JACOBS™

Maidstone Option Testing

Model Output - DRAFT

March 2012

JACOBS

Document control sheet BPP 04 F8

Client: Maidstone Borough Council
Project: Maidstone Option Testing Job No: B1786600
Document Title: Model Output

	Originator	Checked by	Reviewed by	Approved by
ORIGINAL	NAME **M.Nicholls**	NAME **S.Kaler**	NAME **S.Srivastava**	NAME **S.Srivastava**
DATE **March 2012**	SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE
Document Status DRAFT				

REVISION	NAME	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE
Document Status				

REVISION	NAME	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE
Document Status				

REVISION	NAME	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE
Document Status				

JACOBS

Contents

1 Introduction

Jacobs was commissioned by Kent County Council & Maidstone Borough Council in August 2007 to undertake the development of a multi-modal demand model for the town of Maidstone in Kent. Peak period models were developed using VISUM in accordance with the latest DfT guidelines to represent base year conditions for 2007.

The model encompasses Maidstone Borough and the immediate surrounding area in detail, whilst the wider network extends to include the major transport routes across Kent and into London to reflect long distance commuting. The model has been developed to assess typical weekday morning and evening peak conditions.

The Maidstone Multi Modal VISUM model was calibrated and validated against 2007 transport conditions following DfT guidance and is deemed to be robust for forecasting.

The model was used to assess the transport issues relating to Maidstone Borough Council's LDF Core Strategy development options.

Following on from this work Maidstone Borough Council commissioned Jacobs to use the VISUM model to assess alternative options for an Integrated Transport Strategy.

This report outlines the development assumptions and transport measures included in the model for each option tested. The report provides a review of key outputs from the models developed and a summary of the overall model performance.

2 Development / Land Use Assumptions

The housing, retail and employment development assumptions incorporated in the model are summarised in **Table 2-A** below.

Development	Units
Housing	10,080 houses
Retail Convenience	13,307 sqm
Retail Comparison	39,871 sqm
Employment B1A	73,432 sqm
Employment Other	97,632 sqm

Table 2-A 2026 Development Assumptions

The employment distribution and housing development are based on a dispersed development distribution as set in Appendix C of the Core Strategy (February 2011). Details of the development are housed in Appendix A.

3 Scenarios / Transport Measures

Three scenarios have been modelled for 2026 AM and PM peaks. Option 1 is effectively a Do Minimum scenario including the existing park and ride sites together with measures that are generally accepted as reasonable assumptions for the 2026. Options 2 and 3 present alternative scenarios developed around park and ride provision, bus priority measures and other policies.

3.1 Option 1 (Do Minimum)

The measures included in Option 1 (Do Minimum) are as follows:

- Increase in proportion of walking and cycling trips from 12% to 20%
- Reduction in single vehicle occupancy by 15%
- Increase in long stay parking by 50%
- Increase in short stay parking by 20%
- Thameslink rail service – increase of 4 trains per hour
- Increase in bus frequency on all main routes to 10mins
- Romney Place eastbound from Lower Stone Street Bus Only
- M20 traffic signals at junctions 5, 7 and 8
- Park and Ride as existing

3.2 Option 2 (Radial P&R Sites)

The measures included in Option 2 (Do Minimum) are as follows:

- Increase in proportion of walking and cycling trips from 12% to 20%
- Reduction in single vehicle occupancy by 15%
- Thameslink rail service – increase of 4 trains per hour
- Increase in bus frequency on all main routes to 10mins
- Romney Place eastbound from Lower Stone Street Bus Only
- P&R site on Blue Bell Hill (500 spaces)
- P&R site on Sutton Road (600 spaces)
- P&R site on Linton Corner (400 spaces)
- P&R site at Newnham Court (1500 spaces) and close Sittingbourne Road P&R
- Upgrade Willington St and London Rd P&R sites resurfacing and passenger facilities
- HOV/Bus lane inbound north of town centre on A229
- HOV/Bus lane inbound on A274
- Small scale bus priority at Huntsman Lane/Ashford Rd & Willington St/Ashford Rd
- All P&R routes to run with a 10 minute frequency
- Raise P&R fares to £2.00 off peak and to £3.00 during peak
- Increase in long stay parking by 150%
- Increase in short stay parking by 20%
- Reduce town centre parking supply

3.3 Option 3 (North South P&R Spine)

The measures included in Option 3 (Do Minimum) are as follows:

- Increase in proportion of walking and cycling trips from 12% to 20%
- Reduction in single vehicle occupancy by 15%
- Thameslink rail service – increase of 4 trains per hour
- Increase in bus frequency on all main routes to 10mins
- Romney Place eastbound from Lower Stone Street Bus Only
- P&R site at Cobtree Roundabout (1800 spaces)
- P&R site on Sutton Road (600 spaces)
- HOV/Bus lane inbound north of town centre on A229 (various sections)
- Bus gate at eastern end of St Andrews Rd connecting to Tonbridge Road
- Bus priority measures on Coldharbour roundabout and approaches to M20 junction 5
- HOV/Bus lane inbound on A274
- HOV/Bus lane inbound on A229 south from the town centre
- Upgrade a southern link between Bircholt Road and Heath Road
- Close all other P&R sites
- P&R route continuous service from Cobtree to Sutton Road via town (5 min frequency in the peak/10 min frequency throughout the day)
- NW express loop bus (10 min frequency)
- Raise P&R fares to £2.00 off peak and to £3.00 during peak
- Increase in long stay parking by 150%
- Increase in short stay parking by 20%
- Reduce town centre parking supply

The park and ride sites included in the VISUM model for each option are summarised in the table below and their location indicated in **Table 3-A**.

ID	Sites	Number of Spaces		
		Option 1	Option 2	Option 3
1	A20 Willington St P&R	*	*	
2	A249 Sittingbourne Rd	*		
3	A20 London Rd	*	*	
4	A274 Sutton Rd		600	600
5	A229 Cobtree			1800
6	A229 Bluebell Hill		500	
7	A229 Linton Corner		400	
8	A249 Newnham Court		1500	

** Same number of spaces as there are at present*

Table 3-A Park and Ride Sites

The options tested are essentially focussed on park and ride provision and measures to encourage park and ride use. The park and ride model is therefore a key element in the assessment process and the model is described in detail in Appendix F.

Figure 3-1 Park & Ride Site Locations

The bus measures incorporated in the 2026 forecast models for Options 1, 2 and 3 are listed in **Table 3-B** and their location shown in **Figure 3-1**.

ID	Location	Direction	Option 1	Option 2	Option 3
1	Bus lane – A274	inbound		✓	✓
2	Bus lane – A299 south of town centre	in/outbound			✓
3	Bus lane – A229 north of town centre	outbound			✓
4	Bus lane – A229 north of town centre	outbound			✓
5	Bus lane – A229 north of town centre	inbound		✓	✓
6	Bus lane – A229 north of town centre	outbound			✓
7	Bus lane – Cobtree Rdbt	outbound			✓
8	P&R access	inbound			✓
9	Bus priority – Cold Harbour Rdbt	-			✓
10	Bus gate – St Andrew's Way	in/outbound			✓
11	Romney Place – Bus only	-	✓	✓	✓

Table 3-B Bus Priority Measures

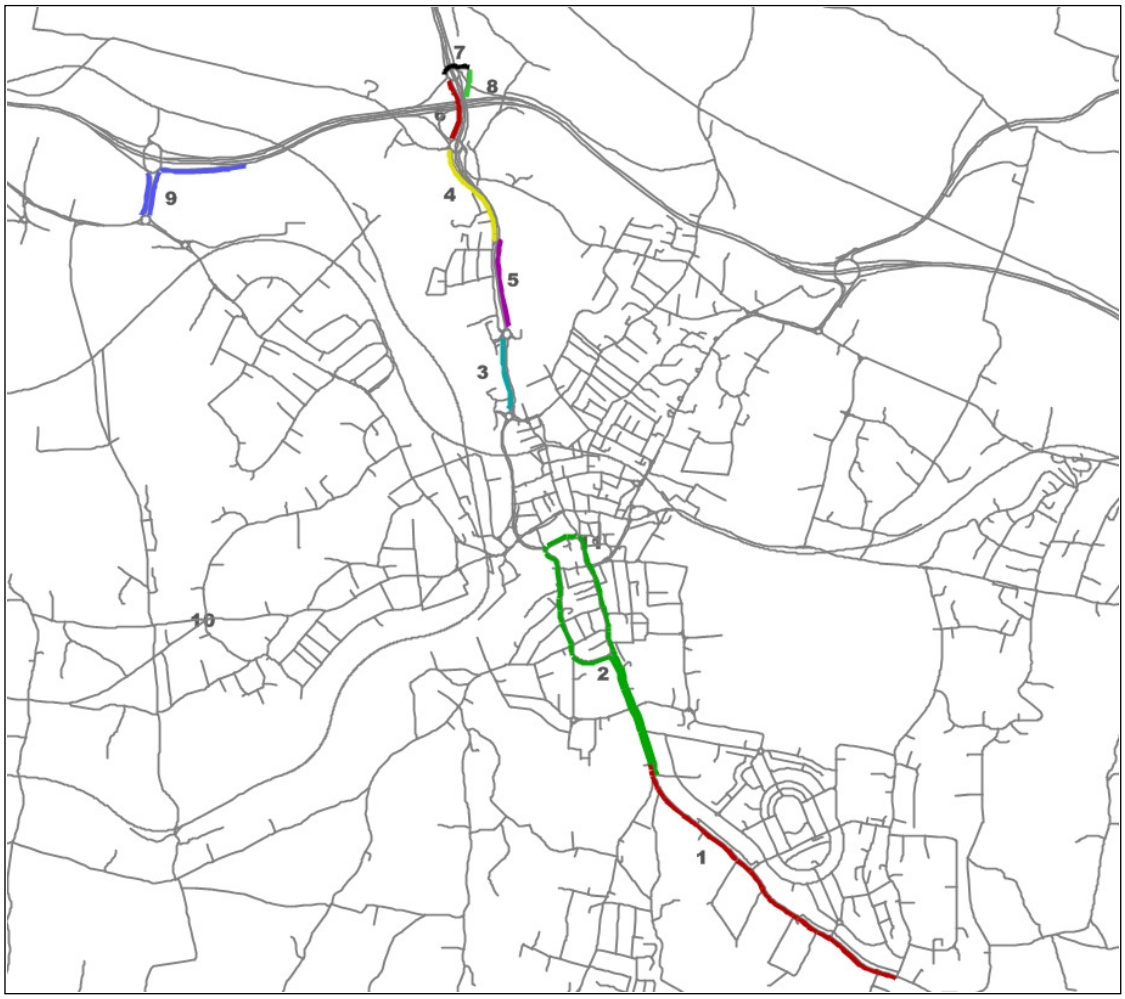


Figure 3-2 Bus Priority Measures

The impact of high occupancy vehicles (HOVs) using the proposed bus lanes has been modelled by the manipulation of link capacity.

Where a new bus lane is planned in addition to the existing road, the use of the bus lane by HOVs will also free up capacity on the existing road. This has been reflected in the model by the upward adjustment of the existing modelled link capacities. Where it is proposed to designate part of the current carriageway as a bus lane there has been a reduction in capacity. However the reduction in capacity has been moderated to take account of the HOVs using the bus lane.

The adjustment of link capacities is based on vehicle occupancy data recorded by roadside interview surveys at 4 sites within Maidstone. This data indicated that on average HOVs account for 18% of traffic movements in the AM peak and 27% in the PM peak.

4 Comparison of Options

The options tested have been assessed based on the change in mode share, Park and Ride usage and network performance and congestion.

4.1 Mode Share

The three scenarios assessed present alternative travel choices based on parking costs, park and ride provision, bus provision and congestion on the network. The outcome is a different pattern of mode choice and a difference in total demand for the peak hours modelled. The increase in Park and Ride trips will not necessarily be matched by a reduction in car trips as the car journey element to the P&R site is still included in the total trips.

AM	Base year 2007	Option 1	Option 2	Option 3
Car (Persons)	32032 (77%)	46860 (87%)	44671 (84%)	44253 (84%)
Bus (Persons)	4837 (12%)	3590 (7%)	4471 (8%)	4522 (9%)
Rail (Persons)	3517 (9%)	2611 (5%)	2018 (4%)	2919 (6%)
P&R (Persons)	979 (2%)	590 (1%)	2380 (4%)	1239 (2%)
Total	**41365**	**53651**	**53540**	**52934**

Table 4-A AM Peak Hour – Person Trips

PM	Base year 2007	Option 1	Option 2	Option 3
Car (Persons)	32006 (81%)	43129 (89%)	39719 (81%)	39682 (82%)
Bus (Persons)	3259 (8%)	2196 (5%)	5076 (10%)	5108 (11%)
Rail (Persons)	3347 (9%)	1778 (4%)	1938 (4%)	1974 (4%)
P&R (Persons)	593 (2%)	858 (2%)	2405 (5%)	1297 (3%)
Total	**39205**	**47961**	**49138**	**48060**

Table 4-B PM Peak Hour - Person Trips

The total person trips reflect the capacity of the system to cater for the travel demand. The highest total travel demand on the network in the AM peak is for Option 1 and in the PM peak for Option 2.

For all three options the AM peak demand is higher than the PM peak. This is a reflection of the different travel pattern and purposes in the AM and PM peak periods modelled.

Car trips account for up to 87% of the total in the AM, followed by bus, which accounts for up to 10%. Park & Ride contributes a maximum of 4%. The key facts to emerge for each option are as follows:

Option 1

- Total travel demand is lower in the PM peak by around 5690.
- Car person trips account for up to 87% in AM travel demand and 80% in the PM.
- P&R trips account for 1% and 2% of the total demand in the AM and PM peaks respectively.
- Bus and rail trips account for 12% of the total trips in the AM peak and 7% in the PM peak.

Option 2

- This option achieves a higher mode shift from car to P&R. This is a response to the choice of P&R sites available and their location.
- Option 2 has the highest total travel demand on the network in the PM peak and a similar travel demand to Option 1 in the AM peak.
- Bus and rail trips in Option 2 account for 12 to 13% of the total trips, a significant increase compared to Option 1.

Option 3

- Total travel demand in the AM peak is lower for Option 3. This is likely to be a response to the reduced network capacity with inclusion of bus lanes on the A274/A229 southern approach to town.
- Mode shift to P&R is less than Option 2 which is expected due to the reduced number of P&R sites.
- The proportion of bus trips increases to 9% and 10%.
- In the AM and PM peak respectively. This response reflects the additional services provided for Option 3.
- There is an increase in rail trips in the AM in particular compared to Option 1 and 2. One reason for this is probably the increased accessibility provided by the additional bus services.

High levels of congestion and delay on the highway network has the effect of causing a shift from car to bus, rail or park and ride, based on the parking costs and fares currently assumed in the model. This may include longer distance trips which, faced with the costs of delay across the network, change their travel pattern to take the park and ride to the town and bus or rail to complete their journey.

Another effect of excessive travel time due to delay and congestion on the network is to reschedule some trips outside of the peak hour.

4.2 Travel Times

Travel times have been extracted for the main radial routes through Maidstone, from the urban fringe to the town centre (routes A to G) and for Hermitage Lane to the west of the town (route H). These urban routes are shown in **Figure 4-1**.

Travel times have also been extracted from the model for selected longer distance routes (rural routes I to N) and for the M20 corridor (routes O to Q).

Details of the all travel times extracted and maps showing the routes are in Appendix B.

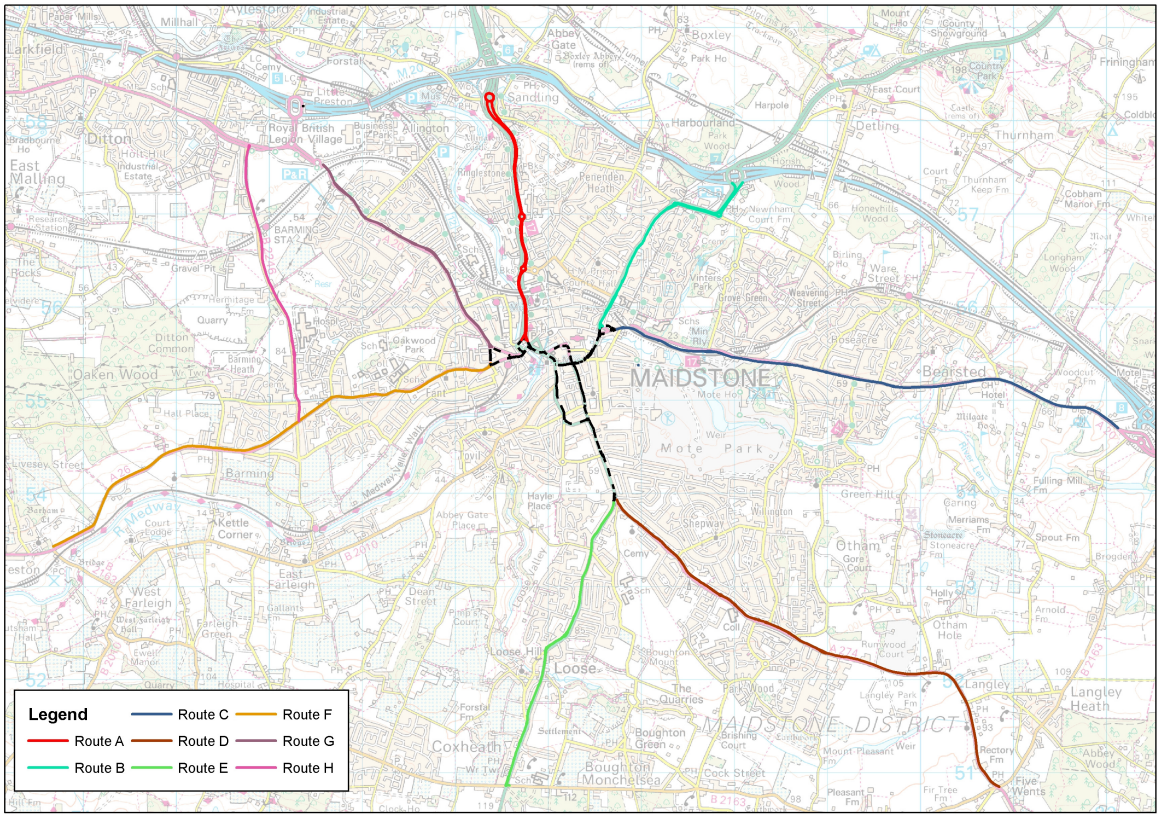


Figure 4-1 Travel Time Routes

Table 4-C and **Table 4-D** summarise the difference in inbound and outbound travel times (routes A to H) of Options 2 and 3 compared with Option 1. The highlighted figures indicate a reduction in travel time.

Option 2

AM and PM travel times are longer on all of the inbound urban routes and the majority of the outbound routes for Option 2, compared to Option 1. During the PM peak, inbound travel times on the A249 and A20 Ashford Road increase by more than 6 minutes compared to Option 1.

Option 3

Table 4-C indicates that Option 3 presents some travel time savings in the AM peak (inbound) compared to Option 1. The most significant impact of Option 3 is on the A20 Ashford Road route inbound in the AM peak and the A20 London Road outbound in the PM peak, where travel times reduce by around 8 minutes in each case.

Route	AM peak			PM Peak		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
A – A229 Royal Engineers		00:02:01	-00:03:52		00:03:36	-00:00:11
B – A249 Sittingbourne Rd		00:02:05	-00:04:12		00:07:51	00:01:42
C – A20 Ashford Rd		00:00:40	-00:08:17		00:06:04	00:00:31
D – A274 Sutton Rd		00:00:58	-00:00:12		00:00:38	00:01:01
E – A229 Loose Rd		00:00:54	-00:01:42		00:01:32	00:01:30
F – A26 Tonbridge Rd		00:00:30	-00:02:28		00:03:12	00:00:25
G – A20 London Rd		00:02:12	-00:03:37		00:01:46	00:02:19
H – Hermitage Lane (NB)		00:00:51	00:00:28		-00:00:35	00:00:28

Table 4-C Travel Time Comparison with Option 1 - Inbound (Urban Routes A-H)

Route	AM peak			PM Peak		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
A – A229 Royal Engineers		00:03:16	-00:01:05		00:03:16	00:01:54
B – A249 Sittingbourne Rd		00:00:53	00:00:52		00:01:51	00:01:17
C – A20 Ashford Rd		00:00:02	00:00:41		00:00:44	00:00:49
D – A274 Sutton Rd		00:03:45	00:01:54		00:03:44	00:04:19
E – A229 Loose Rd		00:00:54	00:01:09		00:01:55	00:03:27
F – A26 Tonbridge Rd		00:02:07	-00:04:13		00:03:55	-00:04:08
G – A20 London Rd		00:06:14	-00:12:29		00:04:28	-00:08:13
H – Hermitage Lane (SB)		00:00:52	00:00:20		00:00:37	00:00:24

Table 4-D Travel Time Comparison with Option 1 - Outbound (Urban Routes A-H)

Table 4-E and **Table 4-F** summarises the difference in travel time on the M20 corridor compared to Option 1. The maximum travel time recorded on the M20 corridor is just over 4 minutes on the longest section between junctions 7 and 8. The difference in travel time for Option 2 and 3 on the M20 corridor compared to Option 1 range from 2 to 28 seconds.

	AM			PM		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
O – M20 Junction 5-6		00:00:04	00:00:17		-00:00:09	-00:00:08
P – M20 Junction 6-7		-00:00:28	-00:00:08		-00:00:18	-00:00:15
Q – M20 Junction 7-8		-00:00:27	-00:00:07		-00:00:27	-00:00:26

Table 4-E Travel Time Comparison with Option 1 - M20 Eastbound (Routes O-Q)

.

	AM			PM		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
O – M20 Junction 5-6		-00:00:03	00:00:09		-00:00:05	-00:00:02
P – M20 Junction 6-7		-00:00:07	00:00:15		-00:00:06	-00:00:02
Q – M20 Junction 7-8		00:00:15	00:00:15		-00:00:10	-00:00:06

Table 4-F Travel Time Comparison with Option 1 - M20 Westbound (Routes O-Q)

4.3 Link Flows

The traffic flows are affected by the shift to P&R and bus modes in particular, by the rerouting of traffic around network to use P&R sites and also by network capacity issues. Vehicle flows have been extracted on radial routes, at locations close to the town centre and on the urban fringe, to provide a general impression of traffic volumes across the network. The locations of the inner and outer traffic monitoring points are shown in **Figure 4-2**. The AM and PM peak traffic flows for each option are summarised in **Table 4-G**, **Table 4-H**, **Table 4-I** and **Table 4-J** (numbers have been rounded to the nearest 10). The highlighted cells of the tables indicate a lower flow for Option 2 or 3 compared to Option 1.

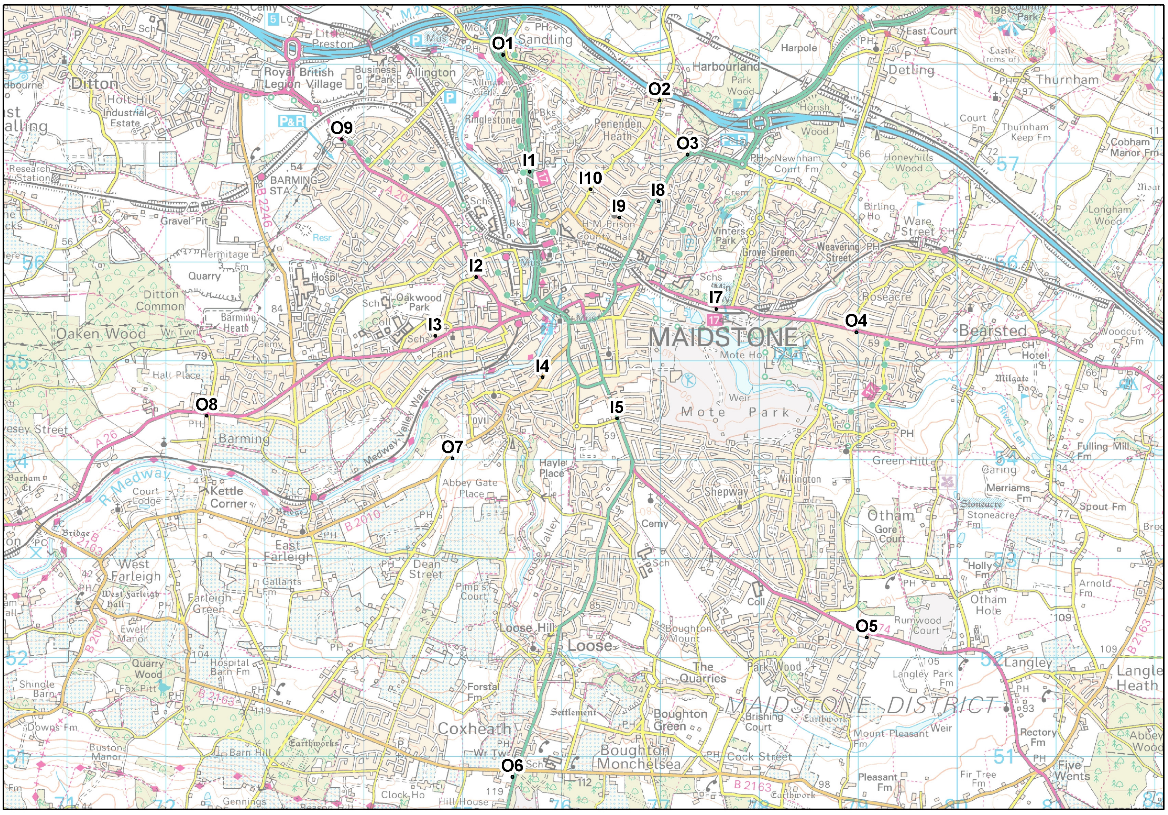


Figure 4-2 Link Flow Locations

ID	Location	AM			PM		
		Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
I1	A229 Royal Engineers	3220	3000	2770	2520	2690	2070
I2	A20 London Road	830	750	1140	450	630	630
I3	A26 Tonbridge Road	950	890	960	770	720	730
I4	B2010 College Road	450	400	480	440	420	480
I6	A229 Loose Road	1270	1440	1320	1050	1120	1050
I7	A20 Ashford Road	1550	1680	1840	740	1360	750
I8	A249 Sittingbourne Rd	1480	1550	1650	1060	1070	1030
I9	Wheeler Street	270	360	370	170	280	130
I10	Boxley Road	780	1030	880	230	800	240

Table 4-G Inbound Flows - Inner Sites

ID	Location	AM			PM		
		Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
I1	A229 Royal Engineers	2470	2470	2570	2360	2150	2400
I2	A20 London Road	980	970	630	840	700	780
I3	A26 Tonbridge Road	870	1040	890	850	810	720
I4	B2010 College Road	290	340	340	320	290	300
I6	A229 Loose Road	1220	1500	1320	930	1280	1300
I7	A20 Ashford Road	360	470	490	770	320	800
I8	A249 Sittingbourne Rd	1290	1090	1340	860	950	1290
I9	Wheeler Street	330	270	180	330	150	230
I10	Boxley Road	820	650	1080	930	530	830

Table 4-H Outbound Flows – Inner Sites

ID	Location	AM			PM		
		Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
O1	A229 Royal Engineers	3580	3660	3250	2720	3030	2340
O2	Boxley Road	450	130	430	160	270	200
O3	A249 Sittingbourne Rd	1500	1490	1750	1210	1310	1130
O4	A20 Ashford Road	1320	1520	1590	900	1360	990
O5	A274 Sutton Road	770	890	820	320	660	580
O6	A229 Linton Road	540	590	510	760	640	590
O7	B2010 Farleigh Hill	870	810	1030	450	630	580
O8	A26 Tonbridge Road	1500	1650	920	950	1420	790
O9	A20 London Road	400	670	1570	650	400	1580

Table 4-I Inbound Flows – Outer Sites

ID	Location	AM			PM		
		Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
O1	A229 Royal Engineers	2840	3170	3190	2540	2400	2620
O2	Boxley Road	530	490	530	550	400	560
O3	A249 Sittingbourne Rd	1410	1350	1470	1060	1060	1430
O4	A20 Ashford Road	1120	1180	1240	1060	1020	1270
O5	A274 Sutton Road	790	810	980	570	630	960
O6	A229 Linton Road	1000	1100	1100	480	710	500
O7	B2010 Farleigh Hill	470	520	520	560	520	580
O8	A26 Tonbridge Road	700	1220	1060	590	730	1200
O9	A20 London Road	2130	2130	2140	900	1490	1530

Table 4-J Outbound Flows – Outer Sites

The A229 Royal Engineers Way is a dual carriageway and carries the highest volume of traffic recorded on the links selected, in both directions and both peak periods. The A229 is the main arterial route from the north serving traffic movements from the north of Kent as well as from the M20 corridor.

The A20 London Rd corridor provides access to the M20 (west) and to key developments to the west of the town and to the A20 P&R site in Options 1 and 2. The AM peak outbound movements on the A20 are higher than the inbound movements for all options.

Traffic gains and losses on the inner sites at Boxley Road and Wheeler Street provide an indication of the degree of rerouting of traffic around the town centre to avoid congestion.

A summary of the main impacts in relation to traffic volumes is continued below:

Option 1

- The highest AM inbound flows for Option 1 are recorded on A229 Royal Engineers, A20 Ashford Rd, A249 and A20 London Rd.

Option 2

- Option 2 has P&R sites which intercept traffic on most of the radial routes.
- Inbound traffic on A249 Sittingbourne Rd remains fairly consistent as the original Sittingbourne Rd P&R traffic is captured by the Newnham Ct P&R site.

Option 3

- Option 3 has higher flows on A249 and A20 E and A20 W inbound as traffic is not captured at P&R sites on these corridors.
- Traffic is reduced on A229 Royal Engineers way as traffic is diverted to the Cobtree P&R site.
- Traffic on A229 from south is constrained by the reduced capacity available as a result of bus lane provision.

- The A20 London Road, outer site, has significantly more traffic than Option 1 or 2. Both Options 1 and 2 include the P&R site at London Road which captures some movements on this corridor.

4.4 Park & Ride

The use of the P&R sites varies significantly and the key factors are:

- Location of the site
- Location of demand
- Site accessibility and capturing demand
- Competition between sites

Table 4-K and **Table 4-L** below summarise the Park and Ride person trips for the AM and PM peaks. Figures showing park and ride car distribution can be found in Appendix E.

ID	Park and Ride site	Base	Option 1	Option 2	Option 3
1	A20 Willington St P&R	282	13	77	
2	A249 Sittingbourne Rd	309	508		
3	A20 London Rd	351	69	90	
4	A274 Sutton Rd			130	473
5	A229 Cobtree				766
6	A229 Bluebell Hill			329	
7	A229 Linton Corner			551	
8	A249 Newnham Court			1203	
	Total	942	590	2380	1239

Table 4-K AM Park & Ride Person Trips

ID	Park and Ride site	Base	Option 1	Option 2	Option 3
1	A20 Willington St P&R	208	39	110	
2	A249 Sittingbourne Rd	278	669		
3	A20 London Rd	75	149	151	
4	A274 Sutton Rd			190	442
5	A229 Cobtree				855
6	A229 Bluebell Hill			349	
7	A229 Linton Corner			504	
8	A249 Newnham Court			1102	
	Total	561	858	2406	1297

Table 4-L PM Park & Ride Person Trips

Option 1 includes the existing park and ride sites and existing parking costs across the town. This option has lower P&R use than the base model which is likely to be a response to distribution of proposed development and subsequent trip demand. Of the three sites the site on A249 Sittingbourne Road is the most popular.

For Option 2 the parking costs have increased in town and there are additional bus lanes at a number of locations. P&R use increases as result of additional parking cost in town together with increase in the number of sites available. The site at the A249 Newnham Court has the highest level of use.

Option 3 also has increased parking costs together with extensive bus lane provision. Capacity is reduced on the highway network to accommodate some of the bus lane sections. There are 2 P&R sites and the A229 Cobtree site is the most popular, serving traffic from the M20 (east and west) and traffic from the A229. Higher parking charges in town, bus lanes and reduced network capacity for other traffic results in more than twice as much P&R use compared to Option 1. The sites at Sutton Rd and Cobtree both have significant time savings for buses using bus lanes compared to car traffic.

The most popular sites across the options are:

- Sittingbourne Rd (Option 1)
- Newhnam Court (Option 2)
- Cobtree (Option 3)

Each of these sites is accessible to the M20 East and West and to the A249 or A229 from the north.

Table 4-M and **Table 4-N** summarise the P&R bus travel times for each of the options. Inbound travel times on the existing routes in Option 1 are fairly consistent at between 7 to 8 minutes. The outbound and inbound services follow different routes and the times differ accordingly. The longest inbound P&R bus travel time is a little over 13 minutes (Option 2), from the A229 Linton Corner site. The longest outbound journey in the PM peak is around 15 minutes to the A20 London Road site (Option 2).

	Park & Ride Site	AM			PM		
		Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
1	A20 Willington St P&R	0:07:30	0:07:28		0:06:35	0:07:03	
2	A249 Sittingbourne Rd	0:07:26			0:06:42	0:06:48	
3	A20 London Rd	0:08:18	0:08:17		0:08:04	0:08:03	
4	A274 Sutton Rd		0:13:48	0:09:56		0:12:49	0:09:03
5	A229 Cobtree			0:04:40		0:04:42	0:04:31
6	A229 Bluebell Hill		0:05:56			0:05:30	
7	A229 Linton Corner		0:13:24			0:12:46	
8	A249 Newnham Court		0:09:04			0:08:28	

Table 4-M P&R Bus Travel Time to Town Centre - Inbound

	Park & Ride Site	AM			PM		
		Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
1	A20 Willington St P&R	0:05:59	0:06:00		0:05:57	0:05:48	
2	A249 Sittingbourne Rd	0:08:02			0:07:39	0:07:43	
3	A20 London Rd	0:16:07	0:20:11		0:11:02	0:15:29	
4	A274 Sutton Rd		0:11:57	0:13:57		0:10:57	0:12:18
5	A229 Cobtree			0:04:44		0:04:35	0:04:35
6	A229 Bluebell Hill		0:06:26			0:06:07	
7	A229 Linton Corner		0:12:48			0:11:57	
8	A249 Newnham Court		0:10:00			0:09:36	

Table 4-N P&R Bus Travel Time to Town Centre – Outbound

4.5 M20 Corridor

Traffic from Maidstone accesses the M20 corridor at junctions 5, 6, 7 and 8. The traffic flows on these sections of the motorway are detailed in Appendix D. The performance of each of the M20 junctions is closely related as traffic routes on or off the motorway in response to network capacity.

Table 4-O and **Table 4-P** below summarise the indicative level of volume to capacity ratio (%). Junction 5-6 has a main carriageway for through traffic (A) and an additional carriageway (B) for more local movements.

	AM				PM			
	Base	Option 1	Option 2	Option 3	Base	Option 1	Option 2	Option 3
M20 J4 -5	90	90	95	130	113	88	64	84
M20 J5 - 6 (A)	50	54	62	80	63	59	41	42
M20 J5 - 6 (B)	61	76	78	69	93	71	58	57
M20 J6 - J7	64	108	84	102	84	86	55	64
M20 J7 -8	54	90	72	87	73	81	46	51

Table 4-O M20 Eastbound Volume/Capacity (%)

	AM				PM			
	Base	Option 1	Option 2	Option 3	Base	Option 1	Option 2	Option 3
M20 J5 -4	96	129	124	138	79	102	89	93
M20 J6 - 5 (A)	72	67	64	79	56	61	43	51
M20 J6 - 5 (B)	49	68	70	88	42	49	44	64
M20 J7 – J6	73	94	87	106	61	69	58	69
M20 J8 -7	74	102	107	107	58	73	62	67

Table 4-P M20 Westbound Volume/Capacity (%)

The M20 between J4 and J5 in both directions is already close to capacity during the peak period. The M20 between J4-5 has the heaviest AM peak flows and is at or over capacity for Options 1, 2 and 3 as is the westbound section between J8 and J7.

4.6 Network Congestion

Figure 4-3 and **Figure 4-5** illustrate the degree of traffic congestion (volume to capacity ratio) across the network for Options 1, 2 and 3 in the AM peak. The links in green are operating within capacity, those highlighted in orange are heavily trafficked (volume to capacity ratio up to 95%) but are just below their operating capacity, while the links in red (volume to capacity ratio over 95%) are already close to or over capacity.

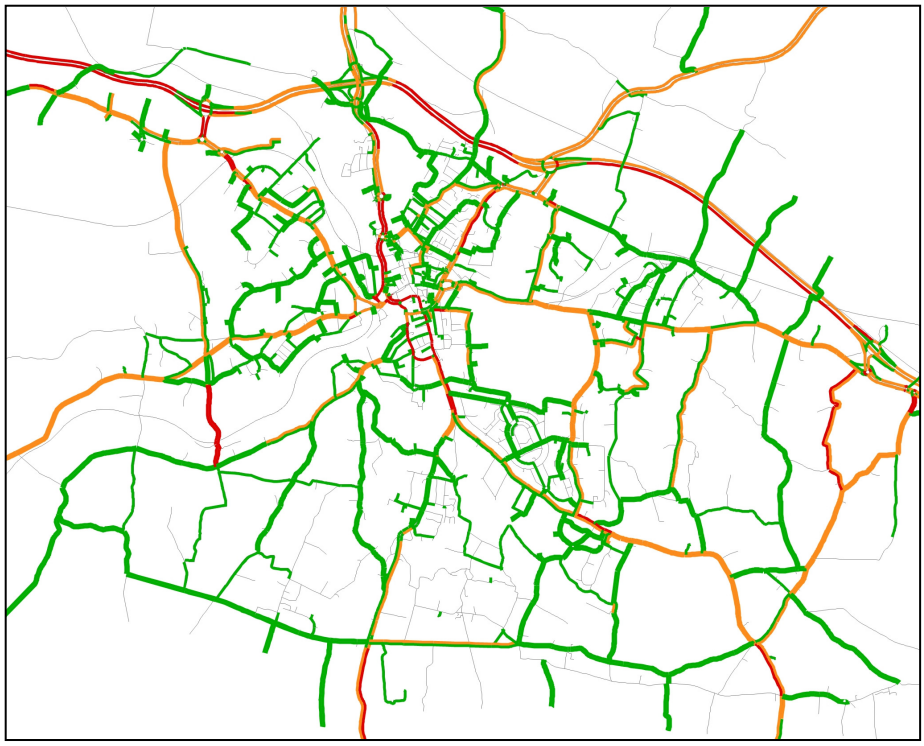


Figure 4-3 Option 1 AM Network Congestion

Figure 4-4 Option 2 AM Network Congestion

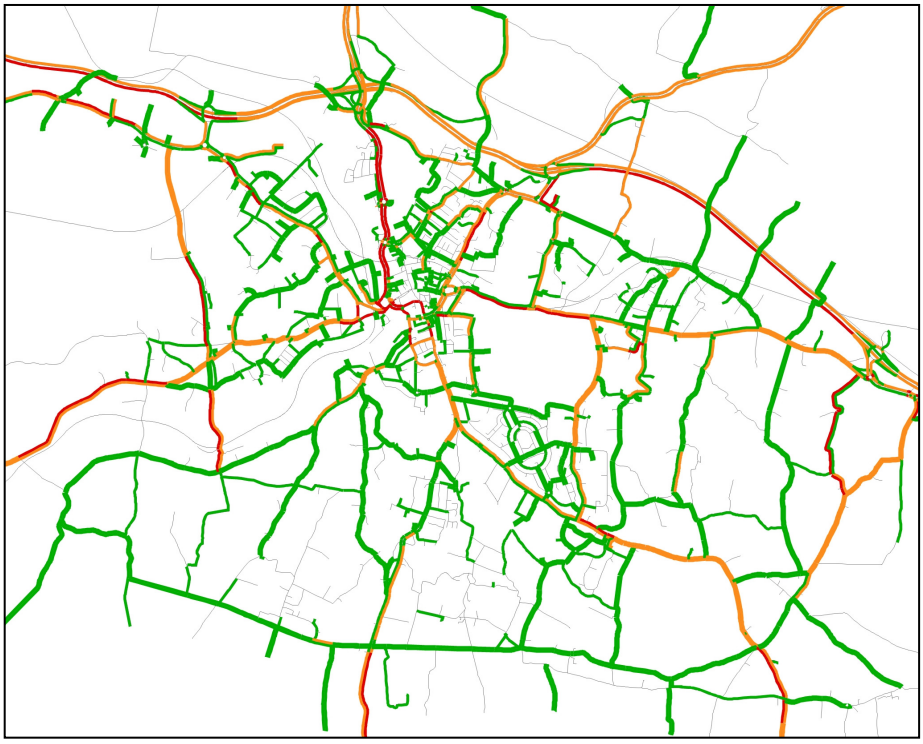


Figure 4-5 Option 3 AM Network Congestion

The figures indicate that all three options have serious congestion around the town centre bridge gyratory and along the inner section of the A229 Royal Engineers Way.

Option 1

There is congestion on the A20 Ashford Road inbound, A249 inbound, Willington St northbound, parts of the A20 London Road westbound as well as on the M20 J5-6 and J8-7. The M20 J5-4 and A20 eastbound, which runs parallel to the motorway, both have flows close to or at capacity.

Option 2

The A229 Bluebell Hill P&R site included in Option 2 captures traffic which, in Option 1, travels eastbound on the M20, from J5 to J6, to access the A249 P&R site. This is reflected in the lower level of congestion on the slip road to the M20 and the M20 J5-J6. The M20 and A20 to the west of the town have high levels of congestion similar to Option 1.

Option 3

The reduced capacity on the A229 south of the town, to accommodate bus lanes, results in a higher level of congestion on this part of the network.

The P&R site at A229 Cobtree attracts some of the traffic which would otherwise have used the A249 Sittingbourne P&R (Option 1), or Newnham Court P&R and A20 London Road P&R (Option 2). This is reflected in lower congestion levels on the A249 and higher levels on the M20 J6-J5.

There is a raised level of congestion in the vicinity of M20 J5 and the Coldharbour roundabout. However in contrast to Options 1 and 2 the balance of flows on the M20 and A20 to the west of the town is altered. The M20 west of junction 5 in both directions has higher levels of congestion and the A20 a lower level.

5 Summary

The Maidstone VISUM Multi Modal Model has been used to assess three different development options (Option 1, Option 2 and Option 3). Each option is based on the same development but incorporates different measures such as various Park & Ride sites, changes in parking charges and bus priority measures. The assessment of the options is based on data extracted from the model for travel demand, travel mode, link flows and journey times on selected routes.

The total travel demand generated by each of the three options is moderated in the peak periods by the ability of the network to cater for it. Consequently the total peak demand on the network differs between the options.

The three options include a range of measures designed to impact on mode choice, in particular on Park and Ride use. The choice of mode available to the trip makers is dependant on the accessibility of alternate modes. An element of the proposed development assumed in the model is focussed outside the town centre and public transport modes are less accessible to these more dispersed developments.

The model output for Options 1, 2 and 3 demonstrates that Park and ride use is dependant not only on the number of sites. There are a number of key factors including site location, site accessibility to the sources of trip demand, policy measures such as parking control and bus priority measures to increase travel time benefits over the car.

Journey times on selected routes provide an indication of the efficiency of traffic movement through the town. However individual journey times on the radial routes are affected by development pressure on sensitive sections of the network and by the convergence of traffic at more heavily congested sections of the network. Traffic moving around the town to avoid congestion in the centre also conflicts with movements on the radial routes, contributing to delay on these routes.

The network is under significant pressure and changes to trip patterns, for example to access park and ride sites, impact on the wider routing patterns. Section of the M20 operates close to capacity in the peak periods and the motorway junctions with the local network come under pressure. Traffic routing is affected by junction capacity on the approaches to the M20.

Options 2 and 3 are developed around different park and ride provision coupled with a range of other measures including bus services, bus priority measures, parking costs etc. Each option has a different impact on an already heavily congested network. The model output supports the need for careful planning of P&R provision and associated policies are needed to maximise their usage and to avoid competition between sites.

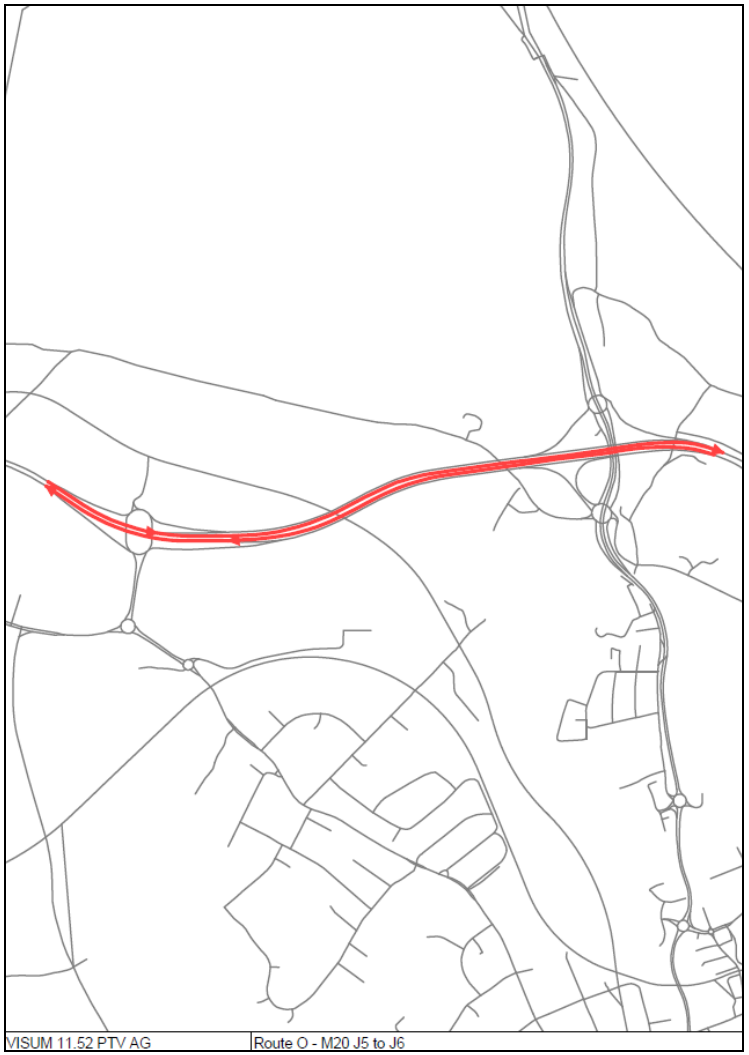
Appendix A Development Assumptions

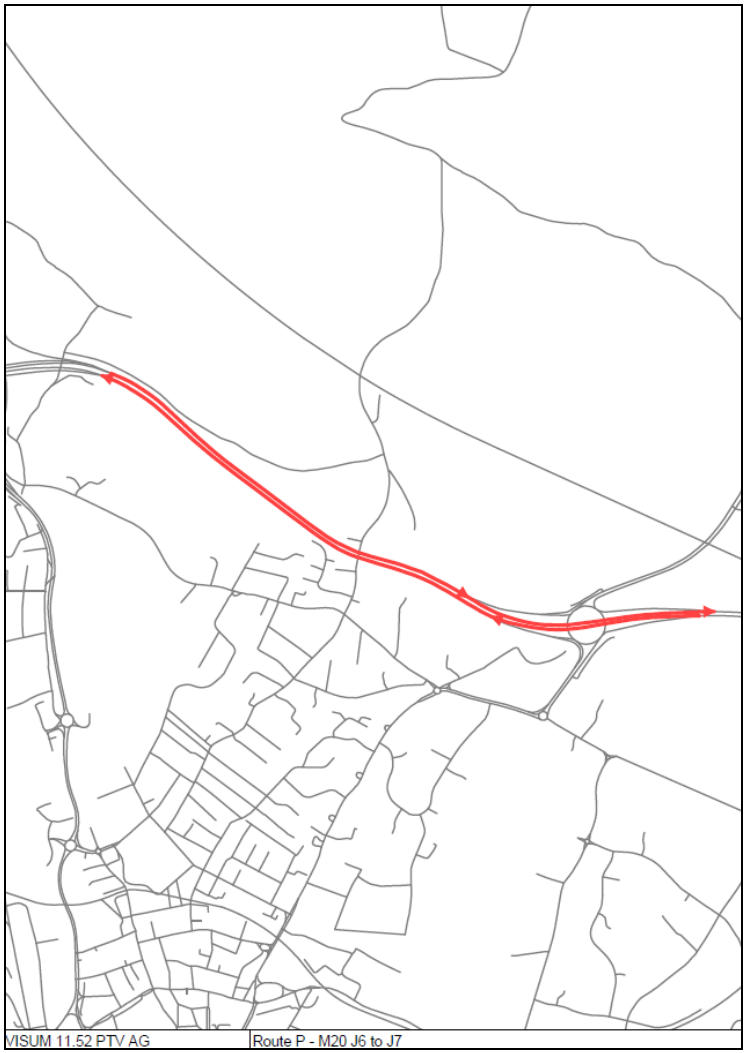
Option S – Total 10,080 houses with Dispersed Development

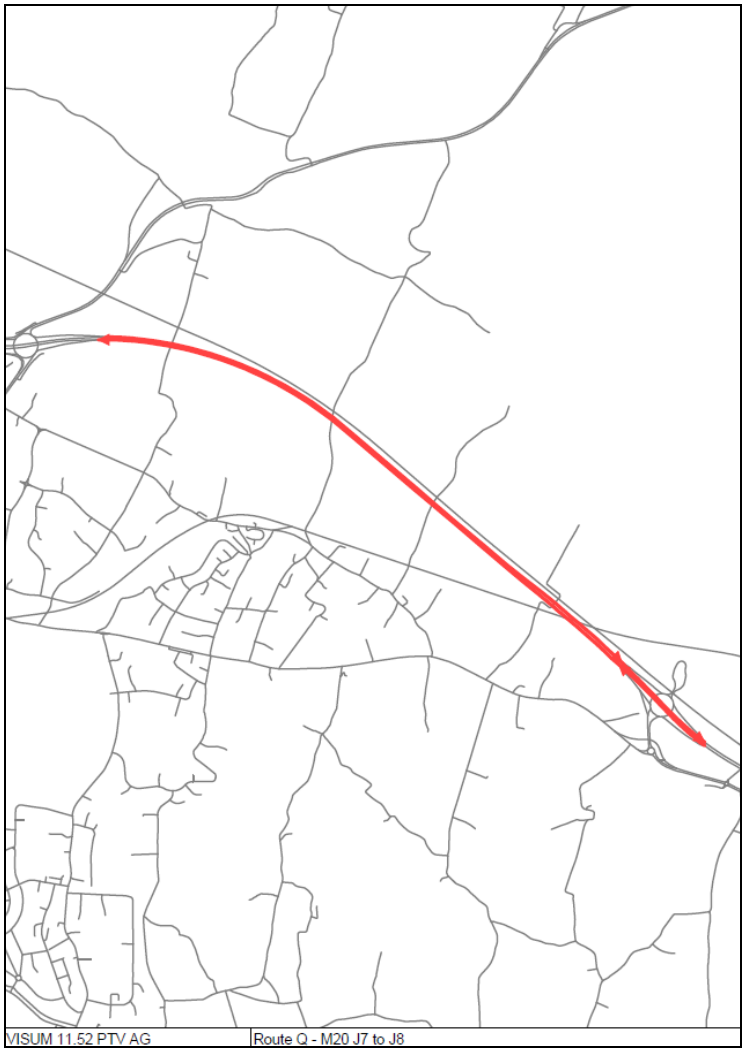
Housing (homes)

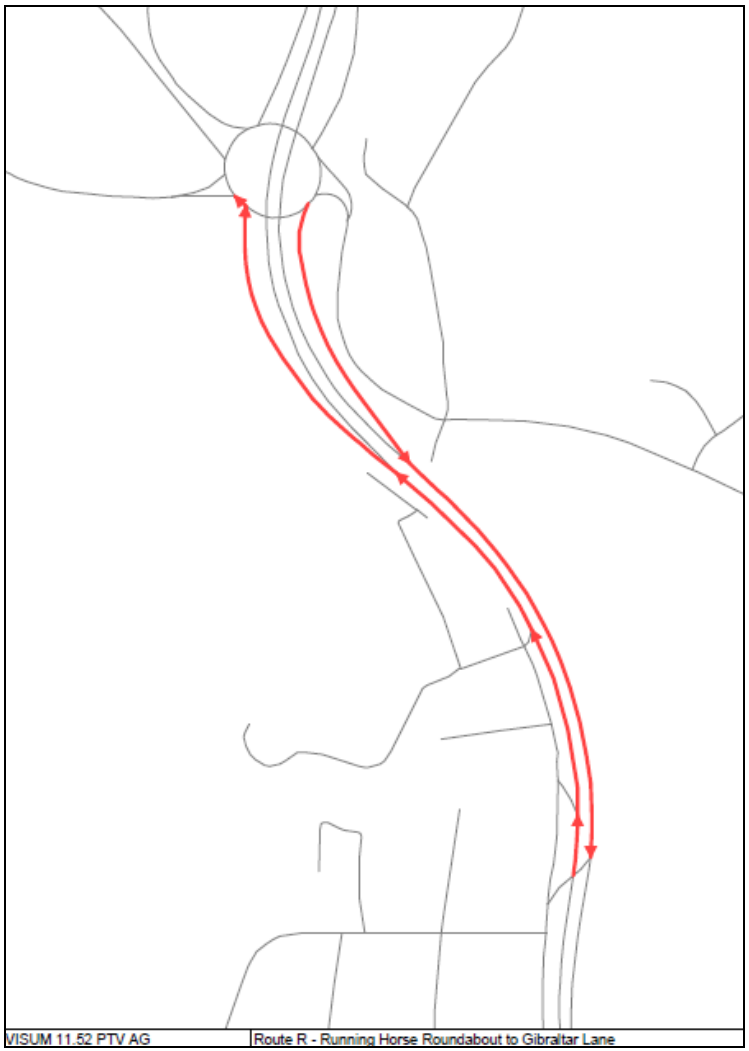
1000 – In the vicinity of Sutton Road
909 – North West fringe (inc. Hermitage Lane)
127 – Ware Street
110 – Lenham
199 – Staplehurst
317 – Marden
192 – Headcorn
316 - Harrietsham

Appendix B Travel Times Maps (Routes O-AI)

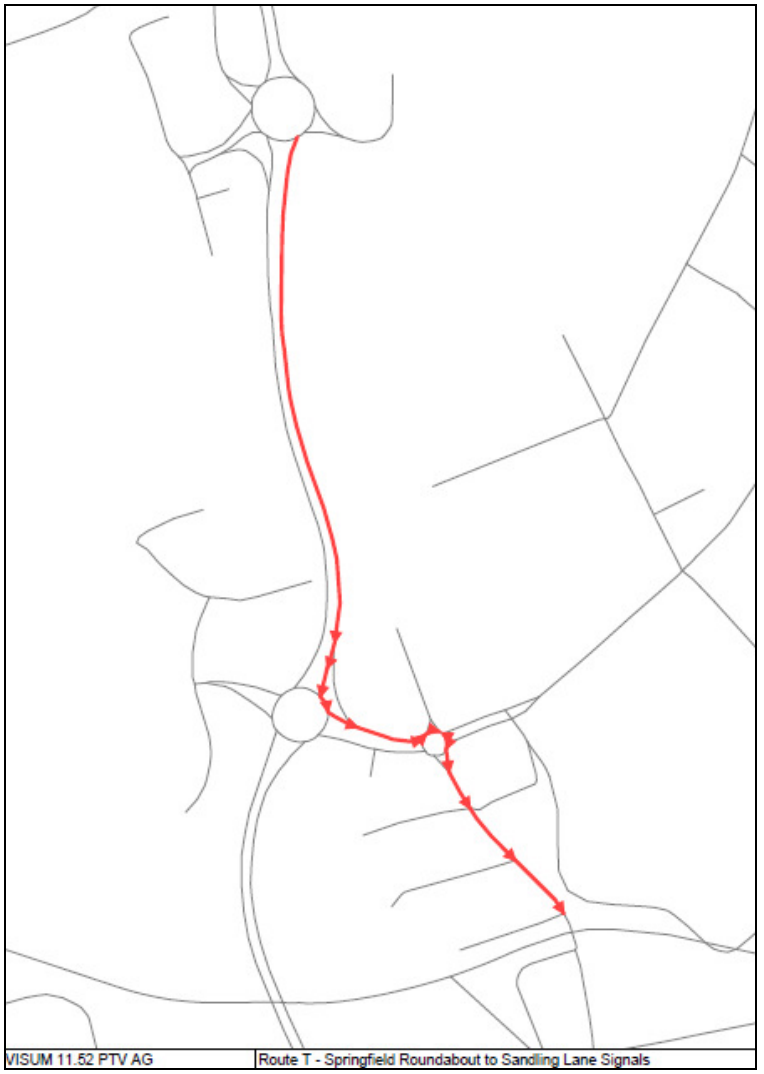

VISUM 11.52 PTV AG
Route O - M20 J5 to J6

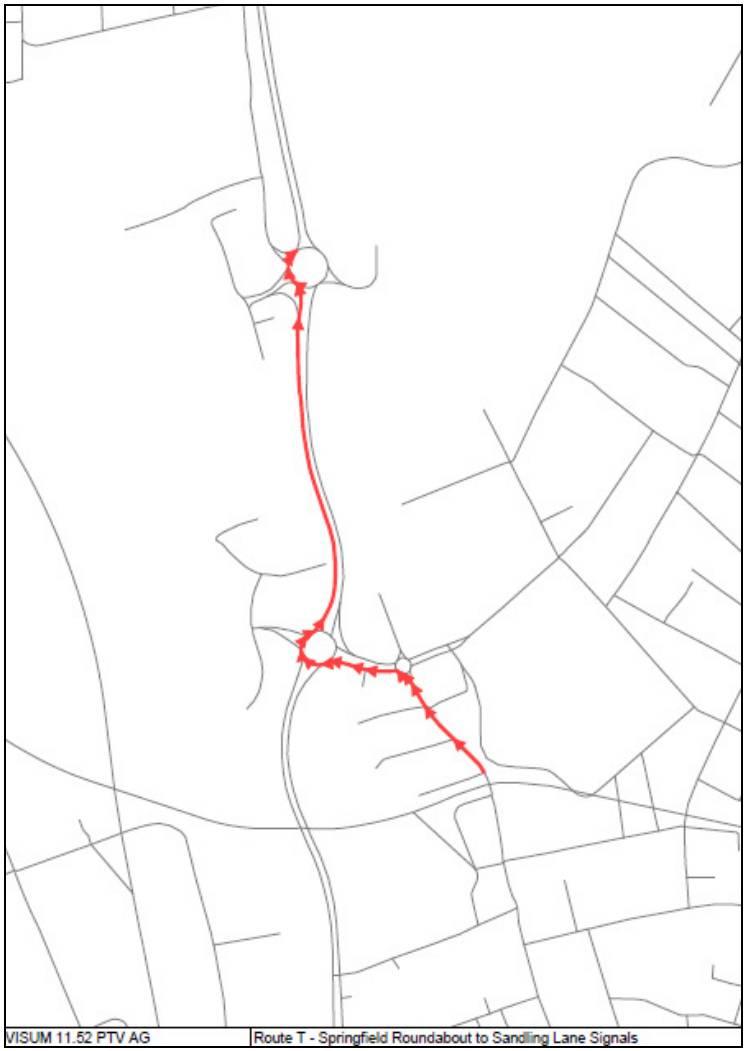

VISUM 11.52 PTV AG
Route P - M20 J6 to J7

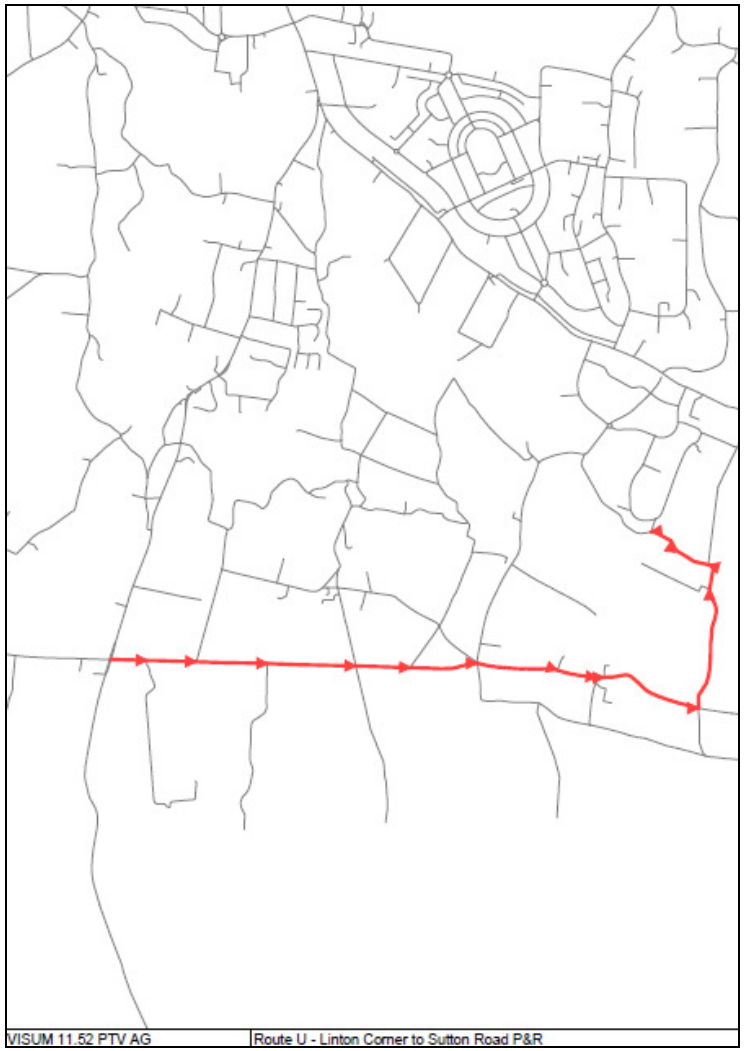

VISUM 11.52 PTV AG
Route Q - M20 J7 to J8

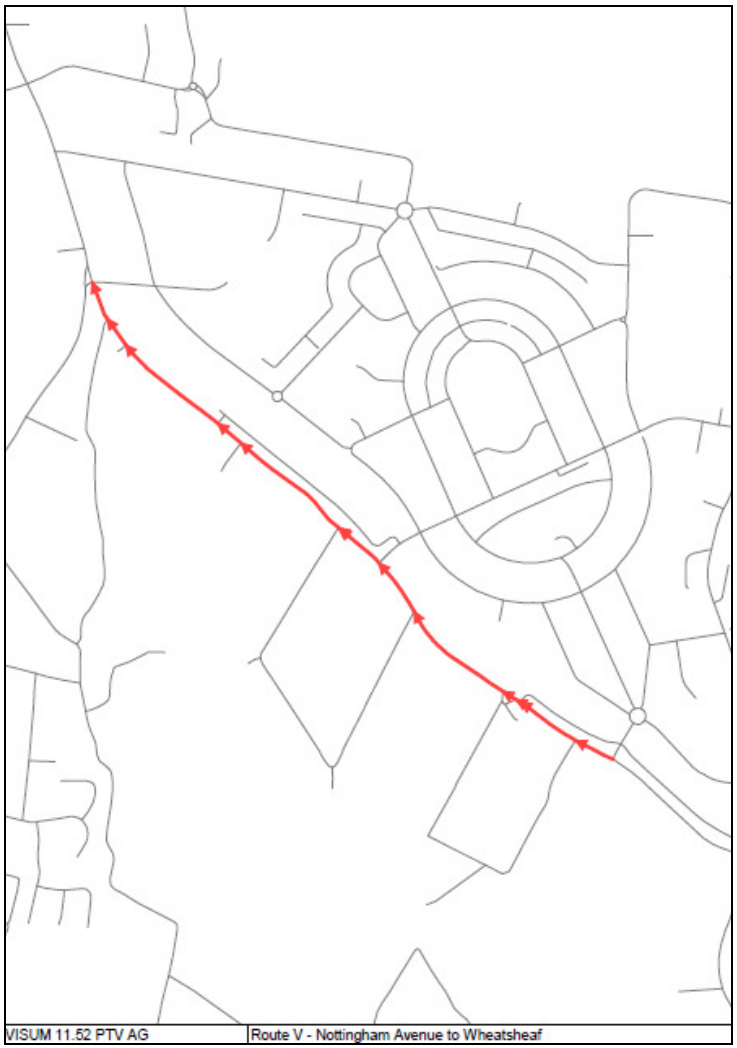

VISUM 11.52 PTV AG
Route R - Running Horse Roundabout to Gibraltar Lane

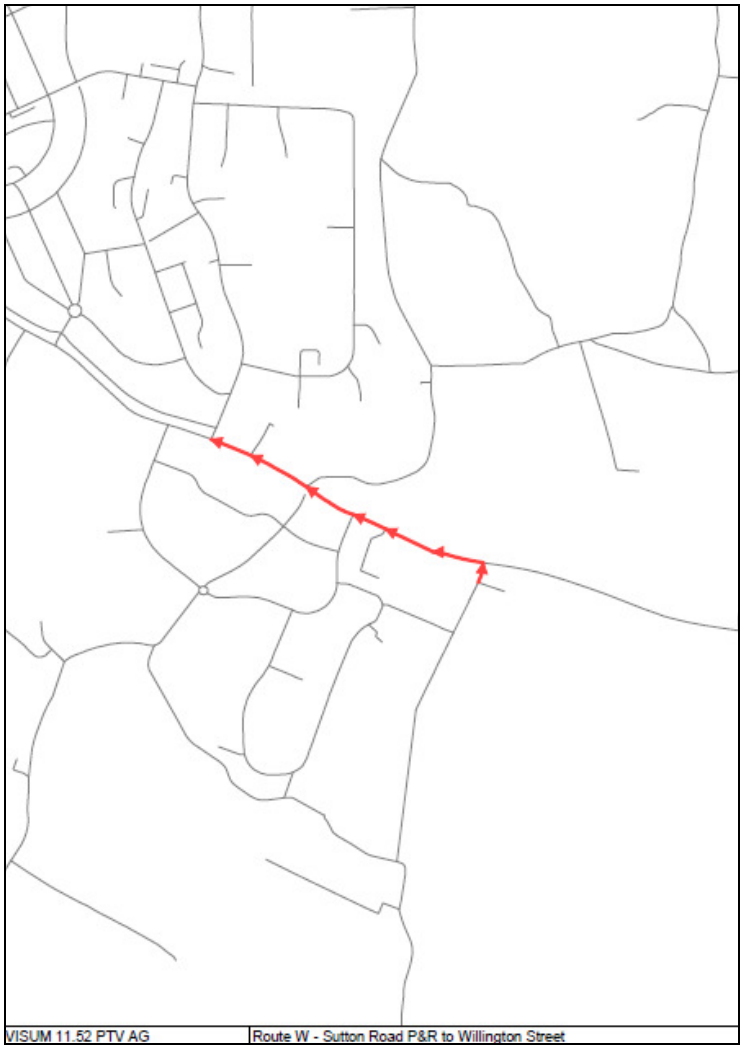

VISUM 11.52 PTV AG
Route S - Gibraltar Lane to Springfield Roundabout


VISUM 11.52 PTV AG
Route T - Springfield Roundabout to Sandling Lane Signals

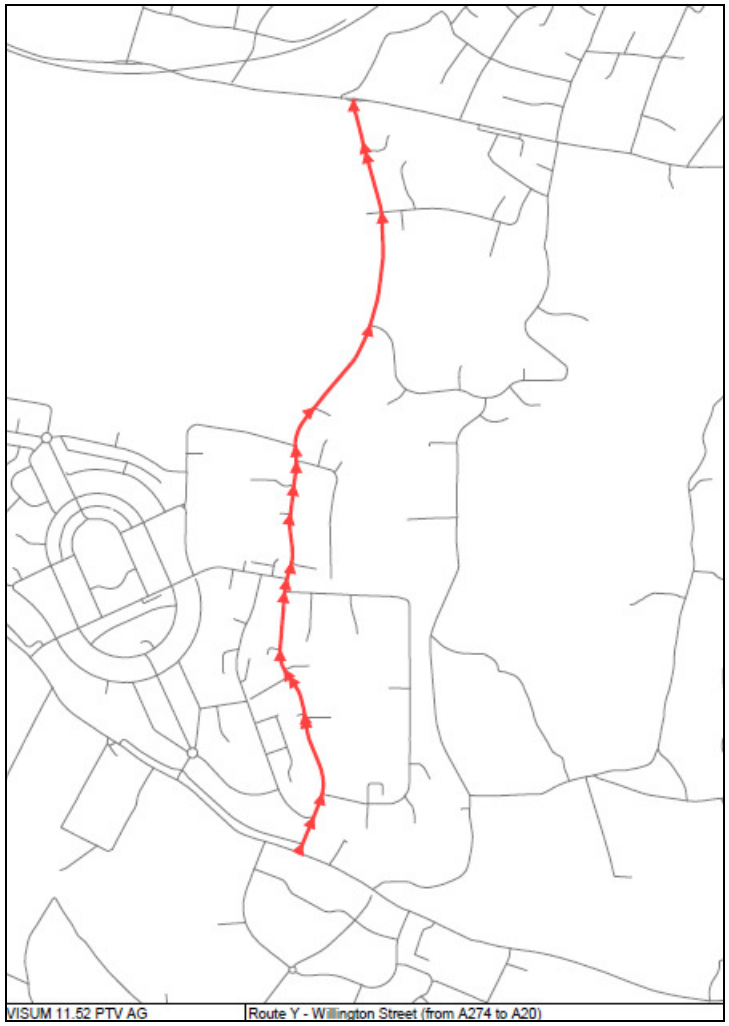

VISUM 11.52 PTV AG
Route T - Springfield Roundabout to Sandling Lane Signals

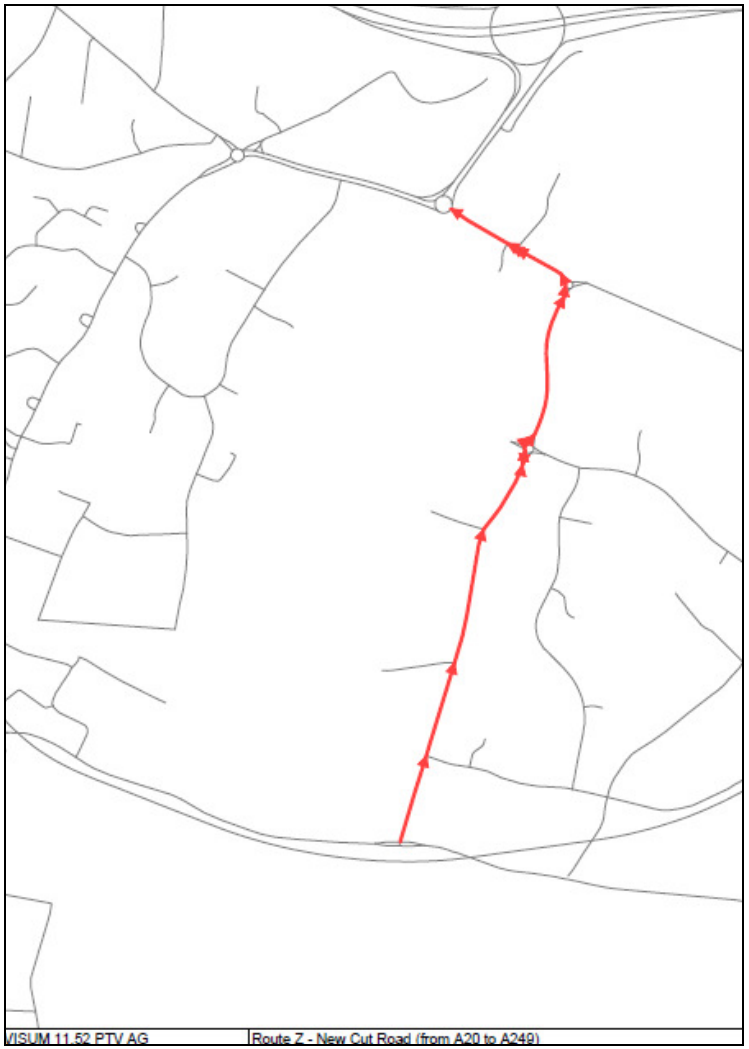

VISUM 11.52 PTV AG
Route U - Linton Corner to Sutton Road P&R

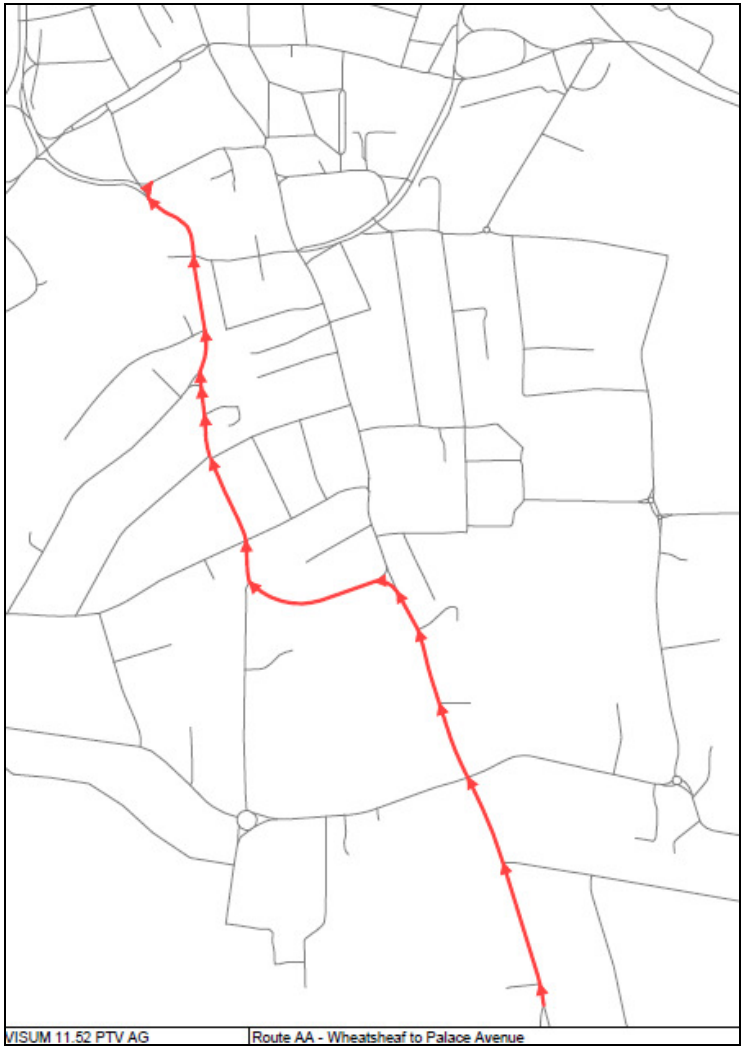

VISUM 11.52 PTV AG
Route V - Nottingham Avenue to Wheatsheaf

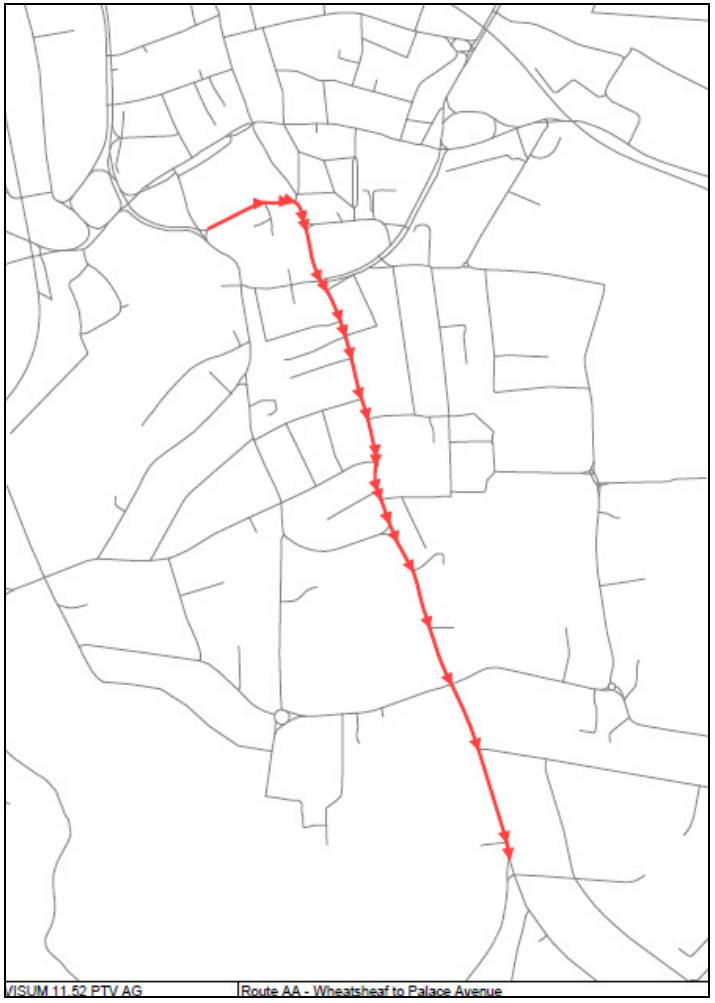

VISUM 11.52 PTV AG
Route W - Sutton Road P&R to Willington Street

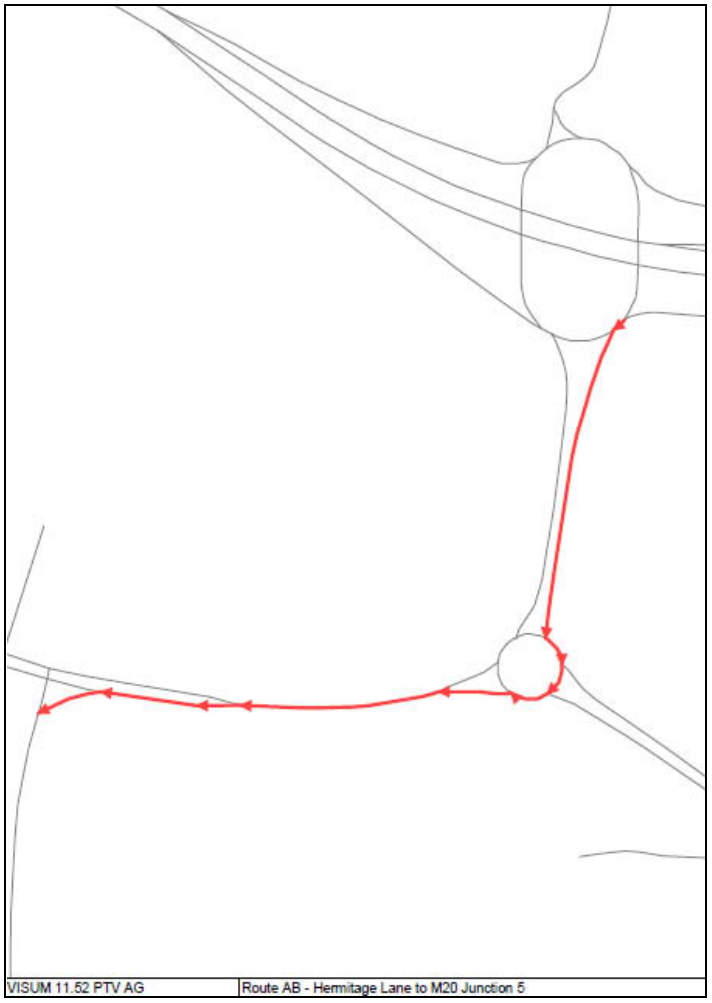

VISUM 11.52 PTV AG
Route X - Sutton Road (Willington Street to Wheatsheaf)

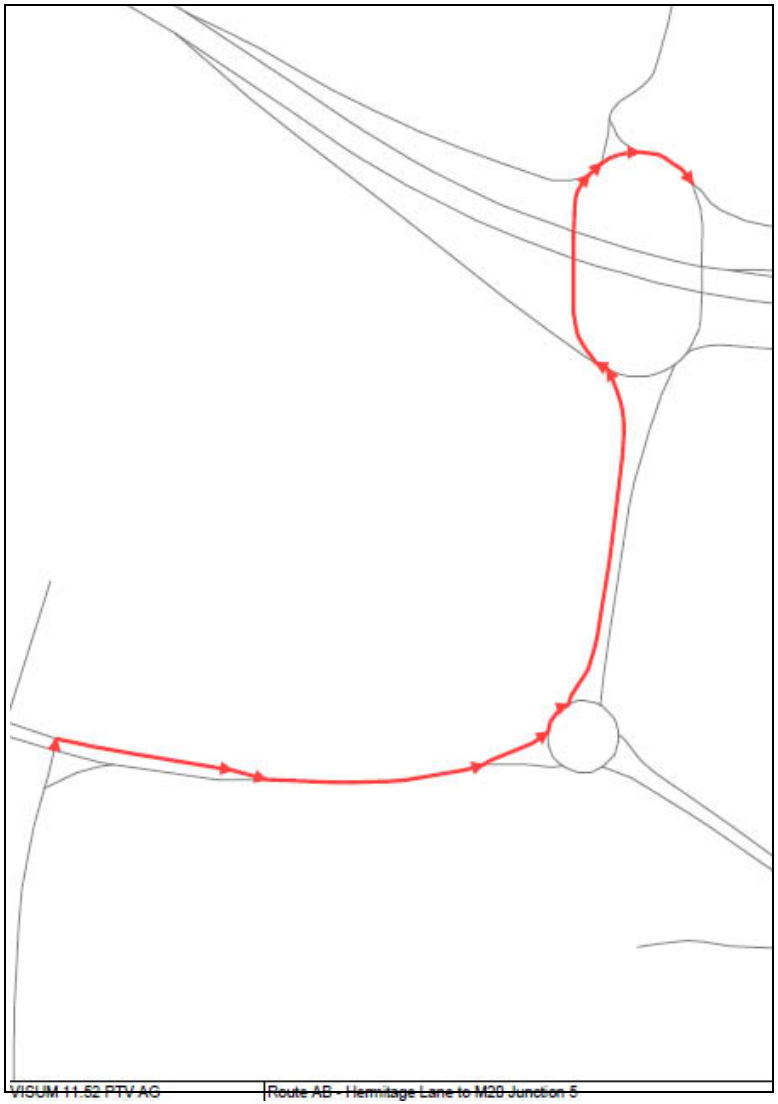

VISUM 11.52 PTV AG
Route Y - Willington Street (from A274 to A20)

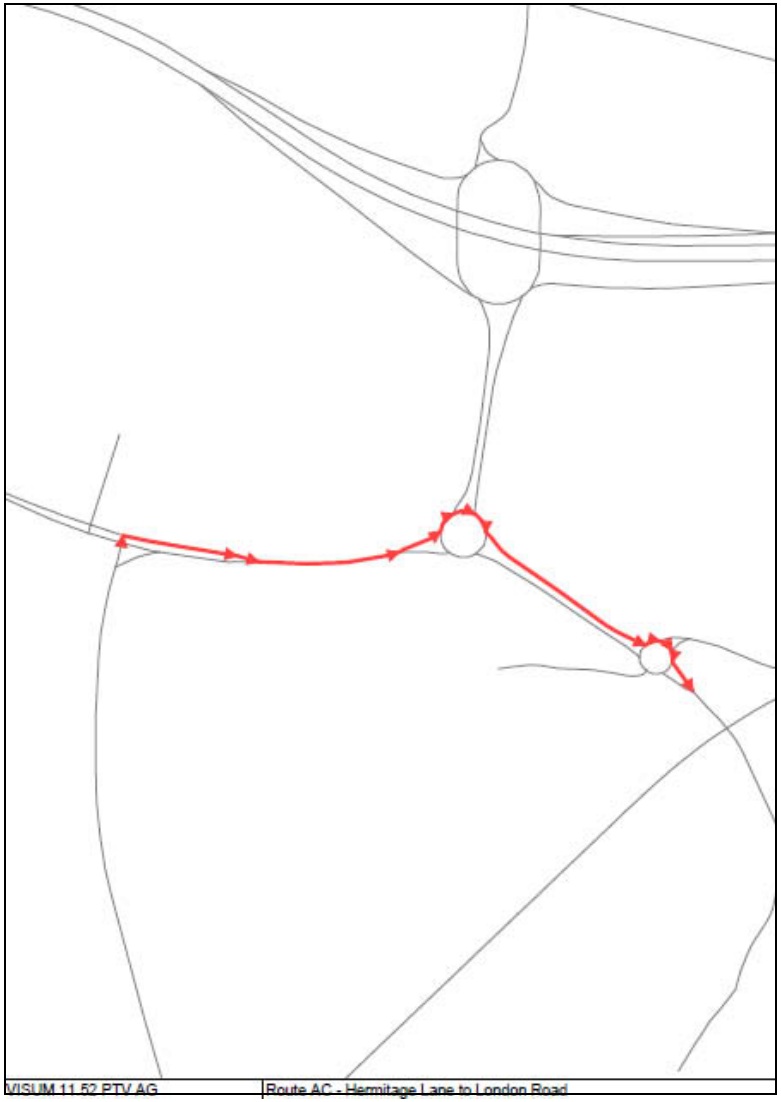

VISUM 11.52 PTV AG
Route Z - New Cut Road (from A20 to A249)

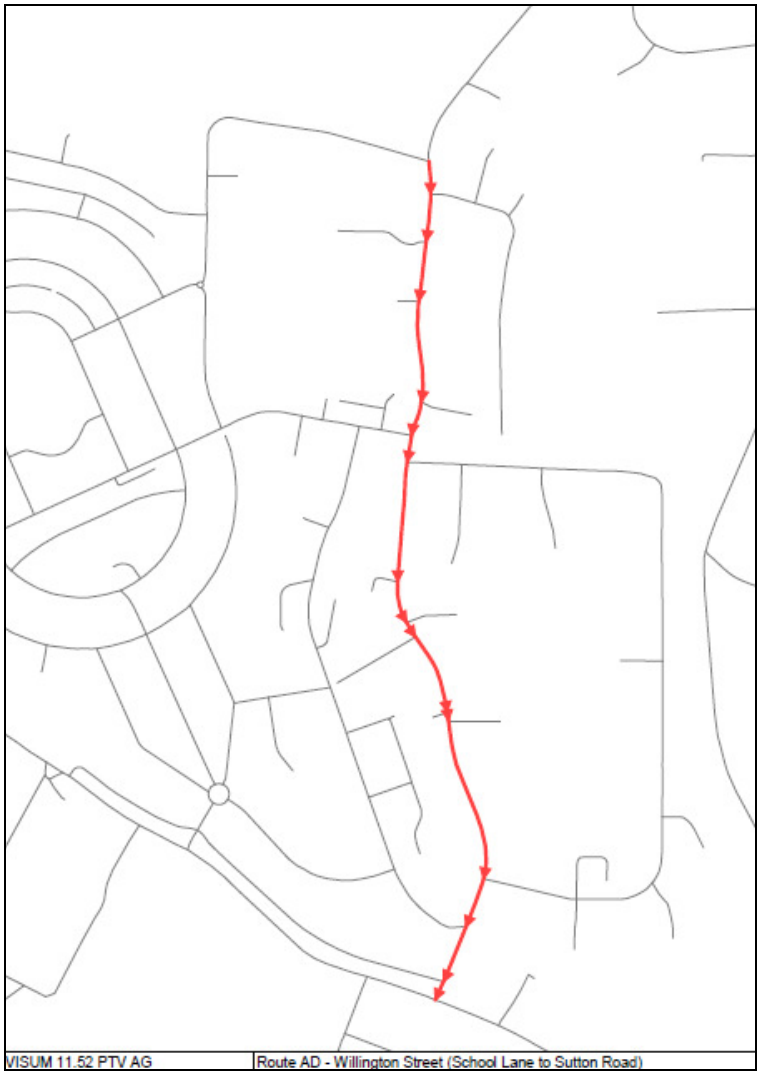

VISUM 11.52 PTV AG
Route AA - Wheatsheaf to Palace Avenue

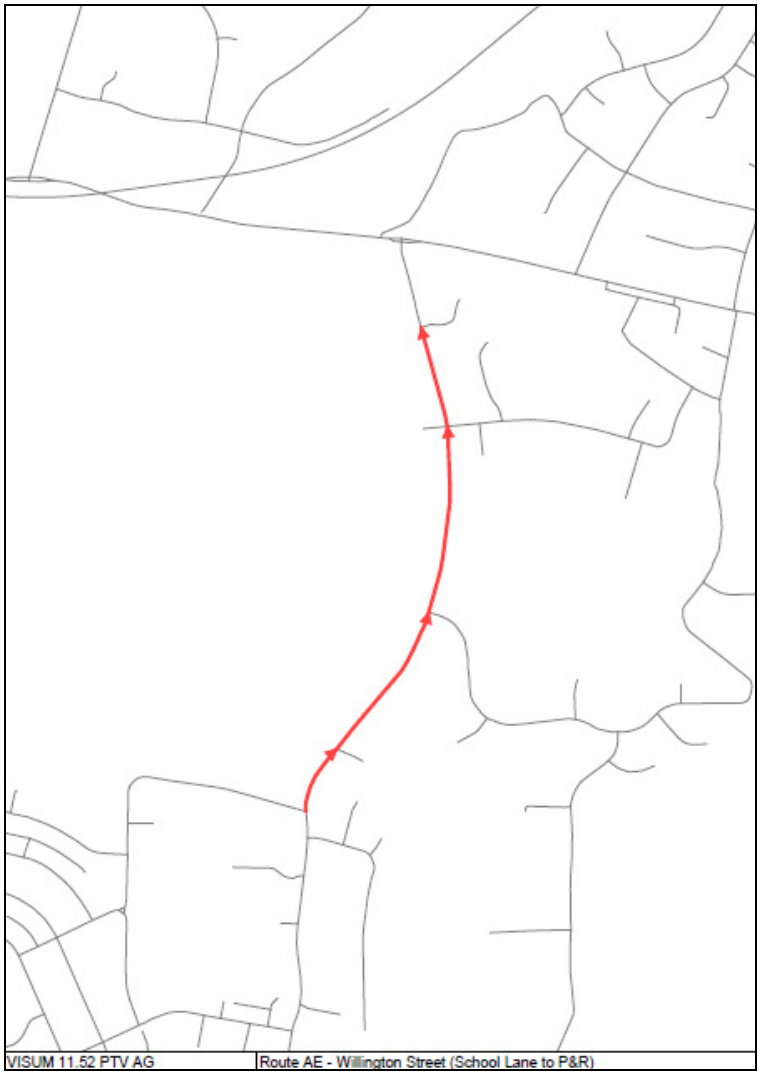

VISUM 11.52 PTV AG
Route AA - Wheatsheaf to Palace Avenue

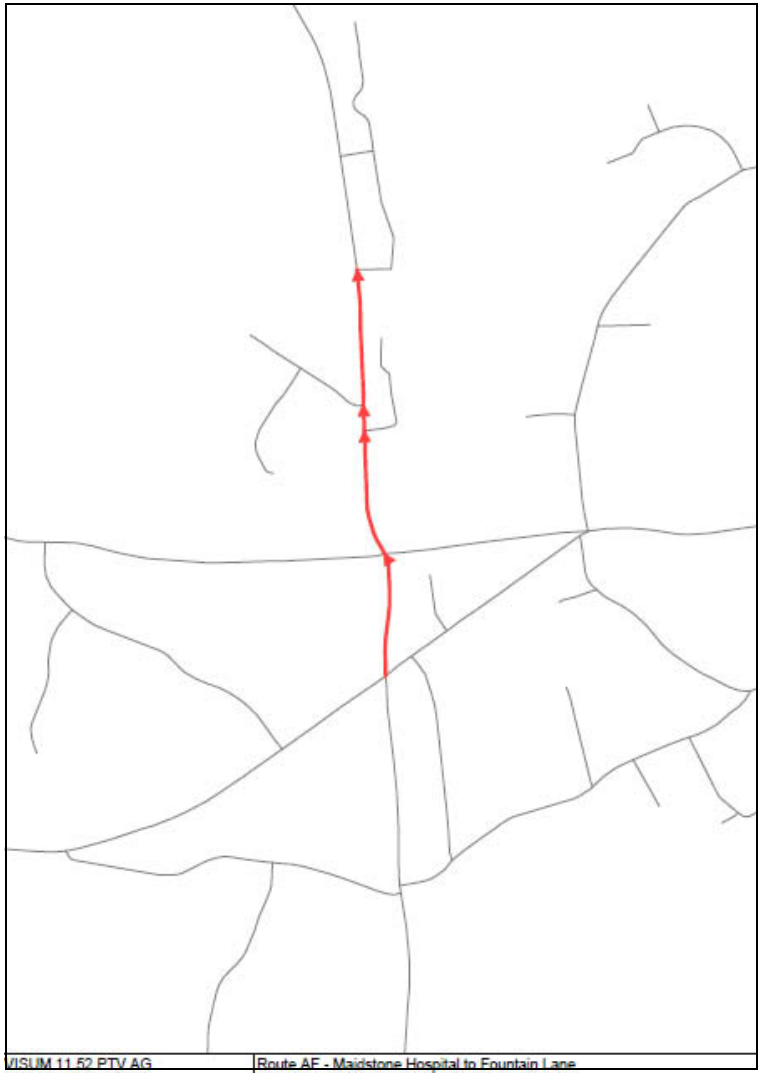

VISUM 11.52 PTV AG
Route AB - Hermitage Lane to M20 Junction 5

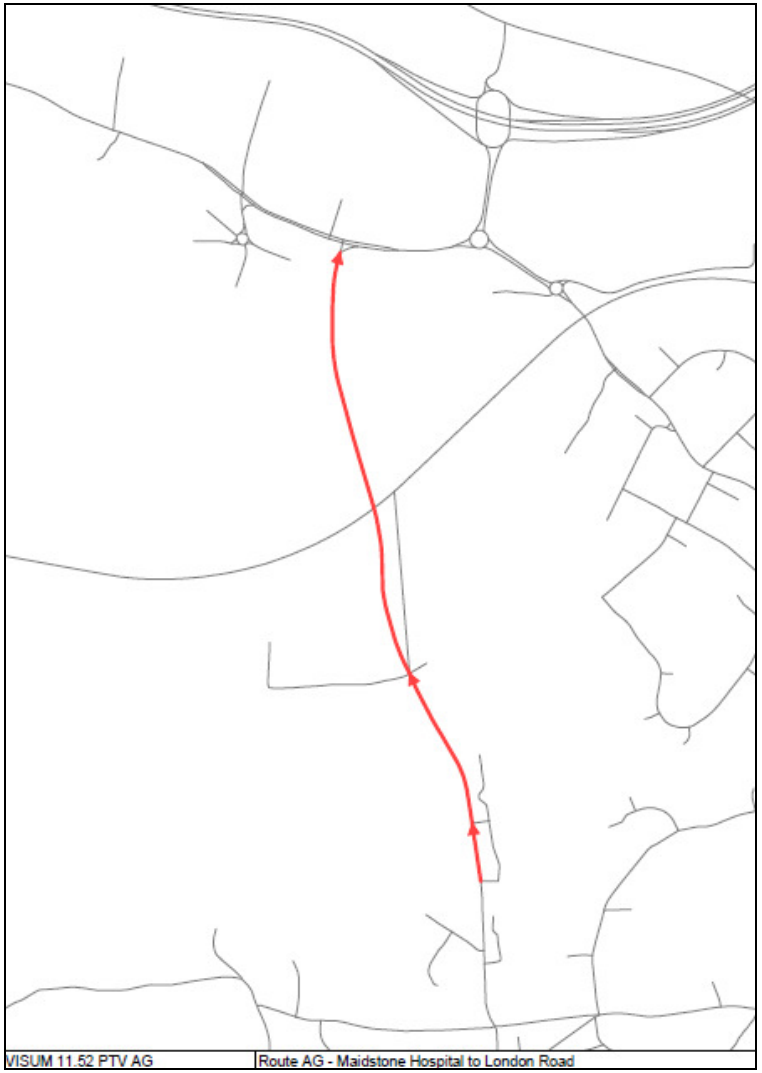

VISUM 11.52 PTV AG
Route AB - Hermitage Lane to M20 Junction 5


VISUM 11.52 PTV AG
Route AC - Hermitage Lane to London Road


VISUM 11.52 PTV AG
Route AD - Willington Street (School Lane to Sutton Road)

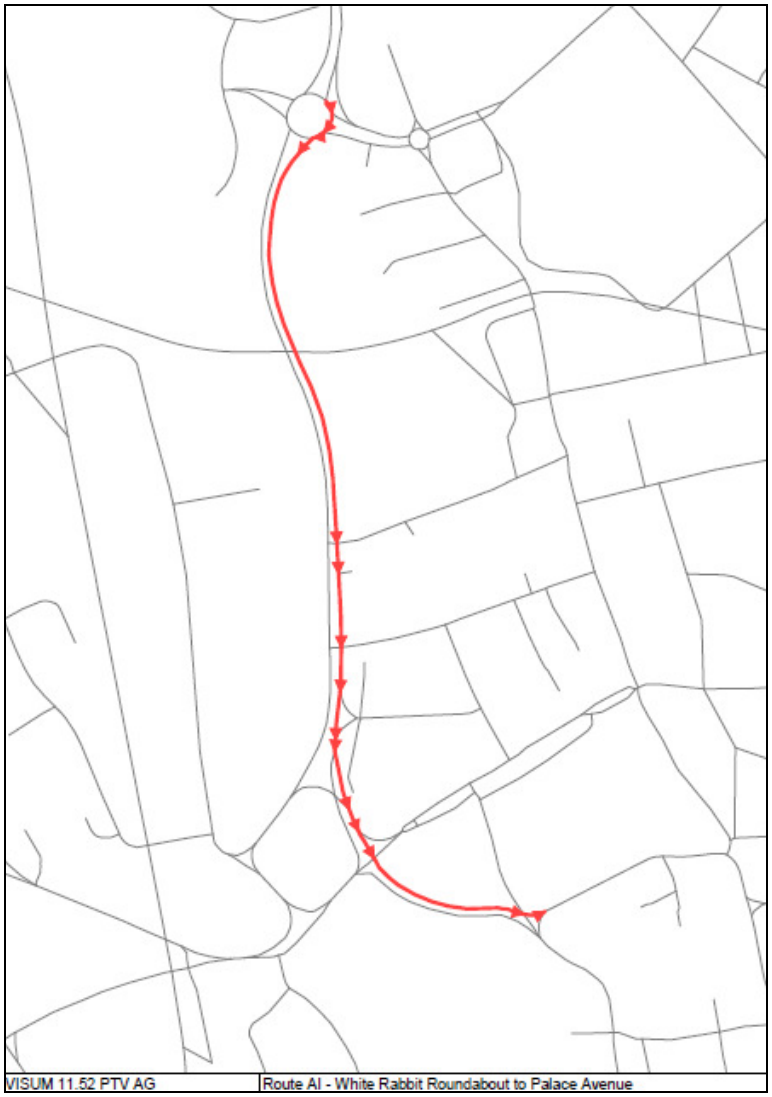

VISUM 11.52 PTV AG
Route AE - Willington Street (School Lane to P&R)

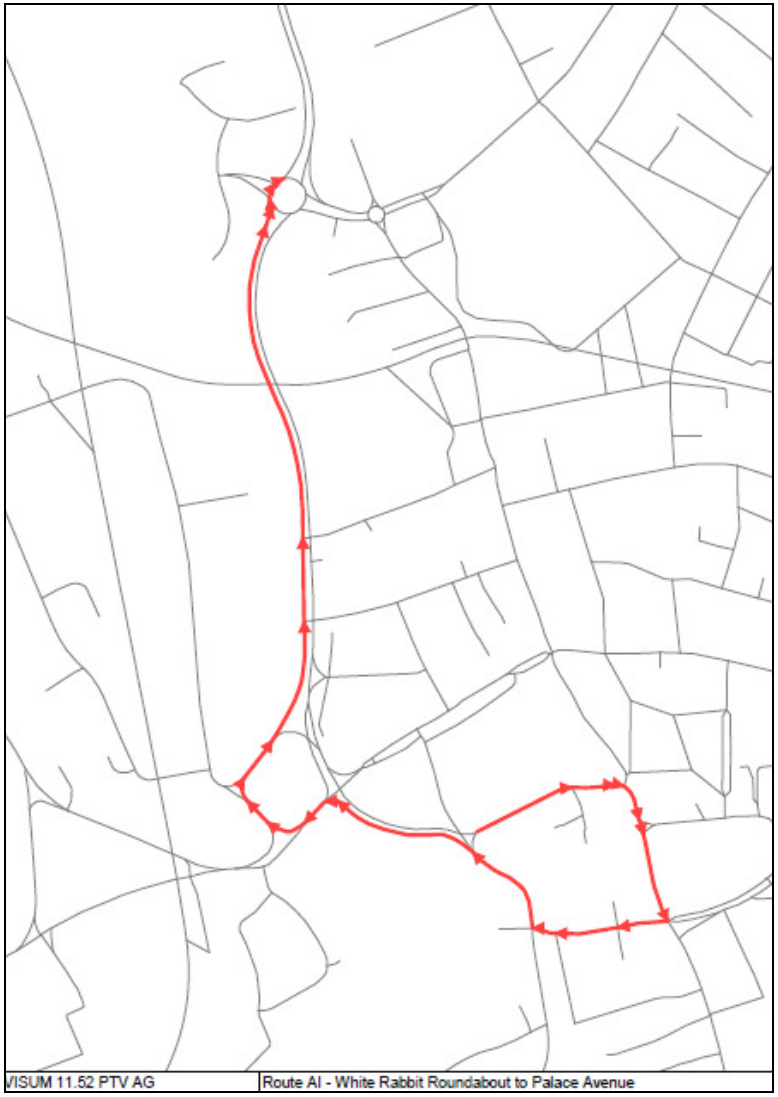

VISUM 11.52 PTV AG
Route AF - Maidstone Hospital to Fountain Lane


VISUM 11.52 PTV AG
Route AG - Maidstone Hospital to London Road


VISUM 11.52 PTV AG
Route AH - Fountain Lane to Palace Avenue


VISUM 11.52 PTV AG
Route AH - Fountain Lane to Palace Avenue


VISUM 11.52 PTV AG
Route AI - White Rabbit Roundabout to Palace Avenue


VISUM 11.52 PTV AG
Route AI - White Rabbit Roundabout to Palace Avenue

Appendix C Travel Times

Routes I to AA

	AM			PM		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
	Inbound	Inbound	Inbound	Inbound	Inbound	Inbound
I - A229 - Blue Bell Hill	00:20:39	00:22:26	00:16:22	00:12:10	00:15:48	00:11:59
J - A249 -M2 J5	00:38:33	00:42:17	00:29:01	00:21:27	00:29:50	00:18:25
K - A20 - Harrietsham	00:45:06	00:47:03	00:36:45	00:25:18	00:36:13	00:31:04
L - A20 - Lenham	00:45:06	00:47:03	00:36:45	00:25:18	00:36:13	00:31:04
M - A274 - Headcorn	00:24:47	00:26:00	00:24:46	00:20:12	00:21:14	00:21:34
N - A229 - Staplehurst	00:23:40	00:24:27	00:21:57	00:17:28	00:19:02	00:19:01
R - Running Horse to Gibraltar Lane	00:00:34	00:00:31	00:00:31	00:00:31	00:00:31	00:00:29
S - Gibraltar Lane to Springfield Roundabout	00:06:37	00:04:13	00:04:55	00:03:02	00:04:13	00:02:49
T - Springfield Roundabout to Sandling Rd Signals	00:05:41	00:06:06	00:06:20	00:01:41	00:06:06	00:04:20
	EB	EB	EB	EB	EB	EB
U - Linton Corner to P&R Site	00:06:23	00:06:24	00:06:45	00:06:18	00:06:24	00:06:23
	Inbound	Inbound	Inbound	Inbound	Inbound	Inbound
V - Nottingham Avenue to Wheatsheaf	00:05:02	00:04:51	00:04:57	00:05:08	00:04:51	00:04:46
W - Sutton Rd P&R to Willington St Jct	00:02:02	00:01:56	00:02:03	00:01:56	00:01:56	00:01:54
X - Willington St/Sutton Rd to Wheatsheaf	00:06:28	00:06:11	00:06:23	00:06:28	00:06:11	00:06:06
	NB	NB	NB	NB	NB	NB
Y - Willington St A20 to A274	00:07:55	00:07:12	00:08:15	00:06:54	00:07:12	00:00:44
Z - New Cut A20 to A249	00:07:14	00:07:02	00:06:33	00:05:51	00:07:02	00:06:28
	Inbound	Inbound	Inbound	Inbound	Inbound	Inbound
AA - Wheatsheaf to Palace Avenue	00:08:12	00:06:02	00:10:26	00:05:52	00:06:02	00:06:33

	AM			PM		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
	Outbound	Outbound	Outbound	Outbound	Outbound	Outbound
I - A229 - Blue Bell Hill	00:25:43	00:29:00	00:24:39	00:16:04	00:19:17	00:17:23
J - A249 -M2 J5	00:21:52	00:23:42	00:22:30	00:19:06	00:19:48	00:17:28
K - A20 - Harrietsham	00:24:59	00:24:10	00:27:45	00:21:41	00:28:06	00:23:57
L - A20 - Lenham	00:24:59	00:24:10	00:27:45	00:21:41	00:28:06	00:23:57
M - A274 - Headcorn	00:25:17	00:29:06	00:27:13	00:18:22	00:22:19	00:22:53
N - A229 - Staplehurst	00:25:24	00:28:42	00:26:38	00:18:24	00:20:50	00:22:20
R - Running Horse to Gibraltar Lane	00:01:06	00:01:06	00:02:35	00:03:30	00:01:06	00:02:45
S - Gibraltar Lane to Springfield Roundabout	00:00:37	00:00:32	00:00:40	00:00:33	00:00:32	00:00:34
T - Springfield Roundabout to Sandling Rd Signals	00:08:24	00:05:50	00:08:00	00:04:57	00:05:50	00:04:44
	WB	WB	WB	WB	WB	WB
U - Linton Corner to P&R Site	00:06:37	00:06:35	00:06:52	00:06:32	00:06:35	00:06:45
	Outbound	Outbound	Outbound	Outbound	Outbound	Outbound
V - Nottingham Avenue to Wheatsheaf	00:04:56	00:04:53	00:05:30	00:04:25	00:04:53	00:04:09
W - Sutton Rd P&R to Willington St Jct	00:01:35	00:01:26	00:01:36	00:01:13	00:01:26	00:01:21
X - Willington St/Sutton Rd to Wheatsheaf	00:06:26	00:06:20	00:07:02	00:04:37	00:06:20	00:05:28
	SB	SB	SB	SB	SB	SB
Y - Willington St A20 to A274	00:09:48	00:08:03	00:10:00	00:07:14	00:08:03	00:00:59
Z - New Cut A20 to A249	00:08:34	00:06:55	00:07:07	00:02:31	00:06:55	00:07:15
	Outbound	Outbound	Outbound	Outbound	Outbound	Outbound
AA - Wheatsheaf to Palace Avenue	00:11:06	00:08:57	00:13:08	00:06:35	00:08:57	00:09:49

Routes AB to AI

	AM			PM		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
AB – Hermitage Lane – M20 J5	00:11:14	00:11:36	00:11:46	00:09:47	00:12:06	00:11:43
AB - M20 J5 – Hermitage Lane	00:10:26	00:12:04	00:02:37	00:08:14	00:10:52	00:02:13
AC – Hermitage Lane – 20/20 rbt	00:10:16	00:12:17	00:08:42	00:07:28	00:10:04	00:07:56
AC - London Rd Rbt – Hermitage Lane	00:01:23	00:02:45	00:01:20	00:01:10	00:02:23	00:01:11
AD – Willington St (School Lane – Sutton Rd)	00:04:40	00:04:48	00:04:49	00:03:28	00:03:57	00:03:58
AD - Sutton Rd – School Lane	00:03:06	00:03:11	00:03:08	00:03:06	00:03:06	00:03:06
AE – Willington St (School Lane – P&R)	00:03:36	00:03:43	00:03:50	00:02:38	00:02:58	00:03:08
AE - P&R – School Lane	00:03:37	00:03:40	00:03:23	00:02:38	00:03:04	00:03:04
AF – Maidstone Hospital – Fountain Lane	00:03:17	00:03:23	00:04:09	00:03:23	00:02:40	00:02:49
AF - Fountain Lane – Maidstone Hospital	00:02:26	00:02:32	00:02:13	00:01:47	00:02:10	00:01:44
AG – Maidstone Hospital – London Road	00:06:25	00:08:14	00:06:12	00:03:58	00:04:16	00:03:46
AG - London Road – Maidstone Hospital	00:02:04	00:02:03	00:02:22	00:01:52	00:01:55	00:02:18
AH – Fountain Lane – Palace Avenue	00:10:35	00:10:48	00:10:44	00:08:42	00:09:24	00:09:02
AH - Palace Avenue – Fountain Lane	00:23:11	00:24:10	00:19:11	00:13:53	00:18:11	00:13:26
AI – White Rabbit – Palace Avenue	00:05:34	00:04:12	00:03:00	00:03:06	00:03:10	00:02:39
AI - Palace Avenue – White Rabbit	00:17:15	00:19:08	00:14:31	00:08:59	00:13:35	00:09:40

Appendix D Motorway Traffic Flow

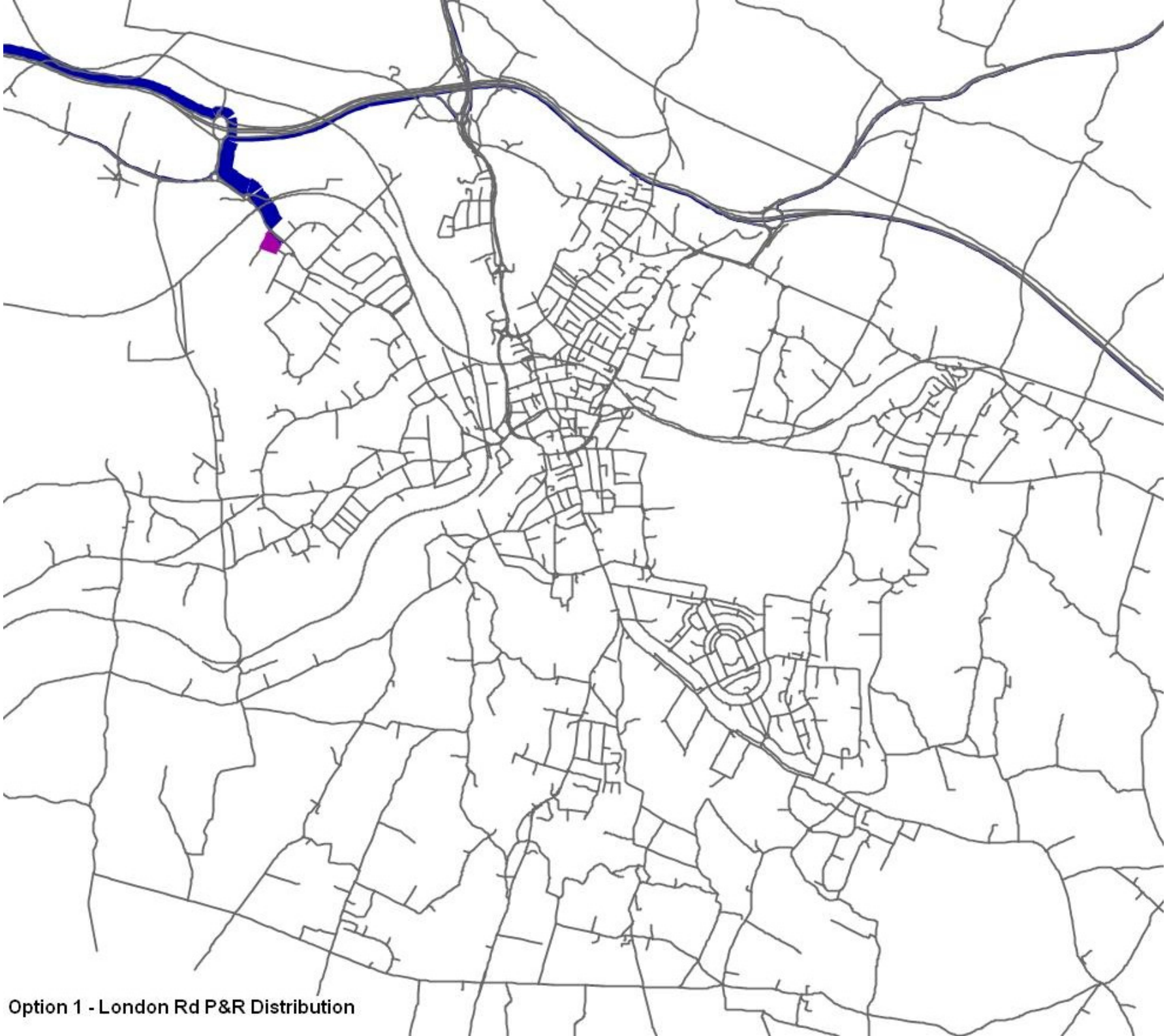
	AM			PM		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
M20 J4 -5	4933	5306	7933	4941	3560	4677
M20 J5 - 6 (A)	3006	3492	4262	3296	2283	2363
M20 J5 - 6 (B)	3006	3103	3483	2850	2323	2262
M20 J6 - J7	7631	6040	8002	6202	3936	4624
M20 J7 -8	4995	4017	5636	4516	2561	2835

M20 Eastbound Flows

	AM			PM		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
M20 J5 -4	7432	6954	8406	5714	4965	5199
M20 J6 - 5 (A)	3765	3559	4752	3388	2431	2864
M20 J6 - 5 (B)	2955	2787	3689	1959	1762	2559
M20 J7 – J6	6676	6233	8194	4996	4180	4984
M20 J8 -7	5576	6004	6565	4066	3449	3739

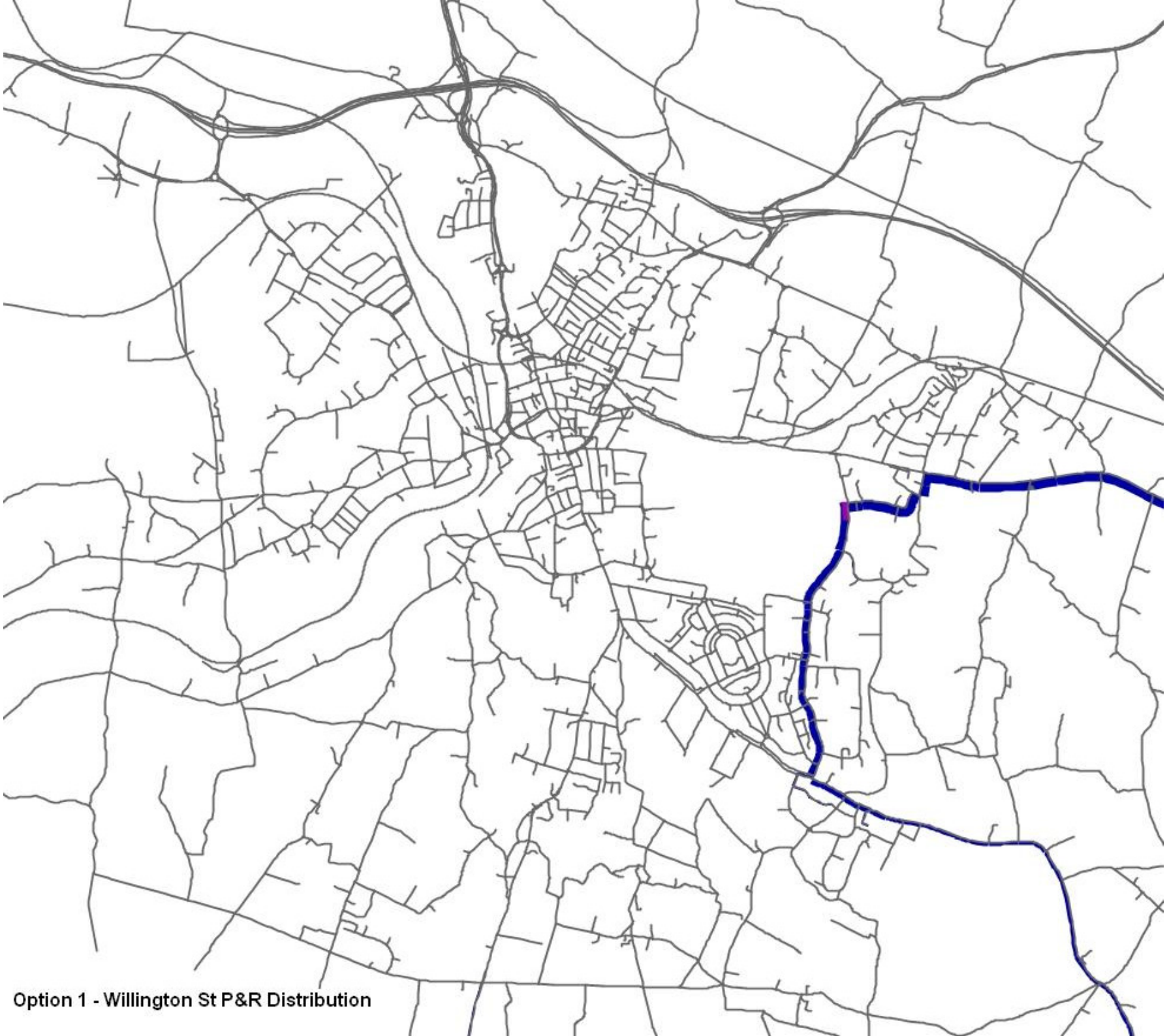
M20 Westbound Flows

Appendix E Park & Ride Car Distribution Plots

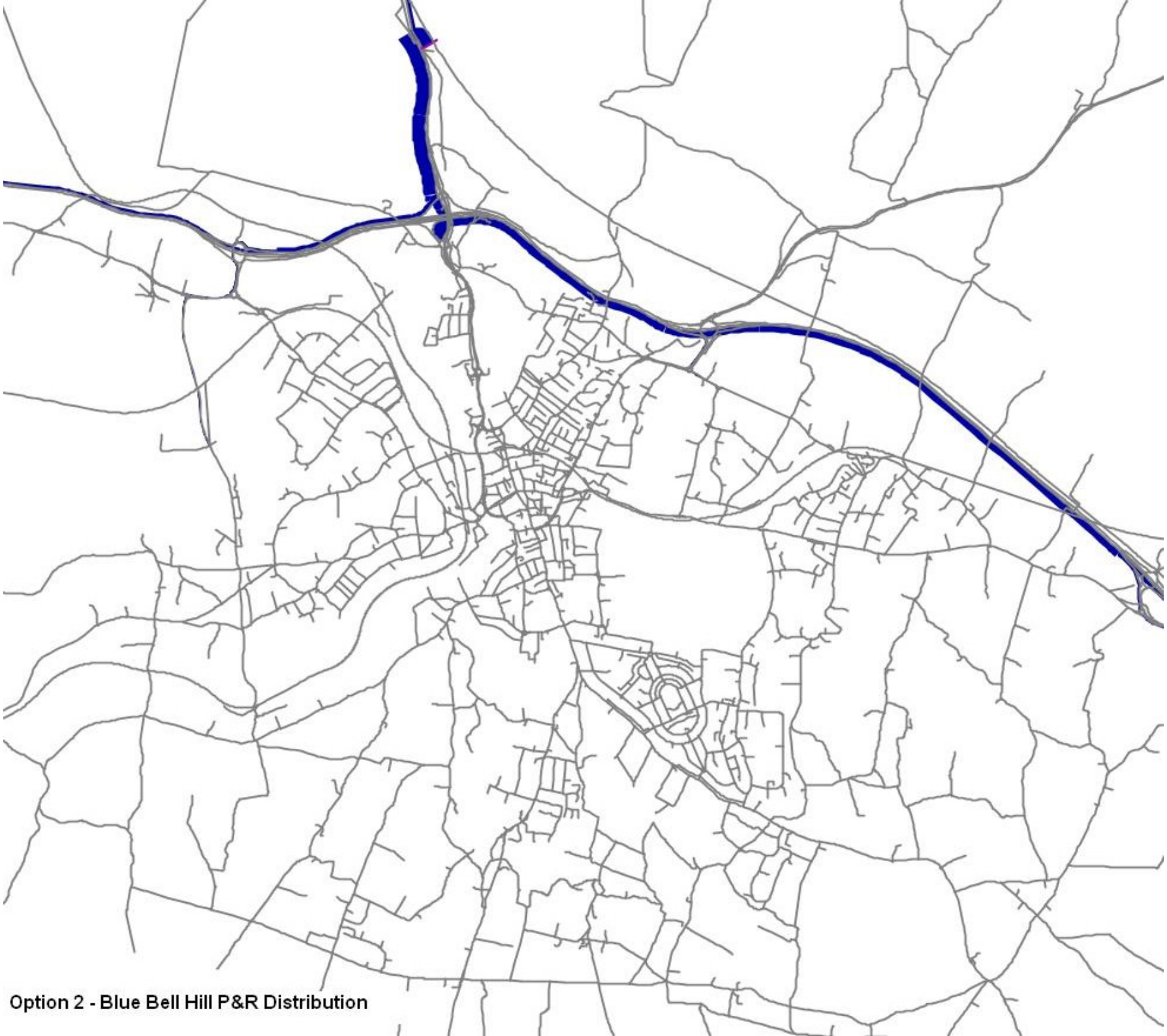


Option 1 - London Rd P&R Distribution

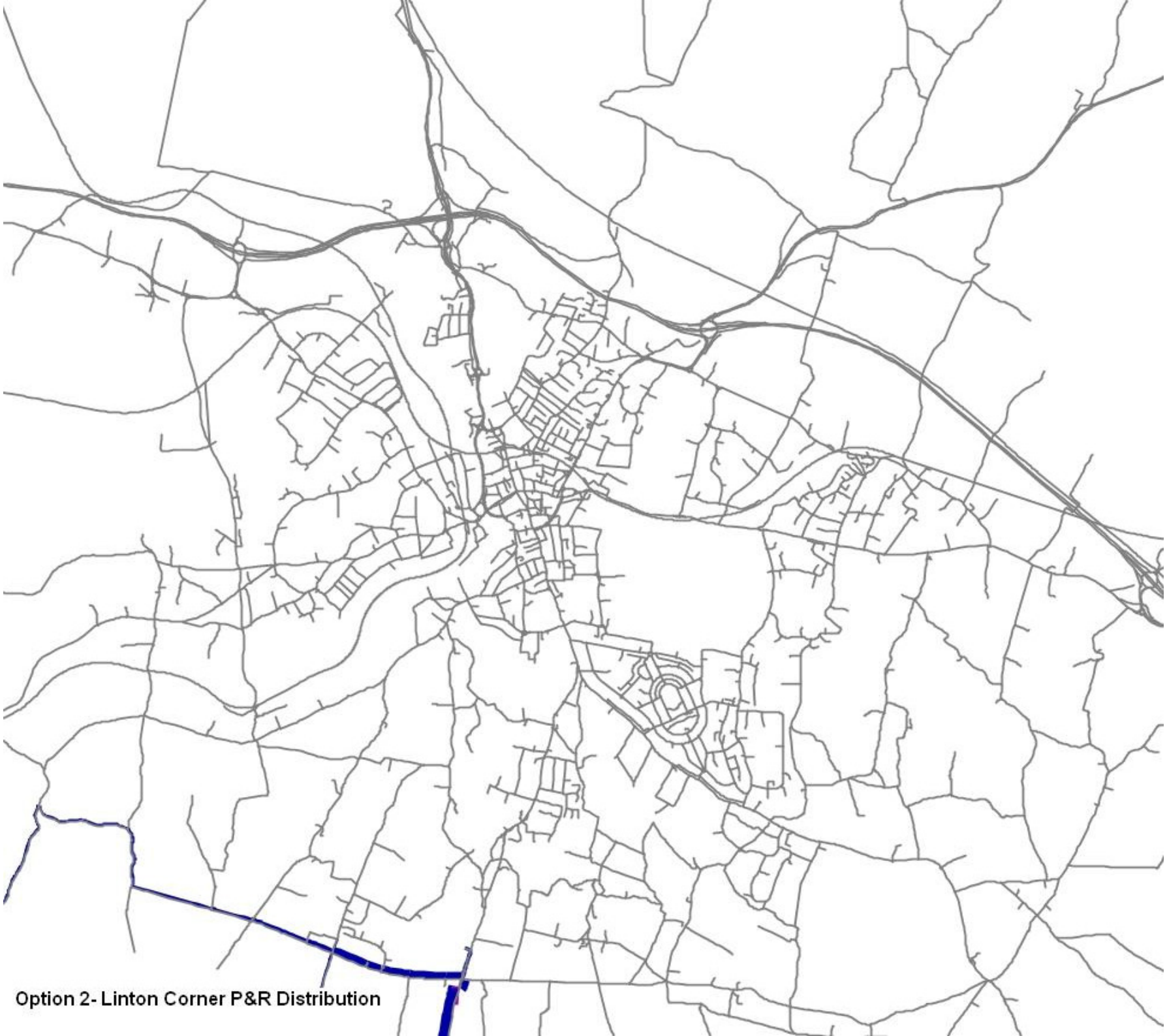
Option 1 - Sittingbourne Rd P&R Distribution

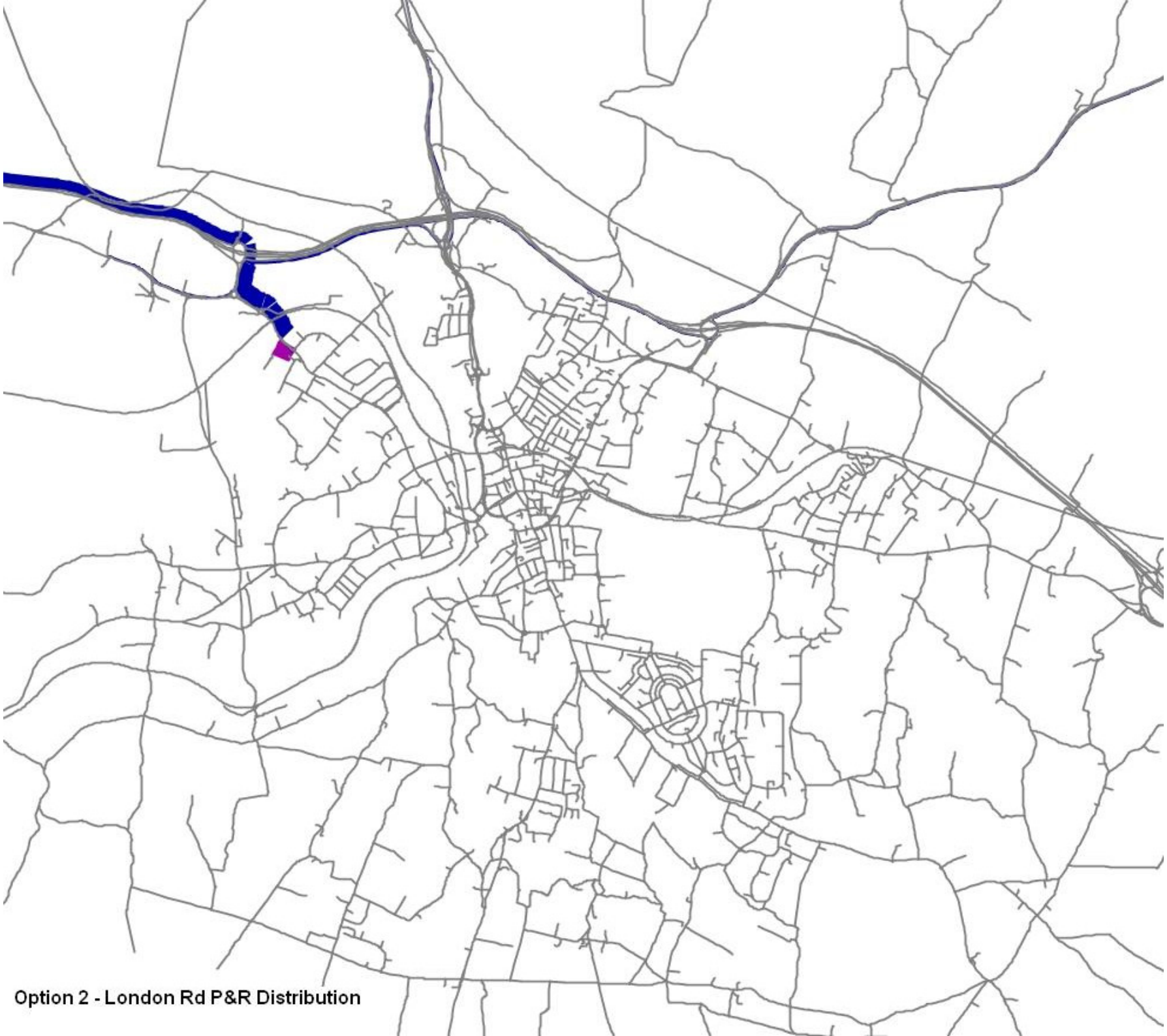


Option 1 - Willington St P&R Distribution

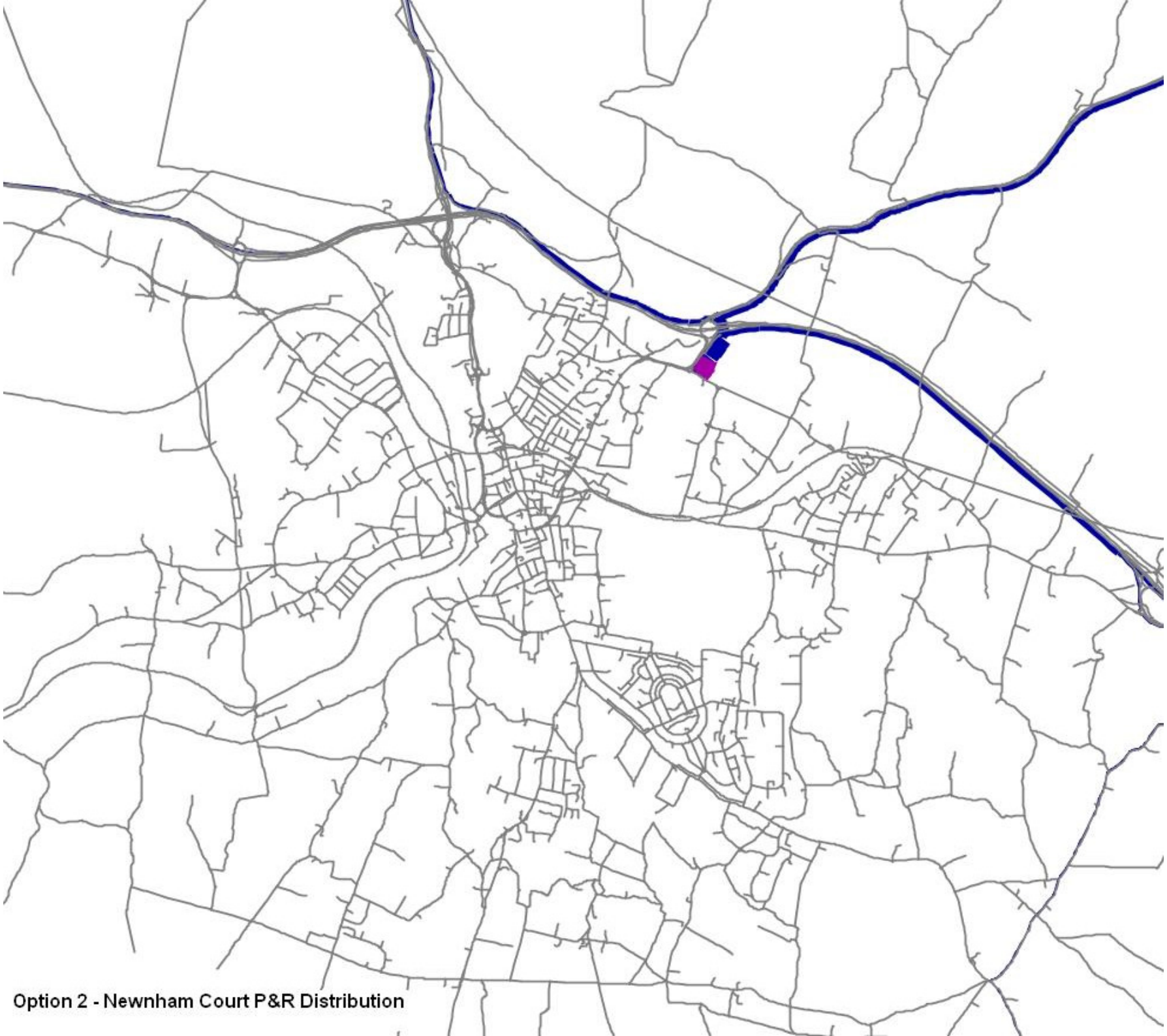


Option 2 - Blue Bell Hill P&R Distribution

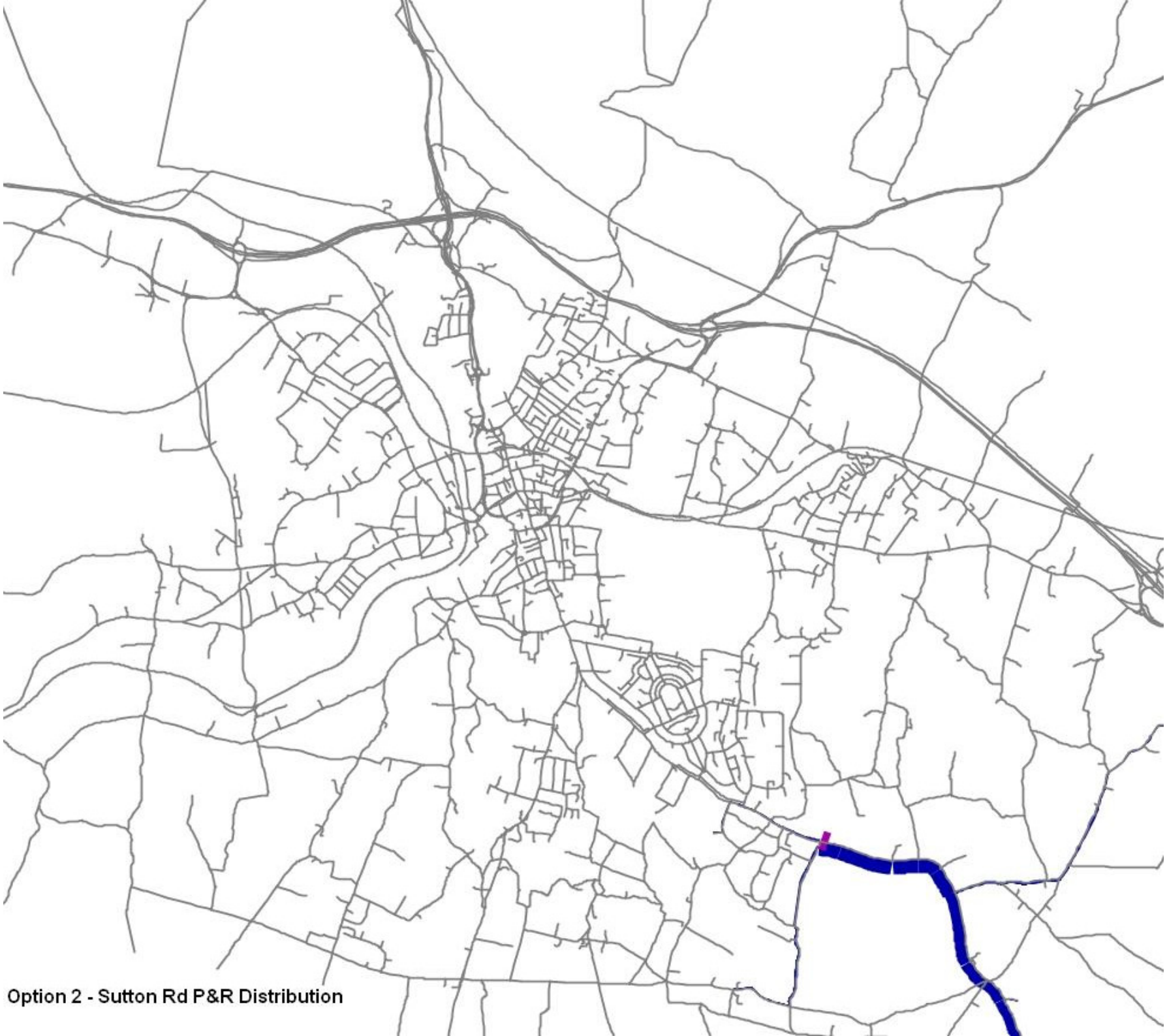

Option 2- Linton Corner P&R Distribution



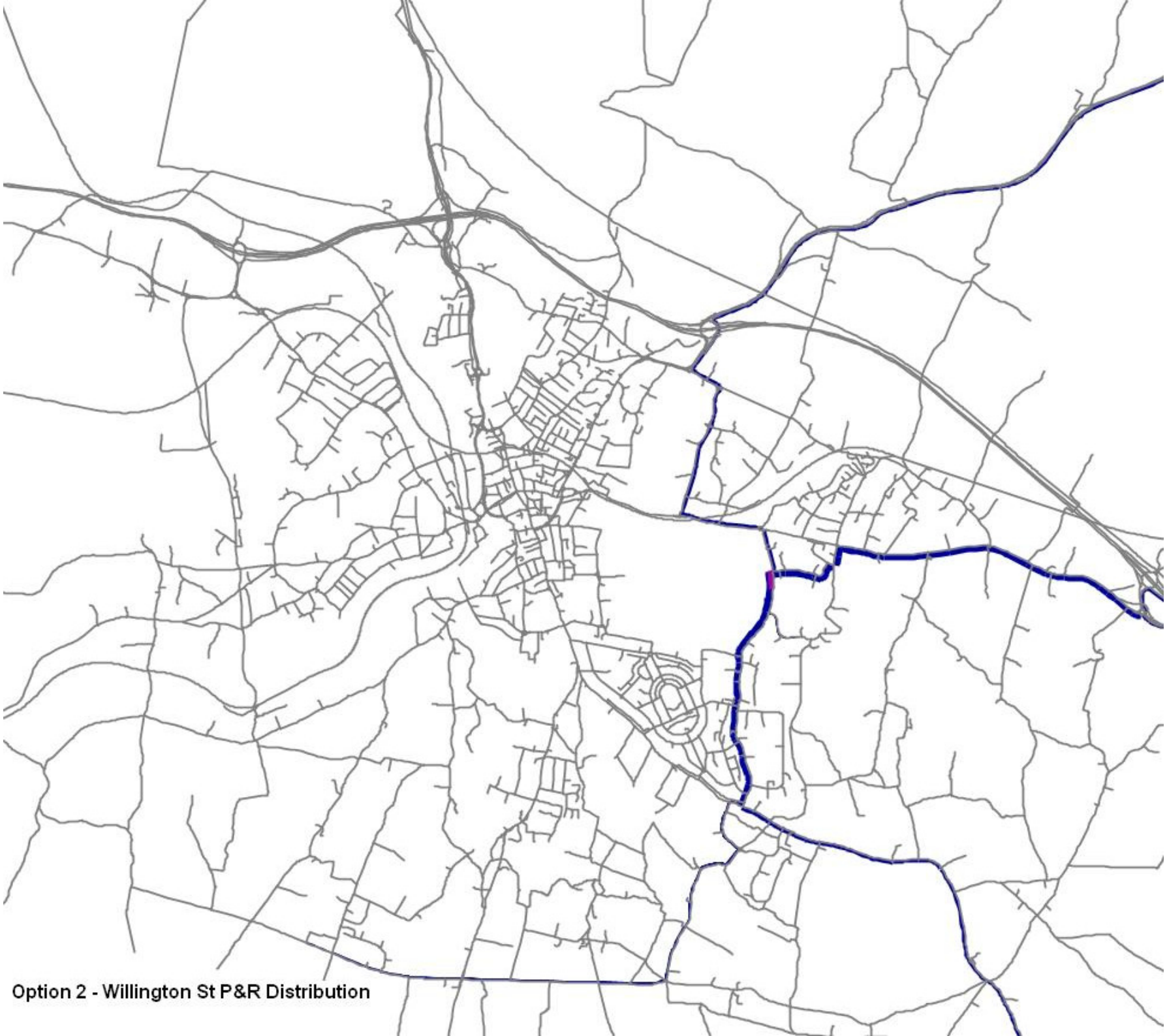
Option 2 - London Rd P&R Distribution



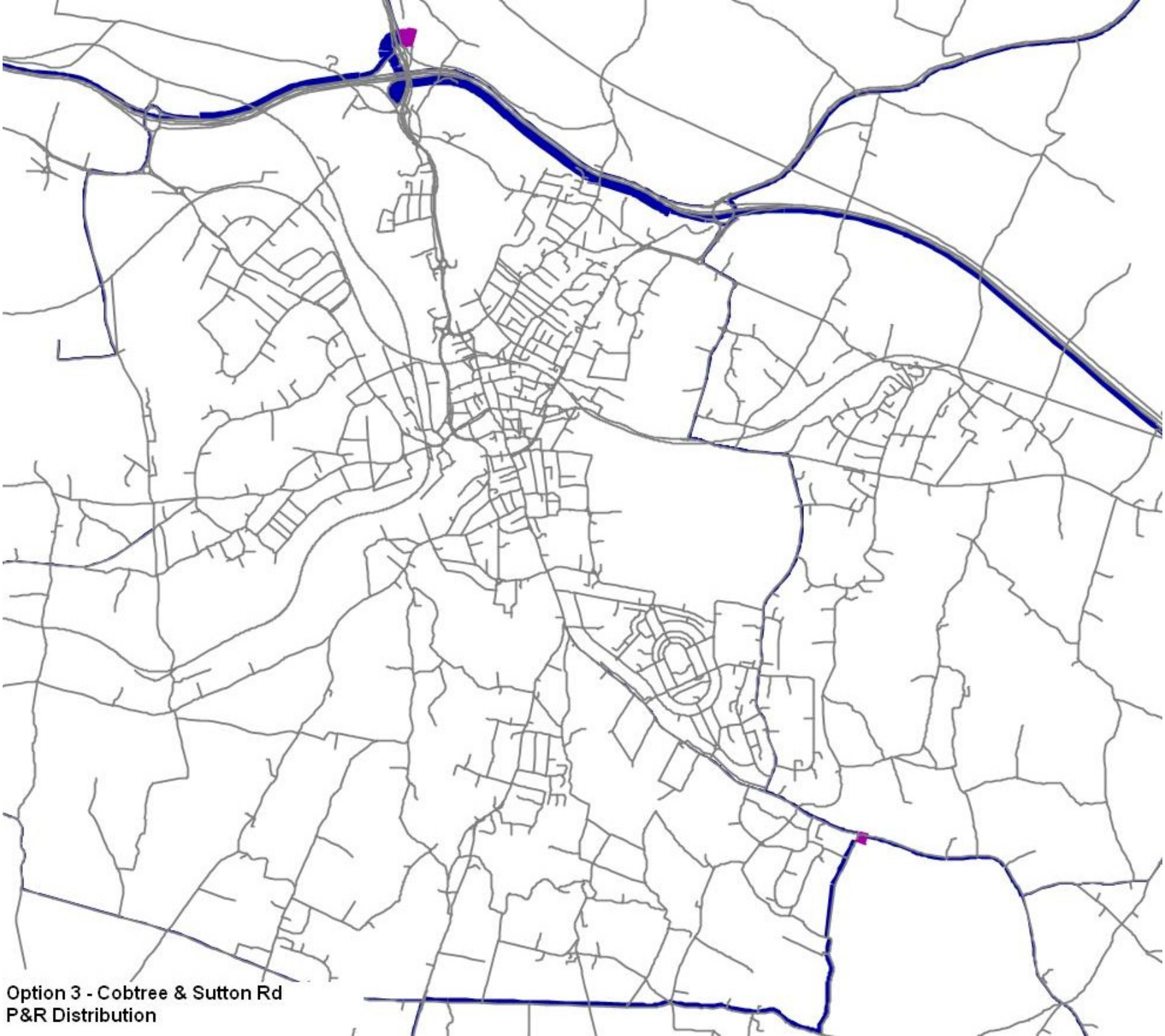
Option 2 - Newnham Court P&R Distribution



Option 2 - Sutton Rd P&R Distribution



Option 2 - Willington St P&R Distribution



Option 3 - Cobtree & Sutton Rd
P&R Distribution

Option 3 - Cobtree P&R Distribution

Appendix F Park & Ride Model

Park and Ride Model

The 2026 Options 1, 2 and 3 models include park and ride sites as specified by Maidstone Borough Council.

The Park and Ride service is assumed to operate with a fare of £2.50, in line with Park and Ride services locally.

To reflect the choice of a Park and Ride site, a Park and Ride Model has been developed and calibrated. The choice model was developed and calibrated based on observed stated preference survey.

Survey Sample

A stated preference interview survey was carried out and interviewees were asked to state their willingness to use a Park and Ride service under five different scenarios, based on varied levels of fuel cost, parking cost and journey times.

The alternative scenarios presented to participants in the survey are as follows;

Scenario 1 Existing situation
Scenario 2 Increased congestion / journey time
Scenario 3 Increased fuel cost
Scenario 4 Increased parking cost
Scenario 5 Increased fuel cost, parking cost and journey time

Scenario 1 is a base scenario which represents an existing situation in terms of fuel cost, fare and level of congestion. For each scenario respondents were asked if they would use a park and ride service.

A record was made of the respondent's current journey purpose. Respondents were asked to assume that Park and Ride buses operate every 10 minutes and that they are travelling alone. The location of Park and Ride sites were defined at the fringes of the town centre.

A further set of interviews was carried out using a digital version of the survey form which was supplied together with information on how to complete it. The digital version of the form was distributed via the internet.

Responses from the on street and the web surveys were collated and cleaned to remove those that could not be used to leave a total sample of 240. The journey purposes of the survey sample are shown in Figure 5-A below. Workers accounted for around 59% of the sample, shoppers for 29% and leisure and other purposed for 12%.

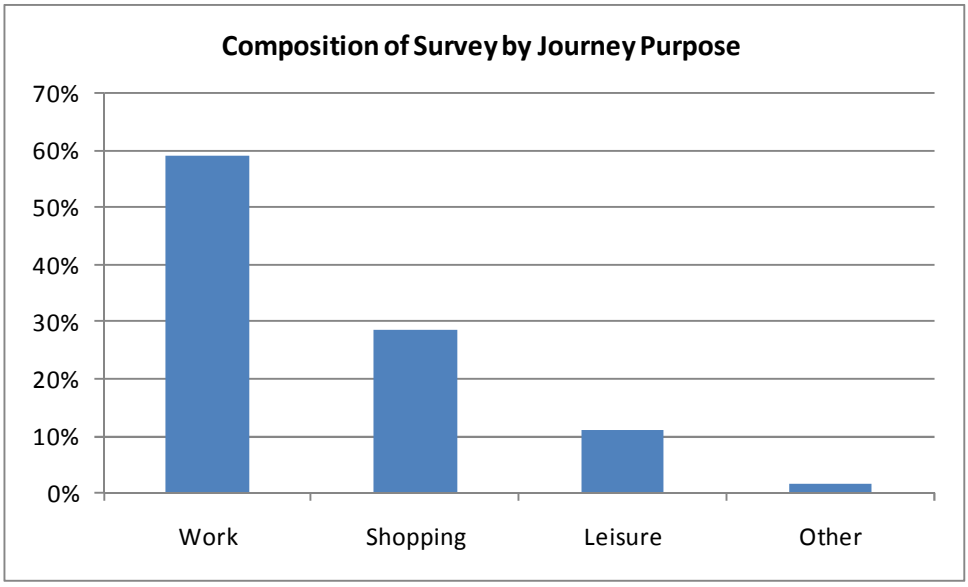


Figure 0-A Composition of Survey Sample by Journey Purpose

There was observed to be an inconsistency in the yes / no responses for leisure journey purposes because the term leisure covers too great a range of possible activities and the timeframe in which leisure activities occur also varies depending on the nature of the activity. The leisure and other journey purposes responses were removed from the sample for modelling purposes.

A total of 199 of the remaining surveys, which incorporated work and shopping trips, were used in the modelling process.

Survey Results

The stated preference survey is essential to the development of the model but also provides a useful insight to the perceptions and response of the local residents to changes in real and perceived travel costs.

Table 0-A summarises the positive responses for each scenario. A total of 59% stated they would use a park and ride service assuming the theoretical existing conditions (Scenario 1). Overall there was a stronger response to increased parking costs than to increases in fuel cost or journey time.

	Scenario	% of YES replies
1	Theoretical existing situation	59%
2	Increased congestion / journey time	66%
3	Increased fuel cost	64%
4	Increased parking cost	70%
5	Increased fuel cost, parking cost and journey time	76%

Table 0-A Percentage of YES replies for Work and Shopping trips combined

Park and Ride Mode Choice Model Calibration

The park and ride mode choice model parameters emerged from SP survey model estimation using the logit model structure and which were then calibrated against the existing/observed travel survey data. Following are the travel attributes used in P&R choice model, the equations applied (for logit model) and the results of calibration:

Attributes Used
****

1. Car: Travel Time and Parking Cost
2. P&R: Travel Time (Car Travel Time+Bus In-Vehicle Time) and P&R Fare

Utility Functions
****

Car: BETA_TT * CAR_TT + BETA_TC_PC * CAR_PC
P&R: BETA_TT * PR_TT + BETA_TC_FAR * PR_FAR

Where:
Beta - Taste/Choice Parameter
TT - Travel Time
TC_PC - Parking Cost
TC_FAR - Fare

Calibrated Utility Parameters
****

Parameter Name	Calibrated Parameter Value
BETA_TT	-0.0397
BETA_TC_PC	-0.00537
BETA_TC_FAR	-0.00605