PROPOSED DISCOUNT FOODSTORE,

NON-FOOD RETAIL AND DRIVE-THRU RESTAURANT, UTTOXETER

ADDENDUM TECHNICAL NOTE 2 - OCTOBER 2018

1 INTRODUCTION

1.1 Vectos have been commissioned by Lidl UK GmbH to provide transport and highways advice to support a hybrid planning application for the development of an area of land located to the north of Brookside Road in Uttoxeter.

1.2 This Addendum Technical Note 2 responds to Amey's October 2018 Addendum Technical Note Review document, which Amey have prepared on behalf of SCC.

1.3 Amey's review confirms that the majority of information presented by Vectos to support the planning application has now been accepted. However, Amey have requested more information regarding the off-site junction assessments undertaken in the TA.

2 OFF-SITE JUNCTION ASSESSMENTS

2.1 Amey's concerns regarding the off-site junction assessments relates to the validation of the JUNCTIONS models of:

- A518 Town Meadows Way/ Brookside Road/ Bridge Street roundabout; and
- A518 Town Meadows Way/ A522 Dove Bank Roundabout.

2.2 It is noted that in the assessment of these junctions the model geometry is consistent through the different scenarios assessed. The results therefore provide an accurate indication of the impact the proposed development will have upon the operation of the junctions.

3 APPROACH TO MODEL VALIDATION

3.1 As outlined in our first Addendum Technical Note, recognised guidance cautions against the use of queue survey data as a means to validate junction models.

3.2 DMRB Volume 12, Section 2, Part 1 states that "*precise validation of queue lengths can be difficult because of the volatility of the observed data*" and does not provide an acceptable threshold for modelled versus observed queue lengths.

3.3 Likewise, TRL's Knowledge Base document 'Measuring queues – is it all a waste of time?', highlights that "*during peak periods there is a large daily variation in queue lengths even if the average flow for each time segment does not vary from day to day*". This was highlighted in Figure 1 of Vectos' Addendum Technical Note 1. The Knowledge Base note is included in **Appendix A**.

3.4 Most pertinently, the Knowledge Base document concludes that "*if the flows and capacity predictions are correct, the queue predictions will be correct*". In considering the robustness of traffic models, this confirms the software developer's advice that when considering the validity of junction models more weight should be applied to the review of demand flows and geometric inputs than queuing.

3.5 In this regard Amey have confirmed their agreement to the modelling geometric parameters adopted in the assessment of both junctions, together with the traffic flow data. On the basis of advice from TRL, the developers of the JUNCTIONS modelling software, the agreement of these factors should provide Amey with comfort that the models provide a realistic baseline against which to assess the impact of the development.

3.6 In considering the appropriateness of our junction modelling Vectos undertook site visits during both weekday and Saturday peak periods, at which time we observed the existing operation of the two roundabout junctions considered in our Transport Assessment.

3.7 Our conclusions from these observations was that the overall operation of the junctions as modelled was reflective of that which occurs on site, including queuing characteristics. On this basis, our professional judgement was that the models as built provide a realistic baseline with which to consider the traffic impact of the proposed development.

Previous Precedent

3.8 It is noted that queue data was not used to validate the junction models that WYG prepared for the adjacent Brookside Business park development, and that the analysis undertaken by WYG included both the roundabout junctions considered in Vectos' Transport Assessment. The WYG Transport Assessment, and the conclusions drawn from it, was accepted by the highway authority.

3.9 It is presumed that the highway authority did not require queue surveys to validate the models as they were comfortable with the input parameters, and therefore in acknowledging TRL guidance were in turn comfortable with the queue predictions. This establishes a precedent for the approach that should be adopted in the highway authority's review of the Lidl planning application.

4 A518 TOWN MEADOWS WAY/ BROOKSIDE ROAD/ BRIDGE STREET ROUNDABOUT

4.1 As outlined in Table 3 of Vectos' Addendum Technical Note, the proposed development will result in the greatest increase in traffic flow at the Town Meadows Way/ Brookside Road junction. This is expected given Brookside Road leads directly to the proposed site access junction.

4.2 Table 3 also revealed that, even adopting the very robust assumption that all primary trips to the proposed development site are new trips, at the Town Meadows Way/ Dove Bank roundabout the proposals would only result in a 1% increase in traffic flow during the PM peak hour and a 3% increase in traffic flow during the Saturday peak hour. The change in traffic flow at this junction, and accordingly the impact upon its overall operation, is therefore de minimis. This is supported by the modelling results.

4.3 As such, it is suggested that the impact of the proposed development, and therefore the detail of the junction modelling, is most pertinent at the Town Meadows Way/ Brookside Road junction.

4.4 In conjunction with the traffic surveys undertaken in 2017 queue survey data was also collected for the Town Meadows Way/ Brookside Road roundabout. This information was not collected for the purpose of model validation, but rather to inform Lidl regarding the likelihood of peak period queuing on Brookside Road affecting the operation of their proposed site access junction.

4.5 Notwithstanding the information presented previously, the results of the capacity model of this junction using 2017 surveyed traffic flows have been compared against the collected queue survey data.

4.6 **Table 1** below provides the results of the 2017 existing traffic flow assessment of the Town Meadows Way/ Brookside Road roundabout, including a comparison with observed queues. The queue survey data is included in **Appendix B**, and the 2017 JUNCTIONS modelling output files included in **Appendix C**. On each arm the observed queues are presented as the sum of queuing across both approach lanes, which reflects the coding of the JUNCTIONS model.

	PM				Sat			
	RFC	Modelled Queue	Average Observed Queue	Diff in Queue	RFC	Modelled Queue	Average Observed Queue	Diff in Queue
Brookside Road	0.14	0	0	0	0.13	0	0	0
A518	0.57	1	1	0	0.51	1	1	0
Bridge Street	0.30	0	1	0	0.34	1	1	0
Town Meadows Way	0.72	3	1	-2	0.60	1	0	-1

Table 1: 2017 Survey Results Including Observed Queue Values

4.7 The results presented in **Table 1** demonstrate that the observed queues closely match those revealed in the JUNCTIONS model. Most importantly, the overall operation of the junction, as suggested by the modelling results, also reflect Vectos' peak hour observations of the junction.

4.8 This therefore adds further weight to our conclusion that the traffic model provides a suitable and robust baseline against which to assess future year traffic flow conditions.

5 SUMMARY AND CONCLUSIONS

5.1 This Addendum Technical Note 2 responds to Amey's October 2018 Addendum Technical Note Review, and provides further commentary on junction model validation.

5.2 The Note draws the following conclusions:

- Advice from the developers of JUNCTIONS states that "if the flows and capacity predictions are correct, the queue predictions will be correct";
- Amey have agreed the geometric inputs and traffic flows, and on this basis should be comfortable with queue predictions;
- The most appropriate way to validate traffic models is through on site observations of how the junctions operate on the ground. In this regard Vectos have undertaken peak hour site visits, and our professional judgement is that both junction models provide an accurate reflection of existing operation on a weekday and Saturday. We therefore consider the models provide a realistic baseline for future year assessment;
- The model geometry is consistent through the different scenarios assessed. The results therefore provide an accurate comparative reflection of the impact the proposed development will have upon the operation of the junctions;
- The highway authority did not require queue validation to support capacity assessments of the same highway network when this was considered by WYG for the Brookside Business Park development. This establishes a precedent which should also be applied to this application; and
- In terms of impact, the Brookside Road/ Town Meadows Road is more pertinent given this experiences the greatest increase in traffic flow. To this end the modelled operation of the Brookside Road/ Town Meadows Way roundabout junction also reflects queue data that was collected in 2017.

5.3 It is therefore concluded that the assessments of the Brookside Road/ Town Meadows Way roundabout and the Town Meadows Way/ Dove Bank roundabout provide a realistic reflection of baseline junction capacity. On this basis the conclusions drawn in the Addendum Technical Note, that is that the proposed development will not have a material impact on the operation of either junction, remain valid.

vectos
transport planning specialists

APPENDICES

APPENDIX A

TRL Knowledge Base Document

Measuring queues – is it all a waste of time?

2nd February 2004 ARCADY Modelling

Measuring queues seems to be the obvious way of checking a model, because queue lengths are one of the main outputs from the programs. In fact some traffic engineers, and their customers, insist on such checks being carried out. If so, they should understand the implications of what they are doing. Apart from the practical difficulties of measuring **mean** queues over successive time intervals there are also mathematical problems to consider.

Categories

ARCADY Modelling

ARCADY/PICADY/OS Technical

Other products

PICADY Modelling

During peak periods (when the flow/capacity ratios are high) there is a large daily variation in queue lengths **even if the average flow for each time segment does not vary from day to day.** To take a typical example, a mean queue of 26 pcu would be derived from queues which varied between 5 pcu and 50 pcu from day to day. In fact, on 1 day in 20 the queue would be outside even this large envelope of possible values. So you can see that many days of queue measurements would have to be taken to obtain a reliable estimate of mean queues. The junction model predictions are based on an infinite number of days! It is surprising how many people think that one day is enough – yet they wouldn't dream of predicting the result of the next General Election after canvassing one person chosen at random (OK maybe this is a more extreme case!)

The routine within the junction models which calculates mean queues is more accurate than the capacity-predicting routine, which of necessity gives average results which ignore the effects of site peculiarities and location. The queue calculation is almost certainly more accurate than your best estimate of demand flows. So if you do go to the trouble and expense of measuring queues, and find a difference between the model predictions and your observations, then you might pause to consider whether perhaps the model is correct and your queues are not. Even if your measured discrepancy is genuine, you will have achieved nothing other than to demonstrate that the demand flows are inaccurate or that the model's capacity prediction is not taking account of all the local circumstances. So time would be better spent tackling these issues.

Consider the accuracy of the demand flow estimates in the model (bear in mind that ODTAB is the least accurate method of specifying them but the most frequently used). The accuracy of the model's capacity prediction can be significantly improved by carrying out a "site specific capacity correction" – refer to the Application Guide for details. Such on-site measurements are much easier and cheaper than trying to measure queues properly!

If the flows and capacity-predictions are correct, the queue predictions will be correct.

Pedestrian crossing and blocking on the same road

Out of memory error when saving files

Stay up to date with ne

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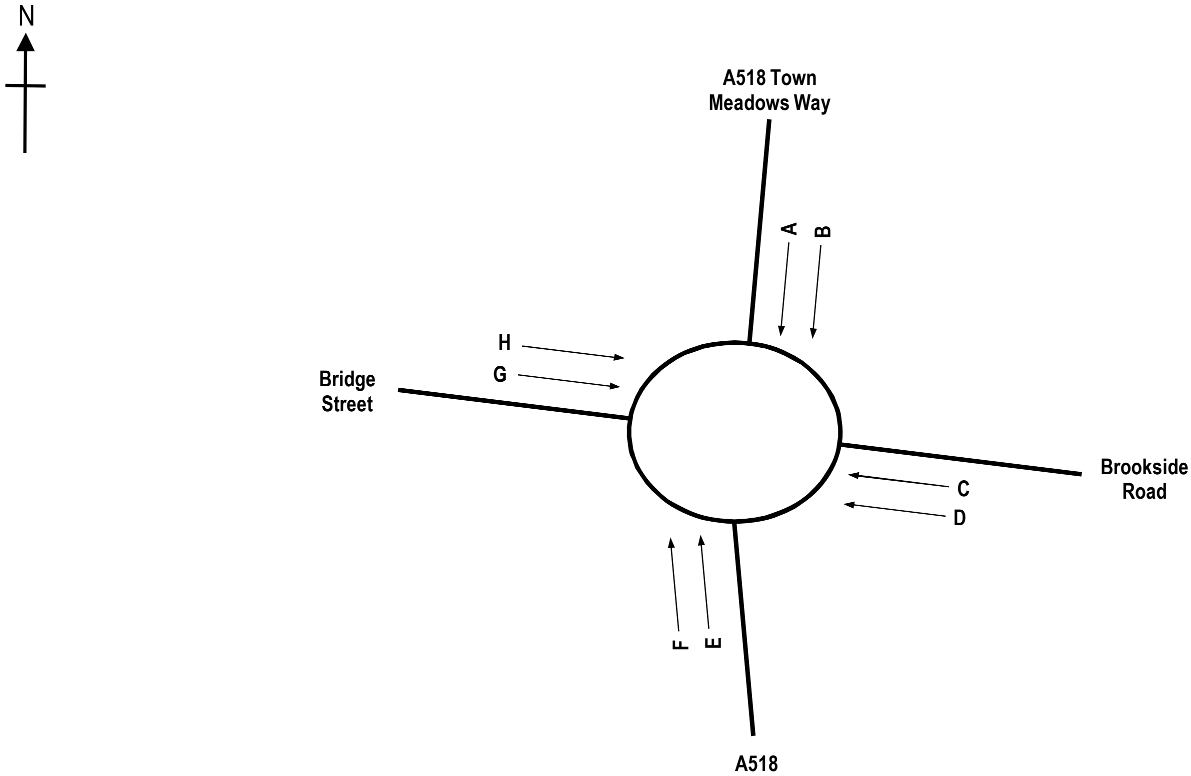
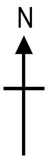
APPENDIX B

A518 Town Meadows Way/ Brookside Road Queue Survey Data

JUNCTION 1





DRAWING TITLE

QUEUE REFERENCE

JOB TITLE

2017.118 UTTOXETER

DRAWN BY	DATE	SCALE	REF
DC	JUL 2017	NTS	FIGURE 3

signal surveys
Traffic Counts and Car Park Surveys
Parkway House, Palatine Road, Northenden, Manchester,
M22 4DB
Tel 0161 998 4226 Fax 0161 998 1189

Time Beginning	A518 Town Meadows Way/Brookside Road/A518/Bridge Street, Queues (vehs) - Friday 14 July 2017							
	A	B	C	D	E	F	G	H
1600	0	0	0	0	2	1	0	0
1605	0	0	0	0	0	0	1	1
1610	0	0	0	0	0	0	1	0
1615	0	0	0	1	0	0	0	0
1620	0	0	0	0	0	0	0	0
1625	0	0	1	0	0	0	0	0
1630	0	0	0	0	0	0	2	0
1635	0	0	0	0	1	0	0	0
1640	0	0	0	0	0	0	2	1
1645	0	0	0	0	0	0	0	0
1650	0	0	0	0	4	1	3	0
1655	0	0	0	0	0	0	0	0
1700	0	0	0	0	0	0	0	0
1705	0	4	0	1	0	0	0	0
1710	0	0	0	0	3	0	0	0
1715	0	1	0	0	0	0	0	0
1720	0	0	0	0	0	0	0	0
1725	0	1	0	0	0	0	0	0
1730	0	0	0	0	0	0	0	0
1735	0	0	0	0	0	0	0	0
1740	0	0	0	0	0	3	1	0
1745	0	0	0	0	0	0	1	0
1750	0	0	0	0	0	0	0	0
1755	0	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0	0
1805	0	0	0	0	0	0	0	0
1810	0	0	0	0	0	0	0	0
1815	0	0	0	0	1	2	0	0
1820	1	0	0	0	0	0	0	0
1825	0	0	0	0	0	0	0	0
1830	1	1	0	0	0	0	0	0
1835	0	0	0	0	0	0	0	0
1840	0	0	0	0	2	0	0	0
1845	0	0	0	0	1	0	0	0
1850	0	0	0	0	0	0	0	0
1855	0	0	0	0	0	0	1	0
1900	0	0	0	0	0	0	0	0

Time Beginning	A518 Town Meadows Way/Brookside Road/A518/Bridge Street, Queues (vehs) - Saturday 15 July 2017							
	A	B	C	D	E	F	G	H
1100	0	1	0	2	0	0	1	0
1105	0	0	0	1	2	0	0	0
1110	1	0	0	0	0	0	2	1
1115	0	0	0	0	0	1	1	1
1120	0	0	0	0	0	0	1	0
1125	0	0	0	0	0	0	2	1
1130	0	0	0	0	0	0	0	0
1135	0	2	0	0	2	1	0	0
1140	0	0	0	0	0	0	0	0
1145	0	0	0	0	0	0	0	0
1150	0	0	0	1	0	0	0	0
1155	0	0	0	0	0	0	0	0
1200	0	0	0	0	1	0	0	0
1205	0	0	1	0	3	0	0	0
1210	0	0	0	0	0	0	0	1
1215	0	0	0	0	0	0	0	0
1220	0	0	0	0	2	0	0	0
1225	0	0	0	0	0	0	1	0
1230	0	0	0	0	1	1	0	0
1235	0	0	0	0	0	0	0	0
1240	0	0	0	0	0	0	0	0
1245	0	0	0	0	0	0	0	0
1250	0	0	0	0	3	0	0	0
1255	0	0	0	0	1	0	0	0
1300	0	0	0	0	0	0	0	0
1305	0	0	0	0	2	0	0	0
1310	1	1	0	0	0	0	0	0
1315	0	0	0	0	0	0	0	0
1320	0	0	0	0	0	0	0	0
1325	0	0	0	0	0	0	0	0
1330	0	0	0	0	0	0	0	0
1335	0	0	0	0	0	0	1	0
1340	0	0	0	0	0	0	0	0
1345	0	0	0	0	0	0	2	0
1350	0	0	0	0	0	0	0	0
1355	0	0	0	0	0	0	0	0
1400	0	0	0	2	1	0	2	0
1405	0	0	0	0	0	0	1	2
1410	0	0	0	0	0	0	0	0
1415	0	0	0	0	0	0	0	0
1420	0	0	0	0	0	0	0	0
1425	0	0	0	1	3	0	1	0
1430	0	0	0	0	0	0	0	0
1435	0	0	0	0	0	0	0	0
1440	0	0	0	0	0	0	0	0
1445	0	0	0	0	0	0	0	0
1450	0	0	0	0	0	0	0	0
1455	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0

APPENDIX C

A518 Town Meadows Way/ Brookside Road
JUNCTIONS Modelling Outputs – Existing Situation

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk

The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution

Filename: South Rbt - A518 Brookside Rd v3_survey flows.arc8
Path: N:\Vectos Job Data\2017\VN70855 Lidl Uttoxeter\Arcady
Report generation date: 29/10/2018 17:24:29

Summary of junction performance

	PM				Sat			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	A1 - Survey							
Arm 1	0.17	9.38	0.14	A	0.14	7.44	0.13	A
Arm 2	1.33	5.04	0.57	A	1.02	4.41	0.51	A
Arm 3	0.42	4.26	0.30	A	0.51	4.42	0.34	A
Arm 4	2.52	7.43	0.72	A	1.46	5.16	0.60	A

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.

"D1 - Survey, PM" model duration: 16:00 - 17:30
"D2 - Survey, Sat " model duration: 11:00 - 12:30

Run using Junctions 8.0.6.541 at 29/10/2018 17:24:27

File summary

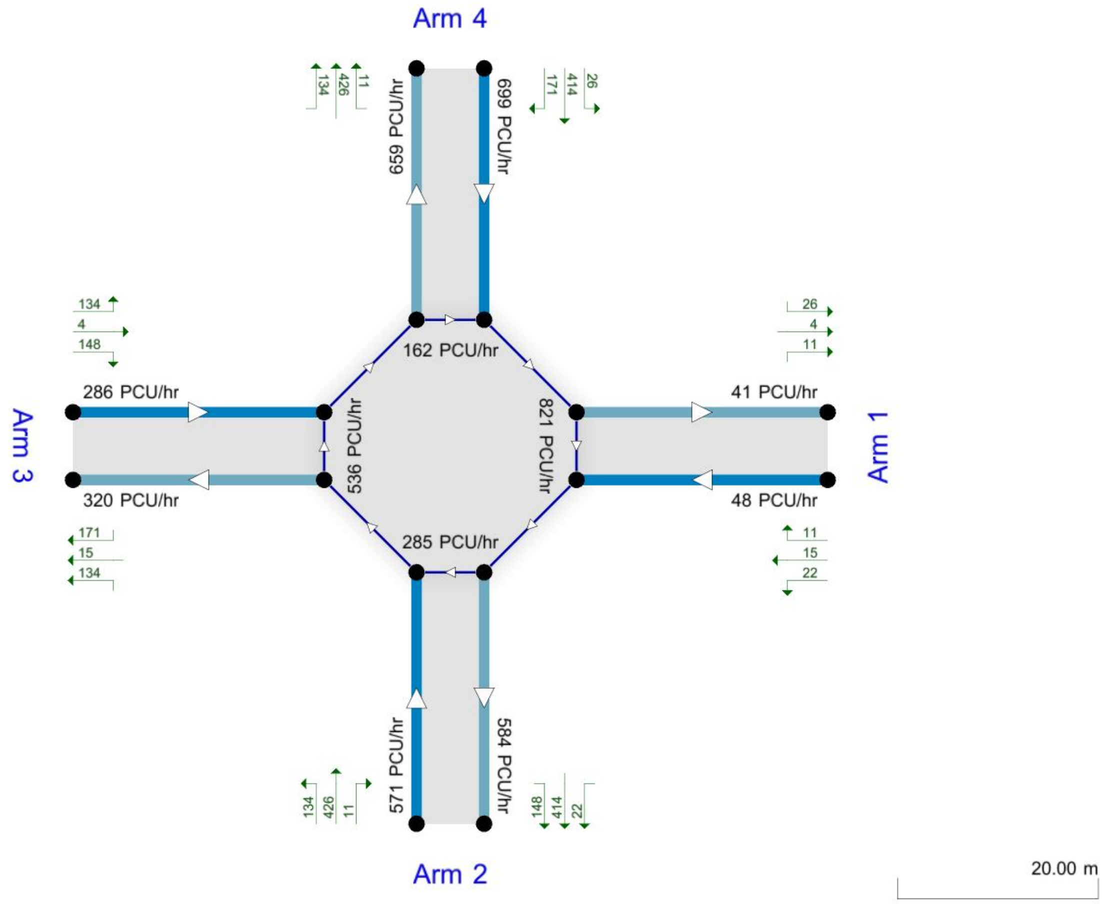
Title	(untitled)
Location	
Site Number	
Date	30/10/2017
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	Office
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	RFC Threshold	Average Delay Threshold (s)	Queue Threshold (PCU)
5.75			N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	PCU	PCU	perHour	s	-Min	perMin



Showing modelled flow through junction (PCU/hr).
Time Segment: (11:00-11:15)
Showing Analysis Set "A1 "; Demand Set "D2 - Survey, Sat "

The junction diagram reflects the last run of ARCADY.

(Default Analysis Set) - Survey, Sat

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Arm 4 - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Survey, Sat	Survey	Sat	Base Flows	ONE HOUR	11:00	12:30	90	15				✓		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Do Geometric Delay	Junction Delay (s)	Junction LOS
1	A518 / Brookside Rd	Roundabout	1,2,3,4				4.83	A

Junction Network Options

Driving Side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Arm	Name	Description
1	1	Brookside Road	
2	2	A518 S Bridge St	
3	3	Bridge Street	
4	4	A518 N Town Meadows Way	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)	Assume Flat Start Profile	Initial Queue (PCU)
1	0.00	99999.00		0.00
2	0.00	99999.00		0.00
3	0.00	99999.00		0.00
4	0.00	99999.00		0.00

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.30	5.70	8.90	8.50	43.00	71.00	
2	3.30	7.80	25.00	41.00	43.00	25.00	
3	3.50	8.00	20.00	20.00	43.00	51.00	
4	4.00	6.40	33.00	50.00	43.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.454	1100.486
2		(calculated)	(calculated)	0.695	1944.137
3		(calculated)	(calculated)	0.616	1718.188
4		(calculated)	(calculated)	0.685	1886.043

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	HV Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (PCU/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	64.00	100.000
2	ONE HOUR	✓	761.00	100.000
3	ONE HOUR	✓	381.00	100.000
4	ONE HOUR	✓	932.00	100.000

Direct/Resultant Flows

Direct Flows Data

Time Segment	Arm	Direct Demand Entry Flow (PCU/hr)	DirectDemandEntryFlowInPCU (PCU/hr)	Direct Demand Exit Flow (PCU/hr)	Direct Demand Pedestrian Flow (Ped/hr)
11:00-11:15	1	48.18	48.18		
11:00-11:15	2	572.92	572.92		
11:00-11:15	3	286.84	286.84		
11:00-11:15	4	701.66	701.66		
11:15-11:30	1	57.53	57.53		
11:15-11:30	2	684.12	684.12		
11:15-11:30	3	342.51	342.51		
11:15-11:30	4	837.85	837.85		
11:30-11:45	1	70.47	70.47		
11:30-11:45	2	837.88	837.88		
11:30-11:45	3	419.49	419.49		
11:30-11:45	4	1026.15	1026.15		
11:45-12:00	1	70.47	70.47		
11:45-12:00	2	837.88	837.88		
11:45-12:00	3	419.49	419.49		
11:45-12:00	4	1026.15	1026.15		
12:00-12:15	1	57.53	57.53		
12:00-12:15	2	684.12	684.12		
12:00-12:15	3	342.51	342.51		
12:00-12:15	4	837.85	837.85		
12:15-12:30	1	48.18	48.18		
12:15-12:30	2	572.92	572.92		
12:15-12:30	3	286.84	286.84		
12:15-12:30	4	701.66	701.66		

Turning Proportions

Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	29.000	20.000	15.000
	2	14.000	0.000	179.000	568.000
	3	5.000	197.000	0.000	179.000
	4	35.000	552.000	228.000	117.000

Turning Proportions (PCU) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.45	0.31	0.23
	2	0.02	0.00	0.24	0.75
	3	0.01	0.52	0.00	0.47
	4	0.04	0.59	0.24	0.13

Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.000	1.000	1.000
	2	1.000	1.000	1.000	1.000
	3	1.000	1.000	1.000	1.000
	4	1.000	1.000	1.000	1.000

Heavy Vehicle Percentages - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	0.0	0.0	0.0
	2	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)	Total Queueing Delay (PCU-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (PCU-min/min)	Inclusive Total Queueing Delay (PCU-min)	Inclusive Average Queueing Delay (s)
1	0.13	7.44	0.14	A	58.73	88.09	9.30	6.33	0.10	9.30	6.33
2	0.51	4.41	1.02	A	698.31	1047.46	64.89	3.72	0.72	64.90	3.72
3	0.34	4.42	0.51	A	349.61	524.42	33.48	3.83	0.37	33.48	3.83
4	0.60	5.16	1.46	A	855.22	1282.83	90.02	4.21	1.00	90.03	4.21

Main Results for each time segment

Main results: (11:00-11:15)

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Entry Flow (PCU/hr)	Exit Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	Saturation Capacity (PCU/hr)	RFC	Start Queue (PCU)	End Queue (PCU)	Delay (s)	LOS
1	48.18	12.05	47.90	40.51	820.58	0.00	728.32	218.49	0.066	0.00	0.07	5.288	A
2	572.92	143.23	570.98	583.52	284.97	0.00	1746.12	1462.71	0.328	0.00	0.49	3.058	A
3	286.84	71.71	285.80	320.29	535.66	0.00	1388.30	877.97	0.207	0.00	0.26	3.262	A
4	701.66	175.41	699.06	659.43	162.03	0.00	1775.10	1548.91	0.395	0.00	0.65	3.337	A

Main results: (11:15-11:30)

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Entry Flow (PCU/hr)	Exit Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	Saturation Capacity (PCU/hr)	RFC	Start Queue (PCU)	End Queue (PCU)	Delay (s)	LOS
1	57.53	14.38	57.43	48.49	982.31	0.00	654.97	218.49	0.088	0.07	0.10	6.025	A
2	684.12	171.03	683.41	698.57	341.17	0.00	1707.07	1462.71	0.401	0.49	0.66	3.515	A
3	342.51	85.63	342.16	383.41	641.17	0.00	1323.32	877.97	0.259	0.26	0.35	3.669	A
4	837.85	209.46	836.82	789.35	193.98	0.00	1753.23	1548.91	0.478	0.65	0.91	3.924	A

Main results: (11:30-11:45)

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Entry Flow (PCU/hr)	Exit Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	Saturation Capacity (PCU/hr)	RFC	Start Queue (PCU)	End Queue (PCU)	Delay (s)	LOS
1	70.47	17.62	70.27	59.34	1202.09	0.00	555.29	218.49	0.127	0.10	0.14	7.418	A
2	837.88	209.47	836.47	854.88	417.48	0.00	1654.05	1462.71	0.507	0.66	1.02	4.396	A
3	419.49	104.87	418.84	469.21	784.73	0.00	1234.90	877.97	0.340	0.35	0.51	4.407	A
4	1026.15	256.54	1023.98	966.12	237.45	0.00	1723.46	1548.91	0.595	0.91	1.45	5.114	A

Main results: (11:45-12:00)

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Entry Flow (PCU/hr)	Exit Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	Saturation Capacity (PCU/hr)	RFC	Start Queue (PCU)	End Queue (PCU)	Delay (s)	LOS
1	70.47	17.62	70.46	59.45	1204.47	0.00	554.21	218.49	0.127	0.14	0.14	7.441	A
2	837.88	209.47	837.85	856.56	418.37	0.00	1653.43	1462.71	0.507	1.02	1.02	4.413	A
3	419.49	104.87	419.48	470.12	786.11	0.00	1234.06	877.97	0.340	0.51	0.51	4.419	A
4	1026.15	256.54	1026.11	967.77	237.82	0.00	1723.21	1548.91	0.595	1.45	1.46	5.164	A

Main results: (12:00-12:15)

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Entry Flow (PCU/hr)	Exit Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	Saturation Capacity (PCU/hr)	RFC	Start Queue (PCU)	End Queue (PCU)	Delay (s)	LOS
1	57.53	14.38	57.73	48.66	985.89	0.00	653.34	218.49	0.088	0.14	0.10	6.045	A
2	684.12	171.03	685.52	701.10	342.51	0.00	1706.14	1462.71	0.401	1.02	0.67	3.531	A
3	342.51	85.63	343.16	384.78	643.25	0.00	1322.03	877.97	0.259	0.51	0.35	3.682	A
4	837.85	209.46	840.00	791.86	194.55	0.00	1752.84	1548.91	0.478	1.46	0.92	3.954	A

Main results: (12:15-12:30)

Arm	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Entry Flow (PCU/hr)	Exit Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	Saturation Capacity (PCU/hr)	RFC	Start Queue (PCU)	End Queue (PCU)	Delay (s)	LOS
1	48.18	12.05	48.29	40.71	824.83	0.00	726.39	218.49	0.066	0.10	0.07	5.309	A
2	572.92	143.23	573.65	586.58	286.53	0.00	1745.04	1462.71	0.328	0.67	0.49	3.076	A
3	286.84	71.71	287.20	321.93	538.25	0.00	1386.70	877.97	0.207	0.35	0.26	3.277	A
4	701.66	175.41	702.72	662.63	162.82	0.00	1774.56	1548.91	0.395	0.92	0.66	3.361	A

Queueing Delay Results for each time segment

Queueing Delay results: (11:00-11:15)

Arm	Queueing Total Delay (PCU-min)	Queueing Rate Of Delay (PCU-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
1	1.03	0.07	5.288	A	A
2	7.13	0.48	3.058	A	A
3	3.81	0.25	3.262	A	A
4	9.51	0.63	3.337	A	A

Queueing Delay results: (11:15-11:30)

Arm	Queueing Total Delay (PCU-min)	Queueing Rate Of Delay (PCU-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
1	1.41	0.09	6.025	A	A
2	9.79	0.65	3.515	A	A
3	5.13	0.34	3.669	A	A
4	13.32	0.89	3.924	A	A

Queueing Delay results: (11:30-11:45)

Arm	Queueing Total Delay (PCU-min)	Queueing Rate Of Delay (PCU-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
1	2.11	0.14	7.418	A	A
2	14.85	0.99	4.396	A	A
3	7.50	0.50	4.407	A	A
4	21.04	1.40	5.114	A	A

Queueing Delay results: (11:45-12:00)

Arm	Queueing Total Delay (PCU-min)	Queueing Rate Of Delay (PCU-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
1	2.17	0.14	7.441	A	A
2	15.30	1.02	4.413	A	A
3	7.68	0.51	4.419	A	A
4	21.87	1.46	5.164	A	A

Queueing Delay results: (12:00-12:15)

Arm	Queueing Total Delay (PCU-min)	Queueing Rate Of Delay (PCU-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
1	1.49	0.10	6.045	A	A
2	10.33	0.69	3.531	A	A
3	5.37	0.36	3.682	A	A
4	14.22	0.95	3.954	A	A

Queueing Delay results: (12:15-12:30)

Arm	Queueing Total Delay (PCU-min)	Queueing Rate Of Delay (PCU-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
1	1.09	0.07	5.309	A	A
2	7.49	0.50	3.076	A	A
3	3.99	0.27	3.277	A	A
4	10.06	0.67	3.361	A	A