Rugby Wide Area Paramics Model

Dunchurch Calibration Count Comparison

Introduction

1. The following note presents an overview of the Rugby Wide Area (RWA) Paramics Microsimulation model development with a specific focus on the level of model calibration and validation in the Dunchurch area of the model network

2. The first part of the note details the steps taken to ensure the model conforms to relevant modelling guidance, whilst reflecting weekday on street conditions accurately. The second part of the note provides a comparison of the modelled count data against data recently collected within Dunchurch by Dunchurch Parish Council.

3. This note is intended to demonstrate that the 2016 RWA Base Model is fit for purpose, and highly reflective of on-street conditions, in this instance with a particular focus on the Dunchurch area.

Model Development Criteria

4. The following section provides an overview of the WebTAG criteria for model calibration and validation in the context of a model development process. The guidance is set out in the Department for Transport - Transport Analysis Guidance (TAG) Unit 3.1 – Highway Assignment Modelling, and was utilised in the development of the Rugby Wide Area Paramics model.

Validation Criteria and Acceptability Guidelines

5. The guidance set out in TAG Unit 3.1, with regards to the development of a model, states that; "the differences between modelled and observed data should be quantified and then assessed using some criteria. The acceptability of the proportion of instances where the criteria are met, should be assessed"[1]

6. The guidance continues to state that the validation of a highway assignment model should include comparisons of the following:

    - Assigned flows and counts totalled for each screenline or cordon, as a check on the quality of the trip matrices;

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[1] TAG Unit 3.1 Highway Assignment Modelling
(https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427124/webtag-tag-unit-m3-1-highway-assignment-modelling.pdf)

- Assigned flows and counts on individual links and turning movements at junctions, as a check on the quality of the assignment; and
- Modelled and observed journey times along routes, as a check on the quality of the network and the assignment

7. With regards to an assessment of the suitability of the model in the Dunchurch area, it is not deemed suitable to review the screenline or cordon count of this section of the model, as the comparison is based on one turning count only (the Dunchurch Crossroads junction count). Screenline and cordon count comparisons for the Rugby Wide Area model wider network were undertaken within the model development, and the results of this analysis were presented within the supporting model validation report.[2]

8. The guidelines for acceptability of the remaining two measures which are applicable in this assessment are set out below:

Link Flow and Turning Movement Calibration

9. A model calibration exercise consists of comparing the observed (surveyed) flows against the modelled flows on the network, specifically reviewing the level of convergence between the two sets of flows. For this comparison the assessment measure applied is the GEH statistic, which is a common comparative measure in this context. The formula of the GEH statistic is as follows:

$$GEH = \sqrt{\frac{(O-E)^2}{0.5(O+E)}}$$

Where

O = Observed flow

E = Modelled assigned flow

10. The GEH is a measure that includes both the absolute and the relative difference. The convergence is considered acceptable if the GEH statistic is less than 5 in 85% of data (TAG Unit 3.1 para 3.2.8). It is considered that using this statistic accounts for the potential variability in observed data.

11. The model calibration comparisons were based on an average of 20 random seed model runs in the AM and PM time periods for which the model was developed (0700-1000 and 1600-1900).

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[2] VM165068.R002_Rugby Wide Area LMVR

Journey Time Validation

12. For the purposes of journey time validation, TAG Unit 3.1 states that the validation should be measured by the percentage difference between modelled and observed journey times, subject to an absolute maximum difference.

13. The validation acceptability guidelines for journey times are defined as modelled journey times being within 15% of the surveyed journey times, or 1 minute if higher than 15%.

Dunchurch Crossroads - Calibration and Validation

14. Using the criteria outlined above, the 2016 RWA Base Model was calibrated and validated to turn count, link count and journey time data. The resultant calibration and validation levels in the Dunchurch Crossroads area of the model are summarised within the following section of this note.

Dunchurch Crossroads Calibration

15. In terms of the Dunchurch area of the model, a turn count for the crossroads, which was collected on Tuesday 21st June 2016, was used in the calibration. **Table 1** and **Table 2** set out the resultant model calibration for the Dunchurch Crossroads area of the model network, with full outputs provided in **Appendix A**:

Table 1 Dunchurch Crossroads Calibration – AM Period (0700-1000)

	07:00 to 08:00		08:00 to 09:00		09:00 to 10:00	
Counts:	12		12		12	
GEH ≤ 5	11		12		11	
%	**92%**		**100%**		**92%**	
GEH ≤						
3	8	67%	11	92%	7	58%
4	8	67%	11	92%	10	83%
5	11	92%	12	100%	11	92%
6	11	92%	12	100%	11	92%
7	12	100%	12	100%	12	100%
8	12	100%	12	100%	12	100%
9	12	100%	12	100%	12	100%
10	12	100%	12	100%	12	100%

16. **Table 1** demonstrates the high level of model calibration achieved in the RWA 2016 Base Model at the Dunchurch Crossroad junction, with the TAG calibration criteria exceeded in all modelled hours.

17. The data presented demonstrates that within the AM peak hour, all modelled flows at the junction are within a GEH value of 5 of the surveyed flows. The pre and post peak hours

demonstrate only one instance in each hour of a modelled flow falling outside of the 5 GEH criteria of the surveyed flows.

Table 2 Dunchurch Crossroads Calibration – PM Period (1600-1900)

	16:00 to 17:00		17:00 to 18:00		18:00 to 19:00	
Counts:	12		12		12	
GEH ≤ 5	11		11		12	
%	**92%**		**92%**		**100%**	
GEH ≤						
3	6	50%	10	83%	12	100%
4	9	75%	11	92%	12	100%
5	11	92%	11	92%	12	100%
6	11	92%	12	100%	12	100%
7	12	100%	12	100%	12	100%
8	12	100%	12	100%	12	100%
9	12	100%	12	100%	12	100%
10	12	100%	12	100%	12	100%

18.   **Table 2** again demonstrates the high level of model calibration achieved in the RWA 2016 Base Model at the Dunchurch Crossroad junction, this time in the PM period. As with the AM period, the TAG calibration criteria is exceeded in all PM modelled hours. Where the GEH value is not less than 5 it is 6 which indicates it is still very close.

The data presented demonstrates that in the pre peak and peak hours, there is one instance in each hour of a modelled flow falling outside of the 5 GEH criteria of the surveyed flows. The post peak hour modelled flows fall below the GEH statistic of 5 for each modelled movement.

Calibration Summary

19.   The data presented in **Table 1** and **Table 2** (and **Appendix A**) demonstrates that the RWA 2016 Base Model presents a good representation of the surveyed count data at the Dunchurch Crossroads. Both the AM and PM peak hours demonstrate that the TAG Unit 3.1 guidance on model calibration has been achieved and exceeded.

20.   This is the same data that was used in the Land at Ashlawn Road West appeal[3] which was, at the time, accepted as representative of conditions at the junction.

Dunchurch Crossroads Validation

21.   Observed journey time surveys were collected for the Dunchurch Crossroads area in 2016. The surveys captured a northbound/southbound route, from the A426/Ashlawn Road

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[3] Ref: APP/E3715/W/16/3147448

roundabout to the A426/Sandford Way junction and an eastbound/westbound route from the junction of Coventry Road/Halfway Lane to the B4429/A45 roundabout.

22.   The extent of these routes are demonstrated by **Figure 1**, and the comparison between observed and modelled journey times on these routes is set out in **Table 3** and **Table 4**:

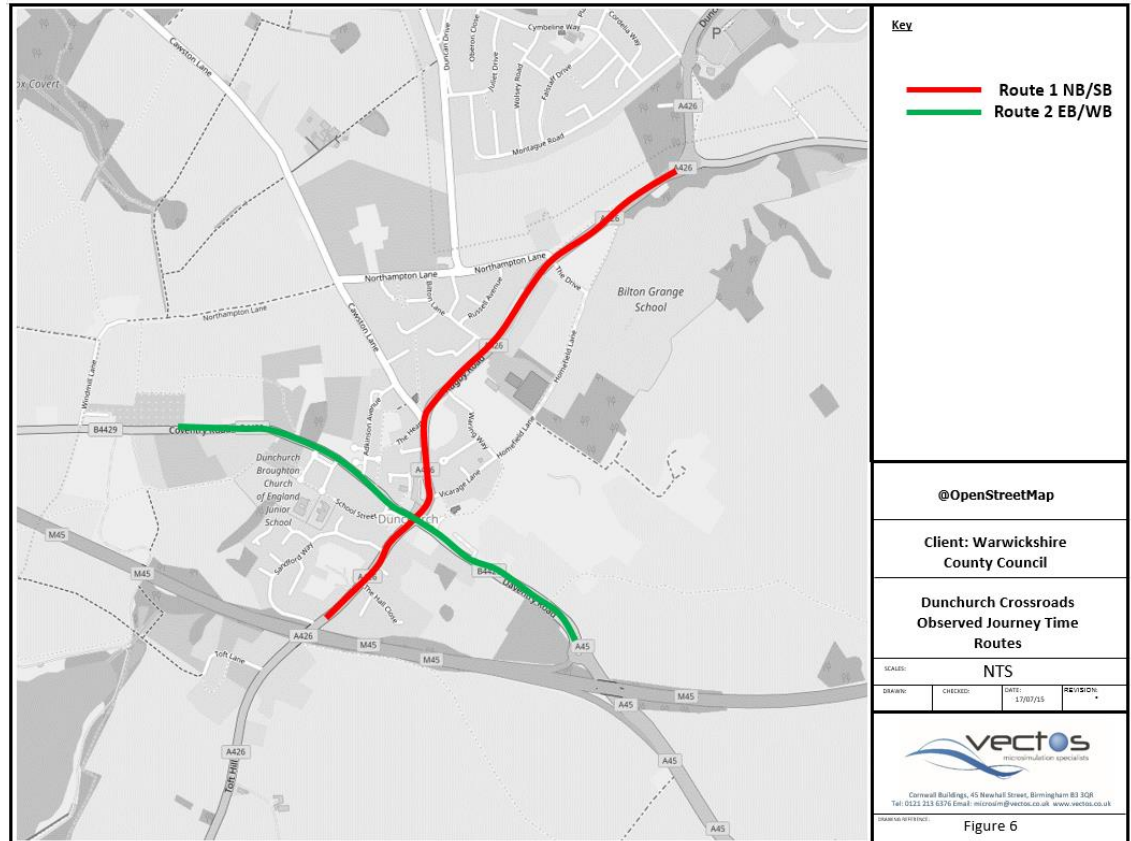**Figure 1 Dunchurch Crossroads Observed Journey Time Routes**

Table 3 – Dunchurch Crossroads Journey Time Validation: AM Period

	Route	OBS (s)	MOD (s)	Diff (s)	Diff (%)	Pass/Fail
0700-0800	Route 1 SB	206	167	39	18.83%	Pass
	Route 1 NB	180	158	22	11.97%	Pass
	Route 2 EB	177	142	35	19.65%	Pass
	Route 2 WB	157	119	38	24.03%	Pass
0800-0900	Route 1 SB	284	292	-8	-2.94%	Pass
	Route 1 NB	244	219	25	10.44%	Pass
	Route 2 EB	209	172	37	17.64%	Pass
	Route 2 WB	151	158	-7	-4.46%	Pass
0900-1000	Route 1 SB	197	172	25	12.72%	Pass
	Route 1 NB	185	171	14	7.68%	Pass
	Route 2 EB	175	153	22	12.82%	Pass
	Route 2 WB	154	135	19	12.53%	Pass

Table 4 - Dunchurch Crossroads Journey Time Validation: PM Period

	Route	OBS (s)	MOD (s)	Diff (s)	Diff (%)	Pass/Fail
1600-1700	Route 1 SB	245	203	42	16.97%	Pass
	Route 1 NB	237	202	35	14.96%	Pass
	Route 2 EB	217	216	1	0.43%	Pass
	Route 2 WB	162	118	44	27.27%	Pass
1700-1800	Route 1 SB	283	307	-24	-8.47%	Pass
	Route 1 NB	271	271	0	-0.03%	Pass
	Route 2 EB	233	245	-12	-5.19%	Pass
	Route 2 WB	164	166	-2	-1.09%	Pass
1800-1900	Route 1 SB	198	173	25	12.41%	Pass
	Route 1 NB	197	195	2	1.16%	Pass
	Route 2 EB	179	173	6	3.16%	Pass
	Route 2 WB	151	126	25	16.60%	Pass

23. The journey time comparisons presented in **Table 3** and **Table 4** reveal that the modelled journey times for the Dunchurch Crossroads validate within the TAG Unit 3.1 criteria of 15% or 1 minute on each approach and all modelled periods.

24. To further support the level of model validation within the Dunchurch area, snapshot analysis was undertaken, comparing the model outputs to Google Traffic 'typical' traffic conditions, in order to ensure that the traffic conditions in this part of the model network are representative of typical conditions.

Figure 2 – Google Typical Traffic vs Model Snapshot (Dunchurch Crossroads: 0830)
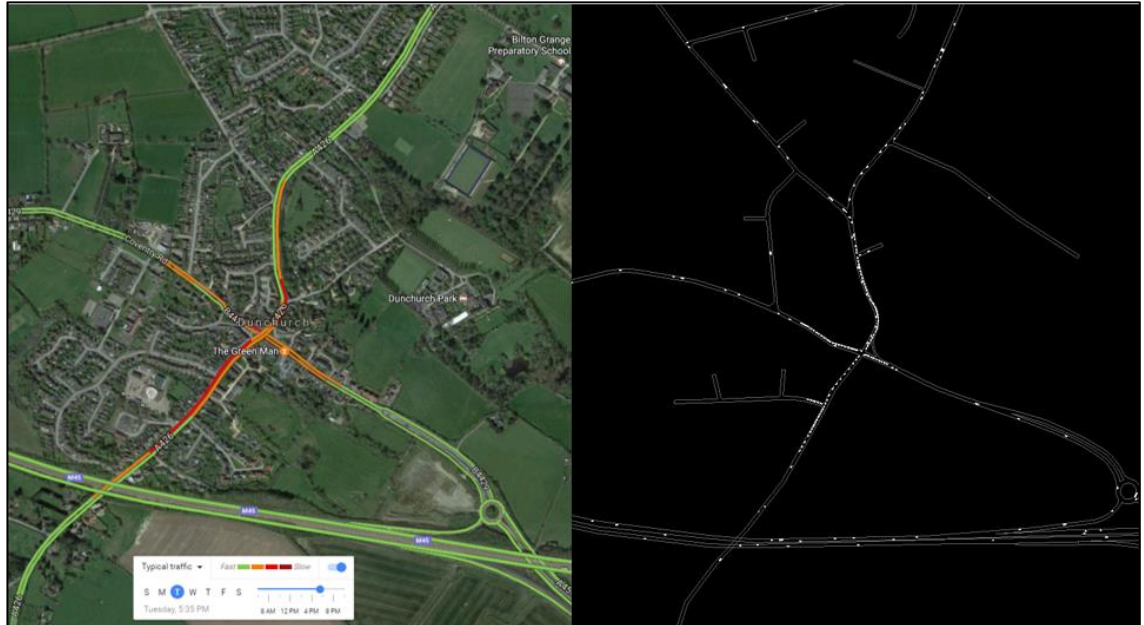

Map data ©2016 Google

25. **Figure 2** demonstrates close similarities between the typical traffic levels in the Dunchurch Crossroads area, and the levels of traffic within the model, during the AM peak time. The plot demonstrates the typical traffic conditions and modelled traffic conditions at 0830AM.

26. The model replicates the queuing/stationary vehicles on the A426 SB approach to the crossroads, with the slow moving vehicles on each other approach also replicated.

Figure 3 - Google Typical Traffic vs Model Snapshot (Dunchurch Crossroads: 1730)

Map data ©2016 Google

27. **Figure 3** again demonstrates close similarities between the typical traffic levels in the Dunchurch Crossroads area, and the levels of traffic within the model, during the PM peak time. The plot demonstrates the typical traffic conditions and modelled traffic conditions at 1730PM

28. The model replicates the queuing/stationary vehicles on the A426 SB and A426 NB approach to the crossroads, with the slow moving vehicles on the eastbound and westbound approaches also replicated, in line with the typical traffic conditions identified in the snapshot.

Validation Summary

29. The data presented in **Table 3** and **Table 4** demonstrates that the RWA 2016 Base Model validates within the required standards against surveyed journey time data on approaches to the Dunchurch Crossroads.

30. Both the AM and PM peak hours demonstrate that the TAG Unit 3.1 guidance on model validation has been achieved and exceeded. This is further supported by comparisons between the modelled outputs and Google Traffic 'typical' conditions.

2018 Dunchurch Crossroads Traffic Count

31.   Following the completion of the 2016 RWA Base Model, VM understand that a further traffic count has been undertaken within the Dunchurch area, on behalf of Dunchurch Parish Council, and that there is a requirement to compare this count data against the 2016 modelled flows. Warwickshire County Council (WCC) provided VM with the traffic data to inform these checks which was obtained from the Parish Council.

32.   This recent traffic data collection exercise has been undertaken for a number of days in late January/early February. This data does not strictly conform to modelling guidelines as the data has not been collected during a neutral period. It is common practice to collect survey data in 'neutral' months. This is in-line with the guidance set out in TAG Unit 2.1 Data Sources and Surveys[4] (paragraph 3.3.6), which states that; "Surveys should be carried out during a 'neutral' or representative month, avoiding main and local holiday periods…..and other abnormal traffic periods. National experience is that the following Monday to Thursdays can be neutral":

- Late March and April – excluding the weeks before and after Easter
- May – excluding the Thursday before and all of the week of each Bank Holiday
- June
- September – excluding school holidays or return to school weeks
- October
- November

33.   The data provided to VM has been collected in the w/c 29th January 2018, and has included count data for the Friday, Saturday and Sunday.

34.   Despite the data being collected in what is considered a non-neutral month, VM have derived an average of the counts for the Tuesday (30th Jan), Wednesday (31st Jan) and Thursday (1st Feb) and compared against the 2016 modelled flows. For the purposes of the comparison, the following surveyed user classes have been aggregated and compared against modelled flows:

- Cars
- LGVs
- OGVs (OGV1 and OGV2)
- PSV (Buses)

35.   The motorcycles (MC) and bicycles (PC) user classes were not included on the basis that these modes were not explicitly modelled within the RWA Base Model.

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[4] TAG Unit M1.2 Data Sources and Surveys
(https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427119/webtag-tag-unit-m1-2-data-sources-and-surveys.pdf)

36. The 2018 surveyed flows also included one movement around the crossroads which was not captured in the model. This is the 'rat-run' from Southam Road to Coventry Road via School Street.

37. As School Street was not included within the model, it was not possible to compare flows on this route. However, upon review of the count data, it appears that on average 13 vehicles make this movement during the AM peak hour, and 9 vehicles during the PM peak hour. Given this low volume of flows, this omission would not be considered significant.

38. The following **Table 5** and **Table 6** present the 2018 traffic count data at the Dunchurch Crossroads against the 2016 RWA Base Model flows, and as a means of comparison demonstrate the level of model calibration against the 2018 flows. Further breakdown of the comparisons with the model flows are also provided in **Appendix B**.

Table 5 Dunchurch Crossroads 2018 Data vs 2016 Modelled Flows – AM Period (0700-1000)

	07:00 to 08:00		08:00 to 09:00		09:00 to 10:00	
Counts:	12		12		12	
GEH ≤ 5	9		12		11	
%	**75%**		**100%**		**92%**	
GEH ≤						
3	9	75%	7	58%	7	58%
4	9	75%	10	83%	8	67%
5	10	83%	12	100%	11	92%
6	10	83%	12	100%	11	92%
7	10	83%	12	100%	12	100%
8	12	100%	12	100%	12	100%
9	12	100%	12	100%	12	100%
10	12	100%	12	100%	12	100%

39. The flows compared in **Table 5** demonstrate that in the AM pre peak hour, the 2016 modelled flows do not fall within the TAG guidance for model calibration, with 75% of flows in the pre peak hour below the 5 GEH statistic.

40. Critically however the AM peak hour modelled flows provide a good match to the 2018 surveyed flows, with all modelled turning movements below 5 GEH statistic when compared to the surveyed counts. Additional to this the post peak hour modelled flows also fall within the TAG calibration criteria.

Table 6 Dunchurch Crossroads 2018 Data vs 2016 Modelled Flows – PM Period (1600-1900)

	07:00 to 08:00		08:00 to 09:00		09:00 to 10:00	
Counts:	12		12		12	
GEH ≤ 5	10		12		12	
%	**83%**		**100%**		**100%**	
GEH ≤						
3	10	83%	6	50%	8	67%
4	10	83%	10	83%	12	100%
5	10	83%	12	100%	12	100%
6	10	83%	12	100%	12	100%
7	12	100%	12	100%	12	100%
8	12	100%	12	100%	12	100%
9	12	100%	12	100%	12	100%
10	12	100%	12	100%	12	100%

41. The flow comparisons reported within **Table 6** demonstrate that in the PM pre-peak hour, the 2016 modelled flows do not fall within the TAG guidance for model calibration, with 83% of flows in the pre peak hour below the 5 GEH statistic.

42. Once again however, the PM peak hour modelled flows provide a good match to the 2018 surveyed flows, with all modelled turning movements below 5 GEH statistic when compared to the surveyed counts. Additional to this the post peak hour modelled flows also fall within the TAG calibration criteria.

43. In addition to the turning movement comparisons summarised in **Table 5** and **Table 6,** a review of the total junction throughput has been undertaken, again comparing the 2018 surveyed flows and the 2016 modelled flows. The resultant junction throughput figures are demonstrated in **Table 7** and **Table 8**.

Table 7 Dunchurch Crossroads Total Throughput Comparisons – AM Period (0700-1000)

	0700-0800			0800-0900			0900-1000		
	OBS	MOD	GEH	OBS	MOD	GEH	OBS	MOD	GEH
Total Throughput	1456	1198	7.1	1596	1718	3.0	1150	1279	3.7

Table 8 Dunchurch Crossroads Total Throughput Comparisons – PM Period (1600-1900)

	1600-1700			1700-1800			1800-1900		
	OBS	MOD	GEH	OBS	MOD	GEH	OBS	MOD	GEH
Total Throughput	1584	1362	5.8	1694	1694	0.0	1268	1388	3.3

44. The total throughput comparisons outlined in **Table 7** and **Table 8** demonstrate a close match when comparing the differences between the 2018 surveyed and 2016 modelled flows during both the AM and PM peak hours. The PM peak hour modelled flows are particularly reflective of the surveyed flows. Furthermore, in the majority of instances where

there is a good match, the flows are higher in the model indicating that the assessment is robust as it considers marginally higher flows than have been demonstrated by both the 2016 and 2018 surveyed flows.

Dunchurch Crossroads 2018 Count Comparison Summary

45.   Despite there being some reservations regarding the month in which the 2018 count has been collected, VM have undertaken a comparison between the 2018 data and the 2016 RWA modelled flows. This comparison has made use of the previously outlined GEH statistic as a comparison tool.

46.   The comparison has revealed that during the AM and PM peak hours there is a very good match between 2018 surveyed flows and the modelled flows, with all modelled flows within 5 GEH of the surveyed. The comparison between the modelled and surveyed flows for the post peak hours in both the AM and PM has also revealed a good match.

47.   The comparison has revealed that the modelled flows are lower than the surveyed flows in the pre-peak hours (AM and PM).

Summary

48.   This note has outlined the process behind the 2016 Rugby Wide Area Paramics Microsimulation Base Model, and the relevant DfT guidelines that the model conforms to. Adherence to these guidelines enables the model to be considered fit for purpose.

49.   The note summarises findings from the check against both 2016 and 2018 survey data. The 2018 data has been provided by Dunchurch Parish Council, the 2016 data is in line with that which was used to support the Ashlawn Road development planning application and subsequent appeal (where the data was subject to extensive review prior to being deemed sound).

50.   The 2018 survey was collected on behalf of Dunchurch Parish Council in late January/early February, and VM have taken an average of the surveyed flows on Tuesday 30th January, Wednesday 31st January and Thursday 1st February for comparison against the modelled flows in line with the guidelines presented within WebTAG.

51.   This comparison has revealed that despite the model being developed against 2016 surveyed data, the flows are still reflective of the 2018 surveyed data, particularly during the AM and PM peak hours with the AM and PM peak hours remaining higher within the modelled network than observed and also being well within the tolerance levels necessary to conclude that the model is fit for purpose.

APPENDIX A

2016 Rugby Wide Area Base Model – Dunchurch Count Calibration

2016 Base Model AM Count Calibration – Dunchurch Crossroads

Approach	To	0700-0800			0800-0900			0900-1000		
		OBS	MOD	GEH	OBS	MOD	GEH	OBS	MOD	GEH
Southam Rd	Coventry Rd	51	52	0.1	62	63	0.1	44	58	2.0
	Rugby Rd	205	208	0.2	276	290	0.8	176	220	3.1
	Daventry Rd	13	16	0.8	13	21	1.9	14	21	1.7
Coventry Rd	Rugby Rd	150	97	4.8	200	199	0.1	170	124	3.8
	Daventry Rd	30	25	1.0	49	44	0.7	17	22	1.1
	Southam Rd	110	66	4.7	160	149	0.9	46	80	4.3
Rugby Rd	Daventry Rd	184	174	0.7	177	208	2.2	107	185	6.5
	Southam Rd	334	231	6.1	284	274	0.6	171	226	3.9
	Coventry Rd	236	171	4.6	173	192	1.4	178	144	2.7
Daventry Rd	Southam Rd	27	25	0.4	46	55	1.3	23	32	1.7
	Coventry Rd	15	16	0.3	36	12	4.9	19	8	3.0
	Rugby Rd	119	117	0.2	207	211	0.3	146	159	1.1
Total Counts		12			12			12		
GEH <5		11			12			11		
Calibration (%)		92%			100%			92%		

2016 Base Model PM Count Calibration – Dunchurch Crossroads

Approach	To	1600-1700			1700-1800			1800-1900		
		OBS	MOD	GEH	OBS	MOD	GEH	OBS	MOD	GEH
Southam Rd	Coventry Rd	119	60	6.2	79	54	3.1	44	48	0.6
	Rugby Rd	320	313	0.4	400	374	1.3	256	302	2.8
	Daventry Rd	15	32	3.5	26	32	1.1	16	24	1.8
Coventry Rd	Rugby Rd	275	202	4.7	312	292	1.2	298	257	2.5
	Daventry Rd	33	22	2.1	36	30	1.0	22	29	1.4
	Southam Rd	78	47	3.9	81	101	2.1	57	66	1.1
Rugby Rd	Daventry Rd	167	145	1.8	165	181	1.2	133	109	2.2
	Southam Rd	173	204	2.3	224	255	2.0	205	230	1.7
	Coventry Rd	150	100	4.5	138	101	3.4	153	123	2.6
Daventry Rd	Southam Rd	19	12	1.8	25	15	2.2	27	18	1.9
	Coventry Rd	33	17	3.2	55	20	5.7	26	25	0.2
	Rugby Rd	215	208	0.5	260	239	1.3	154	157	0.2
Total Counts		12			12			12		
GEH <5		11			11			12		
Calibration (%)		92%			92%			100%		

APPENDIX B

**Dunchurch Parish Council Count - Model Calibration
Comparison**

Dunchurch Parish Council Traffic Count vs 2016 Base Model Flows (AM Period)

Approach	To	0700-0800			0800-0900			0900-1000		
		OBS	MOD	GEH	OBS	MOD	GEH	OBS	MOD	GEH
Southam Rd	Coventry Rd	37	52	2.2	35	63	4.0	30	58	4.2
	Rugby Rd	174	208	2.8	302	290	0.5	193	220	2.0
	Daventry Rd	14	16	0.8	19	21	0.4	13	21	1.9
Coventry Rd	Rugby Rd	187	97	7.6	229	199	1.9	182	124	4.6
	Daventry Rd	24	25	0.2	41	44	0.6	24	22	0.4
	Southam Rd	59	66	0.9	94	149	5.0	44	80	4.6
Rugby Rd	Daventry Rd	198	174	1.6	156	208	4.1	105	185	6.7
	Southam Rd	320	231	5.1	282	274	0.4	183	226	3.2
	Coventry Rd	282	171	7.4	177	192	1.5	177	144	2.5
Daventry Rd	Southam Rd	16	25	2.0	34	55	3.1	18	32	2.8
	Coventry Rd	21	16	1.2	32	12	4.3	23	8	3.8
	Rugby Rd	124	117	0.5	195	211	1.4	158	159	0.1
Total Counts		12			12			12		
GEH <5		9			12			11		
Calibration (%)		75%			100%			92%		

Dunchurch Parish Council Traffic Count vs 2016 Base Model Flows (PM Period)

Approach	To	1600-1700			1700-1800			1800-1900		
		OBS	MOD	GEH	OBS	MOD	GEH	OBS	MOD	GEH
Southam Rd	Coventry Rd	40	60	2.8	26	54	4.4	24	48	4.0
	Rugby Rd	334	313	1.0	389	374	0.7	237	302	4.0
	Daventry Rd	19	32	2.6	16	32	3.3	14	24	2.3
Coventry Rd	Rugby Rd	307	202	6.5	323	292	1.7	285	257	1.6
	Daventry Rd	28	22	1.2	27	30	0.6	22	29	1.4
	Southam Rd	50	47	0.4	65	101	4.1	42	66	3.3
Rugby Rd	Daventry Rd	173	145	1.8	179	181	0.2	128	109	1.7
	Southam Rd	192	204	1.0	203	255	3.5	175	230	4.0
	Coventry Rd	172	100	5.9	151	101	4.4	145	123	1.8
Daventry Rd	Southam Rd	22	12	2.2	17	15	0.5	20	18	0.5
	Coventry Rd	31	17	2.9	41	20	3.8	18	25	1.5
	Rugby Rd	216	208	0.4	257	239	1.1	158	157	0.0
Total Counts		12			12			12		
GEH <5		10			12			12		
Calibration (%)		83%			100%			100%		