GREAT GROVEHURST FARM, SITTINGBOURNE

SUPPLEMENTARY TRANSPORT ASSESSMENT
PART 4 OF 4: APPENDICES I & J

G H DEAN & CO

APRIL 2018

PFA Consulting
Stratton Park House
Wanborough Road
Swindon
SN3 4HG

Tel: 01793 828000
Fax: 01793 835500
Email: admin@pfaplc.com
Web: www.pfaplc.com

engineering the future

PAGE LEFT INTENTIONALLY BLANK

DOCUMENT CONTROL

Job No	D118	
File Reference	G:\workfiles\D118 GT GROVEHURST FARM\REPORTS\D118-DOC05 TA Issue 4 Part 4.docx	
	Name	Date
Prepared by	P D Key & R Cox	9 March 2018
Checked by	C J Mumford	17 April 2018

Issue	Date	Comments	Approved
4	18 April 2018	Submission	G Eves

PAGE LEFT INTENTIONALLY BLANK

APPENDICES

Appendix I

Junctions 9

PICADY 9 - Priority Intersection Module

Version: 9.0.2.5947

Filename: Site Access Staggered Crossroads.j9
Path: F:\Workfile\D118\Junctions Assessment\PFA Models
Report generation date: 16/03/2018 15:13:37

Summary of junction performance

	AM Peak Hour				PM Peak Hour			
	Queue (Veh)	Delay (min)	RFC	LOS	Queue (Veh)	Delay (min)	RFC	LOS
	2023 Baseline With Dev							
Stream B-ACD	0.3	0.35	0.24	C	0.2	0.36	0.14	C
Stream A-BCD	0.0	0.13	0.02	A	0.1	0.13	0.07	A
Stream D-ABC	0.1	0.19	0.12	B	0.1	0.19	0.07	B
Stream C-ABD	0.0	0.13	0.01	A	0.0	0.14	0.02	A
	2031 Baseline With Dev							
Stream B-ACD	0.4	0.42	0.27	D	0.2	0.39	0.15	C
Stream A-BCD	0.1	0.14	0.06	A	0.2	0.16	0.19	A
Stream D-ABC	0.4	0.21	0.28	B	0.2	0.18	0.14	B
Stream C-ABD	0.0	0.14	0.01	A	0.0	0.15	0.02	A

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

File summary

File Description

Title	(untitled)
Location	
Site number	
Date	16/03/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	PFA\trafficteam
Description	

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	Veh	Veh	perHour	min	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	RFC Threshold	Average Delay threshold (min)	Queue threshold (PCU)
5.75				0.85	0.60	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2023 Baseline With Dev	AM Peak Hour	ONE HOUR	07:45	09:15	15	✓
D2	2023 Baseline With Dev	PM Peak Hour	ONE HOUR	16:45	18:15	15	✓
D3	2031 Baseline With Dev	AM Peak Hour	ONE HOUR	07:45	09:15	15	✓
D4	2031 Baseline With Dev	PM Peak Hour	ONE HOUR	16:45	18:15	15	✓

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000

2023 Baseline With Dev, AM Peak Hour

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (min)	Junction LOS
1	untitled	Right-Left Stagger	Two-way	0.02	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description	Arm type
A	Grovehurst Road (North)		Major
B	Great Grovehurst Farm		Minor
C	Grovehurst Road (South)		Major
D	Northwest Sittingbourne		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Width for right turn (m)	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	6.00		✓	3.00	120.0	✓	6.00
C	6.00		✓	3.00	100.0	✓	6.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B	One lane	3.35	19	32
D	One lane	3.85	33	23

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (Veh/hr)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-A	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-B	Slope for D-C
1	A-D	699	-	-	-	0.271	0.271	0.271	-	0.271	-	-
1	B-AD	517	0.094	0.238	-	-	-	0.150	0.340	0.150	0.094	0.238
1	B-C	667	0.102	0.258	-	-	-	-	-	-	0.102	0.258
1	C-B	687	0.266	0.266	-	-	-	-	-	-	0.266	0.266
1	D-A	693	-	-	-	0.268	0.106	0.268	-	0.106	-	-
1	D-BC	542	0.157	0.157	0.357	0.250	0.099	0.250	-	0.099	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.

Streams may be combined, in which case capacity will be adjusted.

Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2023 Baseline With Dev	AM Peak Hour	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	739	100.000
B		ONE HOUR	✓	48	100.000
C		ONE HOUR	✓	699	100.000
D		ONE HOUR	✓	41	100.000

Origin-Destination Data

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	12	717	10
	B	38	0	10	0
	C	693	3	0	3
	D	32	0	9	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	4	0
	B	0	0	0	0
	C	3	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (min)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-ACD	0.24	0.35	0.3	C	44	66
A-BCD	0.02	0.13	0.0	A	9	14
A-B					11	17
A-C					658	987
D-ABC	0.12	0.19	0.1	B	38	56
C-ABD	0.01	0.13	0.0	A	3	4
C-D					3	4
C-A					636	954

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	36	9	328	0.110	36	0.0	0.1	0.205	B
A-BCD	8	2	545	0.014	7	0.0	0.0	0.112	A
A-B	9	2			9				
A-C	540	135			540				
D-ABC	31	8	464	0.067	31	0.0	0.1	0.138	A
C-ABD	2	0.56	533	0.004	2	0.0	0.0	0.113	A
C-D	2	0.56			2				
C-A	522	130			522				

08:00 - 08:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	43	11	285	0.151	43	0.1	0.2	0.247	B
A-BCD	9	2	515	0.017	9	0.0	0.0	0.118	A
A-B	11	3			11				
A-C	645	161			645				
D-ABC	37	9	423	0.087	37	0.1	0.1	0.155	A
C-ABD	3	0.67	503	0.005	3	0.0	0.0	0.120	A
C-D	3	0.67			3				
C-A	623	156			623				

08:15 - 08:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	53	13	225	0.235	52	0.2	0.3	0.347	C
A-BCD	11	3	474	0.023	11	0.0	0.0	0.130	A
A-B	13	3			13				
A-C	789	197			789				
D-ABC	45	11	363	0.124	45	0.1	0.1	0.189	B
C-ABD	3	0.83	462	0.007	3	0.0	0.0	0.131	A
C-D	3	0.83			3				
C-A	763	191			763				

08:30 - 08:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	53	13	225	0.235	53	0.3	0.3	0.349	C
A-BCD	11	3	474	0.023	11	0.0	0.0	0.130	A
A-B	13	3			13				
A-C	789	197			789				
D-ABC	45	11	363	0.125	45	0.1	0.1	0.189	B
C-ABD	3	0.83	462	0.007	3	0.0	0.0	0.131	A
C-D	3	0.83			3				
C-A	763	191			763				

08:45 - 09:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	43	11	285	0.151	44	0.3	0.2	0.249	B
A-BCD	9	2	515	0.017	9	0.0	0.0	0.119	A
A-B	11	3			11				
A-C	645	161			645				
D-ABC	37	9	423	0.087	37	0.1	0.1	0.156	A
C-ABD	3	0.67	503	0.005	3	0.0	0.0	0.120	A
C-D	3	0.67			3				
C-A	623	156			623				

09:00 - 09:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	36	9	328	0.110	36	0.2	0.1	0.206	B
A-BCD	8	2	545	0.014	8	0.0	0.0	0.112	A
A-B	9	2			9				
A-C	540	135			540				
D-ABC	31	8	464	0.067	31	0.1	0.1	0.139	A
C-ABD	2	0.56	533	0.004	2	0.0	0.0	0.113	A
C-D	2	0.56			2				
C-A	522	130			522				

2023 Baseline With Dev, PM Peak Hour

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (min)	Junction LOS
1	untitled	Right-Left Stagger	Two-way	0.01	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2023 Baseline With Dev	PM Peak Hour	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	900	100.000
B		ONE HOUR	✓	24	100.000
C		ONE HOUR	✓	701	100.000
D		ONE HOUR	✓	21	100.000

Origin-Destination Data

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	35	836	29
	B	19	0	5	0
	C	684	9	0	8
	D	16	0	5	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	1	0
	B	0	0	0	0
	C	2	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (min)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-ACD	0.14	0.36	0.2	C	22	33
A-BCD	0.07	0.13	0.1	A	27	40
A-B					32	48
A-C					767	1151
D-ABC	0.07	0.19	0.1	B	19	29
C-ABD	0.02	0.14	0.0	A	8	12
C-D					7	11
C-A					628	941

Main Results for each time segment

16:45 - 17:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	18	5	309	0.059	18	0.0	0.1	0.206	B
A-BCD	22	5	552	0.040	22	0.0	0.0	0.113	A
A-B	26	7			26				
A-C	629	157			629				
D-ABC	16	4	455	0.035	16	0.0	0.0	0.137	A
C-ABD	7	2	510	0.013	7	0.0	0.0	0.119	A
C-D	6	2			6				
C-A	515	129			515				

17:00 - 17:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	22	5	262	0.082	21	0.1	0.1	0.250	B
A-BCD	26	7	523	0.050	26	0.0	0.1	0.121	A
A-B	31	8			31				
A-C	752	188			752				
D-ABC	19	5	411	0.046	19	0.0	0.0	0.153	A
C-ABD	8	2	475	0.017	8	0.0	0.0	0.128	A
C-D	7	2			7				
C-A	615	154			615				

17:15 - 17:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	26	7	195	0.135	26	0.1	0.2	0.354	C
A-BCD	32	8	483	0.066	32	0.1	0.1	0.133	A
A-B	39	10			39				
A-C	920	230			920				
D-ABC	23	6	344	0.067	23	0.0	0.1	0.187	B
C-ABD	10	2	428	0.023	10	0.0	0.0	0.144	A
C-D	9	2			9				
C-A	753	188			753				

17:30 - 17:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	26	7	195	0.135	26	0.2	0.2	0.356	C
A-BCD	32	8	483	0.066	32	0.1	0.1	0.133	A
A-B	39	10			39				
A-C	920	230			920				
D-ABC	23	6	344	0.067	23	0.1	0.1	0.187	B
C-ABD	10	2	428	0.023	10	0.0	0.0	0.144	A
C-D	9	2			9				
C-A	753	188			753				

17:45 - 18:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	22	5	262	0.082	22	0.2	0.1	0.251	C
A-BCD	26	7	523	0.050	26	0.1	0.1	0.121	A
A-B	31	8			31				
A-C	752	188			752				
D-ABC	19	5	411	0.046	19	0.1	0.0	0.153	A
C-ABD	8	2	475	0.017	8	0.0	0.0	0.128	A
C-D	7	2			7				
C-A	615	154			615				

18:00 - 18:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	18	5	309	0.059	18	0.1	0.1	0.207	B
A-BCD	22	5	552	0.040	22	0.1	0.0	0.113	A
A-B	26	7			26				
A-C	629	157			629				
D-ABC	16	4	455	0.035	16	0.0	0.0	0.137	A
C-ABD	7	2	510	0.013	7	0.0	0.0	0.119	A
C-D	6	2			6				
C-A	515	129			515				

2031 Baseline With Dev, AM Peak Hour

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (min)	Junction LOS
1	untitled	Right-Left Stagger	Two-way	0.03	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2031 Baseline With Dev	AM Peak Hour	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	834	100.000
B		ONE HOUR	✓	48	100.000
C		ONE HOUR	✓	741	100.000
D		ONE HOUR	✓	99	100.000

Origin-Destination Data

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	12	795	27
	B	38	0	10	0
	C	735	3	0	3
	D	89	0	10	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	4	0
	B	0	0	0	0
	C	3	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (min)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-ACD	0.27	0.42	0.4	D	44	66
A-BCD	0.06	0.14	0.1	A	25	37
A-B					11	17
A-C					730	1094
D-ABC	0.28	0.21	0.4	B	91	136
C-ABD	0.01	0.14	0.0	A	3	4
C-D					3	4
C-A					674	1012

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	36	9	308	0.117	36	0.0	0.1	0.220	B
A-BCD	20	5	537	0.038	20	0.0	0.0	0.116	A
A-B	9	2			9				
A-C	599	150			599				
D-ABC	75	19	489	0.152	74	0.0	0.2	0.144	A
C-ABD	2	0.56	517	0.004	2	0.0	0.0	0.117	A
C-D	2	0.56			2				
C-A	553	138			553				

08:00 - 08:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	43	11	261	0.165	43	0.1	0.2	0.275	C
A-BCD	24	6	505	0.048	24	0.0	0.1	0.125	A
A-B	11	3			11				
A-C	715	179			715				
D-ABC	89	22	450	0.198	89	0.2	0.2	0.166	A
C-ABD	3	0.67	484	0.006	3	0.0	0.0	0.125	A
C-D	3	0.67			3				
C-A	661	165			661				

08:15 - 08:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	53	13	194	0.272	52	0.2	0.4	0.420	D
A-BCD	30	7	461	0.064	30	0.1	0.1	0.139	A
A-B	13	3			13				
A-C	875	219			875				
D-ABC	109	27	389	0.280	108	0.2	0.4	0.213	B
C-ABD	3	0.83	438	0.008	3	0.0	0.0	0.138	A
C-D	3	0.83			3				
C-A	809	202			809				

08:30 - 08:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	53	13	194	0.272	53	0.4	0.4	0.424	D
A-BCD	30	7	461	0.064	30	0.1	0.1	0.139	A
A-B	13	3			13				
A-C	875	219			875				
D-ABC	109	27	389	0.280	109	0.4	0.4	0.214	B
C-ABD	3	0.83	438	0.008	3	0.0	0.0	0.138	A
C-D	3	0.83			3				
C-A	809	202			809				

08:45 - 09:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	43	11	261	0.165	44	0.4	0.2	0.277	C
A-BCD	24	6	505	0.048	24	0.1	0.1	0.125	A
A-B	11	3			11				
A-C	715	179			715				
D-ABC	89	22	449	0.198	90	0.4	0.3	0.167	B
C-ABD	3	0.67	484	0.006	3	0.0	0.0	0.125	A
C-D	3	0.67			3				
C-A	661	165			661				

09:00 - 09:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	36	9	308	0.117	36	0.2	0.1	0.221	B
A-BCD	20	5	536	0.038	20	0.1	0.0	0.116	A
A-B	9	2			9				
A-C	599	150			599				
D-ABC	75	19	489	0.152	75	0.3	0.2	0.145	A
C-ABD	2	0.56	517	0.004	2	0.0	0.0	0.117	A
C-D	2	0.56			2				
C-A	553	138			553				

2031 Baseline With Dev, PM Peak Hour

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (min)	Junction LOS
1	untitled	Right-Left Stagger	Two-way	0.02	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2031 Baseline With Dev	PM Peak Hour	ONE HOUR	16:45	18:15	15	✓

Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	981	100.000
B		ONE HOUR	✓	24	100.000
C		ONE HOUR	✓	733	100.000
D		ONE HOUR	✓	50	100.000

Origin-Destination Data

Demand (Veh/hr)

		To			
		A	B	C	D
From	A	0	35	865	81
	B	19	0	5	0
	C	715	9	0	9
	D	45	0	5	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	1	0
	B	0	0	0	0
	C	2	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (min)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-ACD	0.15	0.39	0.2	C	22	33
A-BCD	0.19	0.16	0.2	A	74	111
A-B					32	48
A-C					794	1191
D-ABC	0.14	0.18	0.2	B	46	69
C-ABD	0.02	0.15	0.0	A	8	12
C-D					8	12
C-A					656	984

Main Results for each time segment

16:45 - 17:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	18	5	300	0.060	18	0.0	0.1	0.213	B
A-BCD	61	15	545	0.112	60	0.0	0.1	0.124	A
A-B	26	7			26				
A-C	651	163			651				
D-ABC	38	9	492	0.077	37	0.0	0.1	0.132	A
C-ABD	7	2	504	0.013	7	0.0	0.0	0.121	A
C-D	7	2			7				
C-A	538	135			538				

17:00 - 17:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	22	5	251	0.086	21	0.1	0.1	0.262	C
A-BCD	73	18	515	0.141	73	0.1	0.2	0.136	A
A-B	31	8			31				
A-C	778	194			778				
D-ABC	45	11	451	0.100	45	0.1	0.1	0.148	A
C-ABD	8	2	468	0.017	8	0.0	0.0	0.130	A
C-D	8	2			8				
C-A	643	161			643				

17:15 - 17:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	26	7	181	0.146	26	0.1	0.2	0.386	C
A-BCD	89	22	473	0.188	89	0.2	0.2	0.156	A
A-B	39	10			39				
A-C	952	238			952				
D-ABC	55	14	385	0.143	55	0.1	0.2	0.182	B
C-ABD	10	2	419	0.024	10	0.0	0.0	0.147	A
C-D	10	2			10				
C-A	787	197			787				

17:30 - 17:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	26	7	181	0.146	26	0.2	0.2	0.387	C
A-BCD	89	22	473	0.188	89	0.2	0.2	0.156	A
A-B	39	10			39				
A-C	952	238			952				
D-ABC	55	14	385	0.143	55	0.2	0.2	0.182	B
C-ABD	10	2	419	0.024	10	0.0	0.0	0.147	A
C-D	10	2			10				
C-A	787	197			787				

17:45 - 18:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	22	5	251	0.086	22	0.2	0.1	0.263	C
A-BCD	73	18	515	0.141	73	0.2	0.2	0.136	A
A-B	31	8			31				
A-C	778	194			778				
D-ABC	45	11	451	0.100	45	0.2	0.1	0.148	A
C-ABD	8	2	468	0.017	8	0.0	0.0	0.130	A
C-D	8	2			8				
C-A	643	161			643				

18:00 - 18:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (min)	LOS
B-ACD	18	5	300	0.060	18	0.1	0.1	0.213	B
A-BCD	61	15	545	0.112	61	0.2	0.1	0.124	A
A-B	26	7			26				
A-C	651	163			651				
D-ABC	38	9	492	0.077	38	0.1	0.1	0.132	A
C-ABD	7	2	504	0.013	7	0.0	0.0	0.121	A
C-D	7	2			7				
C-A	538	135			538				

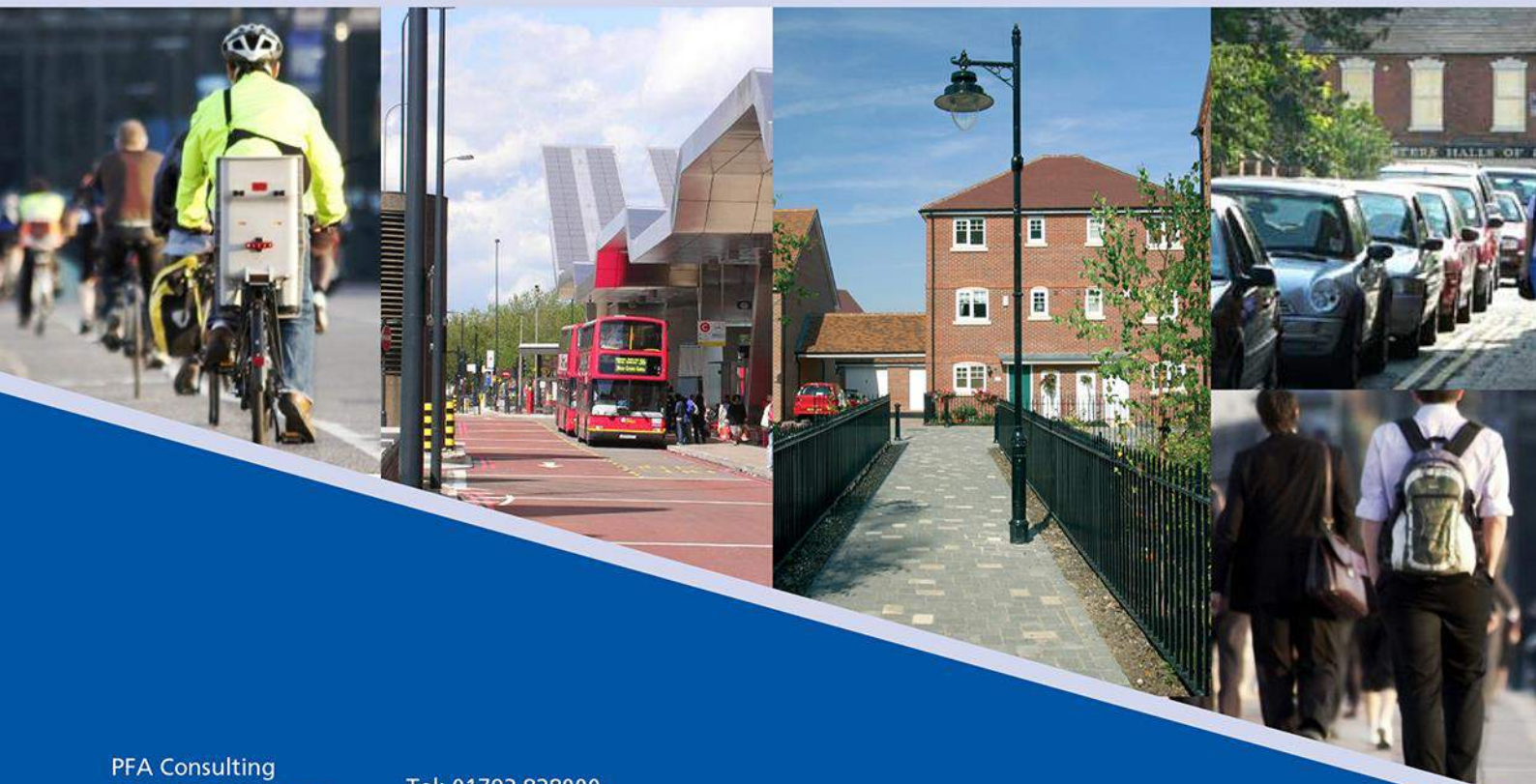
Appendix J

NORTH WEST SITTINGBOURNE

PARAMICS DISCOVERY TRAFFIC MODEL REPORT

PERSIMMON, REDROW, GH DEAN & BOATHOUSE PROPERTIES

APRIL 2018



PFA Consulting
Stratton Park House
Wanborough Road
Swindon
SN3 4HG

Tel: 01793 828000
Fax: 01793 835500
Email: admin@pfaplc.com
Web: www.pfaplc.com

engineering the future

PAGE LEFT INTENTIONALLY BLANK

DOCUMENT CONTROL

Job No	D118	
File Reference	G:\workfiles\D118 GT GROVEHURST FARM\REPORTS\D118-DOC09 PARAMICS Issue 2.docx	
	Name	Date
Prepared By	P Key	16 January 2018
Checked By	A Miles	17 January 2018

Issue	Date	Comments	Approved
1	20 February 2018	Issue to consortium for comment	J Alexander
2	18 April 2018	Submission	C J Mumford

PAGE LEFT INTENTIONALLY BLANK

CONTENTS

PAGE NO.

FIGURES

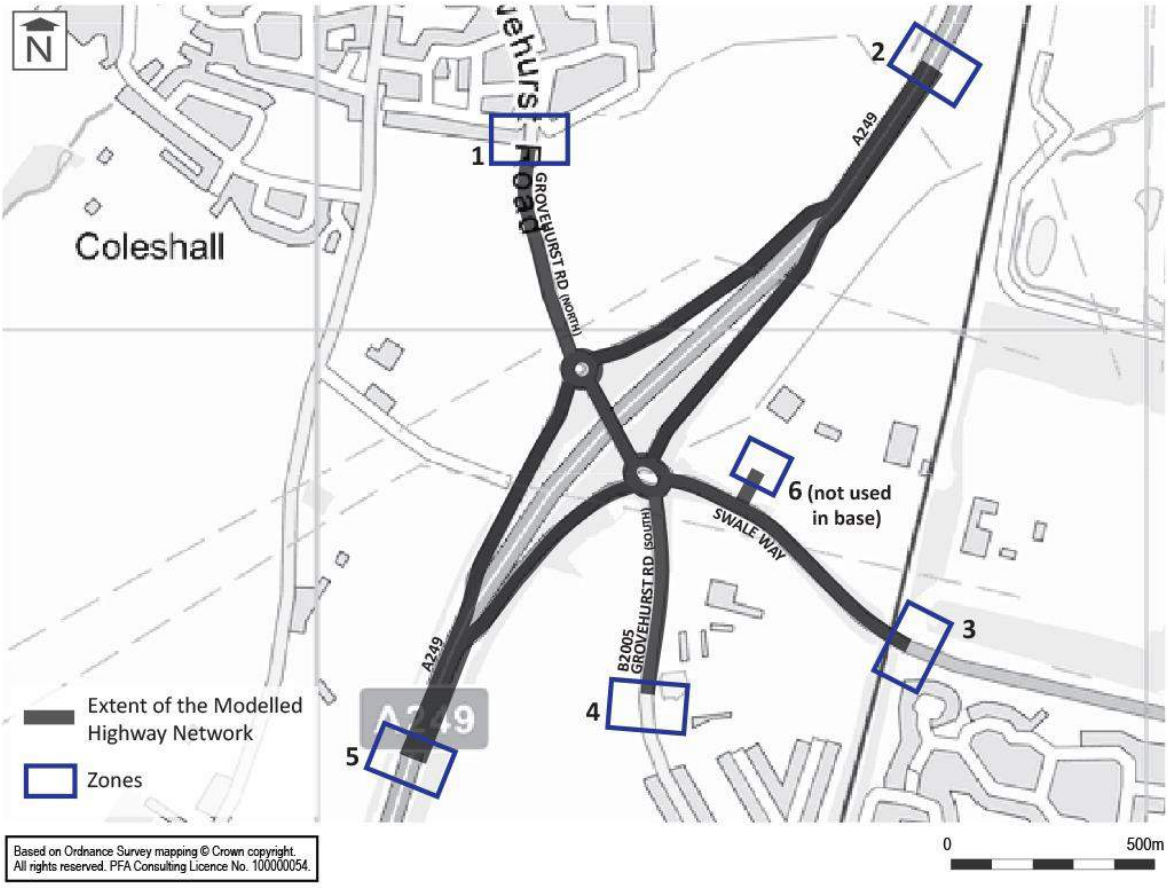
APPENDICES

1. INTRODUCTION

1.1. A Paramics Discovery micro-simulation traffic model of the A249(T) Grovehurst Interchange has been built by PFA Consulting on behalf of Persimmon, Redrow, G H Dean and Boathouse Properties to support proposals for mixed use development on land at North West Sittingbourne under Policy MU1 of 'Bearing Fruits 2031': Swale Borough Local Plan, adopted in July 2017. 'Bearing Fruits 2031' states that the land at North West Sittingbourne is suitable for development comprising a new residential community with a minimum of 1,500 dwellings, and supporting community facilities.

1.2. The extent of the Paramics Discovery modelled highway network is shown in **Figure 1.1**.

Figure 1.1: Local Highway Network and Modelled Zones



1.3. The objective of the modelling exercise is to adequately represent the existing and future operation of the A249(T) Grovehurst Interchange to enable the impact of the proposed residential development to be assessed. This document sets out the details of the model development and validation of the 2015 base year Paramics Discovery traffic model representing the weekday AM and PM peak periods, and also reports on the future scenario forecast assessment.

1.4. Paramics Discovery represents a contemporary approach to the understanding, representation and analysis of traffic. Individual vehicles moving through the network are modelled in detail as is the highway network which can include, for example, vehicle actuated signal control, bus priority measures and traffic calming. It allows variable demand over a specified time period to be input and models the interaction of junctions with one another.

1.5. This model has been built in accordance with the 'Micro-simulation Good Practice Guide', produced by SIAS Limited, the developers of Paramics Discovery.

2. MODEL DEVELOPMENT

Study Area

2.1. **Figure 1.1** shows the extent of the Paramics traffic model which includes the A249(T) Grovehurst Interchange and all approaches, including the A249(T) slip roads, Grovehurst Road North, the B2005 Grovehurst Road and Swale Way.

Model Year and Assessment Time Periods

2.2. The Paramics Discovery model has been developed for a base year of 2015 representing the following time periods:

- Weekday AM Peak Period (07:50-08:50)
- Weekday PM Peak Period (17:00-18:00)

Data Collection

2.3. In order to produce the 2015 base year model, traffic data from an ANPR survey of Grovehurst Interchange was used. The survey was undertaken on Tuesday 3rd November 2015 (a typical weekday) and covered both the AM peak and PM peak time periods. Queue length surveys were also carried out at the roundabouts.

2.4. A summary of the traffic count data for the weekday AM peak hour (07:50-08:50) and weekday PM peak hour (17:00-18:00) time periods is provided at **Appendix A**.

2.5. To validate the model, queue data was collected on all approaches to Grovehurst Interchange, including the connecting link road. The queue data was collected in 5 minute intervals for the same period as the traffic counts referred to above.

Network Development

2.6. The modelled highway network has been constructed using topographical survey data and aerial photography, and supplemented by observations taken on-site. The modelled base year highway network is illustrated on the Paramics network plot shown as **Figure 2.1**.

Figure 2.1: Base Year Modelled Highway Network Paramics Plot

2.7. The base model comprises 6 zones as shown in **Figure 1.1**. Zone 6 in the base model represents the Nicholls Logistics Park. However, no trips have been assigned to the zone. This was decided as any trips to/from the depot using Grovehurst Interchange would have been picked up on the ANPR cameras and so would already been included within the model.

Priority Junctions

2.8. These junctions have generally been coded using default parameters set in Paramics Discovery. Stop lines were placed so that vehicles take the correct path at the turn which helps to ensure that the manoeuvre is undertaken at the appropriate speed. Visibility parameters were used where the junction layout was observed to give a reasonable line of sight for vehicles giving way at a junction. All movements on the minor road approach of priority junctions have been coded as a minor priority. The right turn from a major road into a side road has been coded as a medium priority. The 'Look Through' parameter has been introduced on links where necessary to ensure appropriate gap acceptance for traffic giving-way.

Roundabouts

2.9. All approach arms to roundabouts have been coded as a medium priority. During the calibration of the model, visibility on the approaches was set to 30m as a starting point and adjusted to reflect vehicle behaviour and to calibrate the model to the observed queuing. Gap acceptance modifiers were used where necessary to increase the vehicle throughput on the approaches to reflect observed queues. The 'Look Through' parameter has been introduced on all short circulatory links. The Roundabout Lanes editor was used to ensure appropriate lane usage and give-way behaviour to reflect the conflicts at roundabouts.

Matrix Development

Traffic Demand

2.10. Traffic demand matrices were derived using the observed 1-hour traffic count data. Two demand matrices were built for each time period modelled; 'Lights' (Cars & LGVs) and 'Heavies' (OGV1, OGV2, PSV). The proportions of traffic for each vehicle type were derived from the traffic counts and applied to the matrices.

2.11. The 'matrix estimation' facility within Paramics Discovery was not required given the small size of the network. Accordingly traffic demands were entered directly from the observed traffic counts.

Demand Profiles

2.12. In order to replicate accurately the peaking of traffic flows, the peak period matrices were profiled, i.e. the rate of release of vehicles into the micro-simulation network was varied over the modelled time period. Profiles define the proportion of trips starting their journey in 5 minute time segments over the modelled time period.

2.13. Traffic demand profiles were created for all vehicles for each approach to the network from the traffic counts, taking account of queue data.

2.14. The traffic demand profiles were applied to the origin-destination cells in the matrices to model in detail the variable demand for different trip movements over the modelled time periods. Full details of the demand profiles used in the 2015 base year traffic model are provided at **Appendix B**.

3. MODEL CALIBRATION

3.1. Model calibration is defined as the process by which individual components of a simulation are adjusted to ensure accurate representation of observed traffic conditions. Recorded queue data shows how the corridor operates during the modelled time periods.

3.2. The key global driver behaviour parameters used in the model calibration are included in **Table 3.1**. Default driving parameters are included in all modelled time periods. To avoid modelling bias, the settings for these parameters should remain constant for the existing and any proposed forecast models.

Table 3.1: Key Global Micro-Simulation Parameters

Parameters	Value / Selection
Mean Headway (sec)	1 second (default)
Minimum Gap (m)	2 metres (default)
Driver Behaviour (Aggression / Awareness)	Default
Link Categories	Default
Vehicle Speeds	Speed limits
Seeds/Runs	10 runs with random seeds

Junction and Link Calibration

3.3. Calibration parameters have been applied to the network to allow better representation to reflect observed conditions. Apart from the repositioning of stop lines, the main calibration parameters applied within the model are: the use of 'Visibility', 'gap acceptance modifiers' and 'Look Through'. Additionally traffic demand profiles were adjusted from those calculated to better reflect modelled queuing.

3.4. Gap Acceptance Modifiers (Lane Merge, Lane Cross and Path Cross) have only been applied to reflect on-site observations. The calibration attempted to reflect the observed level of queuing at Grovehurst Interchange.

4. MODEL VALIDATION

4.1. The test if a model is 'fit for purpose' is normally carried out by examining the extent to which the model reproduces observed conditions. Validation of the traffic model was based upon a comparison of observed against modelled traffic flow data and a comparison between observed and modelled journey times.

4.2. The model validation process has been carried out in accordance with the criteria specified in the DMRB Volume 12 'Traffic Appraisal in Urban Areas'. The guidelines are summarised in **Table 4.1** below.

Table 4.1: DMRB Criteria Summary Table (based on Vol 12 Section 2 Table 4.2)

Criteria and Measurements	Acceptability Guidelines
Assigned Hourly Flows:	
1. Individual flows within 100vph (flows<700vph)	85% of all cases
2. Individual flows within 15% (flows 700-2700vph)	85% of all cases
3. Total Screenline flows within 5%	All (or nearly all) screenlines
4. GEH Statistics: individual flows GEH<5	85% of all cases
5. GEH Statistics: screenline flows GEH<4	All (or nearly all) screenlines
Modelled Journey Times:	
6. Times within 15% (or 1 minute, if higher)	85% of all cases

Model Runs

4.3. The output flows and journey times from the model have been collated and averaged based on the results of 10 runs of the model at different seeds. Performing multiple runs and combining the data is statistically more robust than relying on a single run of the model and better reflects the variability of traffic movements experienced in practice.

4.4. The use of different seeds tests the sensitivity and stability of the model. An examination of the flows between each seed run showed that there was little variation which confirms the general stability of the model.

Traffic Flow Validation

4.5. The GEH statistic is used in the validation of a model to compare the difference between an observed flow and an assigned flow and is defined as follows:

$$GEH = \sqrt{(V_O - V_A)^2 / (0.5 \times (V_O + V_A))}$$

where V_O = observed traffic flow and V_A = assigned traffic flow.

4.6. The reason for using the GEH statistic rather than an absolute or relative flow difference is that it caters for a wide range of traffic flows. For example, whereas an absolute difference of 100 vehicles per hour can be important with respect to a flow of vehicles per hour, it is largely irrelevant in a flow of several thousand vehicles per hour.

4.7. **Appendix C** contains tables comparing the modelled turning flows with the observed turning flows for the Grovehurst Interchange. The flows are provided for the AM and PM peak hour modelled time periods. Differences are given in both absolute and percentage terms, together

with the GEH statistic, and whether the individual turning flows comply with the DMRB criteria of acceptability (which requires a GEH value of less than 5).

4.8. **Tables 4.2 and 4.3** summarise the traffic flow validation for Grovehurst Interchange for the modelled AM peak hour (08:00-09:00) and PM peak hour (17:00-18:00) time periods respectively . This shows that the traffic model validates well in respect of DMRB validation criteria with all turning movements having a GEH value of less than 5.

Table 4.2: Grovehurst Interchange Turning Flow Validation AM Peak Hour (07:50–08:50)

Approach	Movement to	Observed Flow	Modelled Flow	GEH	GEH <5
Roundabout Link	Straight Ahead to Grovehurst Rd	162	159	0.2	✓
	Right Turn to A249 Onslip	245	242	0.2	✓
A249 NB Offslip	Left Turn to Grovehurst Rd	49	49	0.0	✓
	Straight Ahead to A249 Onslip	0	0	0.0	✓
	Right Turn to Rbt Link	647	634	0.5	✓
Grovehurst Road North	Left Turn to A249 Onslip	25	25	0.0	✓
	Straight Ahead to Rbt Link	408	403	0.2	✓
A249 SB Offslip	Left Turn to Swale Way	311	305	0.3	✓
	Straight Ahead to Grovehurst Rd	175	171	0.3	✓
	Straight Ahead to A249 Onslip	1	0	1.4	✓
	Right Turn to Rbt Link	4	4	0.0	✓
Swale Way	Left Turn to Grovehurst Rd	78	77	0.1	✓
	Left Turn to A249 Onslip	279	275	0.2	✓
	Straight Ahead to Rbt Link	182	180	0.1	✓
Grovehurst Road South	Left Turn to A249 Onslip	170	168	0.2	✓
	Straight Ahead to Rbt Link	222	219	0.2	✓
	Right Turn to Swale Way	134	131	0.3	✓
Roundabout Link	Left Turn to Swale Way	673	636	1.4	✓
	Straight Ahead to Grovehurst Rd	224	254	1.9	✓
	Right Turn to A249 Onslip	155	142	1.1	✓
Total		**4,144**	**4,074**		

Table 4.3: Grovehurst Interchange Turning Flow Validation PM Peak Hour (17:00–18:00)

Approach	Movement to	Observed Flow	Modelled Flow	GEH	GEH <5
Roundabout Link	Straight Ahead to Grovehurst Rd	220	216	0.3	✓
	Right Turn to A249 Onslip	436	428	0.4	✓
A249 NB Offslip	Left Turn to Grovehurst Rd	206	205	0.1	✓
	Straight Ahead to A249 Onslip	1	0	1.4	✓
	Right Turn to Rbt Link	565	560	0.2	✓
Grovehurst Road North	Left Turn to A249 Onslip	19	19	0.0	✓
	Straight Ahead to Rbt Link	192	193	0.1	✓
A249 SB Offslip	Left Turn to Swale Way	177	176	0.1	✓
	Straight Ahead to Grovehurst Rd	191	190	0.1	✓
	Straight Ahead to A249 Onslip	0	0	0.0	✓

	Right Turn to Rbt Link	33	33	0.0	✓
Swale Way	Left Turn to Grovehurst Rd	135	132	0.3	✓
	Left Turn to A249 Onslip	451	444	0.3	✓
	Straight Ahead to Rbt Link	347	343	0.2	✓
Grovehurst Road South	Left Turn to A249 Onslip	88	87	0.1	✓
	Straight Ahead to Rbt Link	277	274	0.2	✓
	Right Turn to Swale Way	105	103	0.2	✓
Roundabout Link	Left Turn to Swale Way	371	369	0.1	✓
	Straight Ahead to Grovehurst Rd	326	315	0.6	✓
	Right Turn to A249 Onslip	56	66	1.3	✓
Total		**4,196**	**4,153**		

4.9. The above tables show that the traffic flow validation meets the DMRB validation criteria in both the AM and PM peak hours. The modelled traffic flows can therefore be seen to be representative of those observed from the traffic counts.

Modelled Link Flows

4.10. 2015 base year modelled link flows plots derived from the Paramics model for the weekday AM peak hour (07:50-08:50) and weekday PM peak hour (17:00-18:00) are reproduced at **Appendix D**.

Queue Length Validation

4.11. Observed queue length data has been compared with the queue results from the Paramics model for both the AM (07:50 – 08:50) and PM (17:00 – 18:00) peak hours. The queue length graphs show that the modelled queue results broadly reflect the observed queue lengths over both the AM and PM peak hours. The queue length graphs have been reproduced in **Appendix E**.

Conclusion

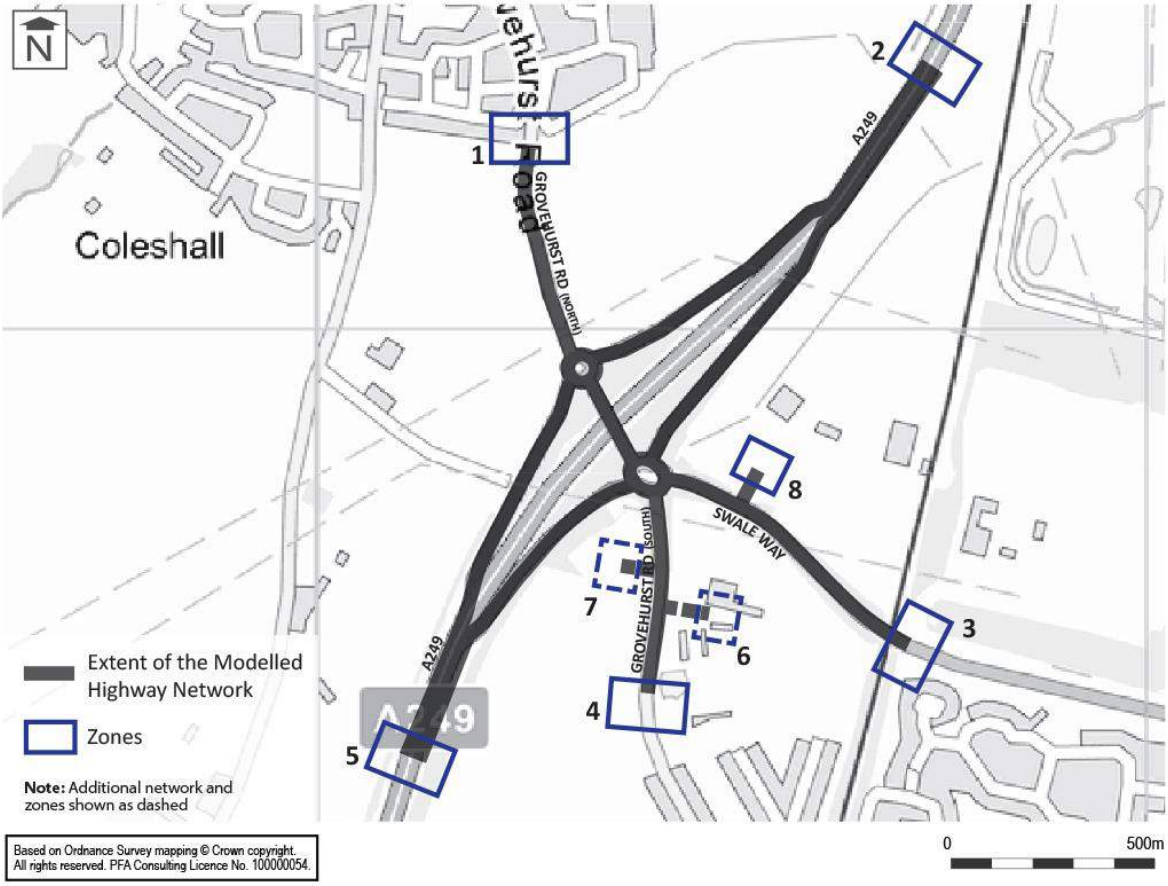
4.12. The traffic model has been shown to perform well against the DMRB validation criteria guidelines for acceptability in respect of traffic flows and queue lengths for both the weekday AM and PM peak periods. The model provides a good representation of existing traffic conditions at Grovehurst Interchange and provides a suitable basis for forecasting future traffic conditions, and for testing future highway and development proposals in the study area.

5. MODEL FORECASTING

5.1. The validated 2015 base year Paramics Discovery model for Grovehurst Interchange was used to create a forecast year model using the committed development traffic and the existing layout of the junction. Subsequently a forecast year with committed development plus the addition of the North West Sittingbourne development traffic was created, to be assessed with the proposed interim improvement scheme for Grovehurst Interchange.

5.2. **Figure 5.1** shows the modelled highway network assessed for the future year forecasting.

Figure 5.1: Future Year Local Highway Network and Modelled Zones



Assessments Scenarios

5.3. **Table 5.1** lists the scenarios used to assess the impact of the proposed North West Sittingbourne development.

Table 5.1: Forecasting Scenario

Scenario No.	Scenario Name	Grovehurst Interchange
1	2015 Base Year	Existing Layout
2	2023 (traffic growth only)	Existing Layout
3	2023 + Committed Development	Existing Layout
4	2023 + Committed Development + North West Sittingbourne	Interim Improvement

Forecast Year Traffic Flows

5.4. In the production of the Transport Assessment for the proposed development at North West Sittingbourne, Peter Brett Associates (PBA) produced a comprehensive spreadsheet to calculate future year traffic flows. This included the following:

- Future assessment years of 2023 and 2031
- Background TEMPro growth factors
- Directly including committed development traffic flows
- Calculating North West Sittingbourne development traffic
- Distributing North West Sittingbourne development traffic using 2011 Census Journey to Work data

5.5. Relevant spreadsheets for the future year scenarios are reproduced at **Appendix F** of this report.

TEMPro Growth Factors

5.6. In order to represent forecast background traffic, growth factors based upon TEMPro v7 were calculated by PBA. These factors have been adjusted to remove any double counting from the committed residential development sites (scoped by PBA with Kent County Council highway officers) which are added explicitly to the background traffic flows.

5.7. The 2023 growth factor calculations are set out in more detail in the PBA TA for North West Sittingbourne. The adjusted 2023 growth factors are summarised below:

- 2015 – 2023 AM growth factor = 1.0938 (rural trunk road)
- 2015 – 2023 PM growth factor = 1.0936 (rural trunk road)
- 2015 – 2023 AM growth factor = 1.0688 (urban principal road)
- 2015 – 2023 PM growth factor = 1.0686 (urban principal road)

5.8. The 2015 traffic flows were factored up to 2023 using the adjusted TEMPro growth factors to create Scenario 2.

5.9. The committed development sites included within Scenario 3 are summarised (in terms of residential units) as:

- SW11/0159 Morrison's Mill Way - 150 residential units left to build out.
- SW14/501588 Stones Farm, Bapchild - 600 houses.
- SW14/505440 Spirit of Sittingbourne - 215 residential units.
- SW/02/1180 - Land at East Hall Farm – 314 residential units left to build out.
- SW/08/1127 – Land at Coleshall Farm, Iwade – 145 residential units left to build out.
- Iwade allocation – 572 residential units.

Proposed North West Sittingbourne Development

5.10. The proposed development at North West Sittingbourne is an allocated site under Policy MU 1 of 'Bearing Fruits 2031', the Swale Borough Local Plan. Part 7a. of Policy MU 1 requires that the development proposals will provide interim improvements at the Grovehurst Road/A249 junction, known in this report as Grovehurst Interchange.

5.11. Part of the North West Sittingbourne allocation is located to the west of Grovehurst Road (south of Grovehurst Interchange). An additional part of the allocation is the Great Grovehurst Farm site located to the east of Grovehurst Road, opposite the North West Sittingbourne site. The combined impact of these two sites constitutes the proposed development scenario assessed within Scenario 4.

5.12. For context a plan showing the full North West Sittingbourne allocation has been included as **Appendix G**.

Trip Generation & Distribution

5.13. PBA calculated the proposed development trip generation using TRICS. This has been agreed with relevant highway officers. The distribution of residential development trips was calculated using 2011 Census Journey to Work data, whilst secondary school trips were distributed using a gravity model. The distributed development traffic in the future year of 2023 is set out on relevant sheets at A**ppendix F**.

5.14. Scenario 4 models the proposed North West Sittingbourne allocation prior to the completion of the internal site link road. Traffic flows for the proposed development demand matrices have been derived from the PBA spreadsheets included in **Appendix F**, namely the 'Total Development Flows' sheets.

Proposed Site Access Arrangements

5.15. The proposed development has been included within the Paramics model as two separate zones. The Great Grovehurst Farm site accesses Grovehurst Road from the east (zone 6) where as the remainder of North West Sittingbourne accesses Grovehurst Road from the west (zone 7). To take into account the second access to North West Sittingbourne situated to the south of the modelled highway network a proportion of trips to the site have been assigned to pass the site access and continue on the Grovehurst Road (South) represented by Zone 4.

5.16. The indicative layout of the site access junctions with Grovehurst Road for the proposed North West Sittingbourne allocation is set out on Peter Brett drawing 27239_5506_032 Rev B reproduced at **Appendix H**.

5.17. **Figure 5.2** shows how the site access arrangements were included within the Paramics mode.

Figure 5.2: Proposed North West Sittingbourne Site Access Junction Paramics Plot

Traffic Demand Profiles

5.18. In order to replicate the traffic flow peaks accurately, the proposed development demands used profiles calculated for G Grovehurst Road South departing traffic and the relevant junction entry arm for arriving traffic. As this model over covers 1-hour time periods and the TRICS data could not be broken down to 15 minute time periods, the traffic count profiles were considered the most suitable way to profile the demand flows.

Grovehurst Interchange Interim Improvement Scheme

5.19. The proposed interim improvement scheme for Grovehurst Interchange is shown on Drawing D118/25 Rev B reproduced at **Appendix I**.

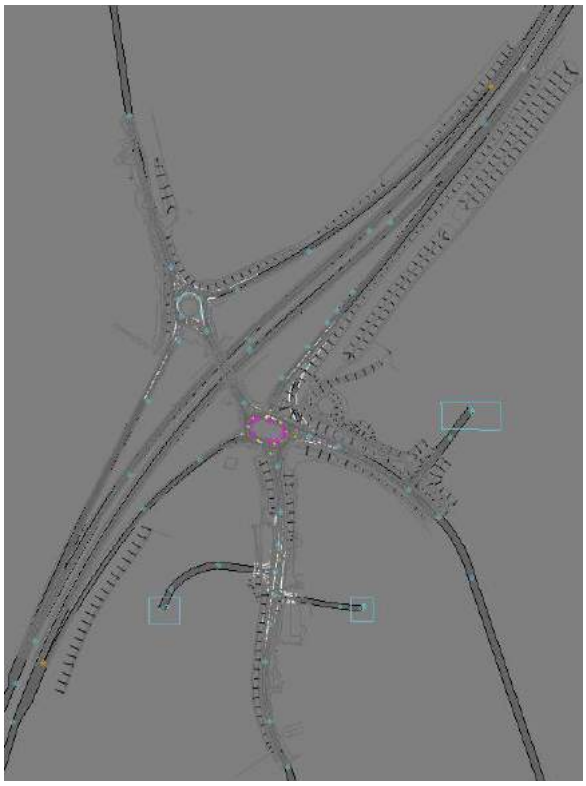
5.20. The interim improvements include:

- Widening to approach of Grovehurst Road South
- Widening to approach of Swale Way
- Widening to approach of Grovehurst Road North
- New filter Lane for traffic from A249 SB offslip to Swale Way
- Increase in size of north western roundabout
- Signalisation of A249 NB offslip and corresponding conflicting traffic
- Improvements to deflection on all non-signalised approaches

5.21. The improvements are designed to provide an interim improvement to Grovehurst Interchange to mitigate the proposed development at North West Sittingbourne, specifically providing a safety improvement to ensure A249 offslip traffic does not queue back onto the mainline carriageway.

5.22. The inclusion of the Grovehurst Interchange Interim Improvement within the Paramics model is shown below as **Figure 5.3.**

Figure 5.3: Grovehurst Interchange Interim Improvement Paramics Plot



6. FORECASTING RESULTS

6.1. A comparison has been made between the four model scenarios to determine the impact of the proposed development at North West Sittingbourne.

Link Flows

6.2. Link flows have been extracted from the Paramics models for the modelled AM (07:50-08:50) and PM (17:00-18:00) peak hours. **Figures 6.1 & 6.2** provide a comparison of the modelled link flows between the four scenarios for the AM and PM peak hours respectively.

Figure 6.1: AM Peak Hour Modelled Link Flows

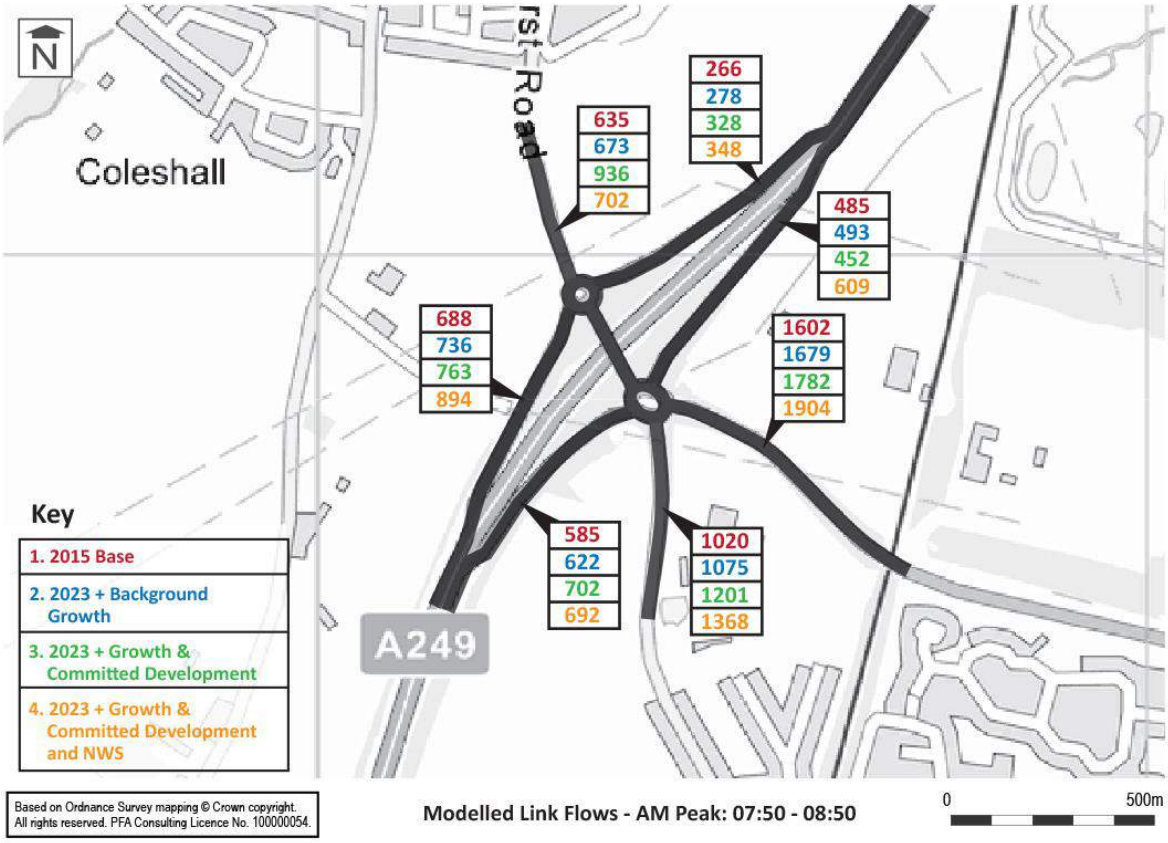
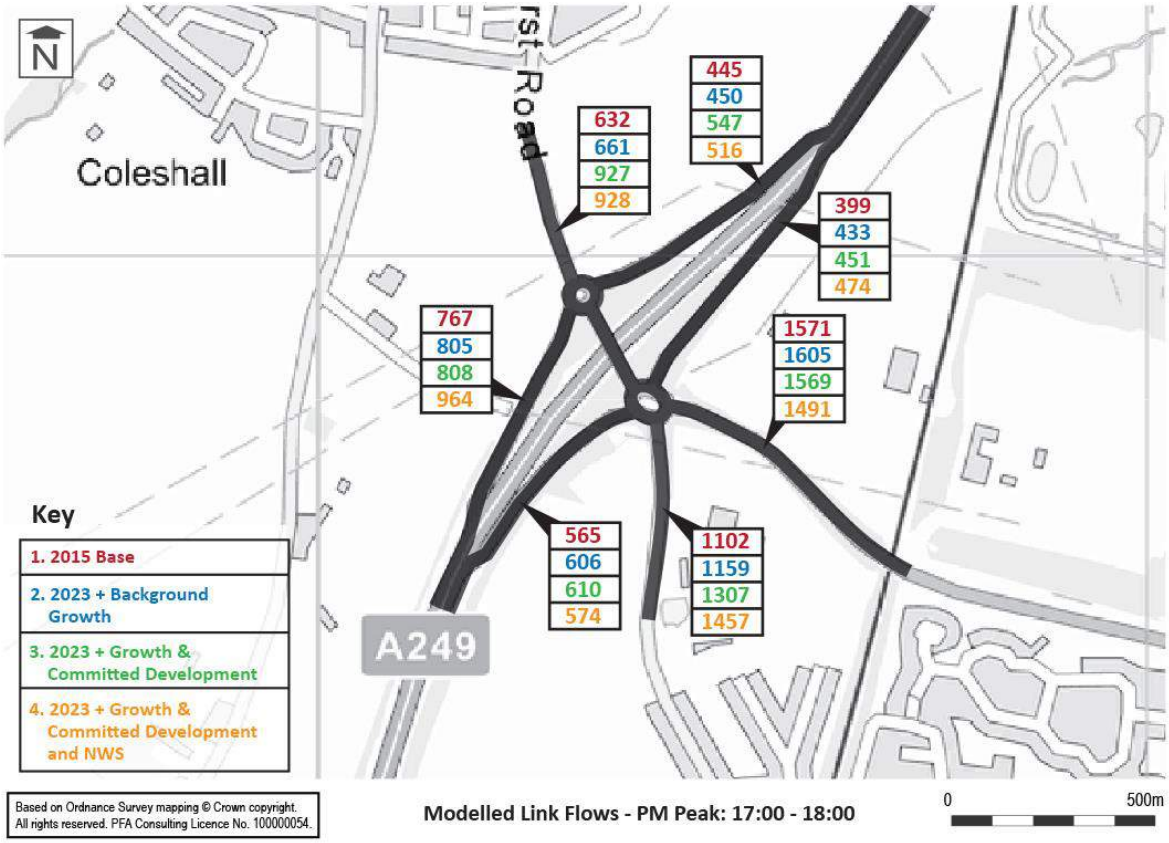


Figure 6.2: PM Peak Hour Modelled Link Flows



6.3. With the inclusion of the committed development traffic in Scenario 3 (excluding North West Sittingbourne), additional traffic through the roundabouts increases by approximately 600 vehicles in each peak hour, equating to a 20% increase in traffic flow. With the inclusion of the proposed development in Scenario 4, an additional circa 200-230 vehicles are added to the network in each peak hour.

6.4. The congestion in the network is causing vehicles flows to be lower on some approaches than the input demand matrix. This is where extensive queuing on the network results in vehicles still traversing the network after the modelled peak hour has finished. This is to be expected in a 1-hour peak model where there is not a sufficient 'warm up' and 'warm down' to allow queues to build and disperse. Further explanation of queuing in the network and the corresponding delay is explained below.

Queue Length Results

6.5. Queue lengths for all scenarios at Grovehurst Interchange have been extracted from the Paramics models.

6.6. A comparison of queue lengths has been undertaken for both the AM peak (07:50-08:50) and PM peak (17:00-18:00) time periods, with queue lengths provided in **Appendix J**.

6.7. To summarise the impact of the proposed North West Sittingbourne allocation including the Interim Improvement, a comparison has been made between the forecast year 'without development' scenario (Scenario 3), and the forecast year 'with development' and with the interim improvements scenario (Scenario 4).

Northwest Roundabout

Grovehurst Road (North)

6.8. In the AM peak hour both Scenario 3 and Scenario 4 are showing large queues on Grovehurst Road (North). Scenario 3 is showing a maximum queue of 150 vehicles. In Scenario 4 the maximum queue length increases to 250 vehicles. The signalisation of the A249 offslip and adjoining circulatory as part of the interim scheme in Scenario 4 only allows give-way movements from Grovehurst Road (North) to manoeuvre during the intergreen period at the signals. In Scenario 3 excessive queuing on the A249 northbound offslip creates more opportunities for manoeuvres from Grovehurst Road (North) though the significant level of committed development traffic in Scenario 3 indicates the approach in its existing give-way form is over capacity with that volume of traffic flow.

6.9. In the PM peak Grovehurst Road (North) is operating with minimal queuing with the exception of Scenario 4 which is resulting in a maximum queue of approximately 50 vehicles.

B2005 (roundabout internal link northbound)

6.10. In both the AM and PM peak hours the northbound internal link of the interchange is operating with no queuing in Scenario 3. However, in Scenario 4 maximum queues of approximately 10 vehicles are experienced in both peaks. The interim improvement scheme signalises the A249 northbound offslip and the adjoining circulatory carriageway thus causing the queuing on the internal link. This is to be expected when adding traffic signals, and is an unavoidable consequence of the benefits the signalisation brings to the A249 offslip.

A249 Northbound Offslip

6.11. In the AM peak hour for Scenario 3 the northbound offslip is seeing queues of approximately 100 vehicles. The signalisation of the A249 northbound offslip as part of the interim scheme in Scenario 4 provides significant reductions in queuing on the offslip with the maximum queue in Scenario 4 similar to the levels of queuing experienced in the 2015 base year.

6.12. In Scenario 3 the PM peak hour is seeing queues of approximately 125 vehicles on the northbound offslip. As would be expected this is due to the addition of committed development traffic flows in Scenario 3 and the junction keeping its existing form. In contrast the signalisation of the A249 northbound offslip in Scenario 4 provides significant reductions in queuing on the offslip.

Southeast Roundabout

A249 Southbound Offslip

6.13. The southbound offslip is seeing maximum queues of approximately 100 vehicles in Scenario 3 in the AM peak hour, exceeding the length of slip road, which allows for about 60 vehicles. In Scenario 4 the introduction of the interim scheme provides a new filter lane for traffic to access Swale Lane from the approach removing the queues.

6.14. In the PM peak hour the maximum queue on the southbound offslip is under 10 vehicles in all forecast year scenarios.

Swale Way

6.15. In the AM peak hour Swale Way is seeing a maximum queue of 15 vehicles in Scenario 3 with the maximum queuing increasing to approximately 20 vehicles in Scenario 4. For the majority of the time period maximum queue lengths are approximately 5 vehicles for both scenarios highlighting the short term nature of peak queuing experienced on the approach.

6.16. In the PM peak hour Swale Way is experiencing maximum queues of 250 vehicles in Scenario 3 with similar queueing experiencing with the addition of the proposed development in Scenario 4.

6.17. The proposed development adds an additional 9 vehicles in AM and 13 in the PM peak hour on Swale Way towards Grovehurst Interchange, a comparatively insignificant amount when compared to the increase from committed development of 61 and 168 respectively.

6.18. With the proposed development and interim improvements the anticipated future conditions are not made worse.

B2005 Grovehurst Road (South)

6.19. In the AM peak hour the approach is seeing a maximum queue of 12 vehicles in Scenario 3 with the maximum queuing increasing to approximately 17 vehicles in Scenario 4. For the majority of the time period there is a maximum queue length of approximately 7 vehicles for both scenarios highlighting the short term nature of peak queuing experienced on the approach.

6.20. In the PM peak period maximum queue lengths are below 10 vehicles on the Grovehurst Road (South) approach for all scenarios assessed. Grovehurst Road (South) is the only route development traffic can use to access the proposed development and the results indicate that the proposed development can be accommodated on the approach with minimal delay.

B2005 (roundabout internal link southbound)

6.21. In both the AM and PM peak hours the southbound internal link of the interchange is operating with maximum queues of approximately 3 vehicles in all scenarios.

Summary

6.22. The model outputs show that without the proposed development at Northwest Sittingbourne, by 2023 severe queuing will be taking place.

6.23. The inclusion of the proposed development traffic and the interim improvements in scenario 4 results in significant improvements to the A429 offslips. Queuing issues on local roads can be attributed to significant committed development traffic and the volume of development traffic on these roads is insignificant in comparison and does not directly make the situation worse.

7. CONCLUSION

7.1. A Paramics Discovery micro-simulation traffic model of the A249(T) Grovehurst Interchange has been built by PFA Consulting on behalf of Persimmon, Redrow, G H Dean and Boathouse Properties to support proposals for mixed use development on land at North West Sittingbourne under Policy MU1 of *Bearing Fruits 2031*: Swale Borough Local Plan, adopted in July 2017. *Bearing Fruits 2031* states that the land at North West Sittingbourne is suitable for development comprising a new residential community with a minimum of 1,500 dwellings, and supporting community facilities.

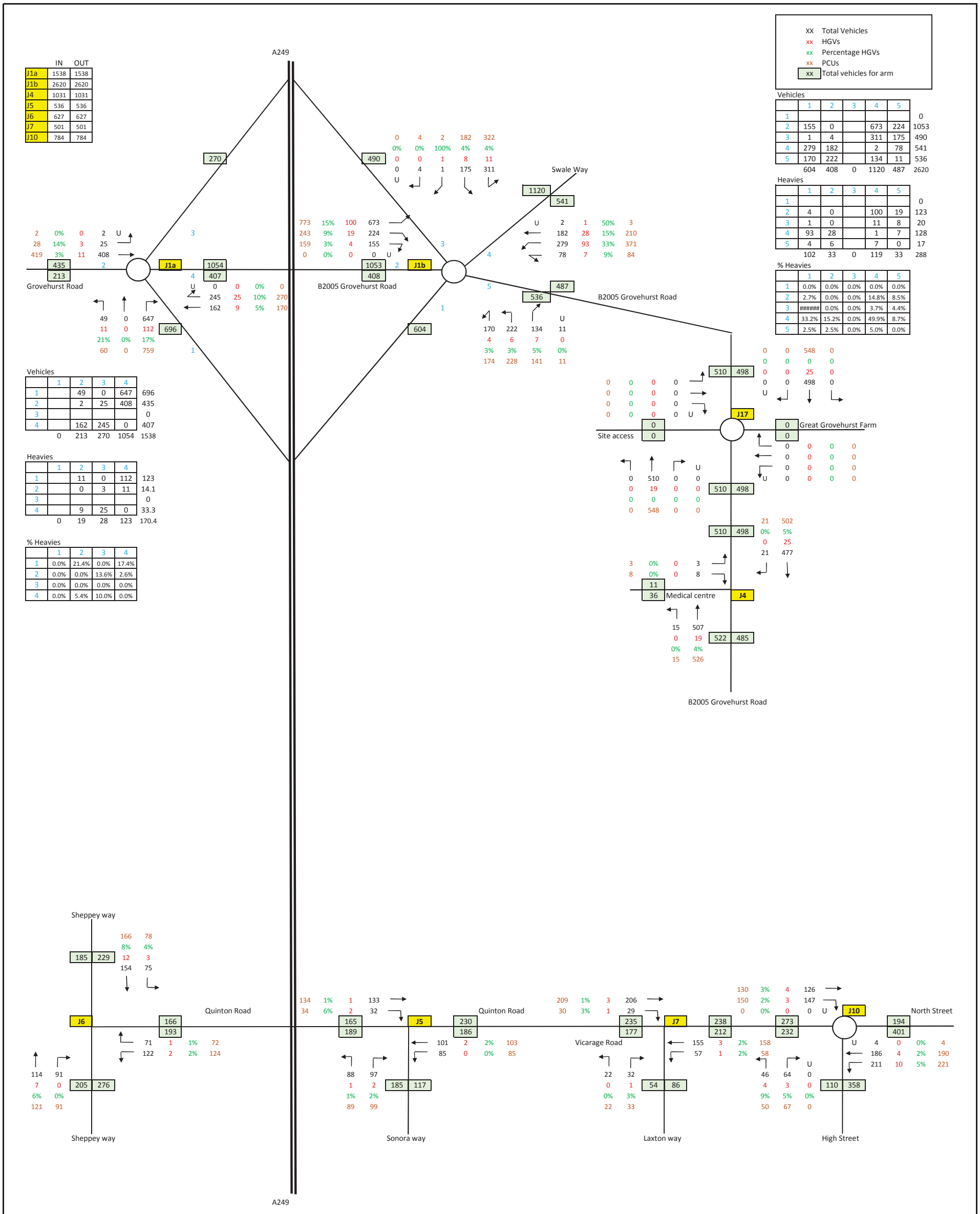
7.2. The Grovehurst Interchange 2015 base year model has been calibrated and validated using traffic count and queue length collected by an independent traffic count company. The traffic model has been shown to perform well against the DMRB validation criteria guidelines for acceptability for traffic flows for the both the weekday AM and PM peak hours whilst broadly reflecting observed levels of queuing.

7.3. The Paramics Discovery model has been used to assess three 2023 forecast year scenarios; two of the scenarios model the impacts of background growth and of committed developments using the existing layout arrangements, whilst the final scenario models an interim improvement at the junction scheduled to come forward as part of the North West Sittingbourne development.

7.4. The model has shown that without the proposed development at North West Sittingbourne, by 2023 severe queuing will be taking place. The inclusion of the proposed development traffic and the interim improvements in scenario 4 results in significant improvements to the A429 offslips, whilst queuing issues on local roads can be attributed to significant committed development traffic; the volume of North West Sittingbourne development traffic on these roads is insignificant in comparison and does not make the situation worse. In the vicinity of the site access on Grovehurst Road (south), development traffic can be accommodated onto the network without significant delays on the approach.

Appendices

Appendix A



	IN	OUT
J1a	1538	1538
J1b	2620	2620
J4	1031	1031
J5	536	536
J6	627	627
J7	501	501
J10	784	784

Vehicles

	1	2	3	4	
1		49	0	647	696
2		2	25	408	435
3					0
4		162	245	0	407
	0	213	270	1054	1538

Heavies

	1	2	3	4	
1		11	0	112	123
2		0	3	11	14.1
3					0
4		9	25	0	33.3
	0	19	28	123	170.4

% Heavies

	1	2	3	4
1	0.0%	21.4%	0.0%	17.4%
2	0.0%	0.0%	13.6%	2.6%
3	0.0%	0.0%	0.0%	0.0%
4	0.0%	5.4%	10.0%	0.0%

Vehicles

	1	2	3	4	5	
1						0
2	155	0		673	224	1053
3	1	4		311	175	490
4	279	182		2	78	541
5	170	222		134	11	536
	604	408	0	1120	487	2620

Heavies

	1	2	3	4	5	
1						0
2	4	0		100	19	123
3	1	0		11	8	20
4	93	28		1	7	128
5	4	6		7	0	17
	102	33	0	119	33	288

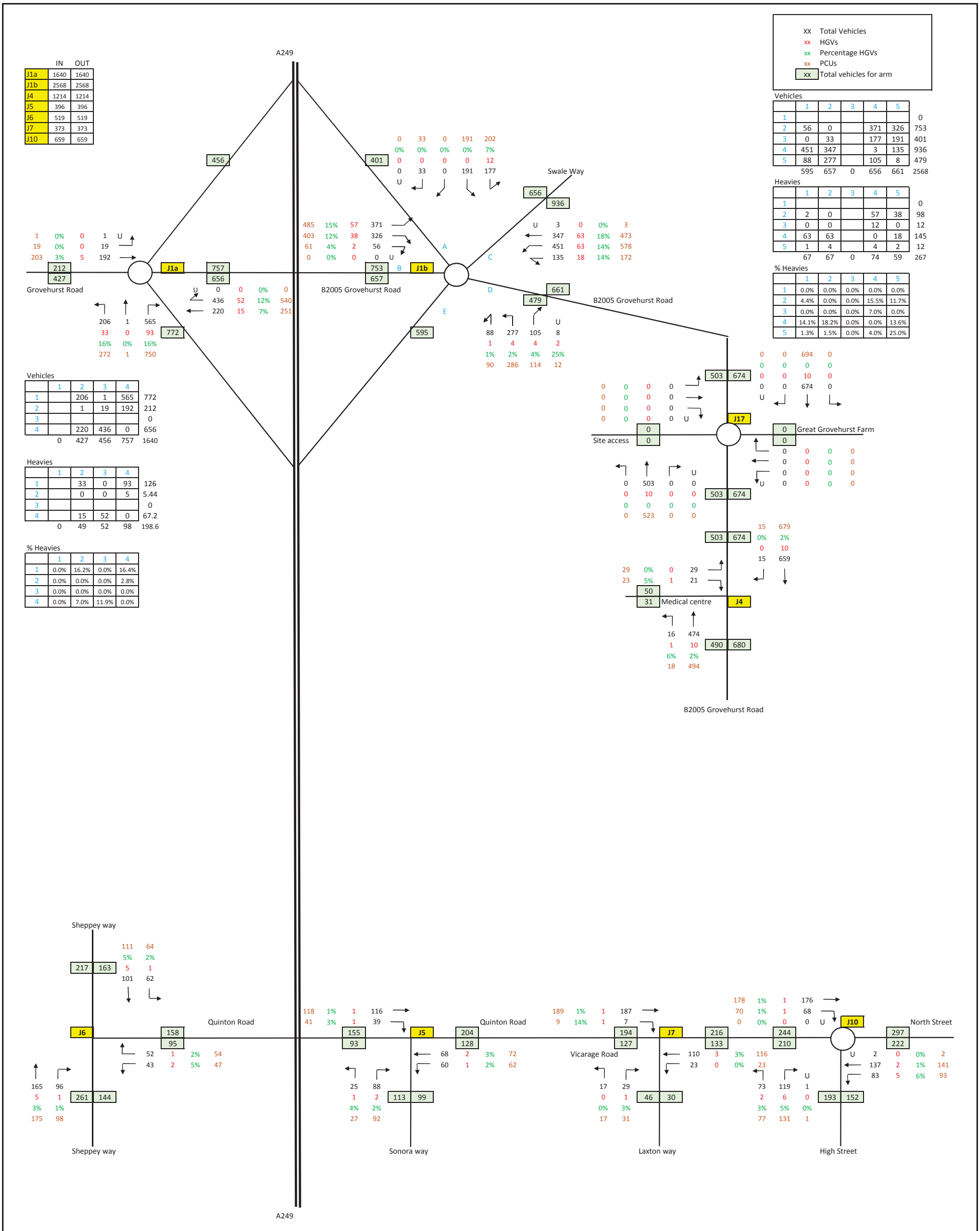
% Heavies

	1	2	3	4	5
1	0.0%	0.0%	0.0%	0.0%	0.0%
2	2.7%	0.0%	0.0%	14.8%	8.5%
3	######	0.0%	0.0%	3.7%	4.4%
4	33.2%	15.2%	0.0%	49.9%	8.7%
5	2.5%	2.5%	0.0%	5.0%	0.0%

2015 observed assessment flows - AM peak hour

Sheet 1 of 2

Figure x.x



	IN	OUT
J1a	1640	1640
J1b	2568	2568
J4	1214	1214
J5	396	396
J6	519	519
J7	373	373
J10	659	659

Vehicles

	1	2	3	4	5	
1						0
2	56	0		371	326	753
3	0	33		177	191	401
4	451	347		3	135	936
5	88	277		105	8	479
	595	657	0	656	661	2568

Heavies

	1	2	3	4	5	
1						0
2	2	0		57	38	98
3	0	0		12	0	12
4	63	63		0	18	145
5	1	4		4	2	12
	67	67	0	74	59	267

% Heavies

	1	2	3	4	5
1	0.0%	0.0%	0.0%	0.0%	0.0%
2	4.4%	0.0%	0.0%	15.5%	11.7%
3	0.0%	0.0%	0.0%	7.0%	0.0%
4	14.1%	18.2%	0.0%	0.0%	13.6%
5	1.3%	1.5%	0.0%	4.0%	25.0%

Vehicles

	1	2	3	4	
1		206	1	565	772
2		1	19	192	212
3					0
4		220	436	0	656
	0	427	456	757	1640

Heavies

	1	2	3	4	
1		33	0	93	126
2		0	0	5	5.44
3					0
4		15	52	0	67.2
	0	49	52	98	198.6

% Heavies

	1	2	3	4
1	0.0%	16.2%	0.0%	16.4%
2	0.0%	0.0%	0.0%	2.8%
3	0.0%	0.0%	0.0%	0.0%
4	0.0%	7.0%	11.9%	0.0%

2015 observed assessment flows - PM peak hour

Sheet 1 of 2

Figure x.x

Appendix B

D118 Iwade Dumbell Roundabout Paramics Model - Traffic Profiles

AM Peak Hour: 07:50-08:50

Traffic Flows		0750-0755	0755-0800	0800-0805	0805-0810	0810-0815	0815-0820	0820-0825	0825-0830	0830-0835	0835-0840	0840-0845	0845-0850
Grovehurst Road North	Profile 1	7.867	11.308	10.298	6.631	8.078	8.078	7.089	7.089	8.69	9.376	7.998	7.499
A249 Offslip SB	Profile 2	9.043	8.595	9.209	5.73	11.354	10.845	8.8	6.548	6.344	5.525	9.209	8.8
Swale Way	Profile 3	6.629	8.063	7.798	4.838	6.809	10.881	14.838	9.928	7.884	4.838	9.431	8.063
Grovehurst Road South	Profile 4	8.44	6.239	9.358	8.073	9.174	8.257	8.624	7.523	9.174	9.174	7.706	8.257
A249 Offslip NB	Profile 5	9.997	12.496	4.533	6.632	10.997	7.323	9.672	7.738	7.185	7.303	7.323	8.801

PM Peak Hour: 17:00-18:00

Traffic Flows		1700-1705	1705-1710	1710-1715	1715-1720	1720-1725	1725-1730	1730-1735	1735-1740	1740-1745	1745-1750	1750-1755	1755-1800
Grovehurst Road North	Profile 6	8.547	8.12	10.256	8.974	6.41	7.692	7.265	6.41	8.547	10.256	7.692	9.829
A249 Offslip SB	Profile 7	9.654	8.02	11.881	12.129	9.654	8.168	7.425	8.663	6.931	9.158	4.208	4.11
Swale Way	Profile 8	8.326	8.58	8.204	8.204	8.204	7.903	8.204	8.48	7.804	8.877	8.552	8.661
Grovehurst Road South	Profile 9	8.484	8.484	8.484	7.243	7.484	9.953	7.656	10.346	8.277	7.243	8.484	7.863
A249 Offslip NB	Profile 10	7.059	9.885	9.913	8.922	8.922	9.688	10.272	9.076	7.91	7.664	5.345	5.345

Appendix C

IWADE DUMBELL ROUNDABOUT MODEL - 2015 TURN FLOW VALIDATION TABLES

Northwestern Roundabout
1 Hour Peak Period Summary
ALL VEHICLES

Location	Nodes	Observed Flow	Model Flow	Diff	% diff	GEH	GEH < 5
07:50-08:50							
Roundabout Link							
Straight Ahead to Grovehurst Rd		162	159	-3	-2%	0.2	✓
Right Turn to A249 Onslip		245	242	-3	-1%	0.2	✓
		407	***401***	**-6**	**-1%**		
A249 NB Offslip							
Left Turn to Grovehurst Rd		49	49	0	0%	0.0	✓
Straight Ahead to A249 Onslip		0	0	0	0%	0.0	✓
Right Turn to Rbt Link		647	634	-13	-2%	0.5	✓
		696	***683***	**-13**	**-2%**		
Grovehurst Road North							
Left Turn to A249 Onslip		25	25	0	0%	0.0	✓
Straight Ahead to Rbt Link		408	403	-5	-1%	0.2	✓
		433	***428***	**-5**	**-1%**		

Southeastern Roundabout
1 Hour Peak Period Summary
ALL VEHICLES

Location	Nodes	Observed Flow	Model Flow	Diff	% diff	GEH	GEH < 5
07:50-08:50							
A249 SB Offslip							
Left Turn to Swale Way		311	305	-6	-2%	0.3	✓
Straight Ahead to Grovehurst Rd		175	171	-4	-2%	0.3	✓
Straight Ahead to A249 Onslip		1	0	-1	-100%	1.4	✓
Right Turn to Rbt Link		4	4	0	0%	0.0	✓
		491	***480***	**-11**	**-2%**		
Swale Way							
Left Turn to Grovehurst Rd		78	77	-1	-1%	0.1	✓
Left Turn to A249 Onslip		279	275	-4	-1%	0.2	✓
Straight Ahead to Rbt Link		182	180	-2	-1%	0.1	✓
		539	***532***	**-7**	**-1%**		
Grovehurst Road South							
Left Turn to A249 Onslip		170	168	-2	-1%	0.2	✓
Straight Ahead to Rbt Link		222	219	-3	-1%	0.2	✓
Right Turn to Swale Way		134	131	-3	-2%	0.3	✓
		526	***518***	**-8**	**-2%**		
Roundabout Link							
Left Turn to Swale Way		673	636	-37	-5%	1.4	✓
Straight Ahead to Grovehurst Rd		224	254	30	13%	1.9	✓
Right Turn to A249 Onslip		155	142	-13	-8%	1.1	✓
		1052	***1032***	**-20**	**-2%**		

IWADE DUMBELL ROUNDABOUT MODEL - 2015 TURN FLOW VALIDATION TABLES

Northwestern Roundabout
1 Hour Peak Period Summary
ALL VEHICLES

Location	Nodes	Observed Flow	Model Flow	Diff	% diff	GEH	GEH < 5
17:00-18:00							
Roundabout Link							
Straight Ahead to Grovehurst Rd		220	216	-4	-2%	0.3	✓
Right Turn to A249 Onslip		436	428	-8	-2%	0.4	✓
		656	***644***	**-12**	**-2%**		
A249 NB Offslip							
Left Turn to Grovehurst Rd		206	205	-1	0%	0.1	✓
Straight Ahead to A249 Onslip		1	0	-1	-100%	1.4	✓
Right Turn to Rbt Link		565	560	-5	-1%	0.2	✓
		772	***765***	**-7**	**-1%**		
Grovehurst Road North							
Left Turn to A249 Onslip		19	19	0	0%	0.0	✓
Straight Ahead to Rbt Link		192	193	1	1%	0.1	✓
		211	***212***	**1**	**0%**		

Southeastern Roundabout
1 Hour Peak Period Summary
ALL VEHICLES

Location	Nodes	Observed Flow	Model Flow	Diff	% diff	GEH	GEH < 5
17:00-18:00							
A249 SB Offslip							
Left Turn to Swale Way		177	176	-1	-1%	0.1	✓
Straight Ahead to Grovehurst Rd		191	190	-1	-1%	0.1	✓
Straight Ahead to A249 Onslip		0	0	0	0%	0.0	✓
Right Turn to Rbt Link		33	33	0	0%	0.0	✓
		401	***399***	**-2**	**0%**		
Swale Way							
Left Turn to Grovehurst Rd		135	132	-3	-2%	0.3	✓
Left Turn to A249 Onslip		451	444	-7	-2%	0.3	✓
Straight Ahead to Rbt Link		347	343	-4	-1%	0.2	✓
		933	***919***	**-14**	**-2%**		
Grovehurst Road South							
Left Turn to A249 Onslip		88	87	-1	-1%	0.1	✓
Straight Ahead to Rbt Link		277	274	-3	-1%	0.2	✓
Right Turn to Swale Way		105	103	-2	-2%	0.2	✓
		470	***464***	**-6**	**-1%**		
Roundabout Link							
Left Turn to Swale Way		371	369	-2	-1%	0.1	✓
Straight Ahead to Grovehurst Rd		326	315	-11	-3%	0.6	✓
Right Turn to A249 Onslip		56	66	10	18%	1.3	✓
		753	***750***	**-3**	**0%**		

Appendix D

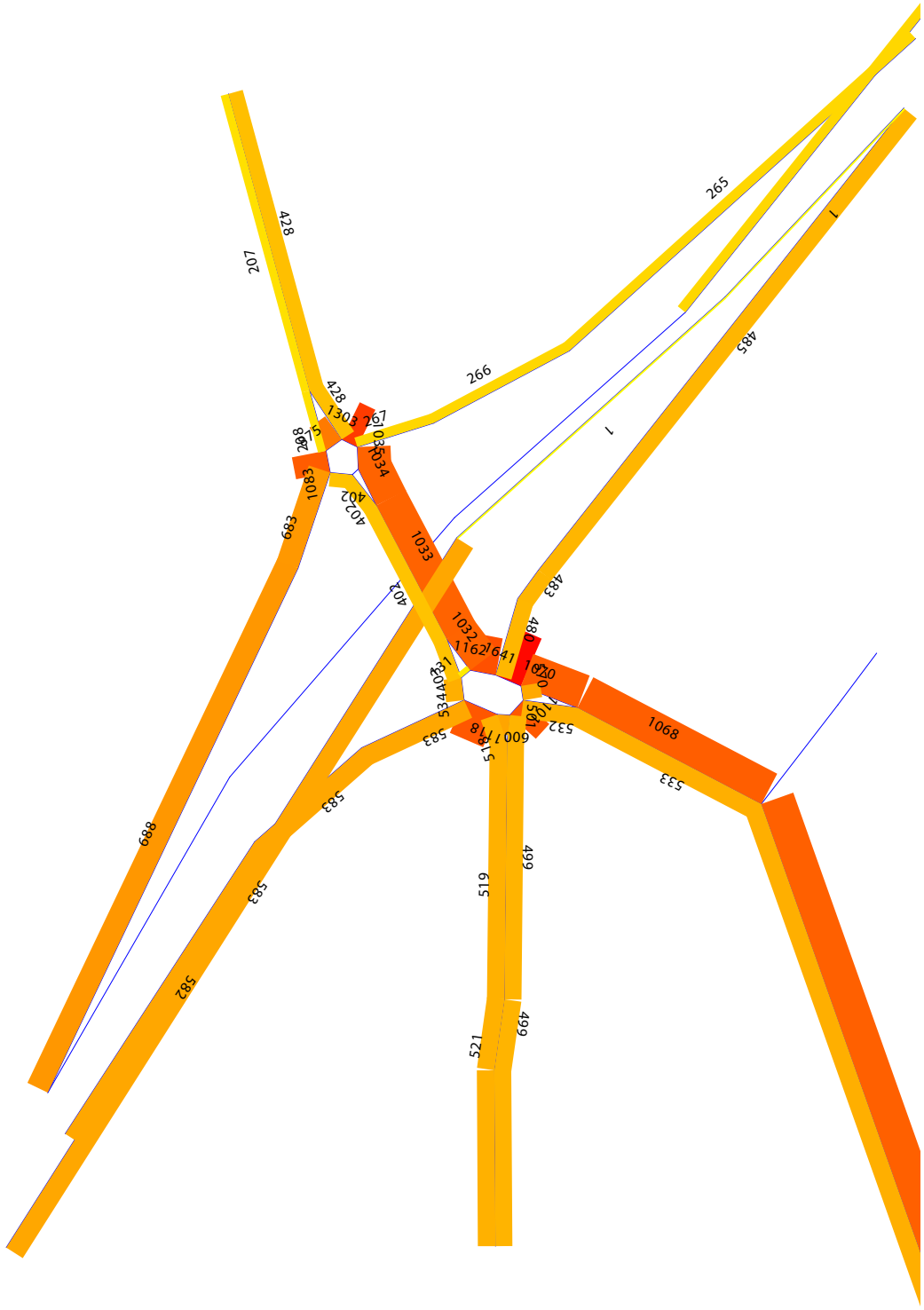
2015 Base AM Link Flows

Data Overlay 1: (1 to 1692)

Modelled Link Flows: (1 to 1692)

Showing: 07:50:00 to 08:50:00

Modelled: 07:50:00 to 18:00:00

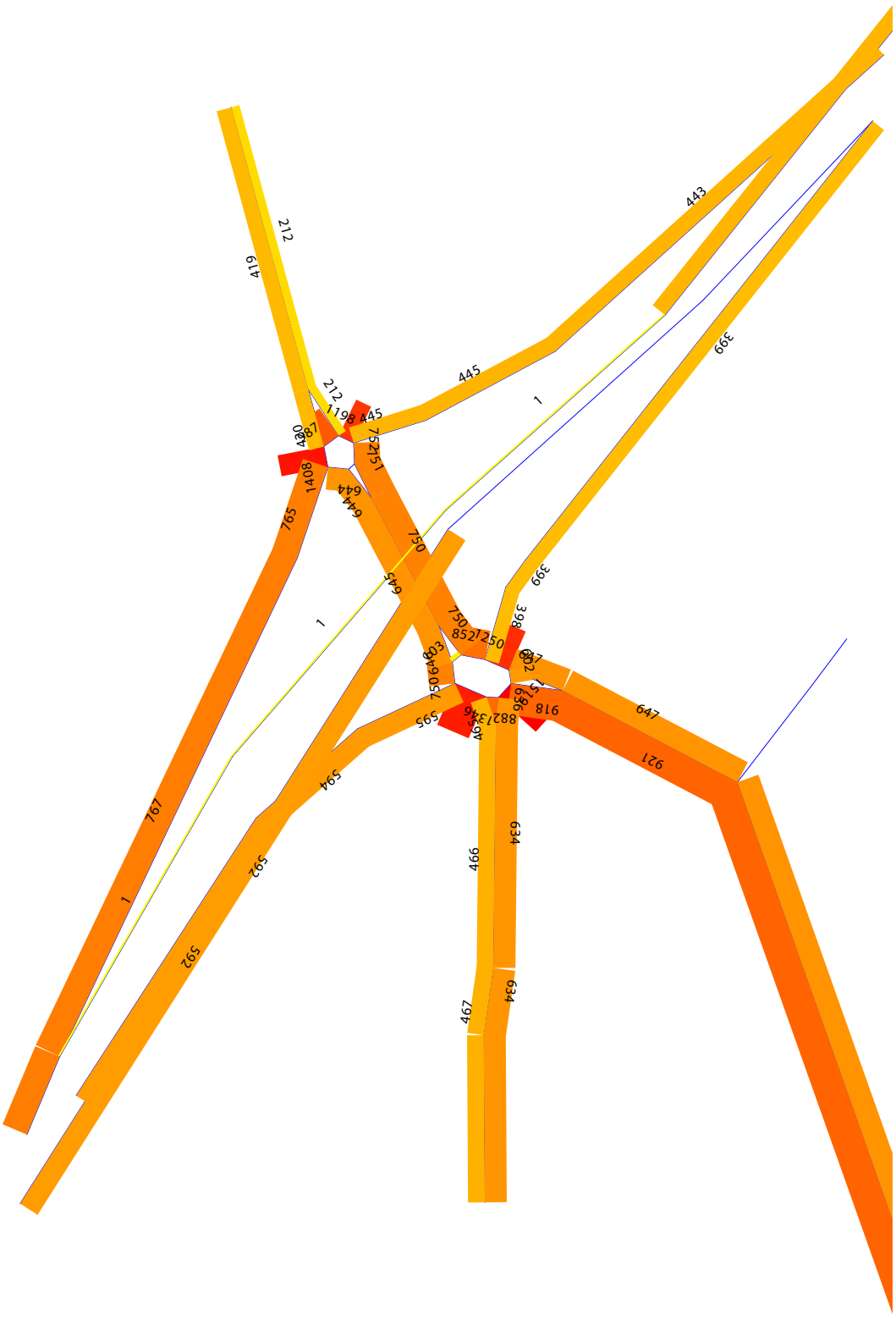


2015 Base PM Link Flows

Modelled Link Flows: (1 to 1519)

Showing: 17:00:00 to 18:00:00

Modelled: 17:00:00 to 19:00:00



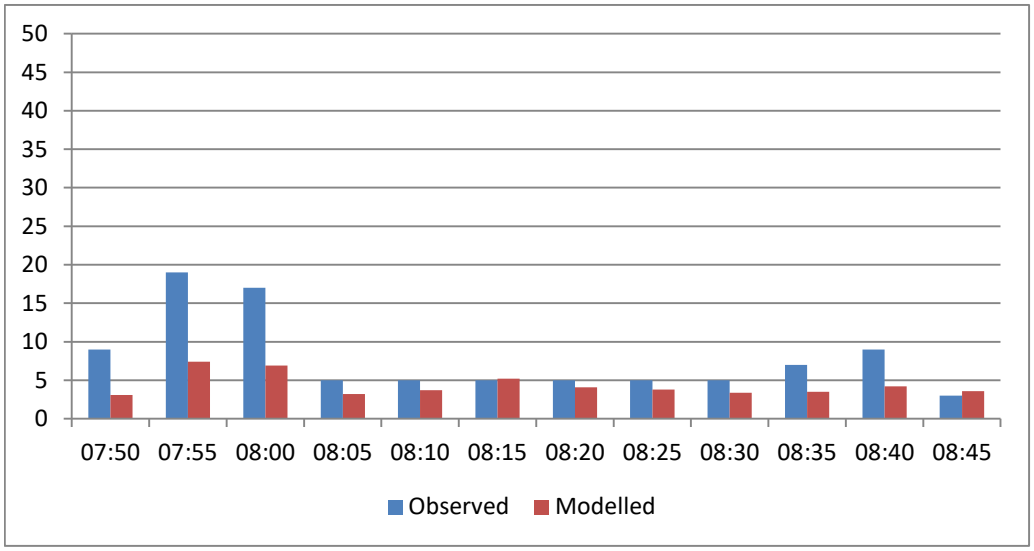
Appendix E

D118: Iwade Dumbell Roundabouts Paramics Discovery Model - Queue Length Results

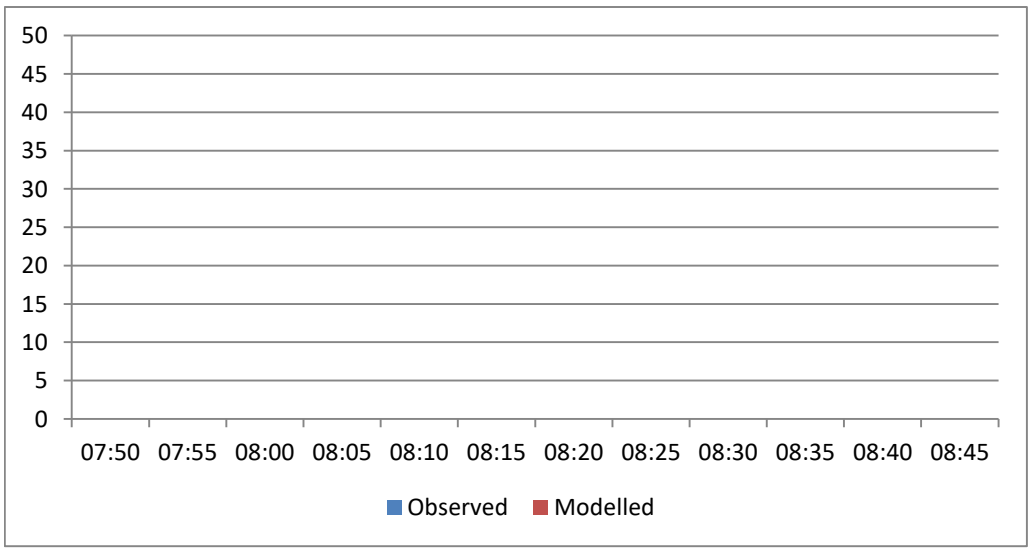
A249 Dumbell Junction - Northwest Roundabout

Queue Length Results - AM Peak Period 07:50 - 08:50

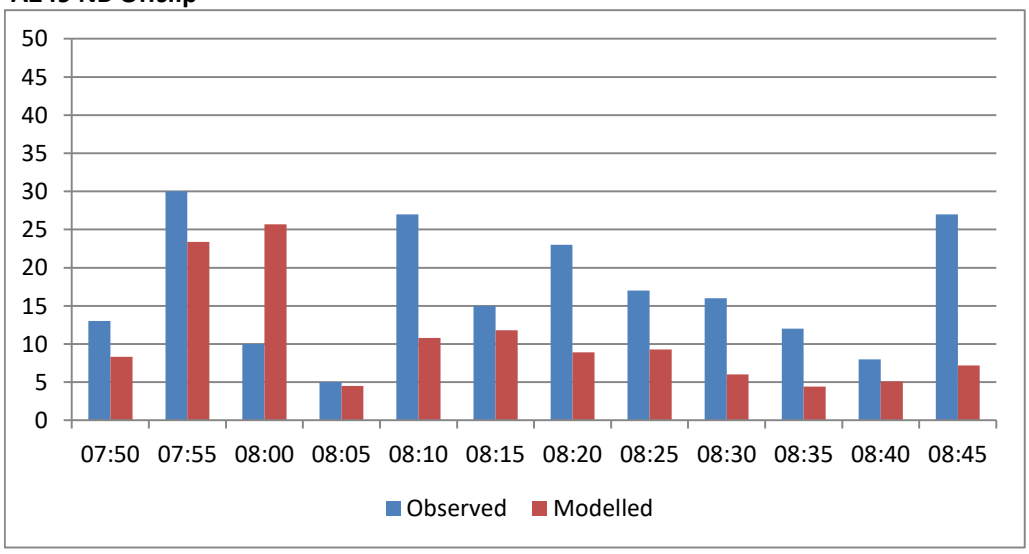
Grovehurst Road North



Roundabout Link



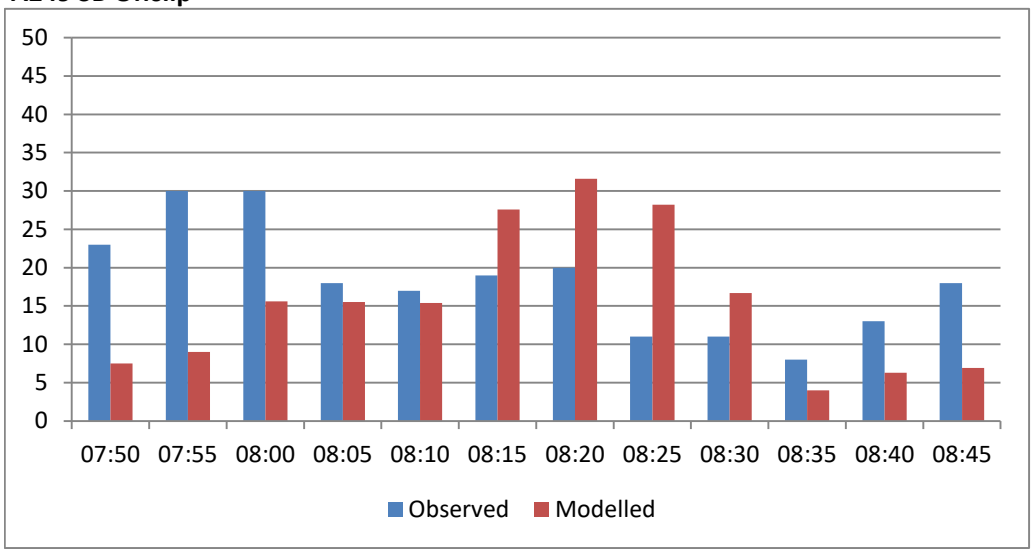
A249 NB Offslip



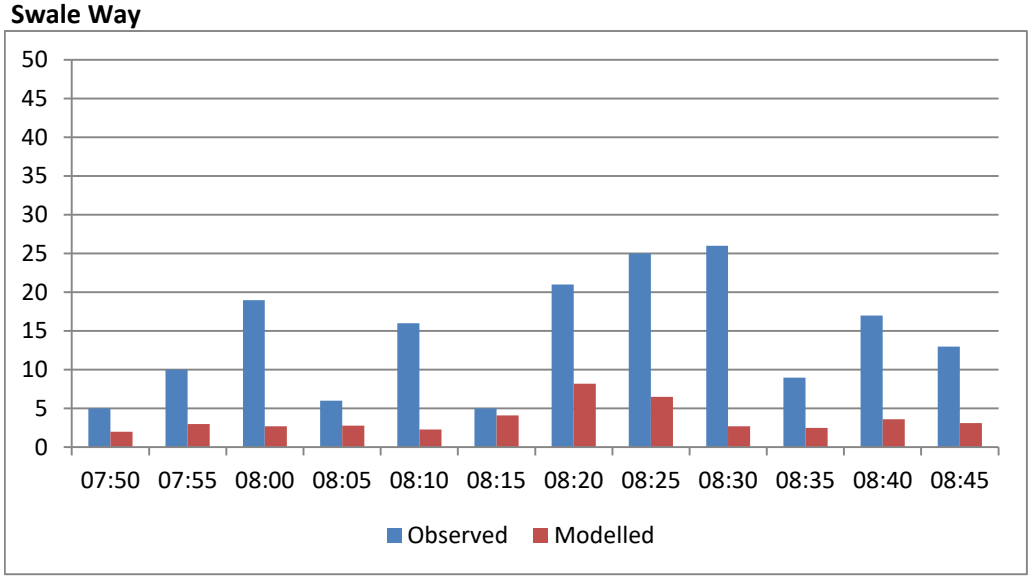
A249 Dumbell Junction - Southeast Roundabout

Queue Length Results - AM Peak Period 07:50 - 08:50

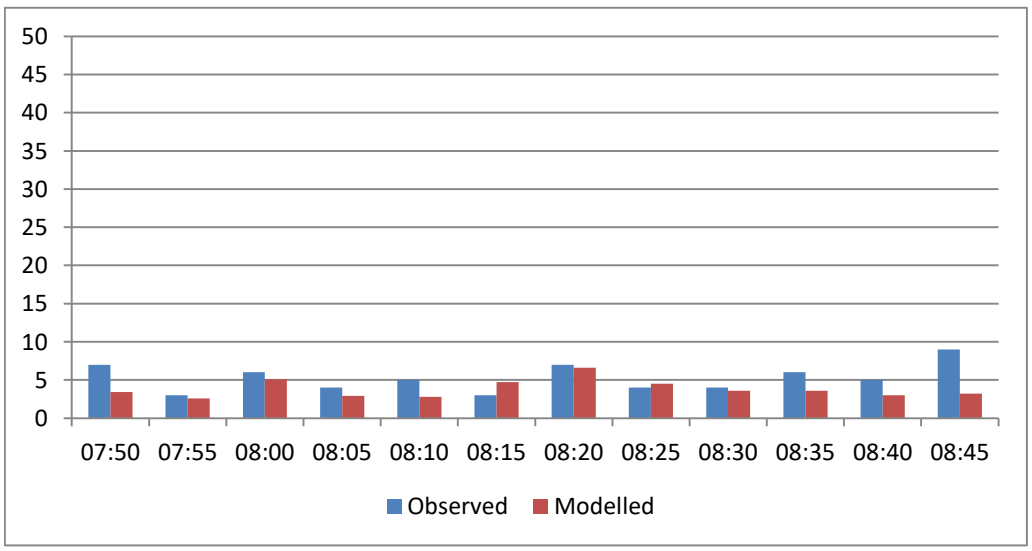
A249 SB Offslip



Swale Way



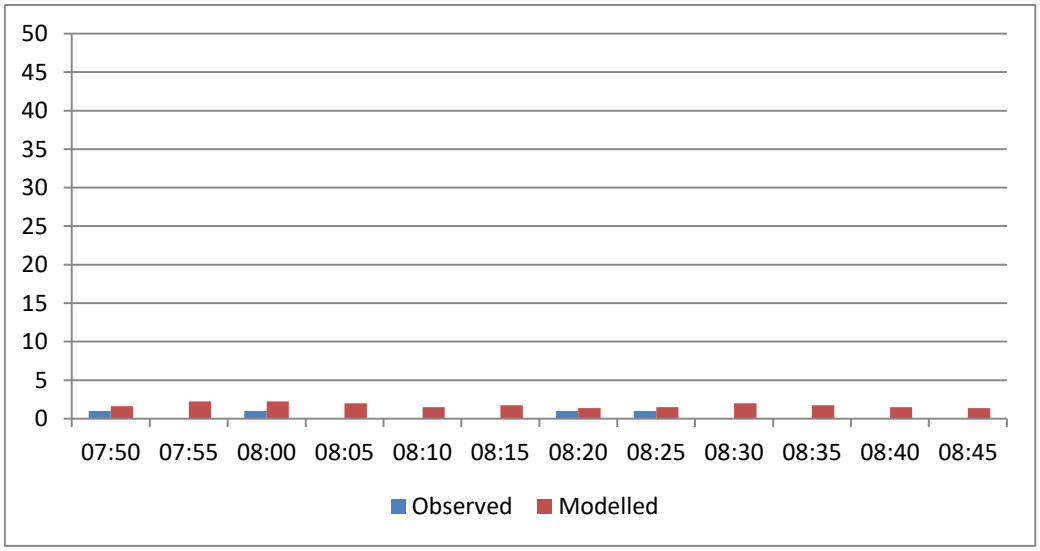
Grovehurst Road South



A249 Dumbell Junction - Southeast Roundabout

Queue Length Results - AM Peak Period 07:50 - 08:50

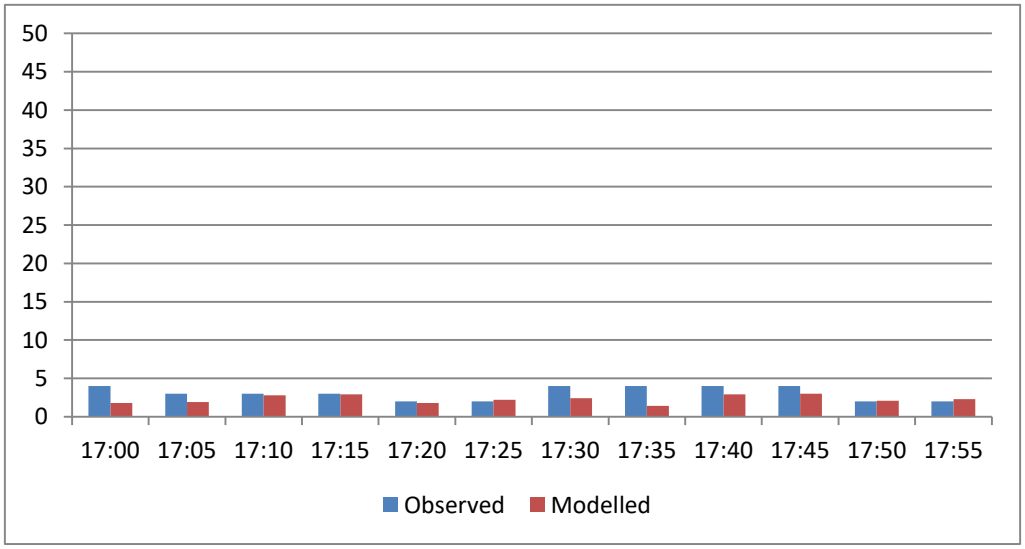
Roundabout Link



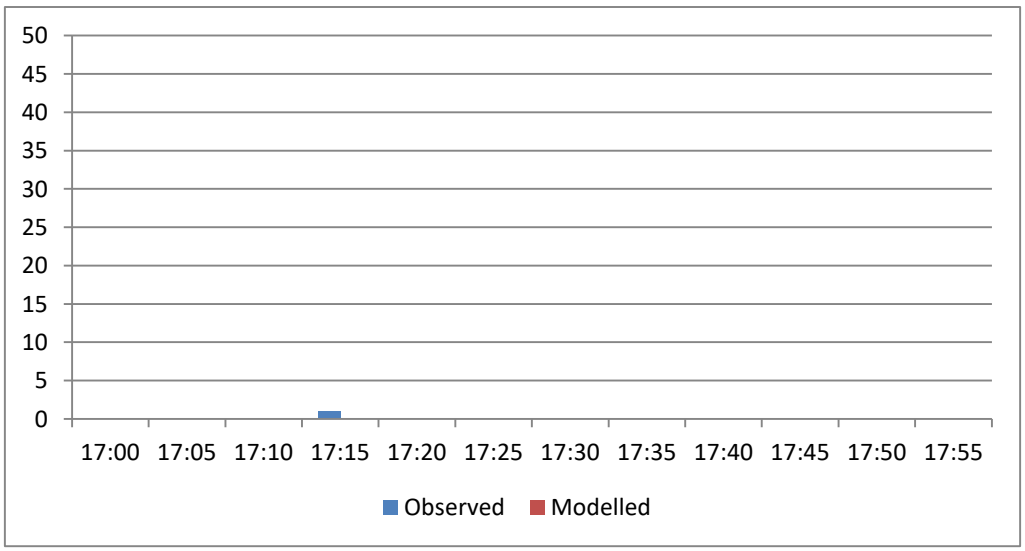
A249 Dumbell Junction - Northwest Roundabout

Queue Length Results - PM Peak Period 17:00 - 18:00

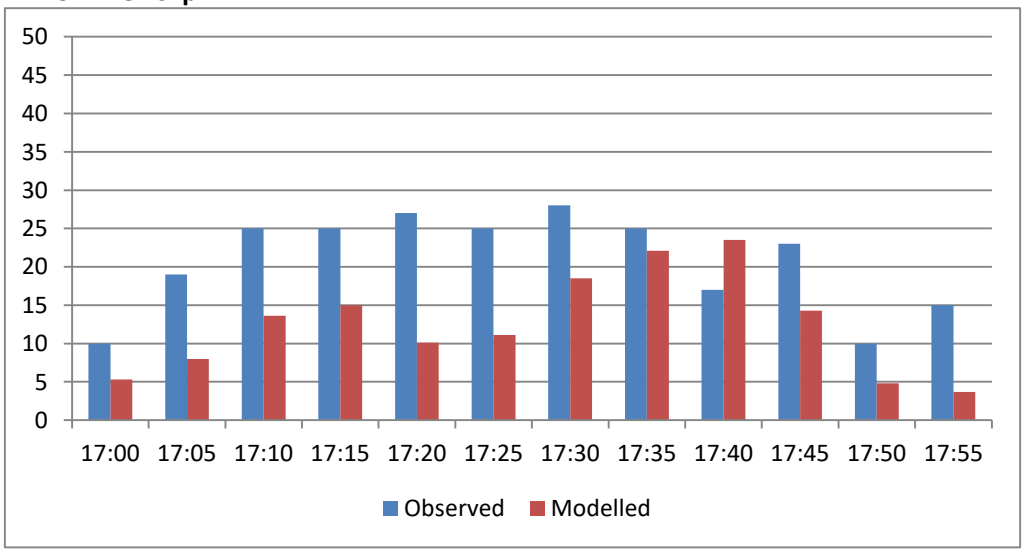
Grovehurst Road North



Roundabout Link



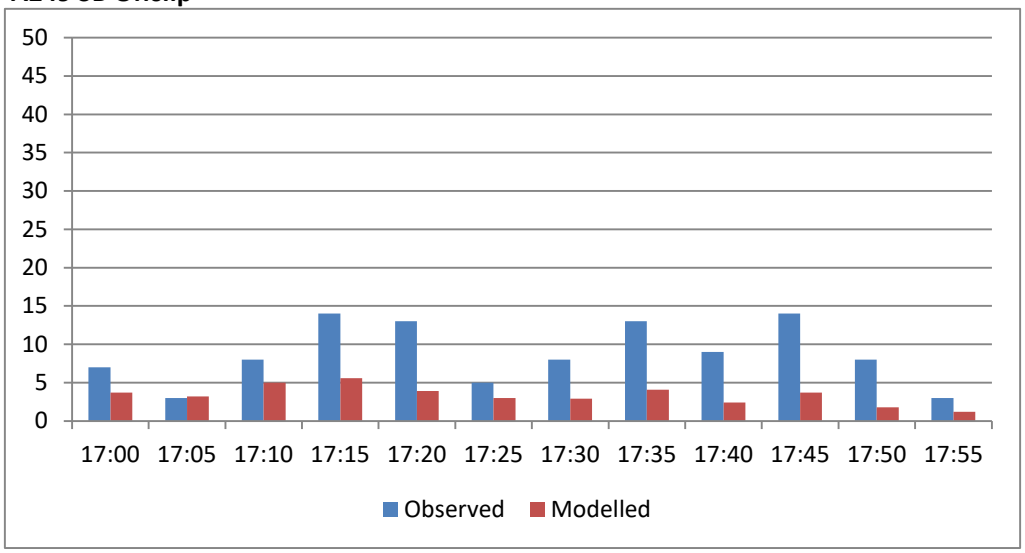
A249 NB Offslip



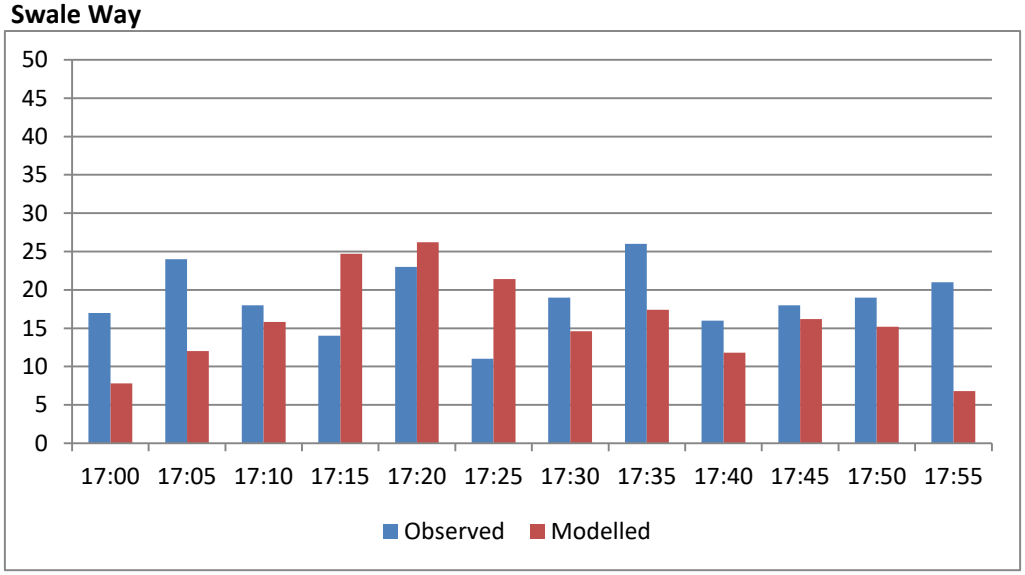
A249 Dumbell Junction - Southeast Roundabout

Queue Length Results - PM Peak Period 17:00 - 18:00

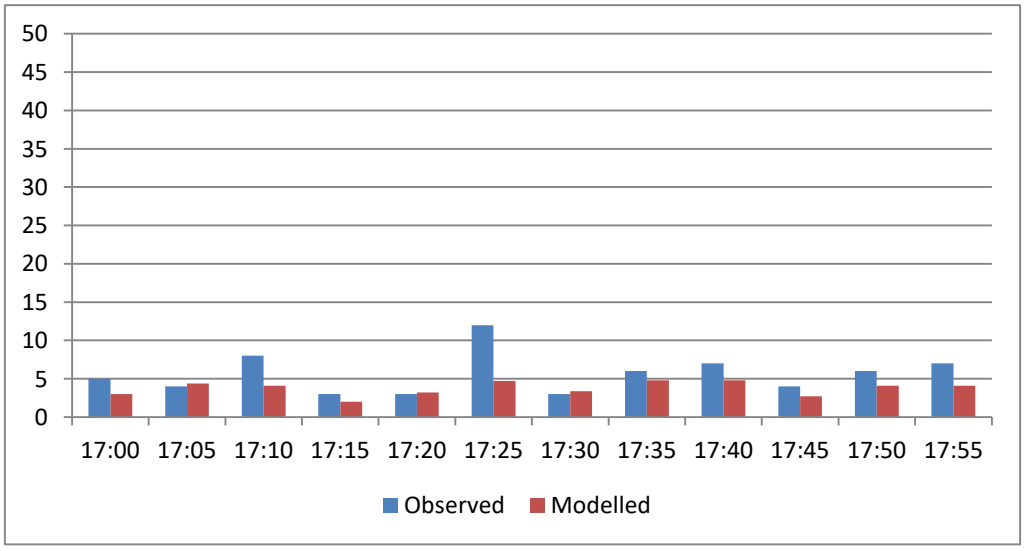
A249 SB Offslip



Swale Way



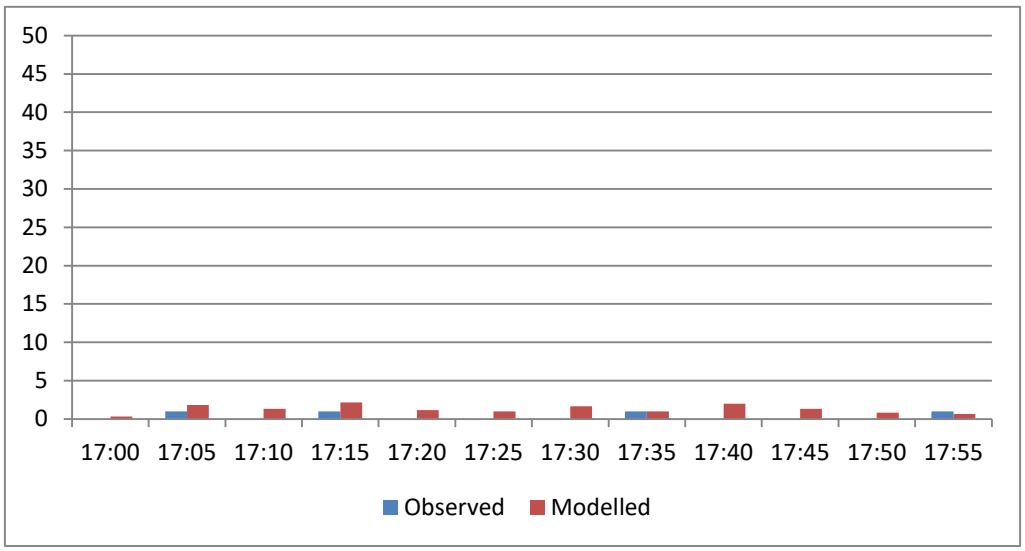
Grovehurst Road South



A249 Dumbell Junction - Southeast Roundabout

Queue Length Results - PM Peak Period 17:00 - 18:00

Roundabout Link



Appendix F

Tempro growth factor **1.0688** local roads
Year **2023** **1.0938** A249

	IN	OUT
J1a	1668	1668
J1b	2827	2827
J4	1102	1102
J5	573	573
J6	670	670
J7	535	535
J10	838	838

XX Total Vehicles
xx HGVs
xx Percentage HGVs
xx PCUs
xx Total vehicles for arm

Vehicles

	1	2	3	4	5	
1						0
2	169	0		720	240	1129
3	1	4		340	191	536
4	305	195		2	83	585
5	186	237		143	12	578
	661	436	0	1205	525	2827

Heavies

	1	2	3	4	5	
1						0
2	5	0		107	20	132
3	1	0		12	8	22
4	101	30		1	7	139
5	5	6		7	0	18
	112	36	0	128	36	311

% Heavies

	1	2	3	4	5
1	0.0%	0.0%	0.0%	0.0%	0.0%
2	2.7%	0.0%	0.0%	14.8%	8.5%
3	######	0.0%	0.0%	3.7%	4.4%
4	33.2%	15.2%	0.0%	49.9%	8.7%
5	2.5%	2.5%	0.0%	5.0%	0.0%

Vehicles

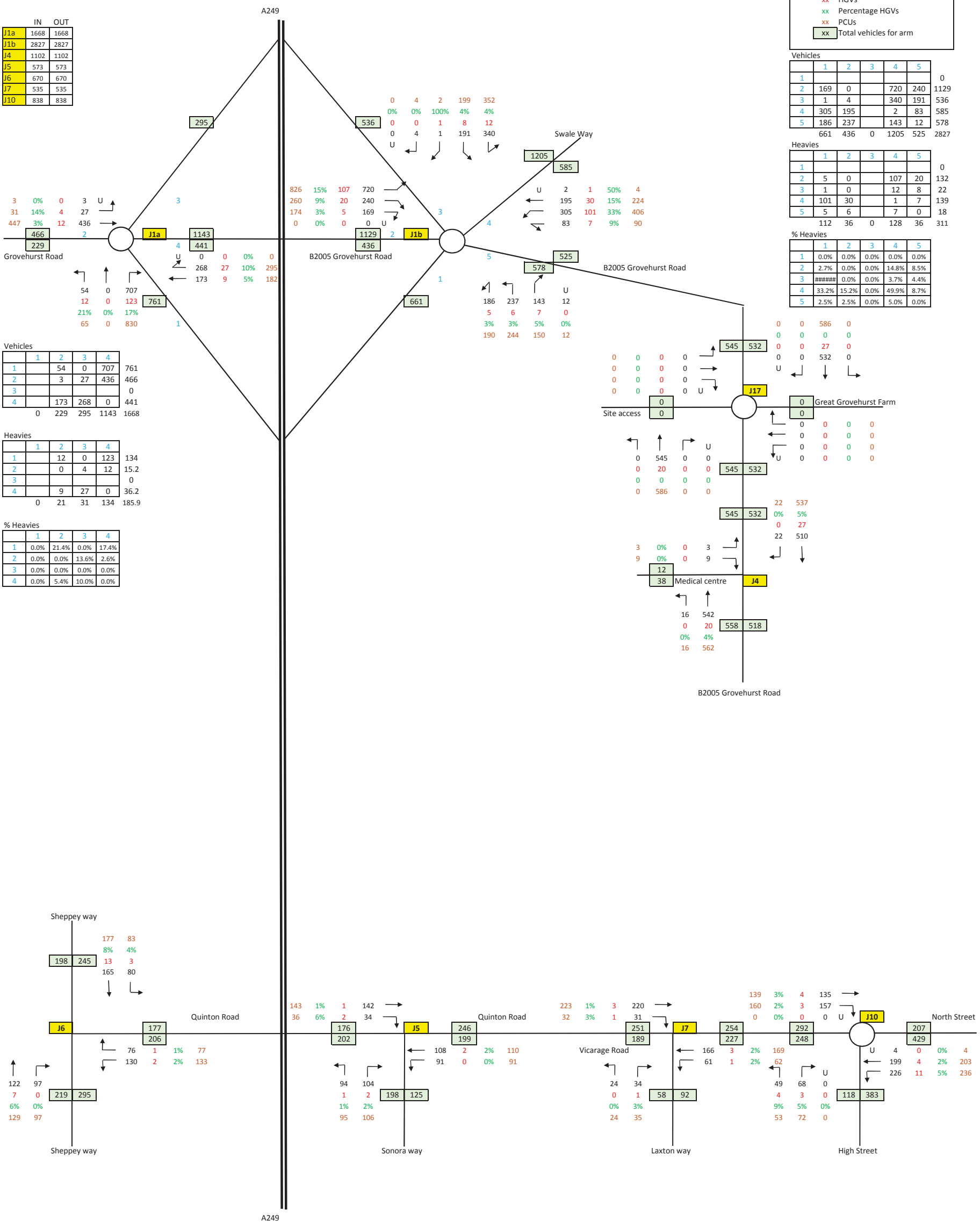
	1	2	3	4	
1		54	0	707	761
2		3	27	436	466
3					0
4		173	268	0	441
	0	229	295	1143	1668

Heavies

	1	2	3	4	
1		12	0	123	134
2		0	4	12	15.2
3					0
4		9	27	0	36.2
	0	21	31	134	185.9

% Heavies

	1	2	3	4
1	0.0%	21.4%	0.0%	17.4%
2	0.0%	0.0%	13.6%	2.6%
3	0.0%	0.0%	0.0%	0.0%
4	0.0%	5.4%	10.0%	0.0%



Tempro growth factor **1.0686** local roads
Year 2023 **1.0936** A249

	IN	OUT
J1a	1783	1783
J1b	2769	2769
J4	1297	1297
J5	423	423
J6	555	555
J7	399	399
J10	704	704

XX Total Vehicles
xx HGVs
xx Percentage HGVs
xx PCUs
xx Total vehicles for arm

Vehicles

	1	2	3	4	5	
1						0
2	62	0		396	349	806
3	0	36		193	209	439
4	493	371		3	144	1011
5	96	296		113	9	514
	651	703	0	705	711	2769

Heavies

	1	2	3	4	5	
1						0
2	3	0		61	41	105
3	0	0		13	0	13
4	69	67		0	20	156
5	1	5		4	2	12
	73	72	0	79	63	287

% Heavies

	1	2	3	4	5
1	0.0%	0.0%	0.0%	0.0%	0.0%
2	4.4%	0.0%	0.0%	15.5%	11.7%
3	0.0%	0.0%	0.0%	7.0%	0.0%
4	14.1%	18.2%	0.0%	0.0%	13.6%
5	1.3%	1.5%	0.0%	4.0%	25.0%

Vehicles

	1	2	3	4	
1		225	1	618	844
2		1	21	205	227
3					0
4		235	477	0	712
	0	461	499	823	1783

Heavies

	1	2	3	4	
1		36	0	101	138
2		0	0	6	5.81
3					0
4		16	57	0	73.2
	0	53	57	107	216.7

% Heavies

	1	2	3	4
1	0.0%	16.2%	0.0%	16.4%
2	0.0%	0.0%	0.0%	2.8%
3	0.0%	0.0%	0.0%	0.0%
4	0.0%	7.0%	11.9%	0.0%

A249

Grovehurst Road

B2005 Grovehurst Road

Swale Way

B2005 Grovehurst Road

Great Grovehurst Farm

Site access

Medical centre

B2005 Grovehurst Road

Sheppey way

Quinton Road

Quinton Road

Vicarage Road

North Street

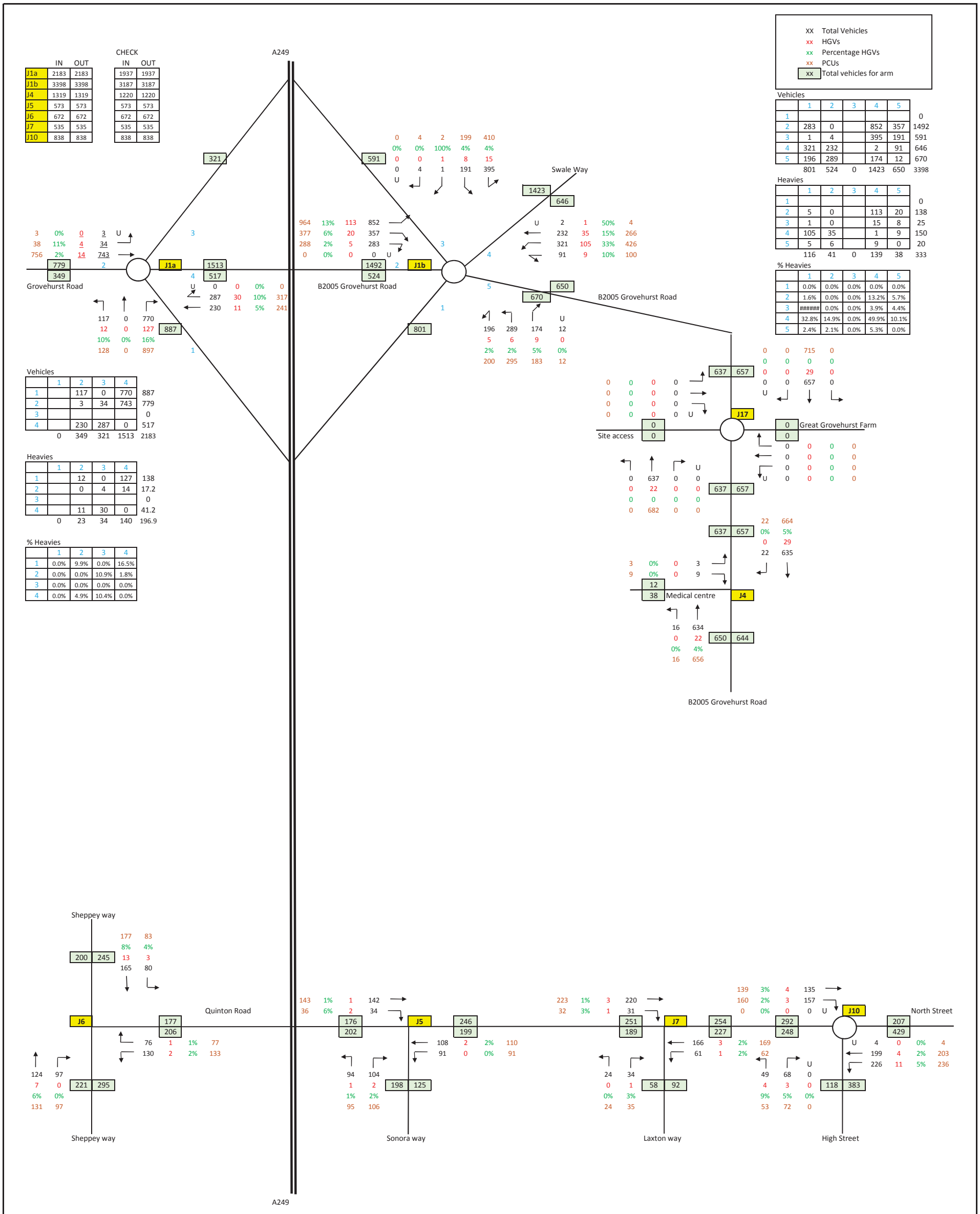
Sheppey way

Sonora way

Laxton way

High Street

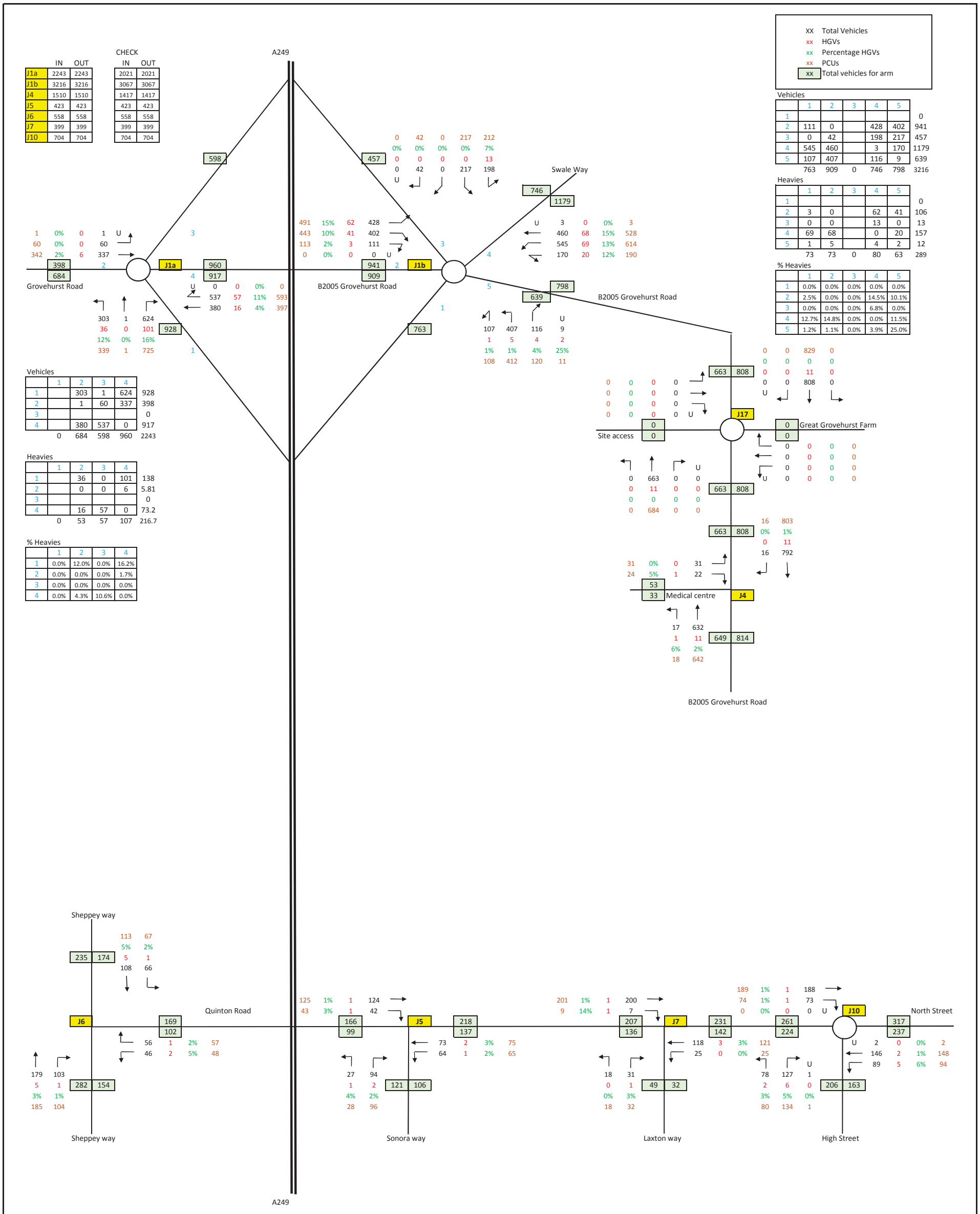
A249



2023 baseline assessment flows - AM peak hour

Sheet 1 of 2

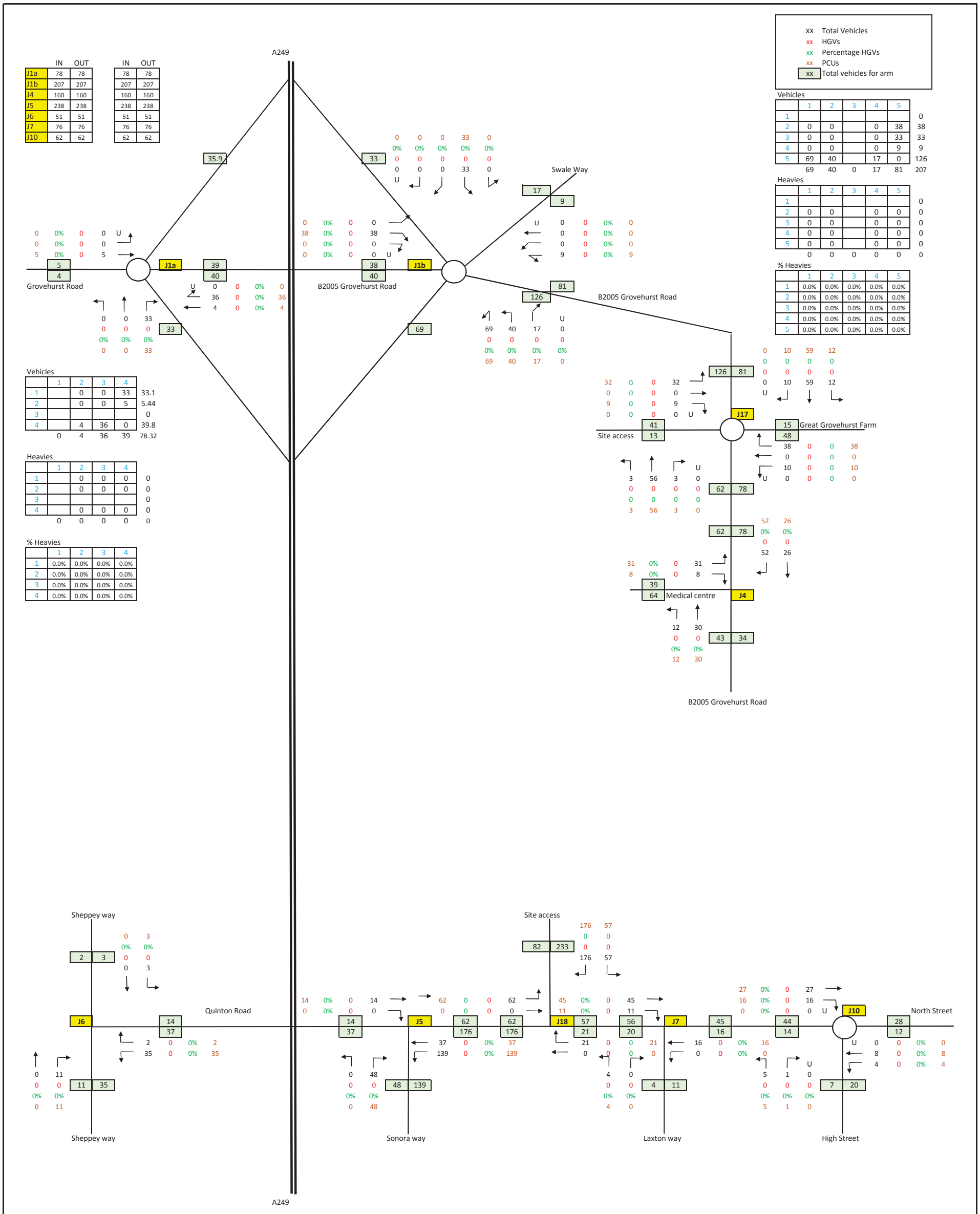
Figure x.x



2023 baseline assessment flows - PM peak hour

Sheet 1 of 2

Figure x.x



	IN	OUT
J1a	78	78
J1b	207	207
J4	160	160
J5	238	238
J6	51	51
J7	76	76
J10	62	62

IN	OUT
78	78
207	207
160	160
238	238
51	51
76	76
62	62

Vehicles

	1	2	3	4	
1		0	0	33	33.1
2		0	0	5	5.44
3					0
4		4	36	0	39.8
	0	4	36	39	78.32

Heavies

	1	2	3	4	
1		0	0	0	0
2		0	0	0	0
3					0
4		0	0	0	0
	0	0	0	0	0

% Heavies

	1	2	3	4
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%

Vehicles

	1	2	3	4	5	
1						0
2	0	0		0	38	38
3	0	0		0	33	33
4	0	0		0	9	9
5	69	40		17	0	126
	69	40	0	17	81	207

Heavies

	1	2	3	4	5	
1						0
2	0	0		0	0	0
3	0	0		0	0	0
4	0	0		0	0	0
5	0	0		0	0	0
	0	0	0	0	0	0

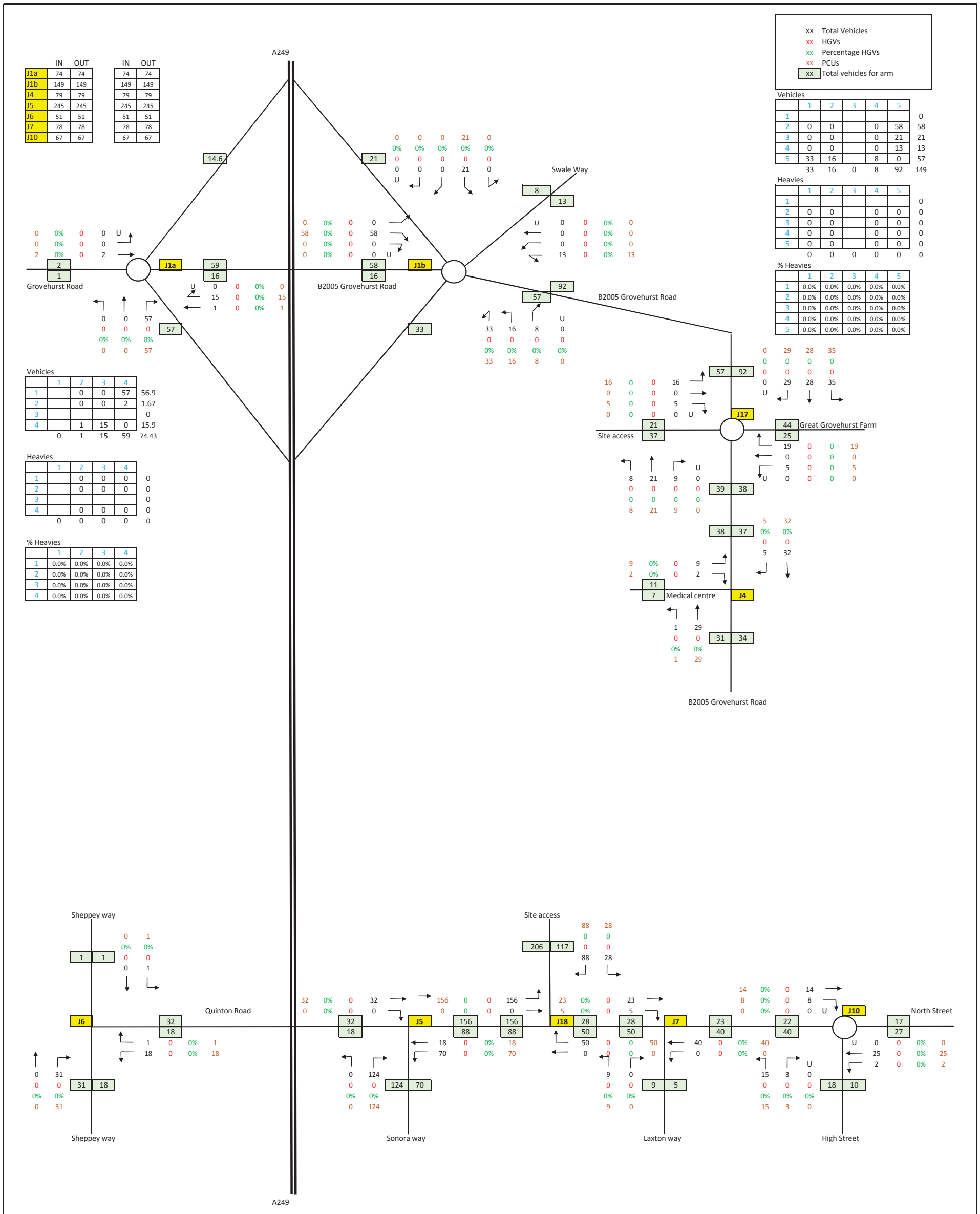
% Heavies

	1	2	3	4	5
1	0.0%	0.0%	0.0%	0.0%	0.0%
2	0.0%	0.0%	0.0%	0.0%	0.0%
3	0.0%	0.0%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%
5	0.0%	0.0%	0.0%	0.0%	0.0%

Total development flows - 2023 AM peak hour

Sheet 1 of 2

Figure x.x



	IN	OUT
J1a	74	74
J1b	149	149
J4	79	79
J5	245	245
J6	51	51
J7	78	78
J10	67	67

IN	OUT
74	74
149	149
79	79
245	245
51	51
78	78
67	67

Vehicles

	1	2	3	4	
1		0	0	57	56.9
2		0	0	2	1.67
3					0
4		1	15	0	15.9
	0	1	15	59	74.43

Heavies

	1	2	3	4	
1		0	0	0	0
2		0	0	0	0
3					0
4		0	0	0	0
	0	0	0	0	0

% Heavies

	1	2	3	4
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%

Vehicles

	1	2	3	4	5	
1						0
2	0	0		0	58	58
3	0	0		0	21	21
4	0	0		0	13	13
5	33	16		8	0	57
	33	16	0	8	92	149

Heavies

	1	2	3	4	5	
1						0
2	0	0		0	0	0
3	0	0		0	0	0
4	0	0		0	0	0
5	0	0		0	0	0
	0	0	0	0	0	0

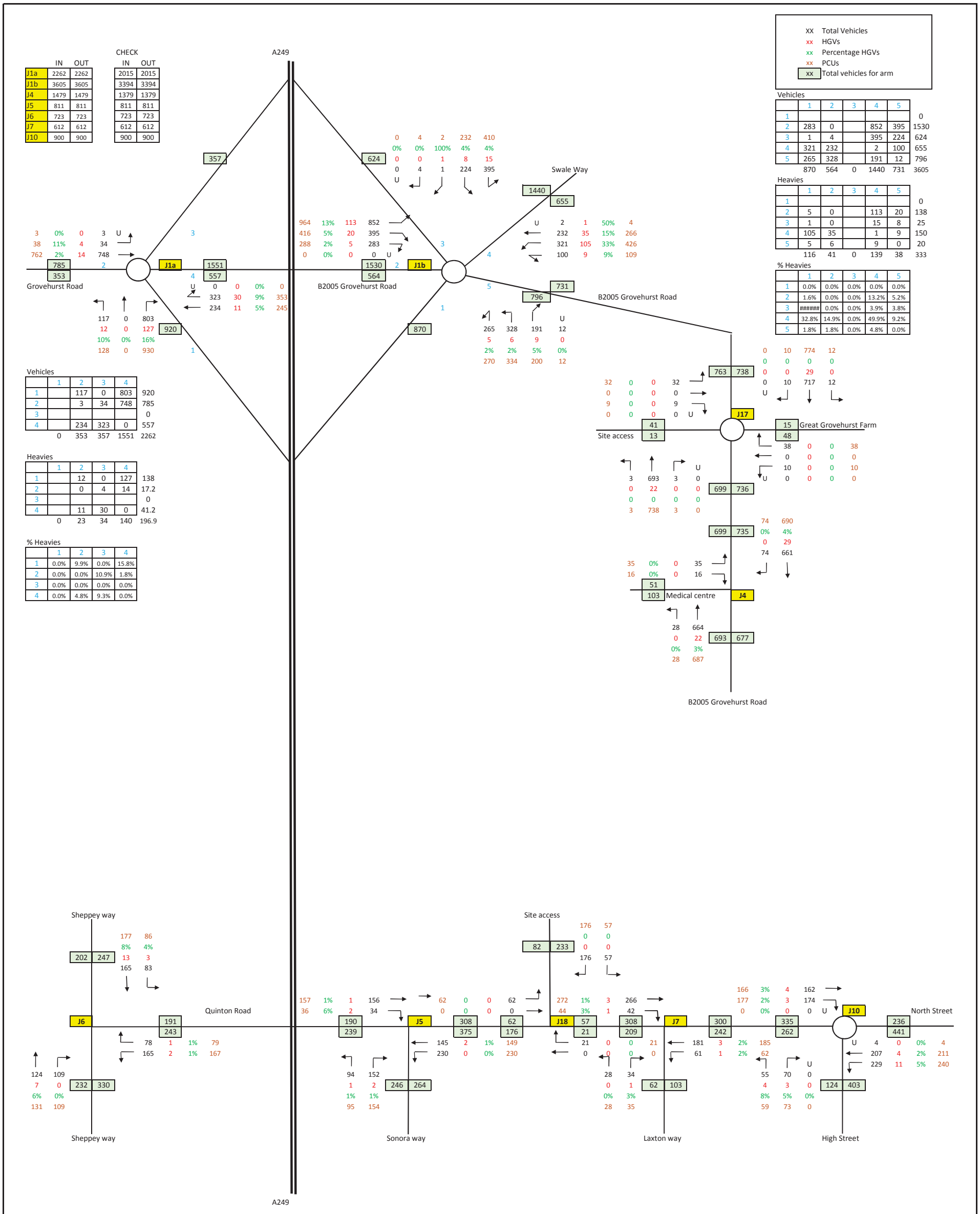
% Heavies

	1	2	3	4	5
1	0.0%	0.0%	0.0%	0.0%	0.0%
2	0.0%	0.0%	0.0%	0.0%	0.0%
3	0.0%	0.0%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%
5	0.0%	0.0%	0.0%	0.0%	0.0%

Total development flows - 2023 PM peak hour

Sheet 1 of 2

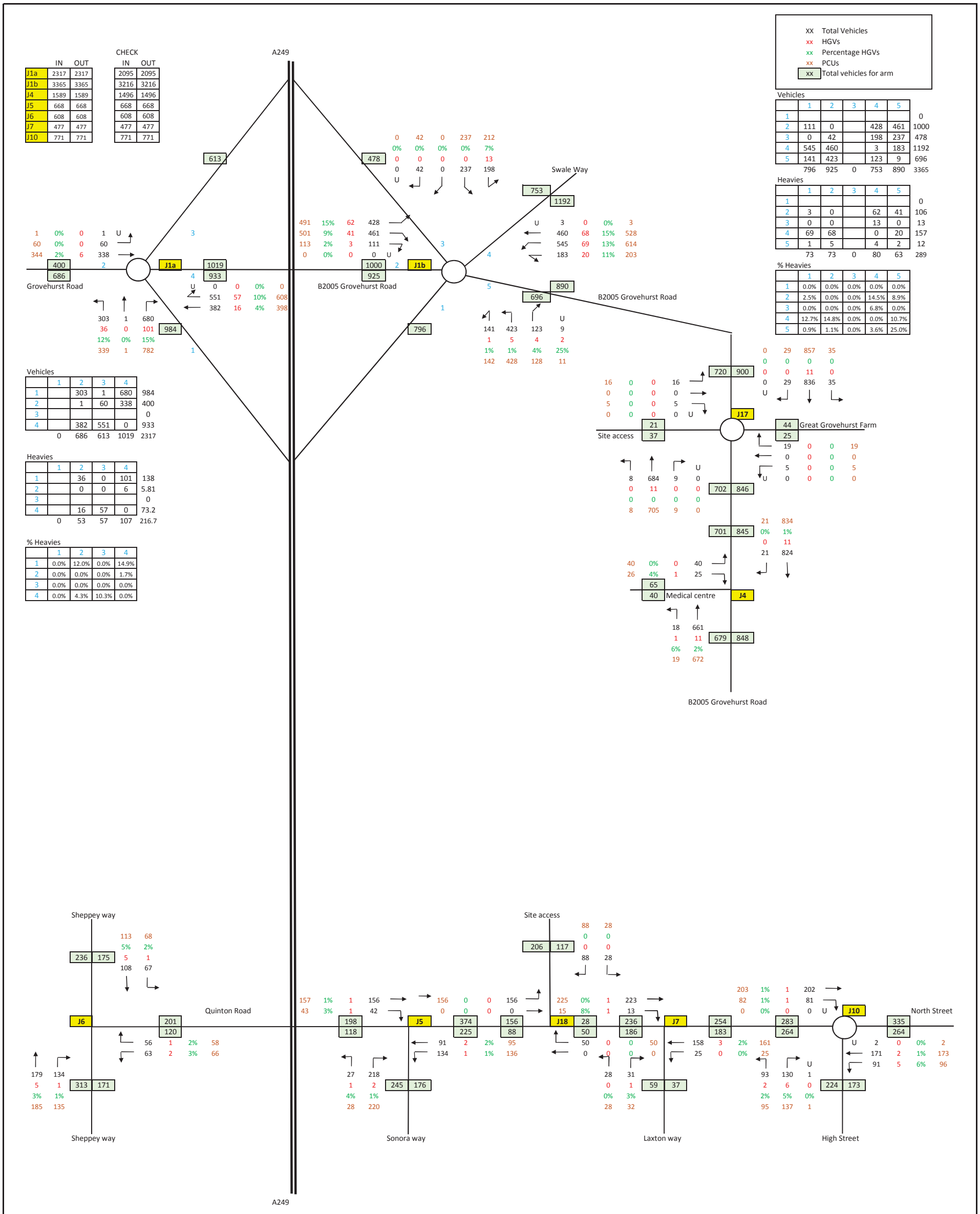
Figure x.x



2023 baseline + development assessment flows - AM peak hour

Sheet 1 of 2

Figure x.x



Vehicles

	1	2	3	4	
1		303	1	680	984
2		1	60	338	400
3					0
4		382	551	0	933
	0	686	613	1019	2317

Heavies

	1	2	3	4	
1		36	0	101	138
2		0	0	6	5.81
3					0
4		16	57	0	73.2
	0	53	57	107	216.7

% Heavies

	1	2	3	4
1	0.0%	12.0%	0.0%	14.9%
2	0.0%	0.0%	0.0%	1.7%
3	0.0%	0.0%	0.0%	0.0%
4	0.0%	4.3%	10.3%	0.0%

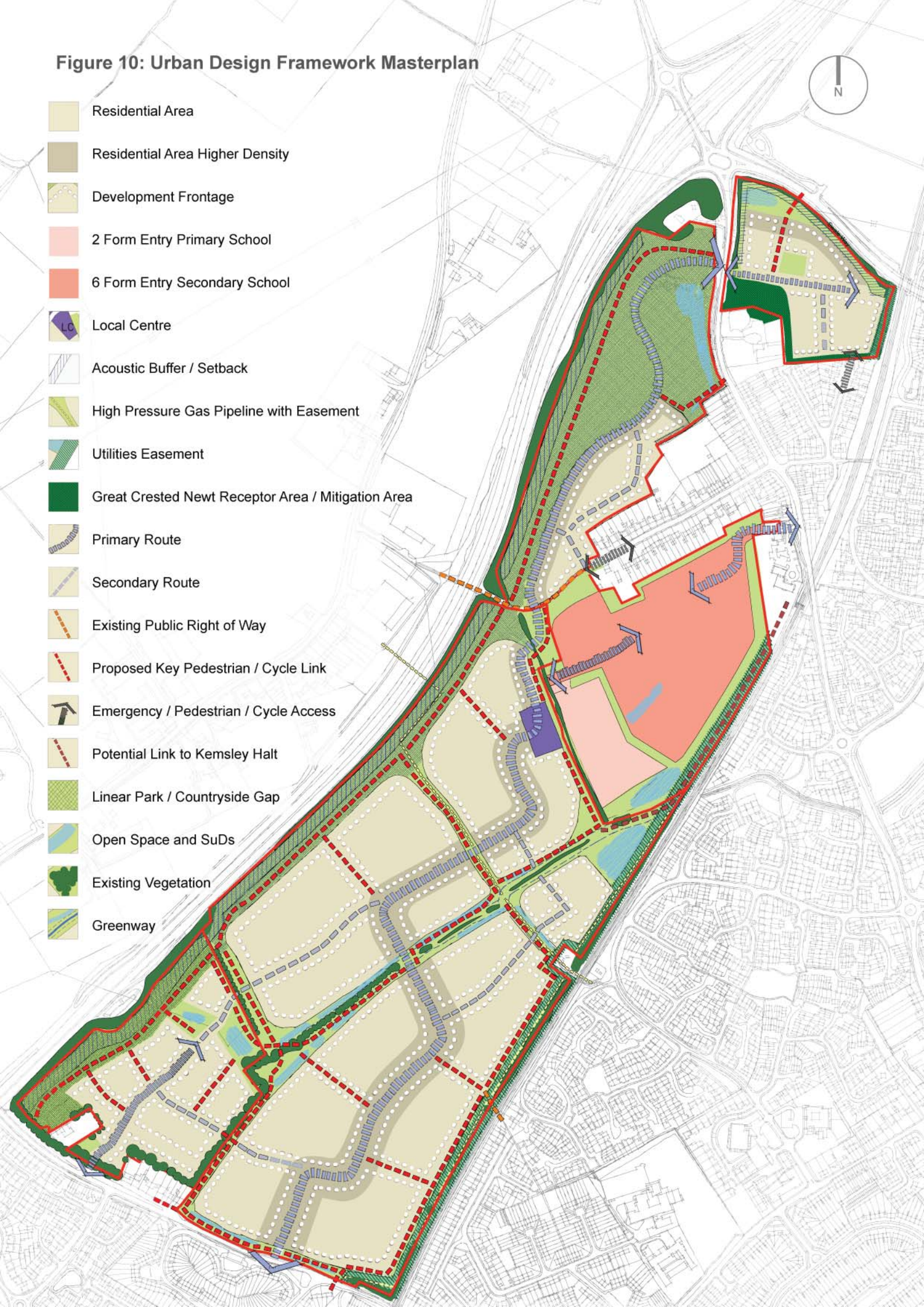
2023 baseline + development assessment flows - PM peak hour

Sheet 1 of 2

Figure x.x

Appendix G

Figure 10: Urban Design Framework Masterplan



Appendix H

EXISTING CROSSING AND CYCLEWAY

PROPOSED CYCLEWAY

2.4M X 43M VISIBILITY SPLAY

PROPOSED CYCLEWAY

PROPOSED FOOTWAY

EXISTING FOOTWAY

POTENTIAL FOOTWAY AND / OR CROSSING POINT

2.4M X 43M VISIBILITY SPLAY

POTENTIAL FOOTWAY AND / OR CROSSING POINT

INTERSECTION OF HIGHWAY BOUNDARY AND THIRD PARTY LAND

GROVEHURST ROAD

Pond

Featherbed House

Great Grovehurst Farm

New House

El Sub Sta

Tank

Great Grovehurst

2.6 3.0 R10.0 30.0 25.0 5.0 2.0

KEY:

- CARRIAGEWAY
- FOOTWAY
- FOOTWAY / CYCLEWAY
- INDICATIVE HIGHWAY BOUNDARY INFORMATION
- INDICATIVE RED LINE BOUNDARY
- INDICATIVE GREAT GROVEHURST FARM BOUNDARY

Mark	Revision	Date	Drawn	Chkd	Appd
B	AMENDED STE ACCESS LAYOUT	05.12.17	JHJ	GH	GH
A	WESTERN JUNCTION LOCATION AMENDED	17.11.17	JHJ	GH	GH

SCALING NOTE: Do not scale from this drawing. If in doubt, ask.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake his own investigation where the presence of any existing sewers, services, plant or apparatus may affect his operations.

Drawing Issue Status

FOR INFORMATION

NORTH WEST SITTINGBOURNE

GROVEHURST ROAD ACCESS JUNCTIONS (R/L)

Client

PERSIMMON HOMES

Date of 1st Issue	Designed	Drawn
09.11.2017	-	JHJ
A0 Scale	Checked	Approved
1:250	GH	GH

Drawing Number: 27239_5504_032

Revision: B

pba peterbrett
Offices throughout the UK and Europe
www.peterbrett.com

ASHFORD
Tel: 01233 651740

Appendix I

PFA consulting

Stratton Park House, Wanborough Road
Swindon, SN3 4HG

Telephone
01793 828000

Website
www.pfaplc.com

NOTES

1. Drawing based upon Topographical Survey prepared by MK Surveys, August 2017.

Rev	Date	Description	Drawn	Check
#	09/10/17	First Issue	CS	GE
A	14/12/17	Pedestrian crossing added.	CS	GE
B	18/04/18	Title Block Amended.	RH	CJM

Status

FOR INFORMATION

Client

Persimmon, Redrow, GH Dean and Boathouse Properties

Project

North West Sittingbourne

Drawing Title

Proposed Interim Improvement Grovehurst Interchange

Drawing No. **D118/25** Rev B

Date: October 2017 | Scale: 1:500 @ A1

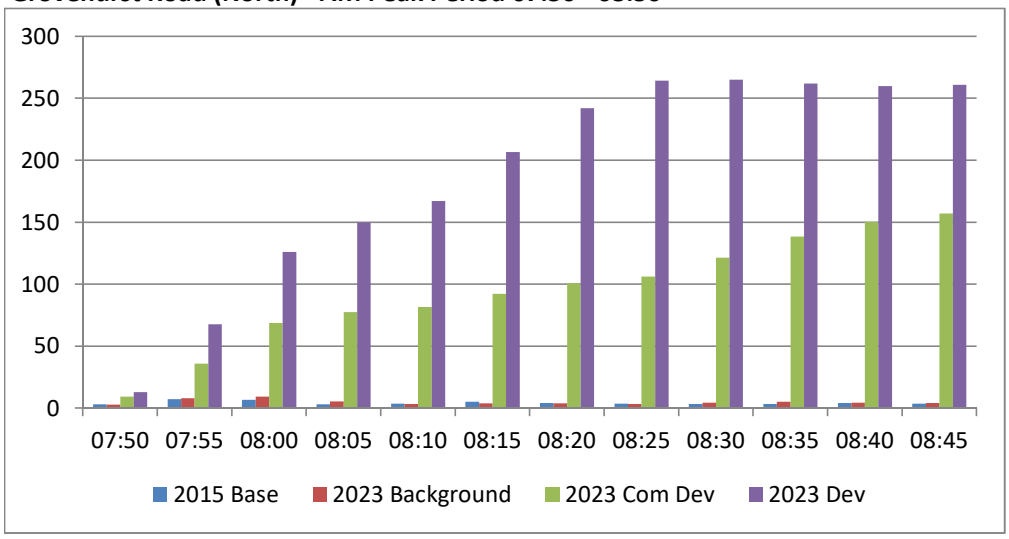
E-Mail: csumbler@pfaplc.com

Appendix J

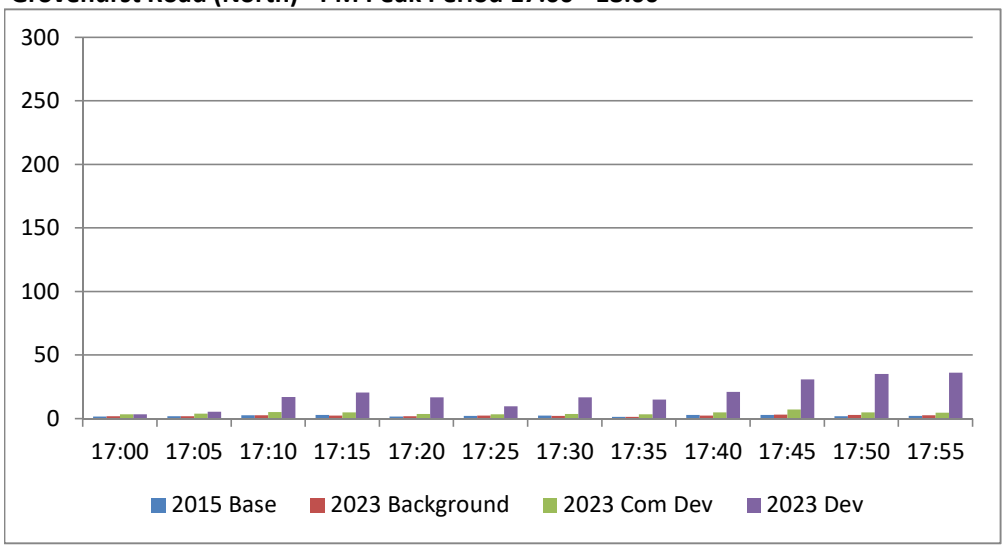
A249 Dumbell Junction - Northwest Roundabout

Queue Length Results

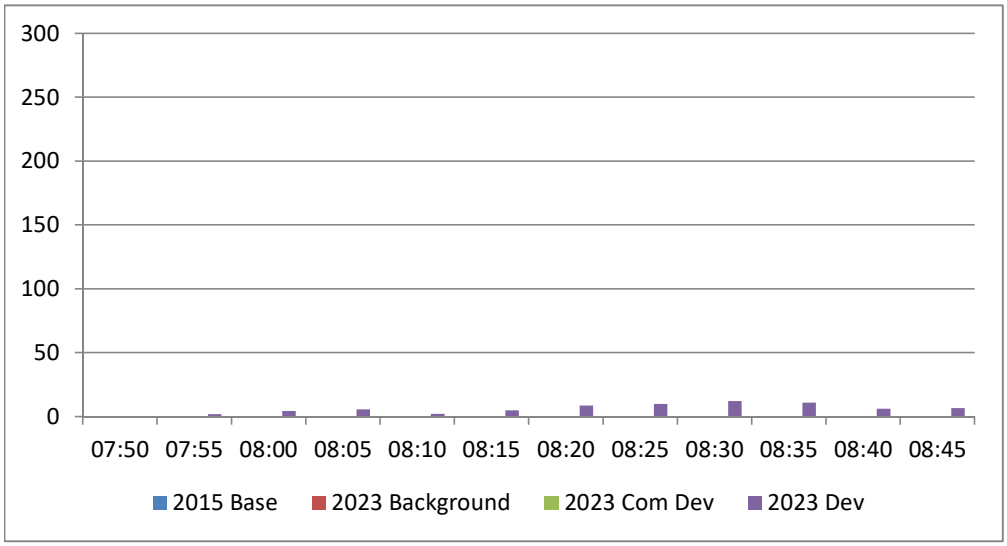
Grovehurst Road (North) - AM Peak Period 07:50 - 08:50



Grovehurst Road (North) - PM Peak Period 17:00 - 18:00



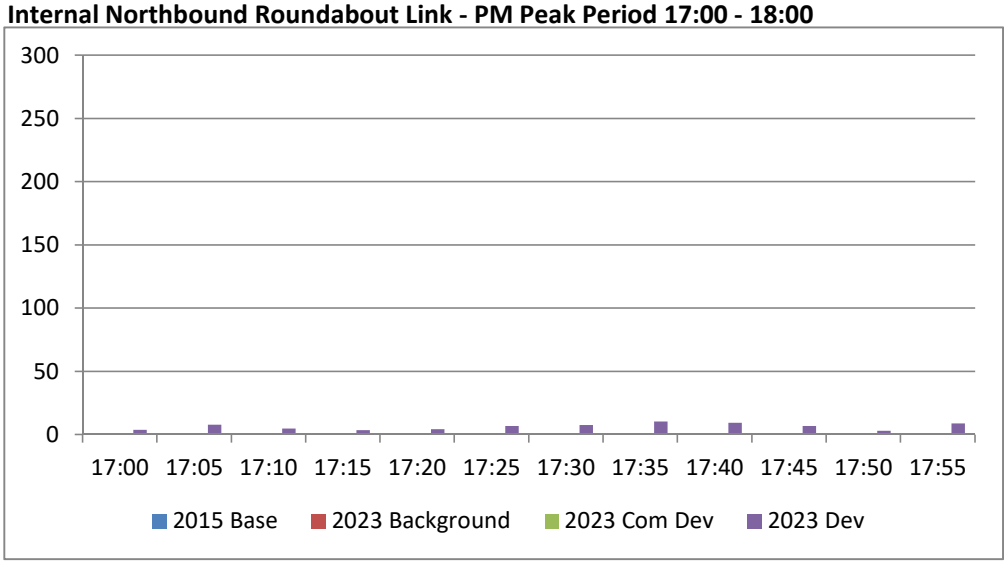
Internal Northbound Roundabout Link - AM Peak Period 07:50 - 08:50



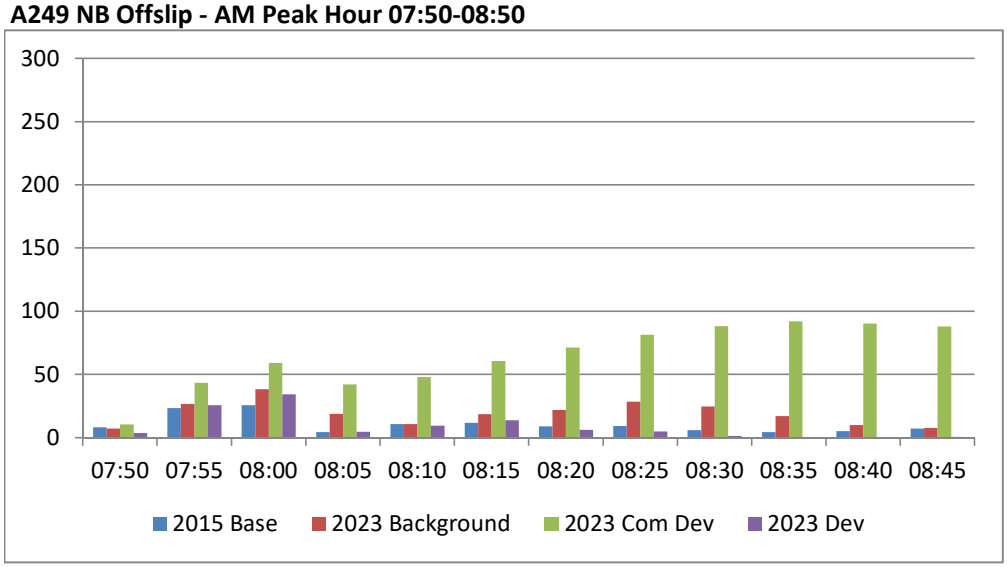
A249 Dumbell Junction - Northwest Roundabout

Queue Length Results

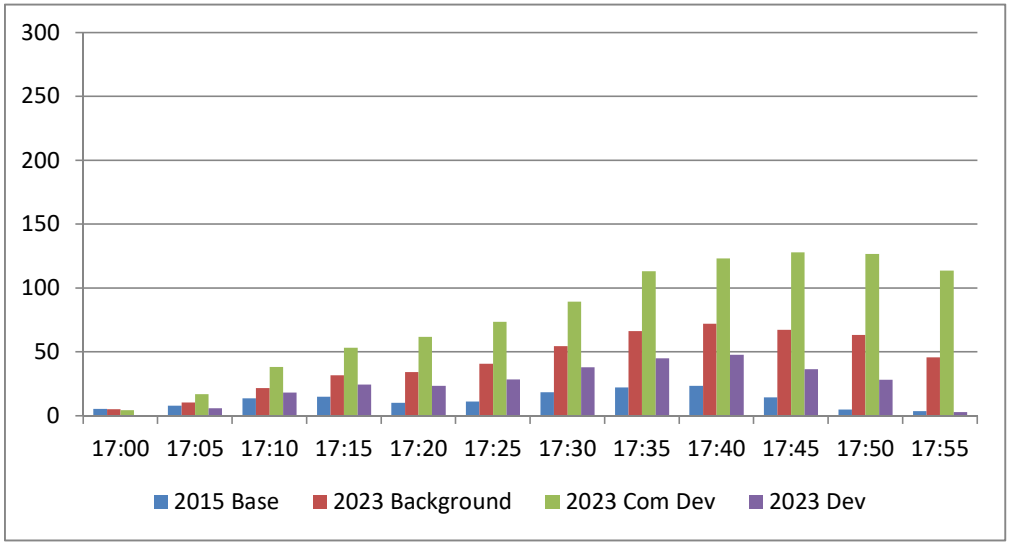
Internal Northbound Roundabout Link - PM Peak Period 17:00 - 18:00



A249 NB Offslip - AM Peak Hour 07:50-08:50



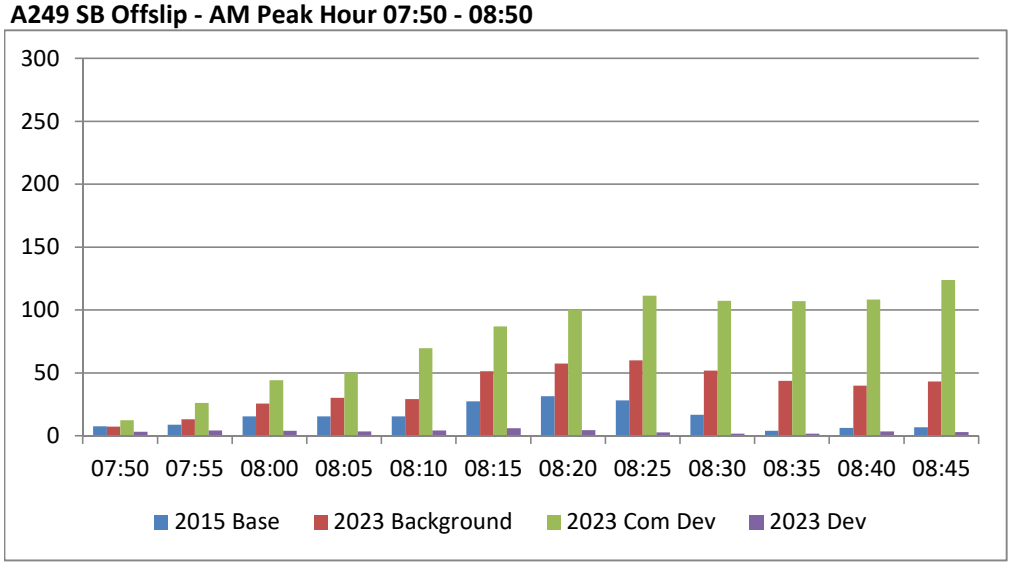
A249 NB Offslip - PM Peak Hour 17:00-18:00



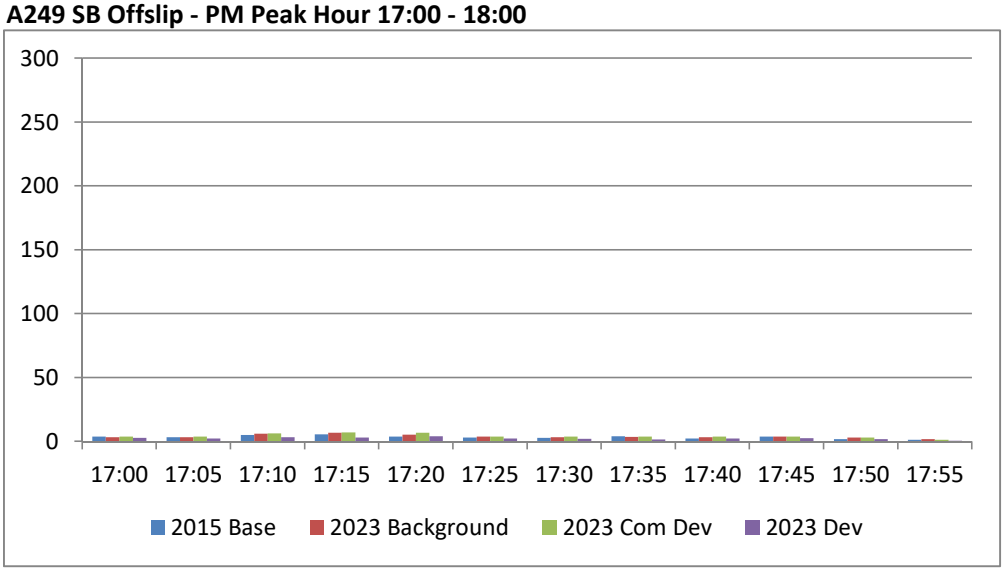
A249 Dumbell Junction - Southeast Roundabout

Queue Length Results

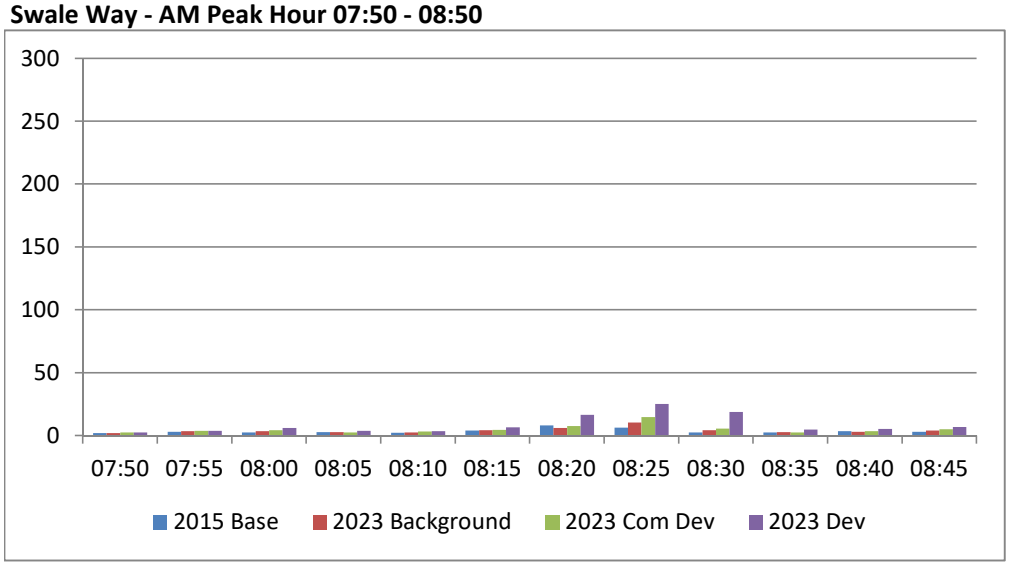
A249 SB Offslip - AM Peak Hour 07:50 - 08:50



A249 SB Offslip - PM Peak Hour 17:00 - 18:00



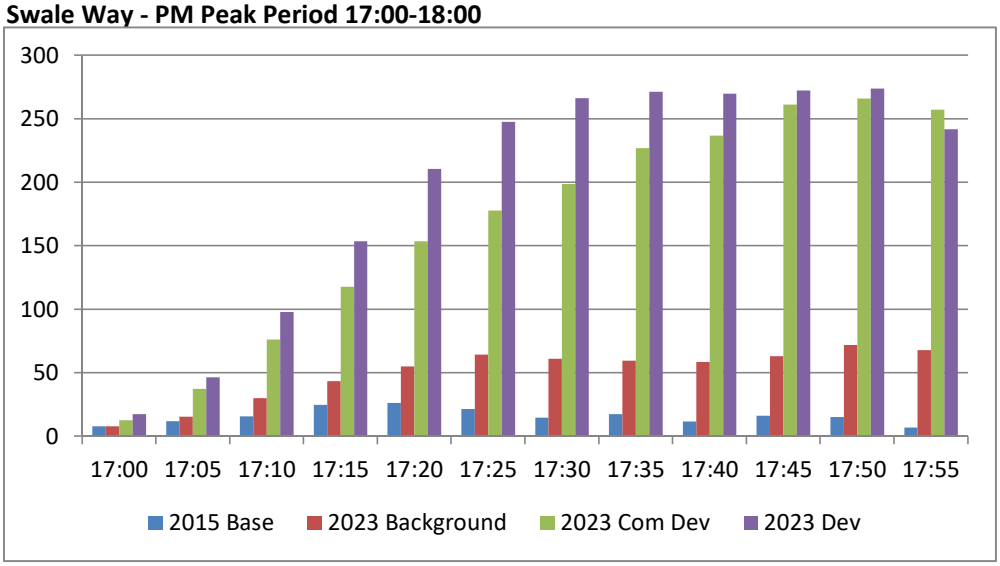
Swale Way - AM Peak Hour 07:50 - 08:50



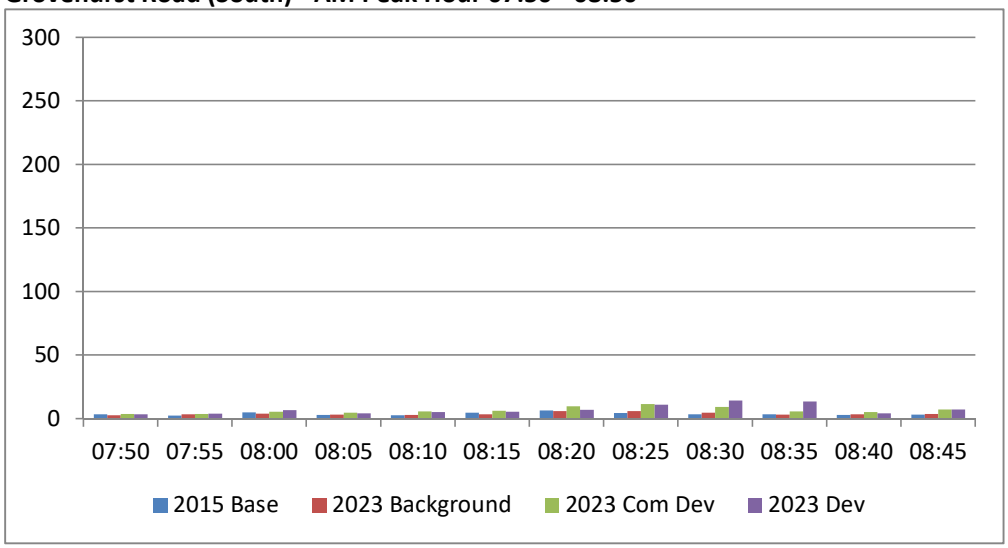
A249 Dumbell Junction - Southeast Roundabout

Queue Length Results

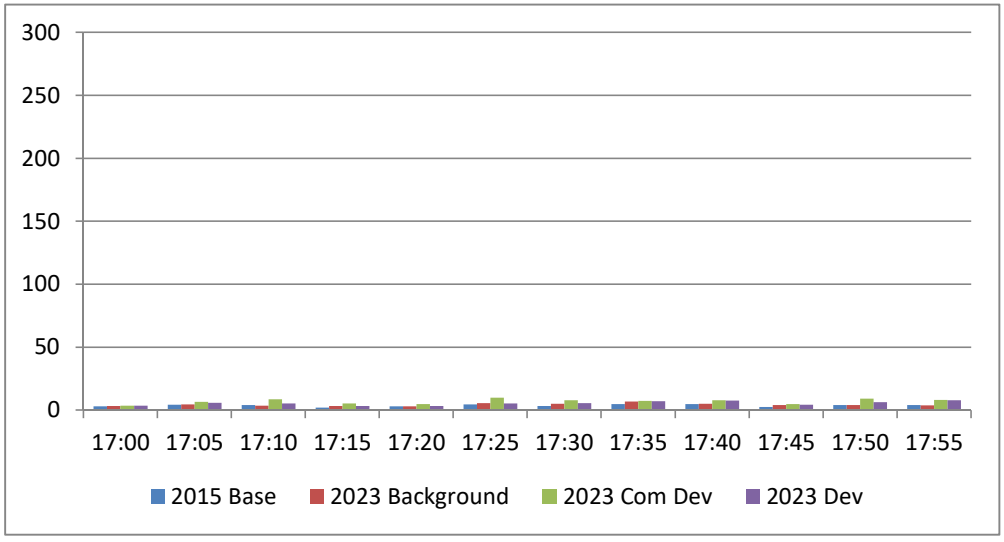
Swale Way - PM Peak Period 17:00-18:00



Grovehurst Road (South) - AM Peak Hour 07:50 - 08:50



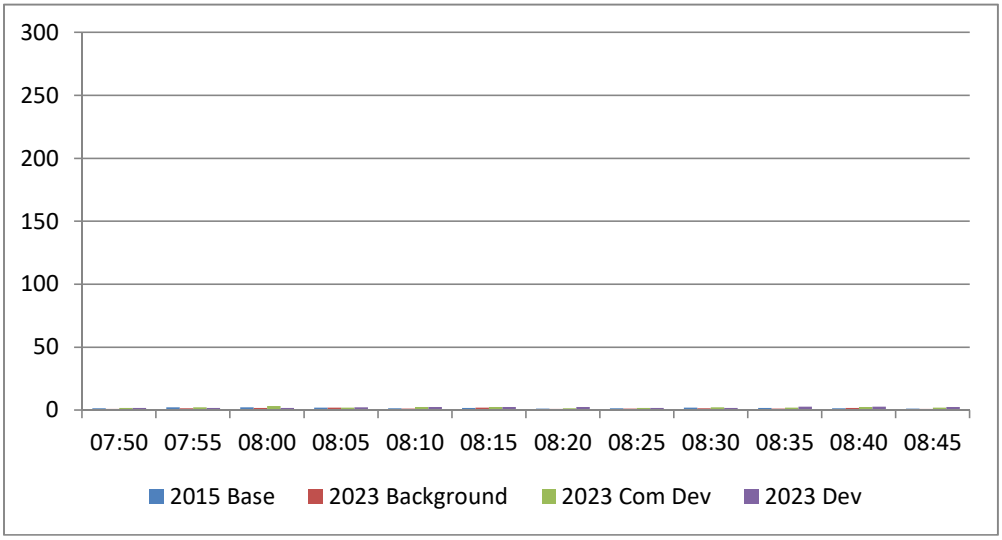
Grovehurst Road (South) - PM Peak Hour 17:00 - 18:00



A249 Dumbell Junction - Southeast Roundabout

Queue Length Results

Internal Southbound Roundabout Link - AM Peak Period 07:50 - 08:50



Internal Southbound Roundabout Link - PM Peak Period 17:00 - 18:00