

Overall, the validation was acceptable at locations important to the A453 corridor appraisal.

6.2.5 Comparison between Modelled and Surveyed Journey Times

Journey time measurements for passenger cars were undertaken on four routes as described in section 2.2.4. A comparison between the surveyed journey times and the modelled times is given in Figure 6.1. For both directions of the four routes values are compared for the morning peak, the interpeak situation and the afternoon peak. The 95th percentile of the observed value has been used as the point against which to compare the modelled journey time. These confidence limits illustrate how good the fit is between the modelled journey time and the observed times. In Figure 6.1 the high and low limits of the bars represent the 95% confidence limits above and below the mean observed journey time.

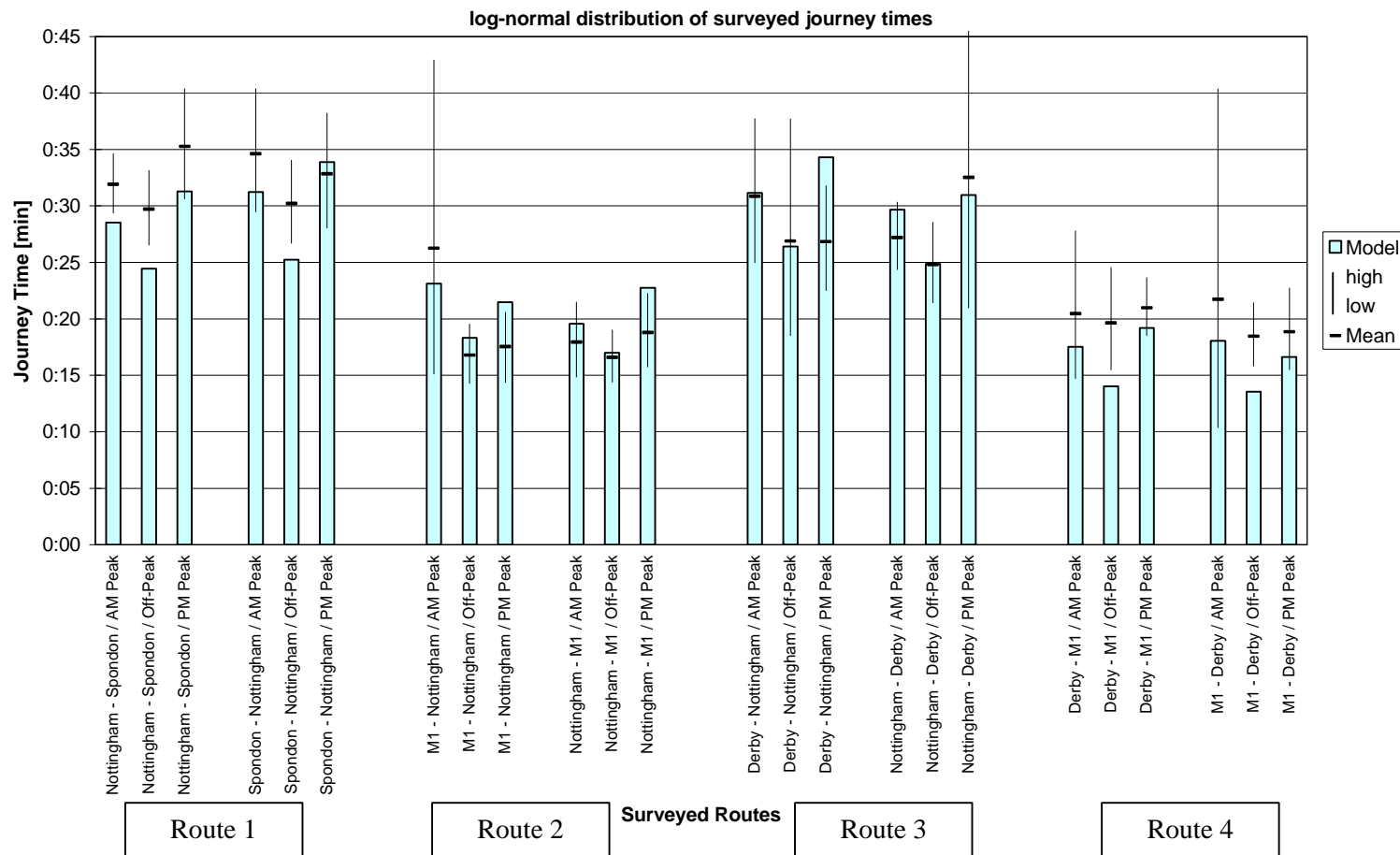


Figure 6.1 : Comparison between Surveyed and Modelled Journey Times

6.2.4 Select link analysis

An example of the select link analysis is given in Figures 6.2 to 6.5. Figures 6.2 and 6.3 show the composition of the AM peak hour traffic flow on the A453 to the southwest of Clifton (inbound and outbound respectively). These show a pattern generally in line with expectation.

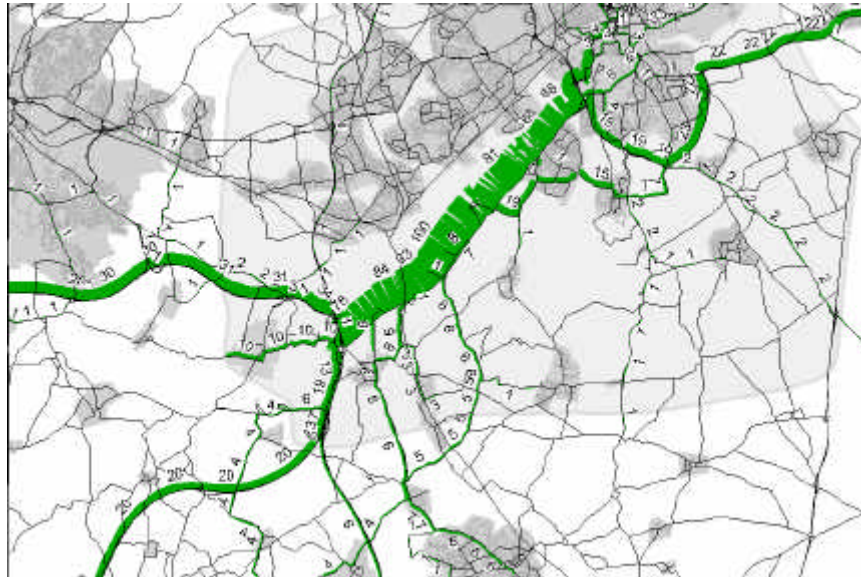


Figure 6.2: Traffic Flow Composition (%) - A453 Southwest of Clifton AM Peak Inbound

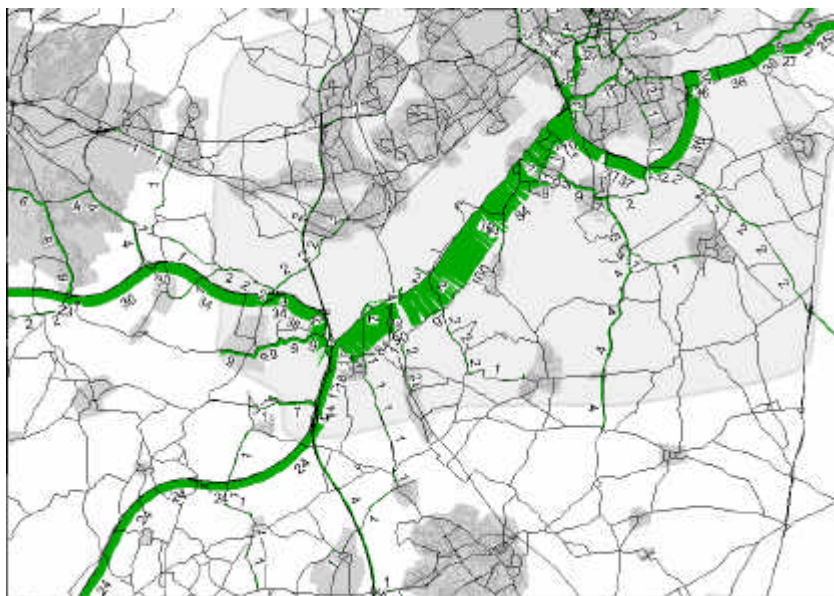


Figure 6.3: Traffic Flow Composition (%) - A453 Southwest of Clifton AM Peak Outbound

6.3 PUBLIC TRANSPORT ASSIGNMENT AND VALIDATION

6.3.1 Introduction

Results from various surveys have been used to calibrate and validate the Public Transport Model. For the Inner Model Area the demand is derived using the synthetic model whilst external movements are modelled based on results of the bus and rail surveys. Both matrices are combined and assigned to the Public Transport network.

The assignment procedure is linebased with average calculations of waiting times at transfers between lines. In the context of this model, a bus line would more commonly be referred to as a bus route.

Similarly to the situation for road traffic, assigned flows at any point on the network comprise a blend of synthesised and directly surveyed movements.

6.3.2 Bus Passengers

The assignment model was calibrated against bus passenger survey data which were collected specifically for the A453 Multi-modal study and other data made available by Nottingham City Council. The validation has also been made using this data, since independent data is not available for public transport. These validation sites can be put together into the outer and the inner screenlines illustrated in figure 2.6. The data collected specifically for the A453 Multi-modal study was used for the outer screenline comparison.

Results are given below in Table 6.13 – Table 6.18 in numerical form and in figures 6.6 to 6.8. A key issue in these comparisons is the recognition of the considerable variability associated with surveys of this type. For this reason comparisons have been made against the actual range of observed values. Were statistical analysis to be applied, the range at the 95% confidence would be significantly wider than that shown.

While the percentage values seem rather high in a number of cases it should be kept in mind, that the absolute values are generally small. In general, the inner screenline performs better than the outer screenline. The inner screenline has a very good comparison in the morning peak inbound and in the evening peak outbound in particular. Comparisons are also acceptable for the opposite directions in these time periods. Given the inherent variability of single day counts, and other difficulties with collecting bus patronage data, the comparisons for all the screenlines in all time periods can be considered to be acceptable.

AM Peak Bus

Inbound

- At the screenline level all modelled totals fall within the range of the two surveys, which suggests a good level of validation.
- At the most important individual links (including the A52, A453 Clifton Lane and Nottingham Road, Gotham) the comparisons are all very good.

Outbound

- The outer screenline modelled total is slightly lower than the range of surveys, although still within 25% of both surveys.
- The B5010 site is quite remote from the main study area, with low flows and as such the difference can be tolerated.
- Most other sites fall within the observed ranges.

Interpeak Bus

Inbound

- Generally much lower volumes of passengers so more difficult to achieve low percentage differences
- A453 Clifton Lane and A52 Derby Road both acceptable, other links small absolute differences.

Outbound

- All screenlines within observed ranges.
- Most links within observed ranges.

PM peak

Inbound

- All screenlines within observed ranges.
- A609 high and A52 low, so some slight mis-assignment possible.

Outbound

- All screenlines within observed ranges.
- A453 Clifton Lane just outside range, but only 4% below the observed

As outlined earlier public transport survey results are subject to a high degree of variability. As such the comparison between modelled and observed flows should be less rigorous than normally considered for road traffic.

6.3.3 Rail Passengers

Rail data was collected as outlined in para 2.3.5.1, in conjunction with the rail operators. This data was used to calibrate and validate the assignment model, hence there is no independent data (as was the case with buses) for validation. Tables 6.19 to Table 6.21 illustrate the comparison between the observed boarding and alighting passenger count data and the assigned flows for the 3 time periods.

As can be seen from these comparisons it can be concluded that the rail part of the model is now well validated. The very low levels of patronage at Attenborough have proved difficult to replicate, although the absolute differences are small.

**Table 6.13 Bus Passenger Assigned Flows and Counts
AM Peak Inbound Comparison**

SITE	Observed Count	Modelled Flow	Difference	% Difference
A609 Ilkeston Rd	133	138	5	4%
B5010 Sandiacre/Stapleford	52	118	66	127%
A6005 Toton Arches	243 ... 355	197	-46 ... -158	-19% ... -45%
A453 Barton Lane	1	3	2	200%
Nottingham Road, Gotham	94	100	6	6%
Outer Screenline Total	523 ... 635	556	33 ... -79	6% ... -12%
A609 Wollaton Rd	272	206	-66	-24%
A52 Derby Road	572 ... 878	778	206 ... -100	36% ... -11%
University Campus	20	10	-10	-50%
A6005 University Boulevard	244 ... 587	171	-73 ... -416	-30% ... -71%
<i>Beeston Corridor Total</i>	<i>1108 ... 1757</i>	<i>1165</i>	<i>57 ... -592</i>	<i>5% ... -34%</i>
A453 Clifton Lane	556 ... 424	514	-42 ... 90	-8% ... 21%
B680 Wilford Rd/Ruddington Lane	37 ... 38	25	-12 ... -13	-32% ... -34%
A60 Near Ruddington	88	59	-29	-33%
A606 Tollerton/A52 Ring Road	143	169	26	18%
<i>Southern Corridor Sub-total</i>	<i>824 ... 693</i>	<i>767</i>	<i>-57 ... 74</i>	<i>-7% ... 11%</i>
Inner Screenline Total	1932 ... 2450	1932	0 ... -518	0% ... -21%

**Table 6.14 Bus Passenger Assigned Flows and Counts
AM Peak Outbound Comparison**

SITE	Observed Count	Modelled Flow	Difference	% Difference
A609 Ilkeston Rd	53	63	10	19%
B5010 Sandiacre/Stapleford	68	27	-41	-60%
A6005 Toton Arches	96 ... 107	109	13 ... 2	14% ... 2%
A453 Barton Lane	0	0	0	0%
Nottingham Road, Gotham	106	91	-15	-14%
Outer Screenline Total	323 ... 334	290	-33 ... -44	-10% ... -13%
A609 Wollaton Rd	106	178	72	68%
A52 Derby Road	136 ... 213	164	28 ... -49	21% ... -23%
University Campus	17	6	-11	-65%
A6005 University Boulevard	65 ... 171	120	55 ... -51	85% ... -30%
<i>Beeston Corridor Total</i>	<i>324 ... 507</i>	<i>468</i>	<i>144 ... -39</i>	<i>44% ... -8%</i>
A453 Clifton Lane	155 ... 220	203	48 ... -17	31% ... -8%
B680 Wilford Rd/Ruddington Lane	2 ... 12	3	1 ... -9	50% ... -75%
A60 Near Ruddington	19	3	-16	-84%
A606 Tollerton/A52 Ring Road	29	12	-17	-59%
<i>Southern Corridor Sub-total</i>	<i>205 ... 280</i>	<i>221</i>	<i>16 ... -59</i>	<i>8% ... -21%</i>
Inner Screenline Total	529 ... 787	689	160 ... -98	30% ... -12%

**Table 6.15 Bus Passenger Assigned Flows and Counts
Interpeak Inbound Comparison**

SITE	Observed Count	Modelled Flow	Difference	% Difference
A609 Ilkeston Rd	70	58	-12	-17%
B5010 Sandiacre/Stapleford	30	25	-5	-17%
A6005 Toton Arches	75 ... 95	53	-22 ... -42	-29% ... -44%
A453 Barton Lane	1	2	1	100%
Nottingham Road,Gotham	31	28	-3	-10%
Outer Screenline Total	207 ... 227	166	-41 ... -61	-20% ... -27%
A609 Wollaton Rd	119	118	-1	-1%
A52 Derby Road	257 ... 395	209	-48 ... -186	-19% ... -47%
University Campus	27	7	-20	-74%
A6005 University Boulevard	52 ... 301	144	92 ... -157	177% ... -52%
<i>Beeston Corridor Total</i>	<i>455 ... 842</i>	<i>478</i>	<i>23 ... -364</i>	<i>5% ... -43%</i>
A453 Clifton Lane	504 ... 178	189	-315 ... 11	-63% ... 6%
B680 Wilford Rd/Ruddington Lane	10 ... 5	0	-10 ... -5	-100%
A60 Near Ruddington	43	16	-27	-63%
A606 Tollerton/A52 Ring Road	51	44	-7	-14%
<i>Southern Corridor Sub-total</i>	<i>608 ... 277</i>	<i>249</i>	<i>-359 ... -28</i>	<i>-59% ... -10%</i>
Inner Screenline Total	1063 ... 1119	727	-336 ... -392	-32% ... -35%

**Table 6.16 Bus Passenger Assigned Flows and Counts
Interpeak Outbound Comparison**

SITE	Observed Count	Modelled Flow	Difference	% Difference
A609 Ilkeston Rd	49	65	16	33%
B5010 Sandiacre/Stapleford	37	27	-10	-27%
A6005 Toton Arches	70 ... 97	64	-6 ... -33	-9% ... -34%
A453 Barton Lane	0	0	0	0%
Nottingham Road,Gotham	23	34	11	48%
Outer Screenline Total	179 ... 206	190	11 ... -16	6% ... -8%
A609 Wollaton Rd	100	95	-5	-5%
A52 Derby Road	284 ... 303	306	22 ... 3	8% ... 1%
University Campus	13	12	-1	-8%
A6005 University Boulevard	61 ... 211	201	140 ... -10	230% ... -5%
<i>Beeston Corridor Total</i>	<i>458 ... 627</i>	<i>614</i>	<i>156 ... -13</i>	<i>34% ... -2%</i>
A453 Clifton Lane	303 ... 248	216	-87 ... -32	-29% ... -13%
B680 Wilford Rd/Ruddington Lane	18 ... 5	0	-18 ... -5	-100%
A60 Near Ruddington	24	20	-4	-17%
A606 Tollerton/A52 Ring Road	39	45	6	15%
<i>Southern Corridor Sub-total</i>	<i>384 ... 316</i>	<i>281</i>	<i>-103 ... -35</i>	<i>-27% ... -11%</i>
Inner Screenline Total	842 ... 943	895	53 ... -48	6% ... -5%

**Table 6.17 Bus Passenger Assigned Flows and Counts
PM Peak Inbound Comparison**

SITE	Observed Count	Modelled Flow	Difference	% Difference
A609 Ilkeston Rd	76	80	4	5%
B5010 Sandiacre/Stapleford	35	31	-4	-11%
A6005 Toton Arches	83 ... 106	119	36 ... 13	43% ... 12%
A453 Barton Lane	0	0	0	0%
Nottingham Road,Gotham	71	67	-4	-6%
Outer Screenline Total	265 ... 288	297	32 ... 9	12% ... 3%
A609 Wollaton Rd	60	160	100	167%
A52 Derby Road	266 ... 367	187	-79 ... -180	-30% ... -49%
University Campus	22	10	-12	-55%
A6005 University Boulevard	74 ... 250	147	73 ... -103	99% ... -41%
<i>Beeston Corridor Total</i>	<i>422 ... 699</i>	<i>504</i>	<i>82 ... -195</i>	<i>19% ... -28%</i>
A453 Clifton Lane	287 ... 178	208	-79 ... 30	-28% ... 17%
B680 Wilford Rd/Ruddington Lane	12 ... 5	1	-11 ... -4	-92% ... -80%
A60 Near Ruddington	33	12	-21	-64%
A606 Tollerton/A52 Ring Road	76	31	-45	-59%
<i>Southern Corridor Sub-total</i>	<i>408 ... 292</i>	<i>252</i>	<i>-156 ... -40</i>	<i>-38% ... -14%</i>
Inner Screenline Total	830 ... 991	756	-74 ... -235	-9% ... -24%

**Table 6.18 Bus Passenger Assigned Flows and Counts
PM Peak Outbound Comparison**

SITE	Observed Count	Modelled Flow	Difference	% Difference
A609 Ilkeston Rd	144	147	3	2%
B5010 Sandiacre/Stapleford	67	70	3	4%
A6005 Toton Arches	169 ... 264	169	0 ... -95	0% ... -36%
A453 Barton Lane	1	17	16	1600%
Nottingham Road,Gotham	80	79	-1	-1%
Outer Screenline Total	461 ... 556	482	21 ... -74	5% ... -13%
A609 Wollaton Rd	330	270	-60	-18%
A52 Derby Road	876 ... 803	605	-271 ... -198	-31% ... -25%
University Campus	12	23	11	92%
A6005 University Boulevard	89 ... 594	397	308 ... -197	346% ... -33%
<i>Beeston Corridor Total</i>	<i>1307 ... 1739</i>	<i>1295</i>	<i>-12 ... -444</i>	<i>-1% ... -26%</i>
A453 Clifton Lane	598 ... 550	527	-71 ... -23	-12% ... -4%
B680 Wilford Rd/Ruddington Lane	28 ... 41	1	-27 ... -40	-96% ... -98%
A60 Near Ruddington	61	38	-23	-38%
A606 Tollerton/A52 Ring Road	146	116	-30	-21%
<i>Southern Corridor Sub-total</i>	<i>833 ... 798</i>	<i>682</i>	<i>-151 ... -116</i>	<i>-18% ... -15%</i>
Inner Screenline Total	2140 ... 2537	1977	-163 ... -560	-8% ... -22%

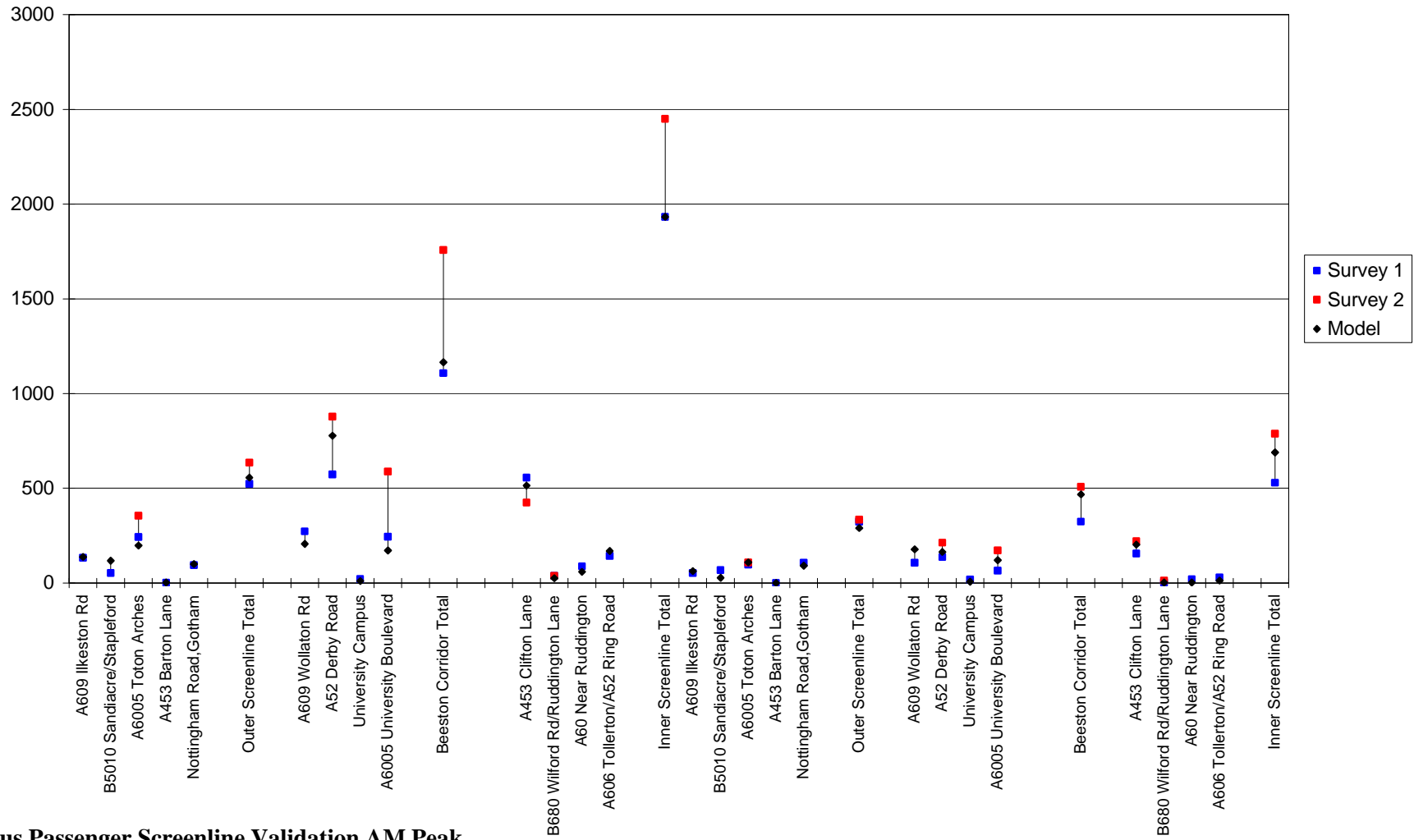


Figure 6.6 Bus Passenger Screenline Validation AM Peak

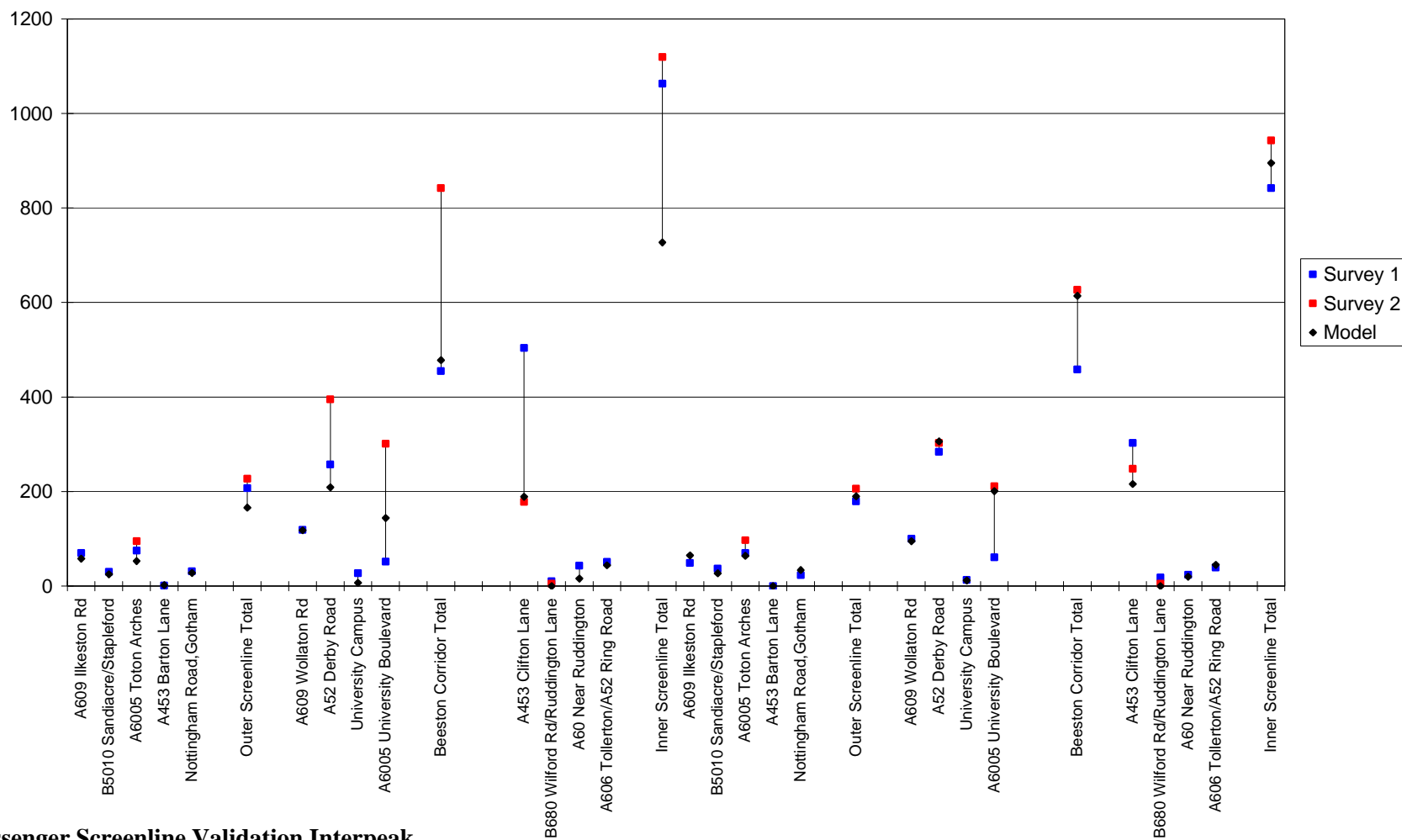


Figure 6.7 Bus Passenger Screenline Validation Interpeak

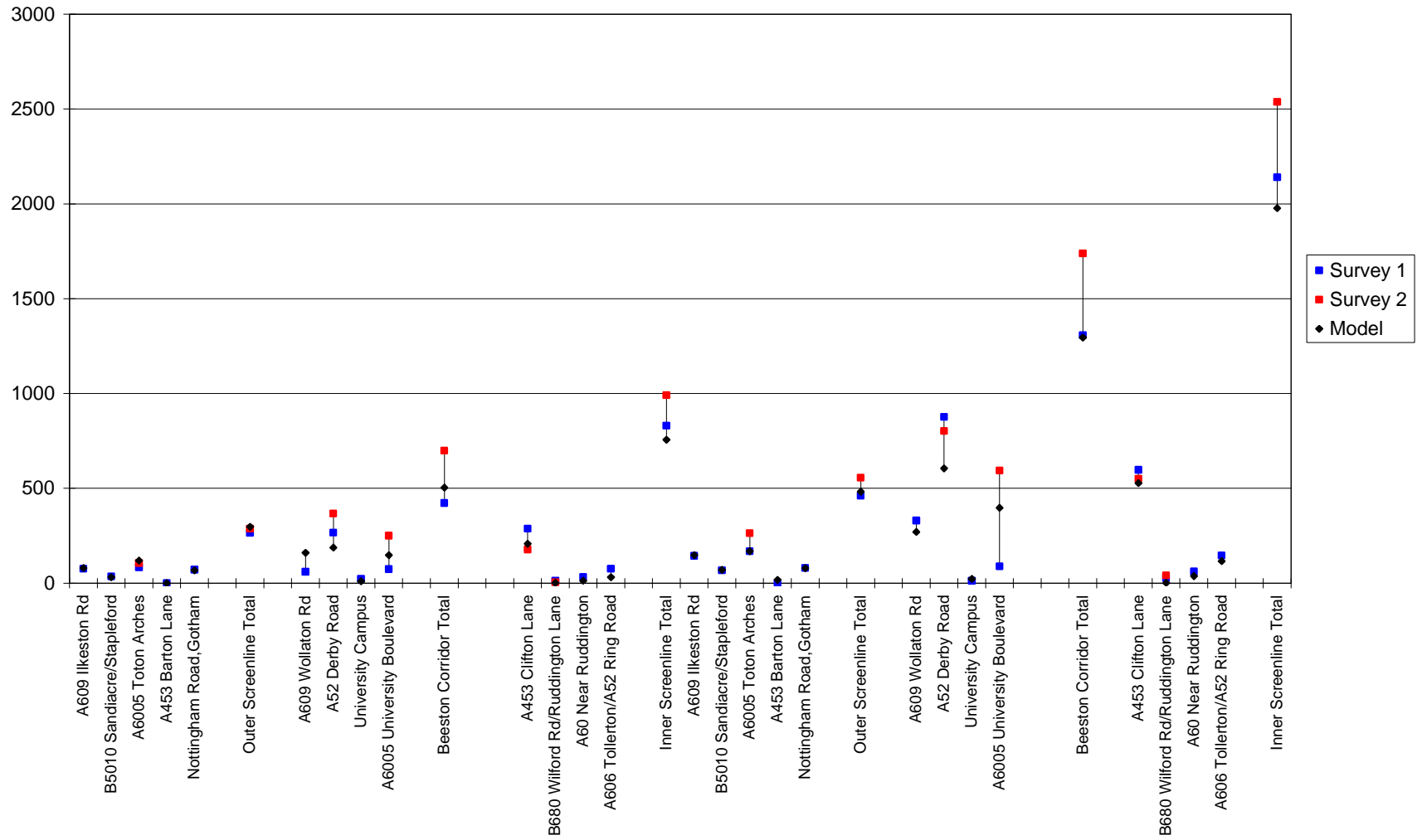


Figure 6.8 Bus Passenger Screenline Validation PM Peak

**Table 6.19 Rail Passenger Alighting and Boarding Flows and Counts
Comparison - AM Peak**

AM peak	Observed		Modelled		Difference		%Difference	
	alighting	boarding	alighting	boarding	alighting	boarding	alighting	boarding
Station								
Attenborough	3	29	0	39	-3	10	-100%	35%
Beeston	72	142	63	120	-9	-22	-13%	-16%
Long Eaton	15	285	3	335	-12	50	-80%	18%
Loughborough	116	135	97	130	-19	-5	-17%	-4%
Nottingham	1062	566	1082	556	20	-10	2%	-2%

**Table 6.20 Rail Passenger Alighting and Boarding Flows and Counts
Comparison – Interpeak**

Off Peak	Observed		Modelled		Difference		%Difference	
	alighting	boarding	alighting	boarding	alighting	boarding	alighting	boarding
Station								
Attenborough	1	0	0	9	-1	9	-100%	2600%
Beeston	17	26	14	21	-3	-5	-18%	-18%
Long Eaton	24	27	29	43	5	16	23%	59%
Loughborough	48	62	51	59	3	-3	6%	-5%
Nottingham	378	309	395	290	17	-19	4%	-6%

**Table 6.21 Rail Passenger Alighting and Boarding Flows and Counts
Comparison - PM Peak**

PM Peak	Observed		Modelled		Difference		%Difference	
	alighting	boarding	alighting	boarding	alighting	boarding	alighting	boarding
Station								
Attenborough	19	7	12	7	-7	0	-35%	-3%
Beeston	77	77	61	105	-16	28	-21%	37%
Long Eaton	186	25	111	43	-75	18	-40%	75%
Loughborough	146	107	141	110	-5	3	-4%	2%
Nottingham	589	1094	536	1132	-53	38	-9%	3%