A4119 CORRIDOR ASSESSMENT, TRAFFIC FORECAST & CAPACITY ASSESSMENT

MAY 2018

REDSTART

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Appendices

1. Introduction

1.1   The Commission

REDSTART was commissioned by Rhondda Cynon Taf County Borough Council (RCTCBC) to undertake an assessment of the A4119 corridor and its ability to accommodate traffic generated from existing and proposed developments in the area.

The RCTCBC Local Development Plan (LDP) for the Southern Strategy area includes a number of housing allocations for Tonyrefail and Coedely, as well as large mixed-use sites in Talbot Green and an employment site to the west of Coedely.   Due to the numerous potential development sites in this area that could add traffic to the A4119 a corridor assessment has been undertaken which assesses the A4119 between Tonyrefail and junction 34 of the M4, as illustrated in Figure 1.1.

Figure 1.1   A4119 Corridor Assessment Area
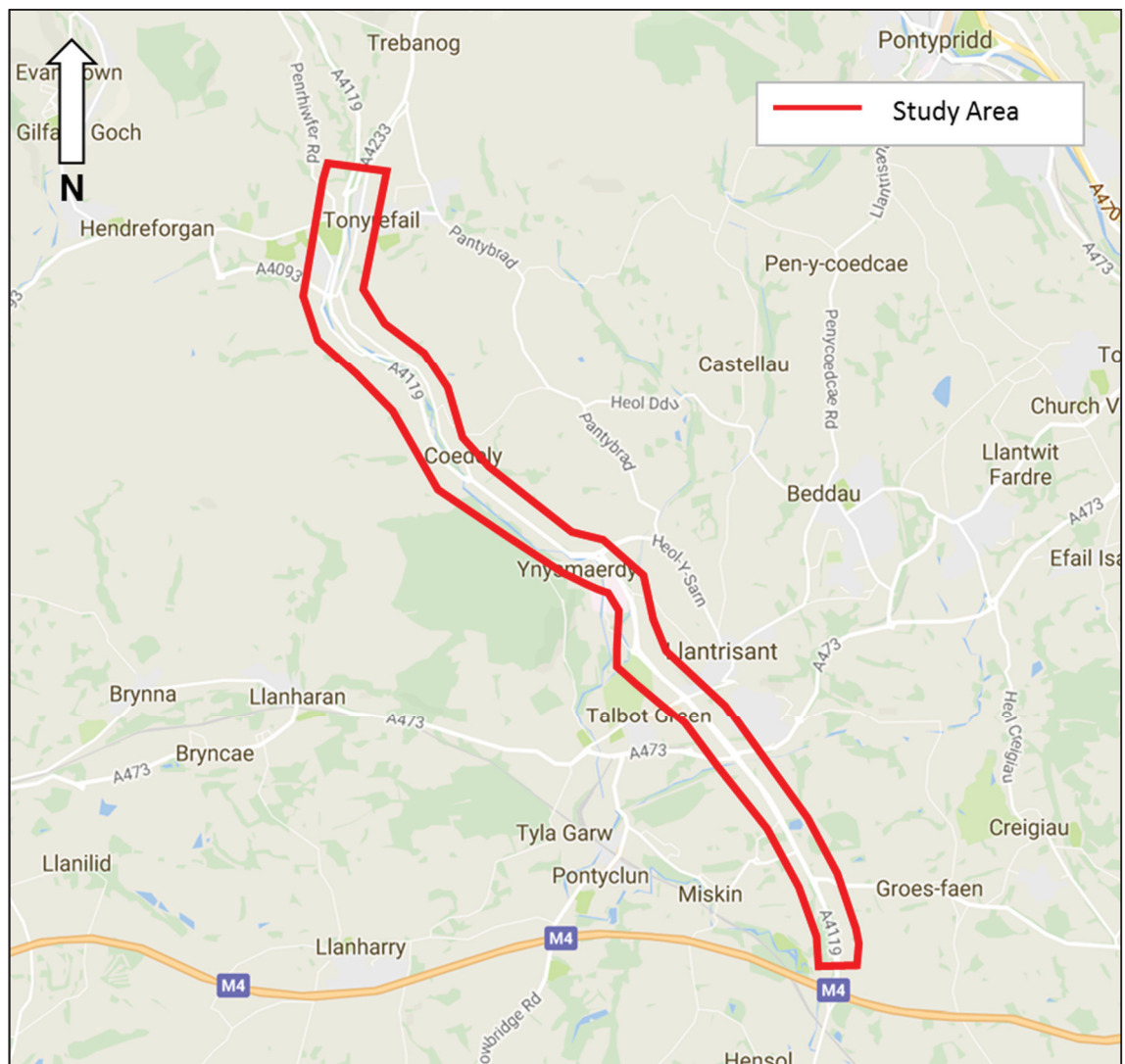
1.2   Purpose of the report

The purpose of this report is to provide the methodology used to assess the current operational capacity and forecast capacity of the A4119 corridor, and present the results of the capacity assessments undertaken. The structure of the report is provided in section 1.3.

1.3   Report Structure

The remainder of the report has been set out in the following chapters:

- Chapter 2: Background;

- Chapter 3: Survey Analysis;

- Chapter 4: Junction model development and validation;

- Chapter 5: Microsimulation model development and validation;

- Chapter 6: Existing A4119 corridor operation;

- Chapter 7: Forecast traffic demand spreadsheet model;

- Chapter 8: Forecast A4119 corridor operation;

- Chapter 9: Summary.

2. Background

The RCTCBC LDP specifies the development strategy and policy framework for RCT over a fifteen-year period to 2021. It is used by the Council to guide and control development and to provide a basis on which to base decisions related to development within the County Borough.

The LDP provides a framework for the development of 14,385 new dwellings in Rhondda Cynon Taf over the 15 year LDP period. This is based on the Welsh Government's National and Sub National Projections for Wales (2006) and equates to an annual increase of 959 dwellings per annum. In addition to the identification of residential development the LDP also recognises the importance of smaller settlements and other land uses in providing a range of services to meet local needs.

The core strategy for RCT advocates a different approach for development in the north and south of the County Borough in-line with social, economic and environmental trends. The A4119 corridor is within the Southern Strategy Area (SSA) which includes Pontypridd, Llantrisant (including Talbot Green), Tonyrefail and Llanharan. The SSA is illustrated in Figure 2.1.

Figure 2.1   RCT LDP Strategy Areas
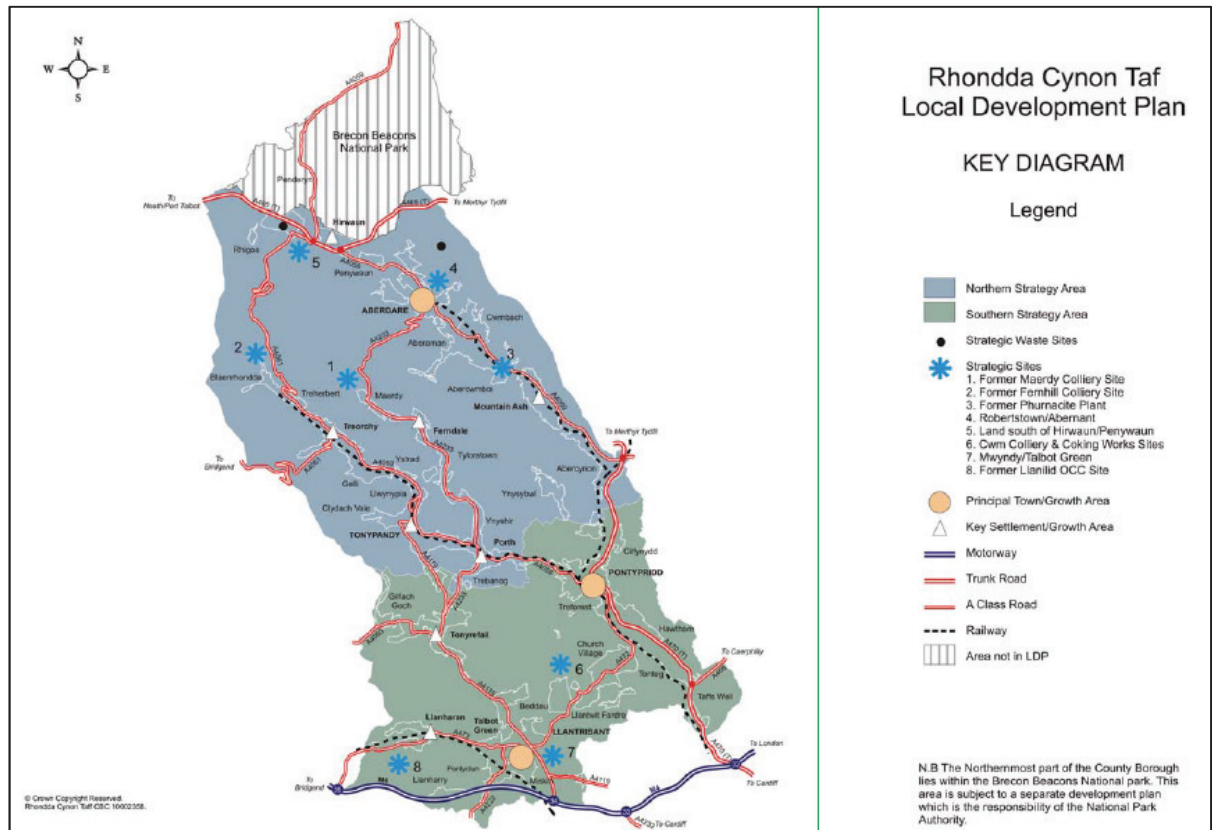
RCTCBC LDP

This study analyses the impact of traffic generated by LDP related development in the SSA upon the operation of the A4119 corridor.

3. Survey Specification and Analysis

In order to analyse the current operation of the A4119 corridor and assess the impact of future development related traffic a series of traffic surveys have been undertaken. These include manual classified count (MCC) surveys, queue surveys and an Automatic Number Plate Recognition (ANPR) survey. The specification and analysis of each survey type is described further below.

3.1 Survey Specification

Manual Classified Count (MCC) Survey

MCC surveys have been undertaken at thirteen junctions within the A4119 corridor as illustrated in Figure 3.1. MCCs were undertaken on Thursday 16th November 2017 between the hours of 07:00 and 10:00 during the AM peak period, and between the hours of 16:00 and 19:00 during the PM peak period. The MCC surveys have been used to produce a junction model of each of the 13 junctions identified below, and to contribute to the matrix estimation process as part of the microsimulation model development.

Queue Surveys

Queue surveys were also undertaken at the thirteen junctions within the A4119 corridor, illustrated in Figure 3.1, on Thursday 16th November 2017. The maximum queue length at each approach to the thirteen junctions was surveyed every 5 minutes between the hours of 07:00 and 10:00 during the AM peak period, and between the hours of 16:00 and 19:00 during the PM peak. The queue surveys have been used to validate the junction models and the microsimulation model.

Automatic Number Plate Recognition (ANPR) Survey

An ANPR survey has been undertaken on the A4119 corridor between the A4119/A4233 roundabout north of Tonyrefail and junction 34 of the M4 near Miskin, as illustrated in Figure 3.1. The ANPR was undertaken on the 9th of January 2018 between 07:00 and 10:00 hours. The ANPR provided Origin – Destination (O-D) trip routing information and journey time information split into 15-minute time segments.

The ANPR survey has been used to produce a traffic demand matrix for the microsimulation model, and the associated journey time results used to validate the microsimulation model.

Figure 3.1   **Survey Locations**
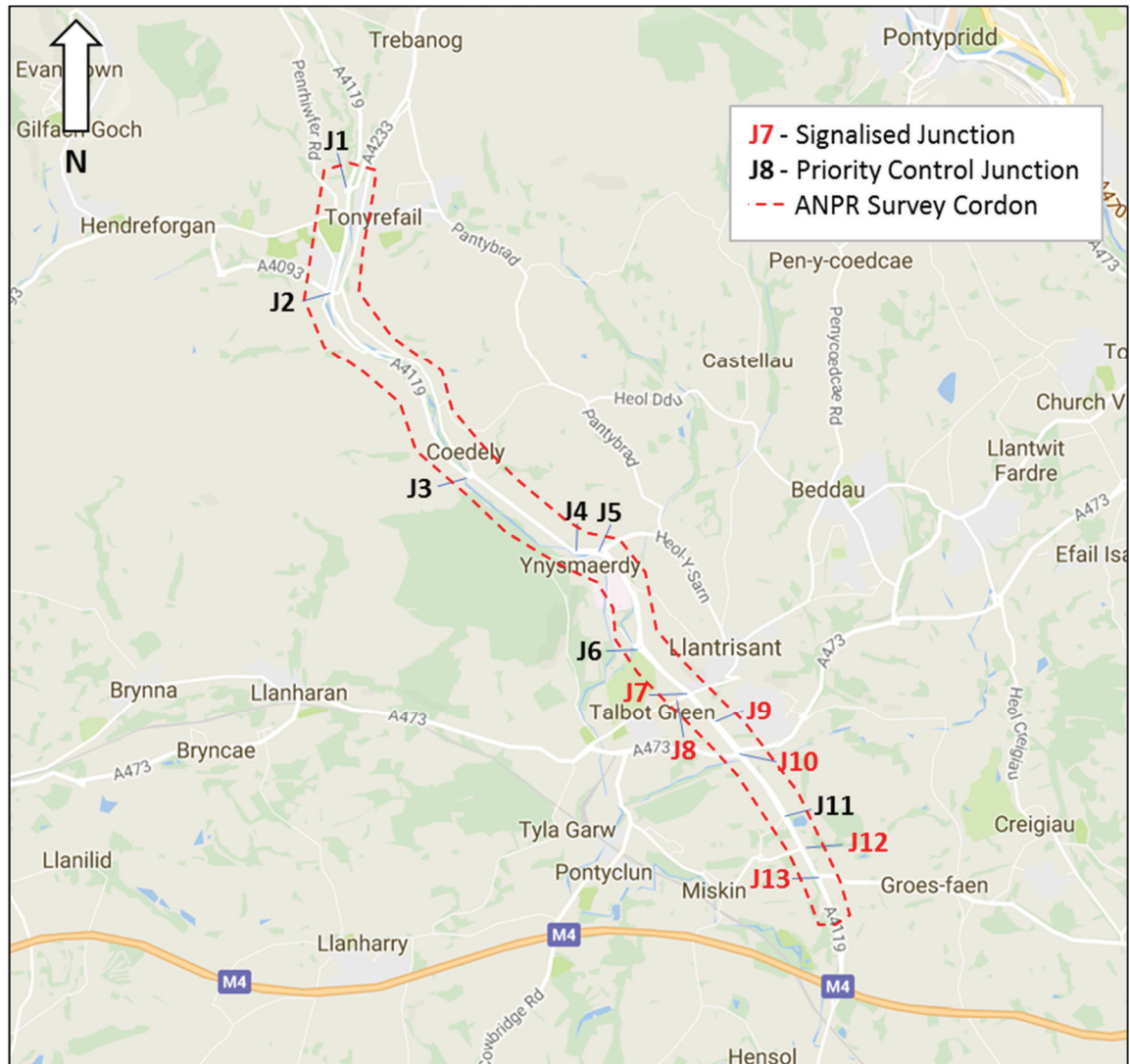
Google

3.2   Survey Analysis

Manual Classified Counts (MCC)

Analysis of the MCC surveys has been undertaken to identify the peak hour within the AM and PM periods for each individual junction and the overall network. The peak hour for each junction is specified within the analysis for each junction in Chapter 4 and the overall network peak hours are identified as 08:00 - 09:00 and 16:45 - 17:45.

The AM and PM period hourly traffic flow profile for the overall network is illustrated in Figure 3.2.

Figure 3.2   *Hourly Traffic Flow*
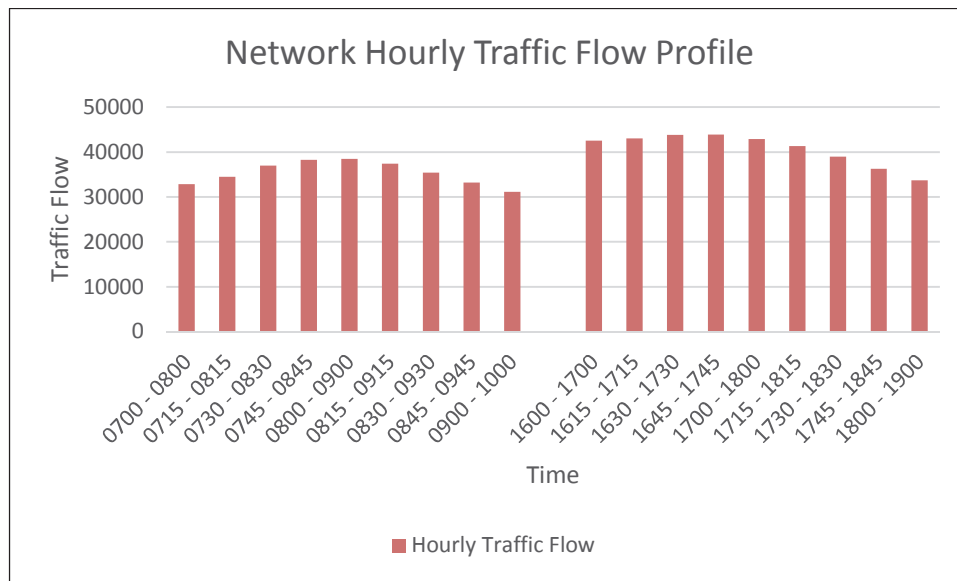
ANPR

The overall sample rates for each time period is presented in table 3.1. It is shown that both AM and PM sample rates are at or above 90% which is a comprehensive level of accuracy. The ANPR sample rate for inbound and outbound movements for each site in both time periods is provided in Appendix A.

Table 3.1 ANPR Sample Rates

Time Period	Count (vehicles)	ANPR (vehicles)	Sample Rate (%)
AM (0700 – 1000)	55748	50538	91%
PM (1600 – 1900)	62355	56211	90%

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4. Junction Model Development and Validation

4.1 Introduction

The existing operation of the A4119 corridor has been assessed using a combination of junction modelling software as well as microsimulation software. This chapter presents the methodology and results associated with the junction model assessments.

The junctions identified in Chapter 3 and listed below have been assessed in the network peak hour (08:00 – 09:00 & 16:45 – 17:45) in order to provide a comparison with the area wide microsimulation model.

4.2 Methodology

Industry standard software Junctions 8 has been used to assess the capacity of the priority controlled junctions, these include:

- Junction 1: A4119/A4233 roundabout;

- Junction 2: A4119/Mill Street/A4093 roundabout;

- Junction 3: A4119/Ely Valley Road/Site Access roundabout;

- Junction 4: A4119/Fire & Rescue Centre Access roundabout;

- Junction 5: A4119/Sterling Drive/Heol y Sarn/Hospital Access roundabout;

- Junction 6: A4119/Magden Park Access roundabout; and

- Junction 11: A4119/Cardiff Road/ALJ Store Access staggered crossroads.

The ARCADY module within Junctions 8 has been used to assess roundabouts, and the PICADY module has been used to assess the staggered crossroads. The geometry and layout associated with the priority controlled junctions has been measured using Google Earth.

The ratio of flow to capacity (RFC) is a measure commonly used at priority controlled junctions to represent operational capacity and has been used to evaluate the junctions listed above. An RFC value of 0.85 is considered to be the upper limit of junction capacity. This is consistent with Transport for London (TfL) Traffic Modelling Guidelines which advises that un-signalled junctions with an RFC value of 0.85 and below may be considered to be operating within capacity. The queue measurement provided by Junctions 8 is the average maximum queue generated within the assessment period, and the delay measurement is the maximum value of average delay per arriving vehicle.

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Industry standard software LINSIG has been used to assess the capacity of the signal controlled junctions, these include:

- Junction 7: A4119 Ely Valley Road/B4595 Talbot Road signalised crossroads;

- Junction 8: B4595 Talbot Road/Danygraig Drive/New Park Retail Estate Access North signalised junction;

- Junction 9: A4119/New Park Retail Estate Access South signalised junction;

- Junction 10: A4119/A473 signalised roundabout;

- Junction 12: A4119/School Road signalised junction; and

- Junction 13: A4119/A4119 Llantrisant Road signalised junction.

Traffic signal model junction layout and dimensions have been attained using Google earth. Traffic signal stage arrangement and timings have been acquired from RCTCBC and input into the traffic signal models.

At signal controlled junctions the degree of saturation (DOS) is the measure used to represent the operational capacity and has been used to evaluate the junctions listed above. A DOS of 90% is considered to represent the upper limit of practical capacity. Practical reserve capacity (PRC) is the measure of available spare capacity and is related to DOS. The queue length measurements provided are mean max queue (MMQ) which is the mean number of PCUs which have queued up before the queue clears the stop-line. The delay measurements provided represent an estimate of the average delay experienced per PCU in seconds.

It should be noted that a junction may operate at an RFC above 0.85, or 90% DOS; however, queues and delay increase exponentially when a junction operates above these thresholds.

4.3   Capacity Assessment Results

This chapter provides the junction model validation and capacity assessment summary results. The full capacity assessment results are provided in Appendix B.

4.3.1   Junction 1: A4119/A4233 roundabout

The results of the A4119/A4233 ARCADY assessment are provided below.

Table 4.3-1   A4119/A4233 Capacity Assessment – 2017 AM Base

Capacity Assessment				Validation	
Arm	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	1	6	0.58	7	6
A4233	1	4	0.37	8	7
A4119 S	1	5	0.57	6	5

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Table 4.3-2   A4119/A4233 Capacity Assessment – 2017 PM Base

Arm	Capacity Assessment			Validation	
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	1	4	0.45	8	7
A4233	0	3	0.28	7	7
A4119 S	5	13	0.83	7	2

The junction model results provided in Tables 4.3-1 and 4.3-2 show that the junction is currently operating well within capacity during the AM peak and near capacity during the PM peaks with a maximum RFC of 0.58 and 0.83 respectively. It is also shown that the junction model results compare well with observed queues with a difference in queue ranging between 1 and 7 PCUs.

4.3.2   Junction 2: A4119/Mill Street/A4093 roundabout

The results of the A4119/Mill Street/A4093 roundabout assessment are provided below.

Table 4.3-3   A4119/Mill Street/A4093 Roundabout Capacity Assessment – 2017 AM Base

Arm	Capacity Assessment			Validation	
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	13	40	0.95	16	3
Mill Street	0	4	0.23	4	4
A4119 S	1	4	0.48	4	3
A4093	2	11	0.71	9	7

Table 4.3-4   A4119/Mill Street/A4093 Roundabout Capacity Assessment – 2017 PM Base

Arm	Capacity Assessment			Validation	
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	2	7	0.65	5	3
Mill Street	0	3	0.22	6	6
A4119 S	7	20	0.88	14	7
A4093	1	10	0.58	9	8

The summary results provided in Tables 4.3-3 and 4.3-4 show that the junction is currently operating over capacity in both the AM and PM peaks with a maximum RFC of 0.95 in the AM and 0.88 in the PM. Comparison between observed and modelled queues shows that the junction validates well with a difference in queue ranging between 3 and 8 PCUs.

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4.3.3 Junction 3: A4119/Ely Valley Road/Site Access roundabout

The results of the A4119/Ely Valley Road/Site Access roundabout assessment are provided below.

Table 4.3-5 **A4119/Ely Valley Road/Site Access roundabout – 2017 AM Base**

| Arm | Capacity Assessment | | | Validation | |
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	3	7	0.72	0	3
Ely Valley Rd	0	5	0.32	5	5
A4119 S	1	3	0.42	0	1
Site Access	0	3	0.02	0	0

Table 4.3-6 **A4119/Ely Valley Road/Site Access roundabout – 2017 PM Base**

| Arm | Capacity Assessment | | | Validation | |
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	1	5	0.54	5	4
Ely Valley Rd	0	3	0.11	6	6
A4119 S	8	16	0.89	3	5
Site Access	0	7	0.24	3	3

The junction results presented in Tables 4.3-5 and 4.3-6 show that the junction is currently operating within capacity during the AM peak and over capacity during the PM peak with a maximum RFC of 0.72 and 0.89 respectively. Comparison between observed and modelled queues shows that the junction validates well with a difference in queue ranging between 0 and 6 PCUs.

4.3.4 Junction 4: A4119/Fire & Rescue Centre Access roundabout

The results of the A4119/Fire & Rescue Centre Access roundabout assessment are provided below.

Table 4.3-7 **A4119/Fire & Rescue Centre Access roundabout – 2017 AM Base**

| Arm | Capacity Assessment | | | Validation | |
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
Fire Service Access	0	5	0.02	1	1
A4119 E	1	3	0.38	3	2
A4119 W	9	22	0.91	4	5

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Table 4.3-8   A4119/Fire & Rescue Centre Access roundabout – 2017 PM Base

| Arm | Capacity Assessment | | | Validation | |
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
Fire Service Access	0	4	0.06	1	1
A4119 E	3	7	0.77	30	27
A4119 W	1	4	0.52	0	1

The summary results presented in Tables 4.3-7 shows that the junction is currently operating over capacity during the AM peak with a maximum RFC of 0.91. It also shows that the junction model queue results compare well with observed queue results with a difference in queue ranging between 1 and 5 PCUs. Table 4.3-8 indicates that the junction is operating well within capacity with a maximum RFC of 0.77. However, the queue results do not compare well on the A4119 East arm with a difference of 27 PCUs.

In light of the above, further analysis of the roundabout operation has been undertaken using the entry lane analysis facility within ARCADY. A review of the roundabout layout indicates that the exit on the western A4119 arm merges down from two lanes to one. As such a secondary lane usage of 40% has been applied to lane two of the A4119 Eastern arm of the roundabout to replicate the lower utility of this lane. The resulting capacity assessment results are provided in table 4.3-9.

Table 4.3-9   A4119/Fire & Rescue Centre Access roundabout – 2017 PM Base

| Arm | Capacity Assessment | | | Validation | |
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
Fire Service Access	0	1	0.06	1	1
A4119 E	33	59	0.98	30	3
A4119 W	0	2	0.52	1	1

The results provided in Tables 4.3-9 indicates that the second lane on the A4119 Eastern arm of the junction is not fully utilised which results in the junction being over capacity and a larger queue than would be expected if both lanes were to be fully used.

4.3.5   Junction 5: A4119/Sterling Drive/Heol y Sarn/Hospital Access roundabout

The results of the A4119/Sterling Drive/Heol y Sarn/Hospital Access roundabout assessment are provided below.

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Table 4.3-10   A4119/Sterling Drive/Heol y Sarn/Hospital Access roundabout – 2017 AM Base

Arm	Capacity Assessment			Validation	
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
Sterling Drive	0	5	0.02	1	1
Heol-Y-Sarn	0	3	0.25	10	10
A4119 S	2	7	0.69	3	1
Site Access	0	5	0.13	2	2
A4119 W	5	12	0.84	13	8

Table 4.3-11   A4119/Sterling Drive/Heol y Sarn/Hospital Access roundabout – 2017 PM Base

Arm	Capacity Assessment			Validation	
	Queue	Delay	RFC	Observed Queue	Difference
Sterling Drive	0	4	0.05	2	2
Heol-Y-Sarn	0	2	0.25	12	12
A4119 S	18	38	0.97	30	12
Site Access	1	13	0.5	21	20
A4119 W	1	4	0.52	22	21

The junction model results provided in Tables 4.3-10 shows that the junction is currently operating at capacity during the AM with a maximum RFC of 0.84. It also shows that the junction model queue results compare well with observed queue results with a difference in queue ranging between 1 and 10 PCUs. Table 4.3-11 indicates that the junction is operating over capacity with a maximum RFC of 0.97. However, the queue results do not compare well with a difference in queue ranging between 2 and 21 PCUs.

In light of the above, further analysis of the roundabout operation has been undertaken using the entry lane analysis facility within ARCADY. A review of the roundabout turning movements indicates that unequal usage is present due to a heavy movement travelling between the A4119 East and West arms, and a large proportion turning left or going ahead on the Heal Y Sarn approach. Due to the merging of the of two lanes into one at the western side of the roundabout and the general layout of the roundabout this could result in a higher usage of the inside lane. As such a secondary lane usage of has been applied to lane two of the A4119 eastern and western arms of the roundabout and the turning movements within each lane has been specified to replicate the actual behaviour of drivers at the roundabout. The resulting capacity assessment results are provided in table 4.3-12.

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Table 4.3-12   A4119/Sterling Drive/Heol y Sarn/Hospital Access roundabout – 2017 PM Base

Arm	Capacity Assessment			Validation	
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
Sterling Drive	0	1	0.05	2	2
Heol-Y-Sarn	1	9	0.77	12	11
A4119 S	26	45	0.97	30	4
Site Access	1	11	0.49	21	20
A4119 W	7	24	0.91	22	15

The junction model results provided in Table 4.3-12 shows that the model compares better with observed queue results with lane movements specified and a secondary lane usage weighting applied to lane two of the A4119 west. It is indicated that the junction operates over capacity with a maximum RFC of 0.97.

4.3.6   Junction 6: A4119/Magden Park Access roundabout

The results of the A4119/Magden Park Access roundabout assessment are provided below.

Table 4.3-13   A4119/Fire & Rescue Centre Access roundabout – 2017 AM Base

Arm	Capacity Assessment			Validation	
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	2	6	0.69	2	0
A4119 S	6	10	0.85	7	1
Magden Park	0	4	0.12	5	5

Table 4.3-14   A4119/Fire & Rescue Centre Access roundabout – 2017 PM Base

Arm	Capacity Assessment			Validation	
	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	2	7	0.7	10	8
A4119 S	3	6	0.76	4	1
Magden Park	3	19	0.78	13	10

The summary results in Tables 4.3-13 and 4.3-14 show that the junction is currently operating at capacity in the AM peak and within capacity during the PM peak with maximum RFC values of 0.85 and 0.78 respectively. Comparison between observed and modelled queues shows that the junction validates well with a difference in queue ranging between 0 and 10 PCUs.

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4.3.7 Junction 7: A4119/B4595 Talbot Road signalised crossroads

The results of the A4119/B4595 Talbot Road signalised crossroads are provided below.

Table 4.3-15   A4119/B4595 Talbot Road signalised crossroads – 2017 AM Base

Capacity Assessment				Validation	
Arm	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
A4119 Northbound Left	5.4%	18	1	-	-
A4119 Northbound Ahead	84.7%	55	21	16	5
A4119 Northbound Ahead	85.5%	55	23	16	7
A4119 Northbound Right	11.5%	42	1	6	5
Talbot Rd Eastbound Left Ahead	64.1 : 64.1%	39	14	6	8
Talbot Rd Eastbound Ahead	43.4%	59	5	3	2
Talbot Rd Eastbound Right	26.1%	58	2	3	1
A4119 Southbound Left Ahead	86.9%	58	22	13	9
A4119 Southbound Ahead Right	87.2 : 87.2%	54	17	12	5
Talbot Rd Westbound Left Ahead	84.1 : 84.1%	78	11	4	7
Talbot Rd Westbound Ahead	81.3%	84	10	3	7
Talbot Rd Westbound Right	85.2%	99	9	5	4
PRC (%)	3.2				
Total Delay (pcuHr)	63.03				
Cycle Time (s)	125				

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Table 4.3-12   A4119/B4595 Talbot Road signalised crossroads – 2017 PM Base

	Capacity Assessment			Validation	
Arm	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
A4119 Northbound Left	4.7%	16	1	-	-
A4119 Northbound Ahead	68.5%	35	17	9	8
A4119 Northbound Ahead	69.7%	35	19	11	8
A4119 Northbound Right	47.9%	46	7	8	1
Talbot Rd Eastbound Left Ahead	66.3 : 66.3%	45	13	6	7
Talbot Rd Eastbound Ahead	103.8%	230	16	5	11
Talbot Rd Eastbound Right	55.4%	86	3	5	2
A4119 Southbound Left Ahead	103.9%	146	57	6	51
A4119 Southbound Ahead Right	105.6 : 105.6%	175	47	20	27
Talbot Rd Westbound Left Ahead	88.2 : 88.2%	96	10	4	6
Talbot Rd Westbound Ahead	83.5%	113	7	3	4
Talbot Rd Westbound Right	72.8%	110	4	4	0
PRC (%)	-17.3				
Total Delay (pcuHr)	117.40				
Cycle Time (s)	125				

The junction model results provided in Tables 4.3-15 and 4.3-16 indicate that the junction is currently operating at capacity in the AM peak hour and over capacity in the PM peak hour. It is also shown that the junction model results compare well with observed queues with the exception of the A4119 southbound approach to the junction. There is a difference in modelled and observed queue at the A4119 southbound approach ranging between 27 and 51 PCUs.

A review of Google traffic data and ANPR journey time data has been undertaken to gain an understanding of the queue discrepancy described above. The Google traffic data indicates that the typical journey time between the Magden Park access (Zone 8) and Talbot Road West (Zone 9) is two minutes at off-peak and five minutes during the PM peak as illustrated in Figure 4.1. The ANPR also indicates that the journey time between Zone 8 and Zone 9 is 3:49.

In light of this, it is likely that there is a queue present on the A4119 north arm of the junction during the PM peak and that an error has occurred in the queue survey.

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Figure 4.1   A4119 North Journey Time (A4119/B4595 Talbot Road signalised crossroads)

Google
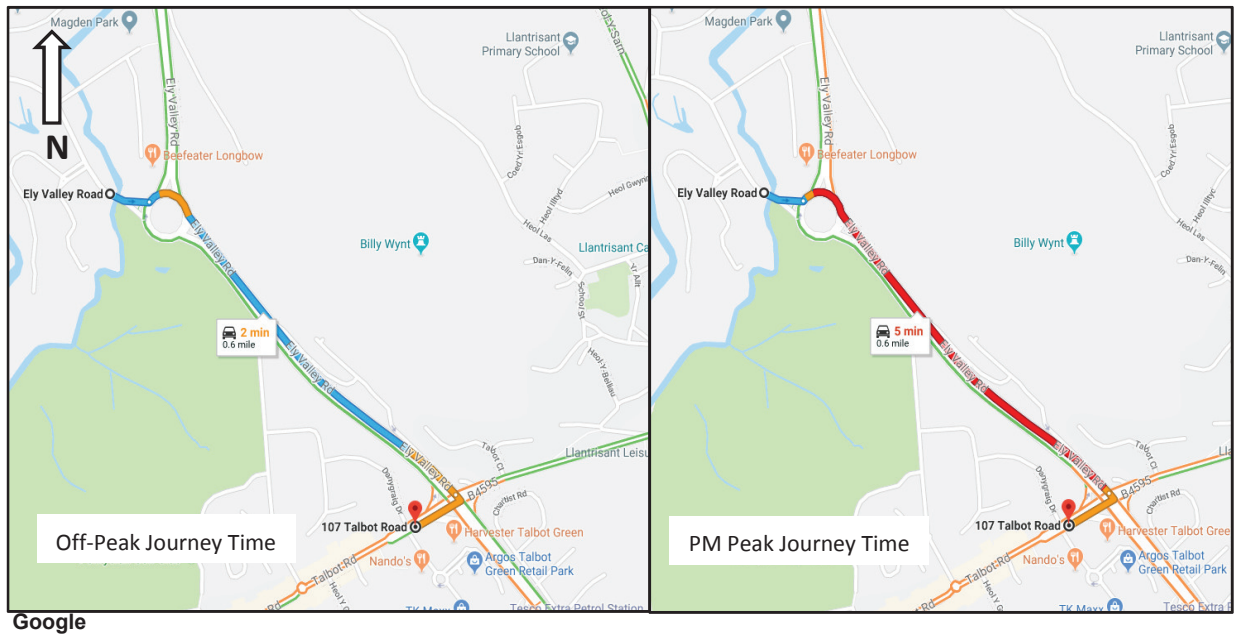
4.3.8   Junction 8: B4595 Talbot Road/Danygraig Drive/New Park Retail Estate Access (North) signalised junction

The results of the B4595 Talbot Road/Danygraig Drive/New Park Retail Estate Access (North) signalised junction are provided below.

Table 4.3-17   B4595 Talbot Road/Danygraig Drive/New Park Retail Estate Access (North) signalised junction – 2017 AM Base

	Capacity Assessment			Validation	
Arm	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
Talbot Rd E Left Ahead	47.8%	26	6	9	3
Talbot Rd E Right Ahead	49.0%	26	6	8	2
NewPark Access Left	16.1%	21	2	3	1
NewPark Access Ahead Right	27.2%	47	1	2	1
Talbot Road West Left Ahead Right	50.0 : 50.0%	9	5	13	8
PRC (%)	80.1				
Total Delay (pcuHr)	7.6				
Cycle Time (s)	80				

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Table 4.3-18   B4595 Talbot Road/Danygraig Drive/New Park Retail Estate Access (North) signalised junction – 2017 PM Base

Arm	Capacity Assessment			Validation	
	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
Talbot Rd E Left Ahead	65.60%	37	7	8	1
Talbot Rd E Right Ahead	67.60%	37	8	6	2
NewPark Access Left	32.40%	23	3	6	3
NewPark Access Ahead Right	64.60%	45	5	4	1
Talbot Road West Left Ahead Right	69.2 : 69.2%	15	6	17	11
PRC (%)	30.1				
Total Delay (pcuHr)	14.00				
Cycle Time (s)	80				

The junction model results provided in Tables 4.3-17 and 4.3-18 indicate that the junction is currently operating well within capacity with an RFC of 80.1% in the AM peak hour and 30.1% in the PM peak hour. It is also shows that the junction model results compare well with observed queues with a difference in queue ranging from one to 11 PCUs.

It should be noted that a review of the survey video was undertaken to understand how often the pedestrian crossing was called. It was found that the pedestrian crossing was called twice in the AM peak hour and five times in the PM peak hour. This is a very small proportion of the total number of cycles within the hour and as such the pedestrian stage has been omitted from the junction model stage sequence.

4.3.9   Junction 9: A4119/New Park Retail Estate Access (South) signalised junction

The results of the A4119/New Park Retail Estate Access (South) signalised junction are provided below.

Table 4.3-19   A4119/New Park Retail Estate Access (South) signalised junction – 2017 AM Base

Arm	Capacity Assessment			Validation	
	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
A4119 N Ahead	40.10%	16	8	5	3
A4119 N Ahead Right	43.7 : 61.4%	24	8	8	0
A4119 S Ahead Left	64.4 : 64.4%	15	12	12	0
A4119 S Ahead	52.20%	17	12	8	4
New Park Access Left Right	61.9 : 61.9%	50	4	5	1
New Park Access Right	38.40%	59	3	2	1
PRC (%)	39.8%				
Total Delay (pcuHr)	17.78 seconds				
Cycle Time (s)	114				

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Table 4.3-20   *A4119/New Park Retail Estate Access (South) signalised junction – 2017 PM Base*

	Capacity Assessment			Validation	
Arm	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
A4119 N Ahead	54.30%	24	12	9	3
A4119 N Ahead Right	57.4 : 76.0%	31	12	14	2
A4119 S Ahead Left	78.5 : 78.5%	20	16	14	2
A4119 S Ahead	65.40%	27	16	11	5
New Park Access Left Right	79.4 : 79.4%	48	11	12	1
New Park Access Right	66.40%	54	9	6	3
PRC (%)	13.4%				
Total Delay (pcuHr)	31.15				
Cycle Time (s)	114				

The summary results in Table 4.3-19 shows that the A4119/NewPark Retail Access junction operates well within capacity during the AM peak with a PRC of 39.8%, a maximum DOS of 64.4%, a maximum delay of 59 seconds and a maximum MMQ of 12 PCUs. Table 4.3-20 shows that during the PM peak the junction operates within capacity but with a lower level of PRC at 13.4%, a maximum DOS of 79.4%, maximum delay of 54 seconds and a maximum MMQ of 16 PCUs. It is also possible to see that the model validates well with difference in queue between modelled results and observed ranging between 0 and 5 PCUs.

4.3.10   Junction 10: A4119/A473 signalised roundabout

The results of the A4119/A473 signalised roundabout are provided below.

Table 4.3-21   *A4119/A473 signalised roundabout – 2017 AM Base*

	Capacity Assessment			Validation	
Arm	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
A4119 Southbound Left Ahead	89.8 : 89.8%	53	11	14	3
A4119 Southbound Ahead	88.3 : 88.3%	50	11	13	2
A473 Westbound Ahead Ahead 2	87.3 : 77.4%	31	10	26	16
A473 Westbound Ahead	71.50%	41	7	9	2
A4119 Northbound Left Ahead	84.6 : 84.6%	35	13	18	5
A4119 Northbound Ahead	86.4 : 86.4%	35	14	15	1
A473 Eastbound Left Ahead	83.5 : 39.6%	33	6	14	8
A473 Eastbound Ahead	57.7 : 45.9%	34	4	4	0
PRC (%)	0.2				
Total Delay (pcuHr)	54.27				
Cycle Time (s)	75				

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Table 4.3-22   A4119/A473 signalised roundabout – 2017 PM Base

Capacity Assessment				Validation	
Arm	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
A4119 Southbound Left Ahead	96.5 : 96.5%	66	19	21	2
A4119 Southbound Ahead	95.7 : 95.7%	63	18	20	2
A473 Westbound Ahead Ahead 2	99.0 : 96.3%	72	16	22	6
A473 Westbound Ahead	93.5%	88	11	10	1
A4119 Northbound Left Ahead	95.8 : 95.8%	57	21	20	1
A4119 Northbound Ahead	98.2 : 98.8%	63	27	20	7
A473 Eastbound Left Ahead	91.4 : 51.9%	33	7	12	5
A473 Eastbound Ahead	73.0 : 57.6%	38	5	4	1
PRC (%)	-10.0				
Total Delay (pcuHr)	101.56				
Cycle Time (s)	75				

The junction model results provided in Tables 4.3-21 and 4.3-22 indicate that the junction is currently operating at capacity with an RFC of 0.2% in the AM peak hour and -10% in the PM peak hour. It can also be seen that the junction model queue results compare well with the observed queues with the exception of the A473 westbound approach in the AM peak hour. Observed queues on this approach at the junction are 16 PCUs higher than that modelled. The survey video has been reviewed and it has been found that this is likely to be due to the exit blocking on the A4119 southbound exit arm of the junction as illustrated in Image 4.1.

Image 4.1   A4119 Exit Blocking AM Peak (A4119/A473 signalised roundabout)

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4.3.11   Junction 11: A4119/Cardiff Road/ALJ Store Access staggered crossroads

The A4119/Cardiff Road/ALJ Store Access junction has been assessed using the staggered crossroads module within PICADY. The results of the PICADY assessments are provided below.

Table 4.3-23   A4119/Cardiff Road/ALJ Store Access Staggered Junction – 2017 AM Base

	Capacity Assessment			Validation	
Arm	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	0	9	0.24	4	4
ALJ Store Access	0	0	0.00	1	1
A4119 S	0	6	0.01	1	1
Cardiff Road	1	17	0.42	6	5

Table 4.3-24   A4119/Cardiff Road/ALJ Store Access Staggered Junction – 2017 PM Base

	Capacity Assessment			Validation	
Arm	Queue (PCU)	Delay (Seconds)	RFC	Observed Queue (PCU)	Difference (PCU)
A4119 N	1	16.25	0.49	7	6
ALJ Store Access	26	inf	inf	3	23
A4119 S	0	8	0.01	1	1
Cardiff Road	72	inf	inf	4	69

Table 4.3.23 shows that the junction is currently operating well within capacity during the AM peak hour with a maximum RFC of 0.42. It is also possible to see that the junction validates well with a difference in queue ranging between 1 and 5 PCUs.

Table 4.3.24 indicates that the junction is currently operating well above capacity with the significant queues and infinite delay and RFCs on the minor arms. This is not consistent with the observed queues and as such it is likely that the model is not accurately reflecting the traffic behaviour that is occurring on the ground. The queue surveys indicate that there are significant queues along the A4119 and as such it is likely that there is unconventional traffic behaviour occurring such as courtesy let out manoeuvres which is not captured by the PICADY model.

4.3.12   Junctions 11, 12 & 13: A4119/Cardiff Road Priority Junction & A4119/School Road & A4119/Llantrisant Road Signalised Junctions

The A4119/Cardiff Road, A4119/School Road & A4119/Llantrisant Road junctions have been modelled as a signal junction network model. The results are provided below.

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Table 4.3-25 A4119/Cardiff Road, A4119/School Road, A4119/Llantrisant Road LinSig model results - 2017 AM Base

Arm	Capacity Assessment			Validation	
	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
J11: A4119 / Cardiff Road					
A4119 North Ahead Right	28.0 : 28.0%	1	1	2	1
Right Left	38.70%	8	2	2	0
J12: A4119 / School Road Jct					
A4119 North Ahead	67.70%	26	17	17	0
A4119 North Ahead Right	53.7 : 53.7%	23	12	17	5
A4119 South Left Ahead	76.4 : 76.4%	26	18	14	4
A4119 South Ahead	66.80%	26	18	12	6
School Road Right Left	79.2 : 79.2%	51	14	14	0
J13: A4119 / Llantrisant Road					
A4119 N Left Ahead	65.2 : 65.2%	20	21	19	2
A4119 N Ahead	63.60%	27	18	17	1
A4119 Groesfaen Road Left Right	80.0 : 80.0%	43	14	17	3
A4119 S Ahead	42.40%	11	9	8	1
A4119 S Right Ahead	58.3 : 58.3%	12	12	15	3
PRC (%)	12.6				
Total Delay (pcuHr)	49.12				
Cycle Time (s)	116 / 124				

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Table 4.3-26   A4119/Cardiff Road, A4119/School Road, A4119/Llantrisant Road LinSig model results - 2017 PM Base

	Capacity Assessment			Validation	
Arm	Degree of saturation (%)	Delay (s/pcu)	MMQ (pcu)	Observed Queue (PCU)	Difference (PCU)
J11: A4119 / Cardiff Road					
A4119 North Ahead Right	27.4 : 47.0%	2	3	3	1
Right Left	33.60%	10	2	2	0
J12: A4119 / School Road Jct					
A4119 North Ahead	57.00%	9	12	10	2
A4119 North Ahead Right	36.5 : 36.5%	10	6	8	2
A4119 South Left Ahead	92.2 : 92.2%	25	27	23	5
A4119 South Ahead	82.40%	22	28	20	8
School Road Right Left	78.4 : 78.4%	72	7	7	0
J13: A4119 / Llantrisant Road					
A4119 N Left Ahead	66.5 : 66.5%	23	22	21	1
A4119 N Ahead	63.30%	32	18	15	3
A4119 Groesfaen Road Left Right	89.1 : 89.1%	62	20	22	2
A4119 S Ahead	76.30%	18	27	24	3
A4119 S Right Ahead	90.1 : 90.1%	24	39	35	4
PRC (%)	-2.4				
Total Delay (pcuHr)	61.86				
Cycle Time (s)	112 / 132				

Table 4.3.25 and 4.3.26 show that the junction is currently operating near capacity during the AM peak and over capacity during the PM peak with maximum DOSs of 80.0% and 92.2% respectively. It is also possible to see that the junction validates well with a difference in queue ranging between 0 and 8 PCUs.

It should be noted that an Underutilised Green Time (UGT) adjustment has been applied to the A4119 southbound movement at both A4119/School Road and A4119/Llantrisant Road junctions in the AM peak in order to capture the exit blocking occurring at this time. The UGT observed at these junctions is illustrated in images 4.2 and 4.3.

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Image 4.2   ***A4119 Exit Blocking AM Peak (A4119/School Rd Junction)***
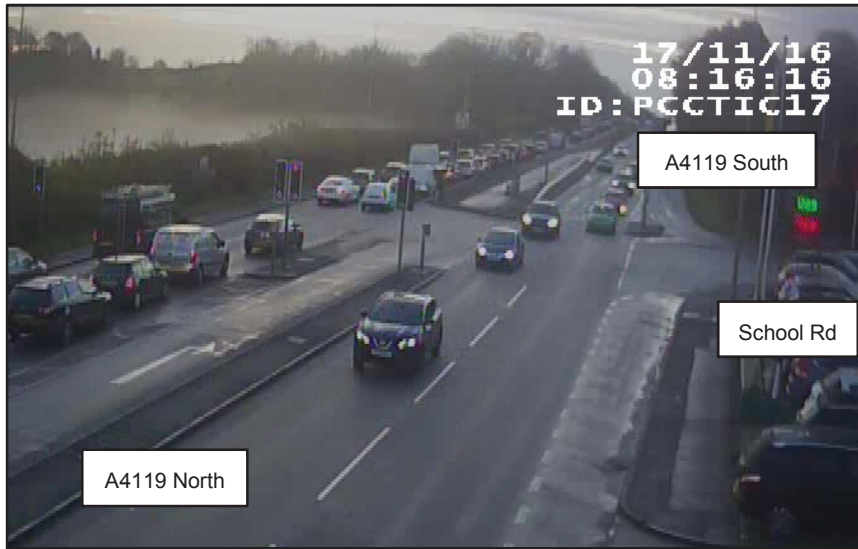
Image 4.3   ***A4119 Exit Blocking AM Peak (A4119/Llantrisant Rd Junction)***

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5. Microsimulation Model Development and Validation

This chapter presents the methodology used to develop the A4119 corridor microsimulation model and the results of the model calibration and validation. The microsimulation model consists of 27 zones, each representing a point into and/or out of the network. The model extents and zones are illustrated in figures 5.1 and 5.2.

Figure 5.1   Model Extents – Zones (North)

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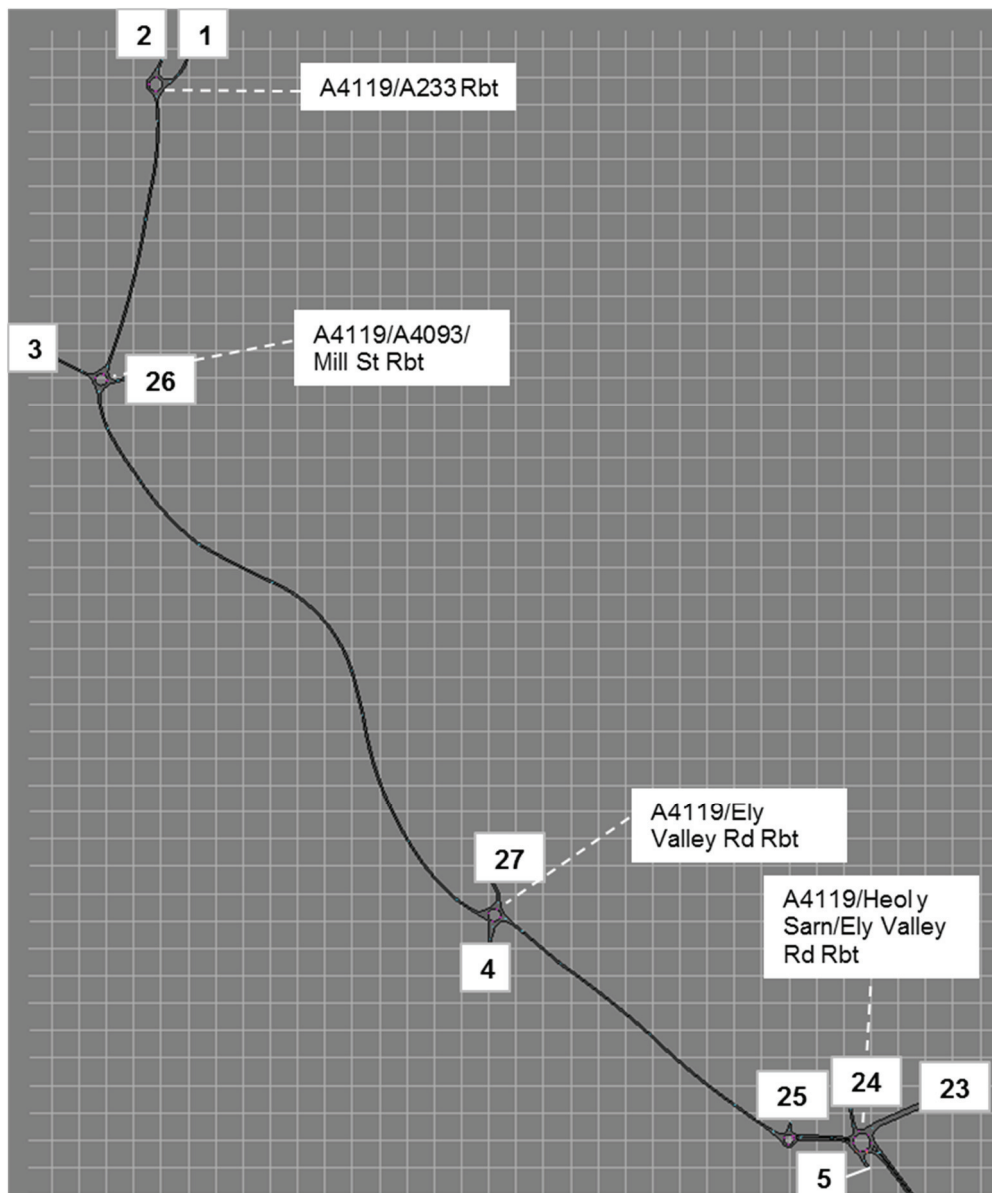
Figure 5.2   *Model Extents – Zones (South)*
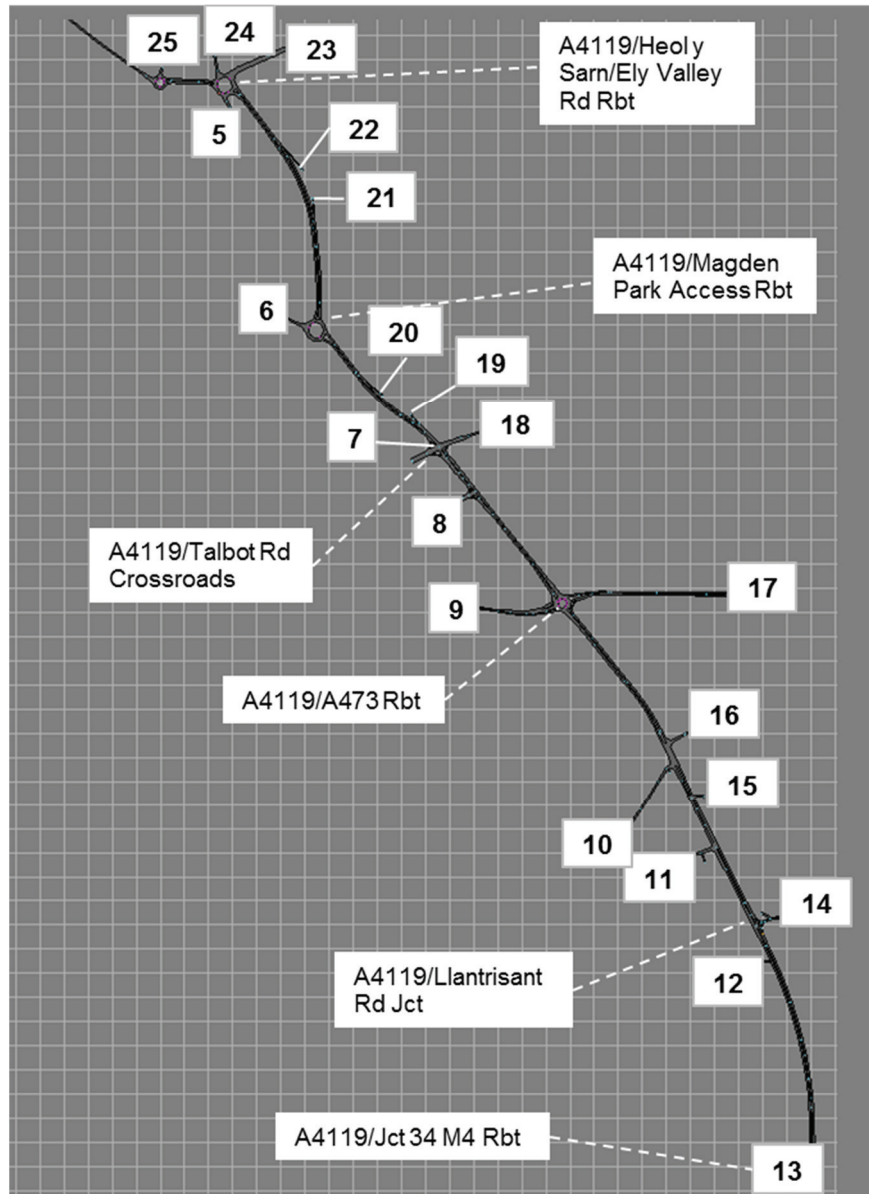
5.1   Matrix Development and Matrix Estimation (ME)

The matrix estimation (ME) facility within Paramics was used to estimate a demand matrix for each vehicle class including cars, LGVs and heavy vehicles for the AM and PM 3-hour peak time periods.

The following information was used to estimate the matrix:

- O-D element of the ANPR survey was used to inform the routing of trips within the demand matrix and formed the prior matrix element of the ME process;

- The MCC traffic survey data was used to control the traffic flow values at all junctions within the network, and formed the survey file within the ME process;

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- Origin and destination totals from the MCC traffic survey data were used as constraints within the ME process to ensure the correct number of vehicles enter and exit the network;

- A PIJA (Proportion of vehicles going from points I to J that are Assigned to each link) file was run during a model simulation to ascertain any routing information from the model.

All junction turning movements were included in the ME process which amounts to 109 turning movements. The results of the ME process are summarised in table 5.1 and provided in full in Appendix C. The Geoffrey E Havers (GEH) statistic has been used to compare observed and estimated or modelled traffic flows. The GEH formula compares observed and modelled traffic flows in terms of relative and absolute difference and is similar to Chi-square statistical analysis. A GEH value less than 5 is generally considered to be a good match between observed and modelled/estimated traffic flows.

Table 5.1   Matrix Estimation Result Summary

AM				
Matrix Vehicle Class	Average Difference (GEH)	Movements above 5 (GEH)	Max Difference (GEH)	Max Difference (Veh)
Cars	0.91	0	4.02	+72
LGVs	0.70	0	4.38	-41
HVs	0.83	1	5.75	-32
PM				
Matrix Vehicle Class	Average Difference (GEH)	Movements above 5 (GEH)	Max Difference (GEH)	Max Difference (Veh)
Cars	0.74	0	3.97	+81
LGVs	0.74	1	5.91	-41
HVs	0.69	0	3.47	-7

Table 5.1 shows that the estimated matrices match observed traffic flows well with only one estimated movement in each time period with a GEH difference greater than 5. The reason for the difference between observed and estimated turning movements was investigated. It was found that the difference occurred due to discrepancies in observed turning movements between junctions. The matrix estimation process would therefore average the conflicting turning movement counts.

A traffic demand release profile was produced for each zone to zone movement within the matrix. This was based on the traffic demand profile provided in the MCC survey data and is provided for each 15 minute time segment within the AM and PM three hour time periods.

5.2   Model Network Development

In order to code the A4119 corridor network in Paramics an Ordinance Survey (OS) CAD layer was used to trace the carriageway extents. Signal controlled junctions were coded using staging arrangement and signal timings information attained from RCTCBC.

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In order to replicate the blocking back that occurs at the M4 eastbound on-slip at Junction 34 a capacity restraint has been coded into the network in the form of a signalised node. This has been calibrated so that the resulting queue and journey times are produced on the A4119.

Site visits were undertaken during the peak hour in order to ensure queues and delays were occurring in the correct place on the network.

5.3   Model Calibration and Validation

Turning Count Calibration

The performance of the model was assessed and calibrated by comparing modelled turning count flows with the turn counts recorded by the MCC surveys. The Transport Appraisal Guidance (WebTAG) calibration requirements are presented in table 5.2.

Table 5.2   WebTAG Calibration Requirements

Criteria	Description of criteria	Acceptability Guideline
1	Individual flows within 100veh/h of counts for flows less than 700 veh/h	> 85% of cases
	Individual flows within 15% of counts for flows from 700 to 2700 veh/h	
	Individual flows within 400 veh/h of counts for flows more than 2700 veh/h	
2	GEH < 5 for individual flows	

The summary results of the model calibration are presented in tables 5.3. The full calibration results for all movements is provided in Appendix D.

Table 5.3   Summary Calibration Results

Criteria	Movements that meet the requirement	
	AM	PM
Individual flows within 100veh/h of counts for flows less than 700 veh/h	100%	100%
Individual flows within 15% of counts for flows from 700 to 2700 veh/h	100%	100%
Individual flows within 400 veh/h of counts for flows more than 2700 veh/h	100%	100%
GEH < 5 for individual flows	100%	100%

Table 5.3 shows tha the model calibrates well compared with observed flows with all movements meeting WebTAG requirements.

Journey Time Validation

The model was validated by comparing modelled journey times with recorded journey times attained from the ANPR. The model was also validated by comparing queue results with observed queues. The WebTAG validation guidance is provided in table 5.4.

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Table 5.4   ***WebTAG Validation Criteria***

Criteria	Acceptability Guideline
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	> 85% of cases

The model journey time validation results are presented in tables 5.5 to 5.8. Journey time survey results with a sample size lower than 10 have been excluded. The difference in journey time is presented for each zone to zone movement with differences greater than 60 seconds highlighted in red (modelled greater than observed), and differences less than -60 seconds highlighted in blue (modelled less than observed). The percentage difference in journey time is also presented.

Table 5.5   ***AM Model Validation Results (Seconds)***

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1		10	21	-23	-22	10	-23	-57															53			-23	
2	7		23	-32	-37	0	-24	-63										28					-11			16	
3	-21	10		21	0		-19	0															-24			22	
4																											
5		-2																					5				
6							-23																				
7	-9	0	22		-17	19												5					17		11	-4	4
8						21												-19					44				
9													-39				-10										
10																	-43										
11													-19	-44			-75										
12																											
13									-18		-74	-2		-29			7										
14									1		-52			67			-32										
15																											
16																											
17									31	-34				-49	-112												
18		-49			-33	-36	-21	0																			
19																		-75									
20																											
21																											
22																											
23		22	9		8	3	-24	-35																	10	12	
24																											
25																											
26	58	101	21				-44																				
27				48	-11		-35	18															1				

Table 5.6   **AM Model Validation Results (%)**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1		34%	13%	-6%	-4%	2%	-3%	-8%															11%			-15%	
2	46%		14%	-8%	-7%	0%	-3%	-8%										4%					-2%			11%	
3	-18%	13%		10%	0%		-3%	0%															-6%			109%	
4																											
5		-1%																					13%				
6							-18%																				
7	-2%	0%	6%		-9%	21%												8%					10%		6%	-1%	2%
8						14%												-19%					21%				
9													-9%				-8%										
10																	-21%										
11													-6%	-34%			-30%										
12																											
13									-7%		-39%	-3%		-15%			3%										
14									0%		-23%		31%				-9%										
15																											
16																											
17									23%	-18%			-11%	-36%													
18		-9%			-15%	-21%	-23%	0%																			
19																		-56%									
20																											
21																											
22																											
23		6%	3%		24%	4%	-13%	-15%																	16%	4%	
24																											
25																											
26	55%	99%	68%				-8%																				
27				154%	-5%		-10%	5%																			

During the AM peak hour 93% of selected zone to zone movements met the journey time validation criteria. As such the model is considered to validate well. A small number of zone to zone journey times had moderate differences. These were investigated and found to be less significant movements that may be improved further should these specific movements require further validation.

Table 5.7   **PM Model Validation Results (Seconds)**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1		9	0		-34		11																-8			-7	
2	4		1		-28		-22	-59															-23			-5	
3	-5	0					74	-22															17			12	
4	-73	-52																									-23
5	43	-40	-46																				47				1
6							57	41										-48					71				
7	24	19	42		25	66												27					54			66	31
8	-42	1	-44															27					72				-10
9											-4	-26					-27										
10																	-38										
11													-66	2													
12																											
13									26		-23	-40		18			-57										
14									45		30		71				-59										
15																	-96										
16																											
17									23	-72			5	-22													
18			21			35	-19	-2																			-10
19																		3									
20																											
21																											
22																											
23	-16	-48	-45		4		-7	-53																			2
24																							0				
25																							32				
26	-9	-9	4																				5				
27							35																2				

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Table 5.8   PM Model Validation Results (%)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1		40%	0%		-9%		2%																-2%			-8%	
2	27%		1%		-7%		-3%	-9%										0%					-6%			-6%	
3	-5%	0%					14%	-4%															6%			40%	
4	-15%	-11%																									-51%
5	7%	-6%	-7%																				61%				1%
6							25%	17%										-18%					69%				
7	3%	2%	6%		13%	88%												38%					32%			10%	9%
8	-5%	0%	-6%															30%					35%				-3%
9													-1%	-11%				-18%									
10																		-14%									
11													-28%	2%													
12																											
13									8%		-11%	-34%		10%				-14%									
14									14%		21%		79%					-15%									
15																		-36%									
16																											
17									19%	-35%			2%	-10%													
18		3%				27%	-19%	-2%																			-3%
19																	5%										
20																											
21																											
22																											
23	-3%	-7%	-8%		13%		-3%	-16%										0%									1%
24																							2%				
25																							65%				
26	-9%	-8%	17%																				2%				
27							9%																2%				

During the PM peak hour 92% of selected zone to zone movements met the journey time validation criteria. As such the model is considered to validate well. A small number of zone to zone journey times had moderate differences. These were investigated and found to be less significant movements that may be improved further should these specific movements require further validation.

In addition to zone to zone journey time validation the journey time for trips from the north to the middle of the network (A4119/A4233 roundabout to A4119/A473 Talbot Green roundabout) and vice versa as well as from the middle of the network to the south (A4119/A473 Talbot Green roundabout to Junction 34 of M4) and vice versa have been compared. The results are presented in table 5.9.

Table 5.9   A4119 major route journey time validation

Journey	AM				PM			
	Obs	Mod	Diff (s)	Diff (%)	Obs	Mod	Diff (s)	Diff (%)
North (Jct1) to Middle (Jct 10)	713	767	-55	-8%	744	691	53	7%
Middle (Jct 10) to North (Jct 1)	529	551	-22	-4%	886	830	56	6%
Middle (Jct 10) to South (Jct 13)	465	420	45	10%	323	276	47	15%
South (Jct 13) to Middle (Jct 10)	256	264	-8	-3%	353	363	-10	-3%

Table 5.9 shows that all the major journeys along the A4119 corridor meet WebTAG criteria and validate well.

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5/ Microsimulation Model
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Validation

Queue Validation

The model was also validated using queue information gained through peak hour site visits and queue survey information. The most notable queues which have been incorporated into the model during the AM period include:

- Large queues on the A4119 southbound approach to the A4119/A4093/Mill Street Roundabout (Junction 2);
- Large queues on the A4119 southbound approach to the A4119/Ely Valley Road Roundabout (junction 3);
- Moderate queues at the A4119/Talbot Road crossroads;
- Large queues generated along the A4119 in a southbound direction between the A473/A4119 roundabout and Junction 34 of the M4 between 07:00 and 08:00 which reduce to small to moderate queues between 08:00 and 09:00.

The most notable queues which have been incorporated into the model during the PM period include:

- Large queues on the A4119 northbound approach to the A4119/A4093/Mill Street Roundabout (Junction 2);
- Large queues on the A4119 northbound approach to the A4119/Ely Valley Road Roundabout (junction 3);
- Moderate to large queues on the A4119 northbound approach to the A4119/Fire Station access roundabout (Junction 4) and the A4119/Heol-y-Sarn/Hospital Access roundabout (Junction 5).
- Moderate queues at the A4119/Talbot Road crossroads;
- Moderate queues generated along the A4119 in a northbound direction between the A473/A4119 roundabout and Junction 34 of the M4 between.

6. Existing A4119 Corridor Operation

The junction and micro-simulation models have been used to understand the existing operation of the A4119 corridor and identify operational issues at junctions and carriageway links.

6.1 AM Peak (08:00 – 09:00)

During the AM period the most notable capacity issues were found at the following locations:

6.1.1 A4119/A4093/Mill Street Roundabout (Junction 2)

During the AM peak period significant queues are generated at the A4119/A4193/Mill Street roundabout, particularly in a southbound direction on the A4119. This is identified by the extended queues highlighted in the Paramics model, figure 6.1, and the junction model results for the A4119 north (Section 4.3.2) which indicated an RFC of 0.95, a queue of 13 vehicles and a delay of 40 seconds.

Figure 6.1   A4119/A4093/Mill Street Roundabout (Junction 2) capacity issues - AM
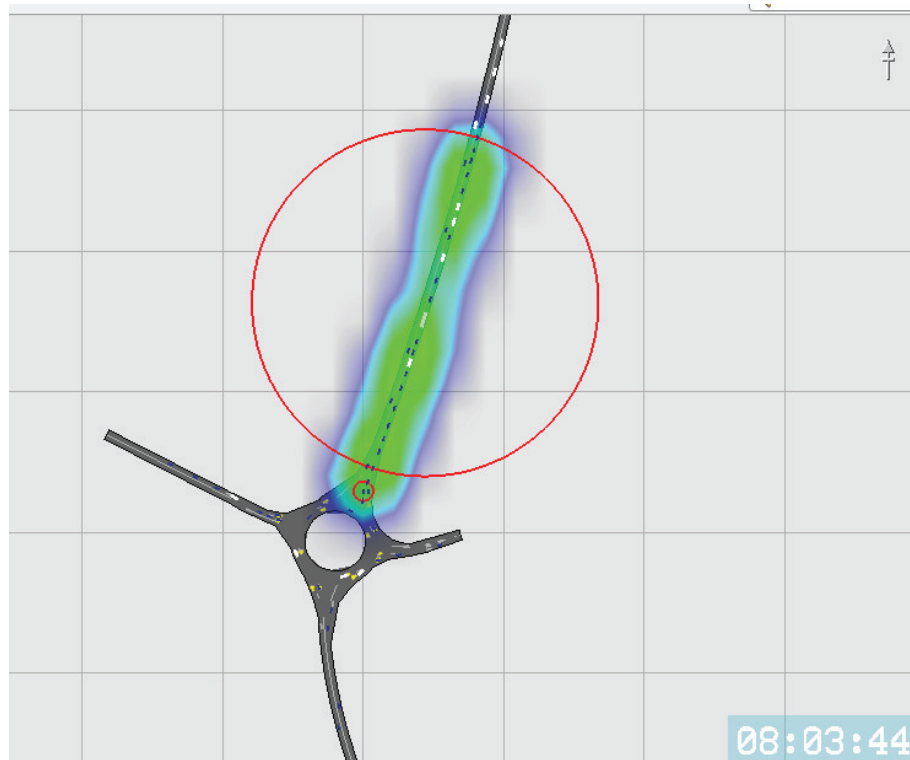
6.1.2 A4119/Ely Valley Road Roundabout (junction 3)

Significant queues are also identified on the A4119 southbound approach to the A4119/Ely Valley Road Roundabout (junction 3). This is identified by the Paramics model as illustrated in figure 6.2, and supported to some degree by the junction model (Section 4.3.3) which indicated that the A4119 southbound approach operates at an RFC of 0.72. It should be noted that the junction models is likely to overestimate the performance of the roundabout as there are more than one lane on approach to the roundabout with unequal lane usage likely.

Figure 6.2   *A4119/Ely Valley Road Roundabout (Junction 3) capacity issues - AM*
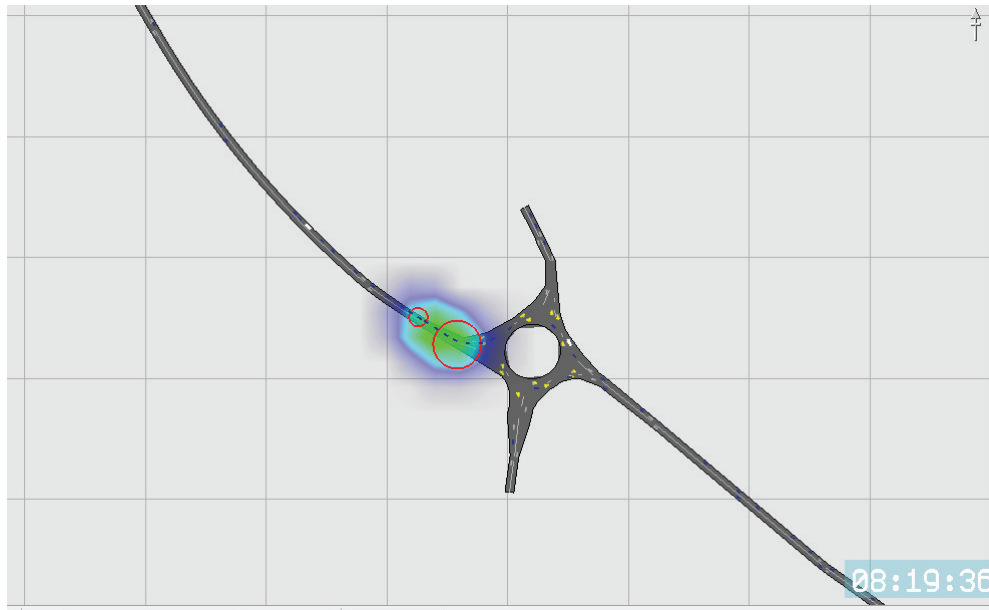
6.1.3   *A4119 Ely Valley Road between Coedely (Junction 3) and Royal Glamorgan Hospital Roundabout (Junction 5)*

Reduced vehicle speeds and extended queues are identified along the A4119 between Coedely (Junction 3) and the Royal Glamorgan Hospital roundabout (Junction 5). This is illustrated in the Paramics model visualisation in figure 6.3, and identified in the junction model results in Section 4.3.4.

Figure 6.3   *A4119 Ely Valley Road between Coedely (Junction 3) and Royal Glamorgan Hospital Roundabout (Junction 5) capacity issues - AM*
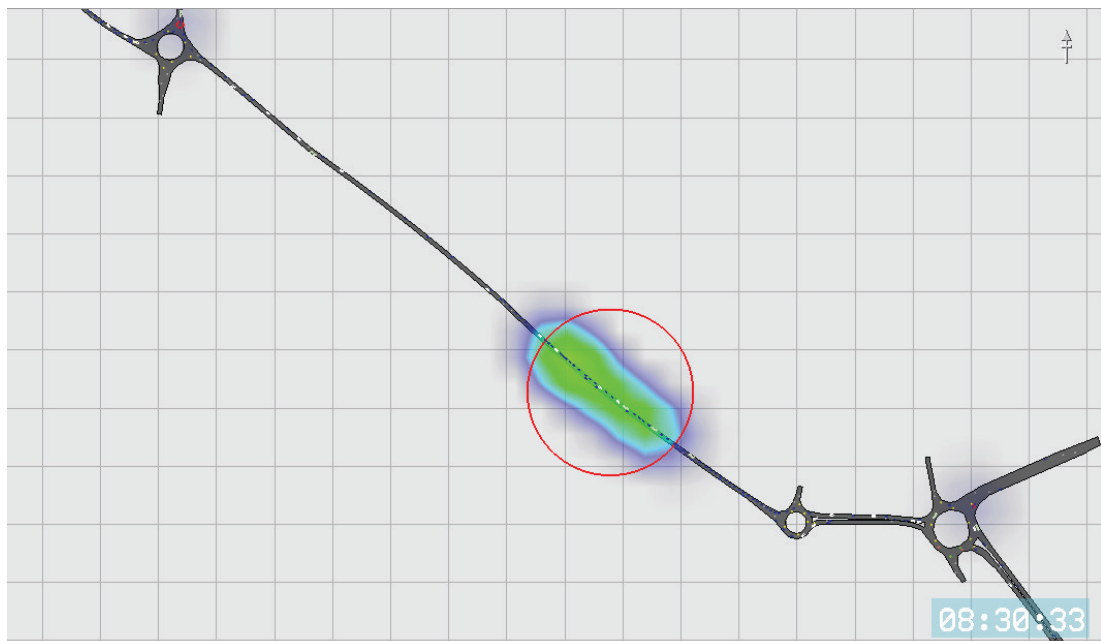
6.1.4   Junction 34 of the M4

Significant queuing and junction exit blocking is identified at the M4 eastbound on-slip. This is identified in the Paramics visualisation (figure 6.3) and in the junction model results in section 4.3.10 & 4.3.12. Although this occurs before the network peak between 07:00 and 08:00 the resulting queues affect the operation of the peak between 08:00 and 09:00.

Figure 6.4   ***M4 Junction 34 Eastbound on-slip capacity issues - AM***
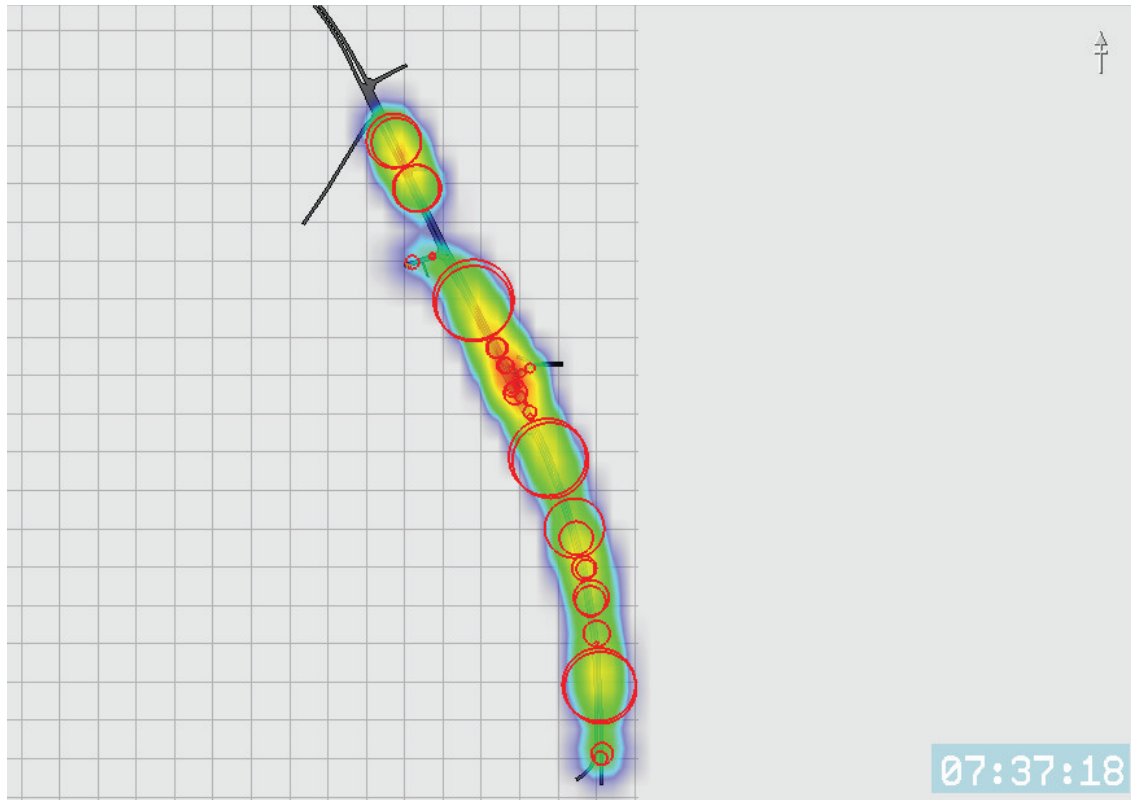
6.2   PM Period (16:00 – 19:00)

During the PM period the most notable capacity issues were found at the following locations:

6.2.1   *A4119/A4093/Mill Street Roundabout (Junction 2)*

Significant queues and reduced vehicle speeds are identified on the A4119 northbound approach to the A4119/A4093/Mill Street roundabout (Junction 3). This is illustrated by the Paramics visualisation (Figure 6.5) and supported by the junction model (Section 4.3.2) which indicated that the junction operates at an RFC of 0.88.

Figure 6.5   *A4119/A4093/Mill Street Roundabout (Junction 2) capacity issues - PM*
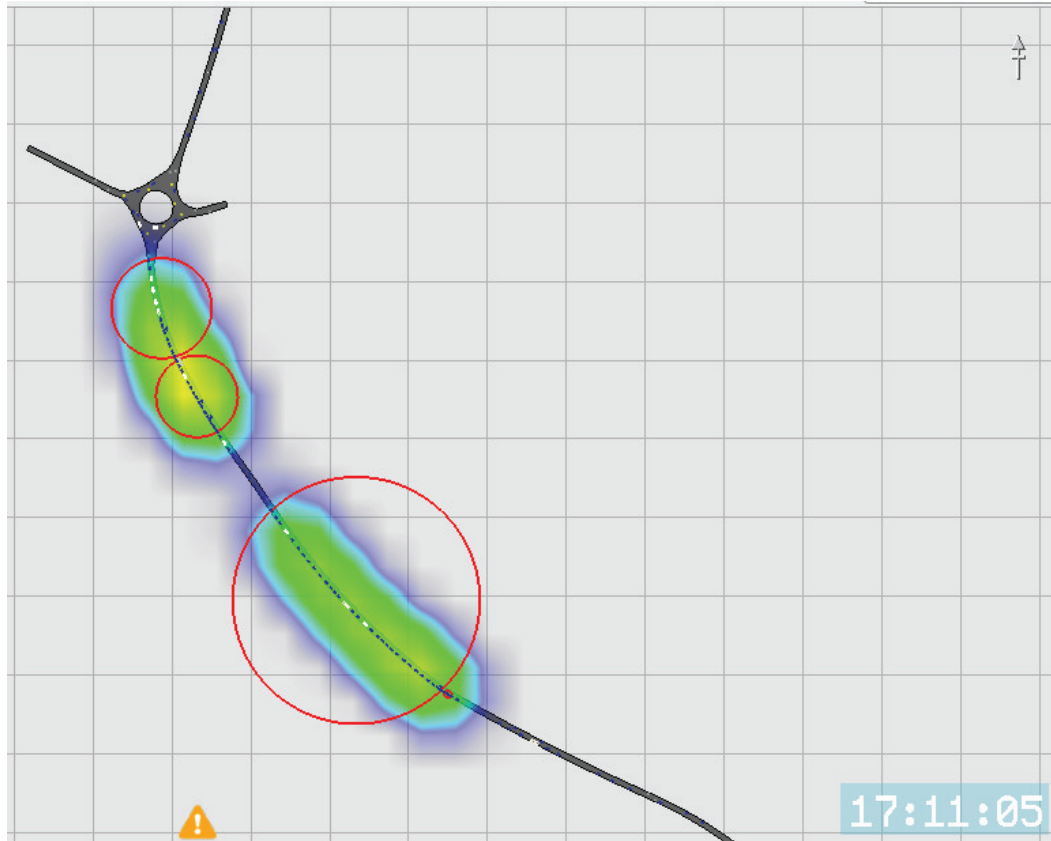
6.2.2   A4119 Ely Valley Road between Coedely (Junction 3) and the Royal Glamorgan Hospital Roundabout (Junction 5)

Significant congestion was identified on the A4119 in a northbound direction between Coedely (Junction 3) and the Royal Glamorgan Hospital Roundabout (Junction 5). This is illustrated in the Paramcis visualisation (Figure 6.6) and supported by the junction model results in Section 4.3.4 which indicated that the junction operates with an RFC of 0.98.

Figure 6.6   *A4119 Ely Valley Road between Coedely (Junction 3) and the Royal Glamorgan Hospital roundabout (Junction 4) capacity issues - PM*
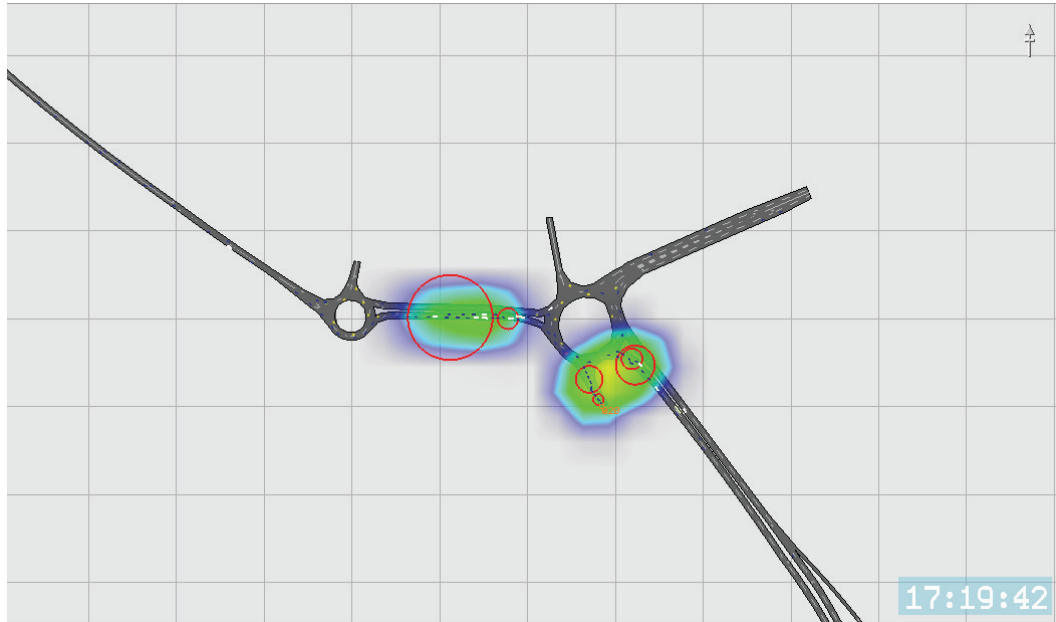
6.2.3   A4119/Talbot Road Signalised Crossroads

Extended queues and delay are identified at the A4119/Talbot Road signalised crossroads, particularly on the A4119 southbound approach. This is illustrated in Figure 6.6 and supported by the junction model capacity assessment results (Section 4.3.7) which indicated that the junction is over capacity with a DOS of 103%-105% on the A4119 southbound approach.

Figure 6.7   *A4119/Talbot Road Signalised Crossroads capacity issues - PM*
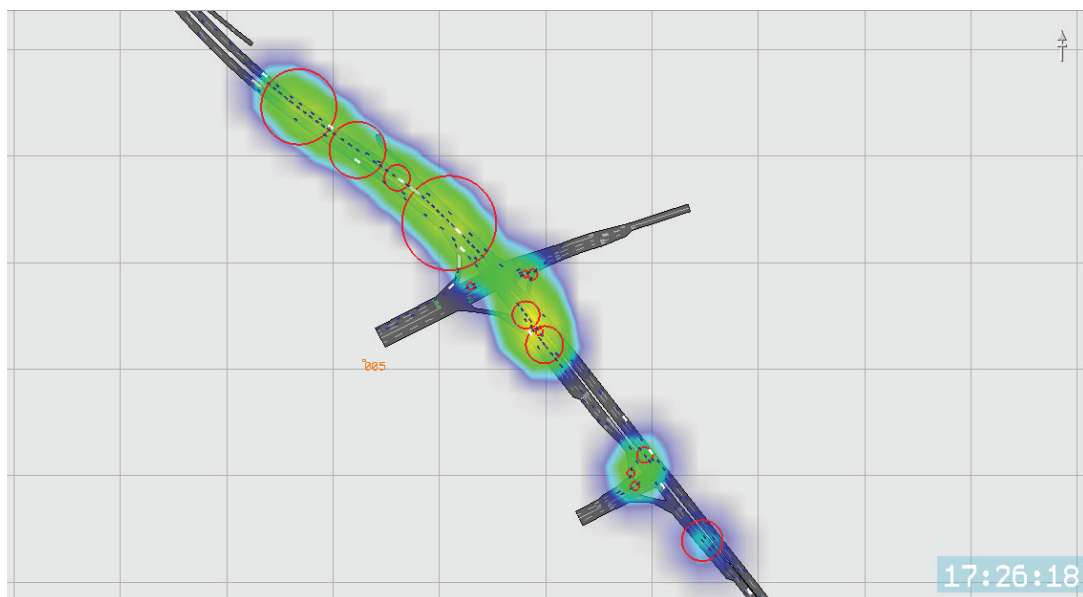
6.2.4   A4119 between Junction 34 of the M4 and the A4119/A473 roundabout

Moderate to large queues and delay are identified along the A4119 in a northbound direction. This is illustrated in the Paramics visualisation in figure 6.8 and supported by the junction model assessment results in Section 4.3.10 and 4.3.12 which indicate that the A4119/A473 and the A4119/A4119 Llantrisant Road junctions are operating at capacity with DOSs of 95% and 90% respectively.

Figure 6.8   **A4119 between Junction 34 of the M4 and the A4119/A473 roundabout capacity issues - PM**
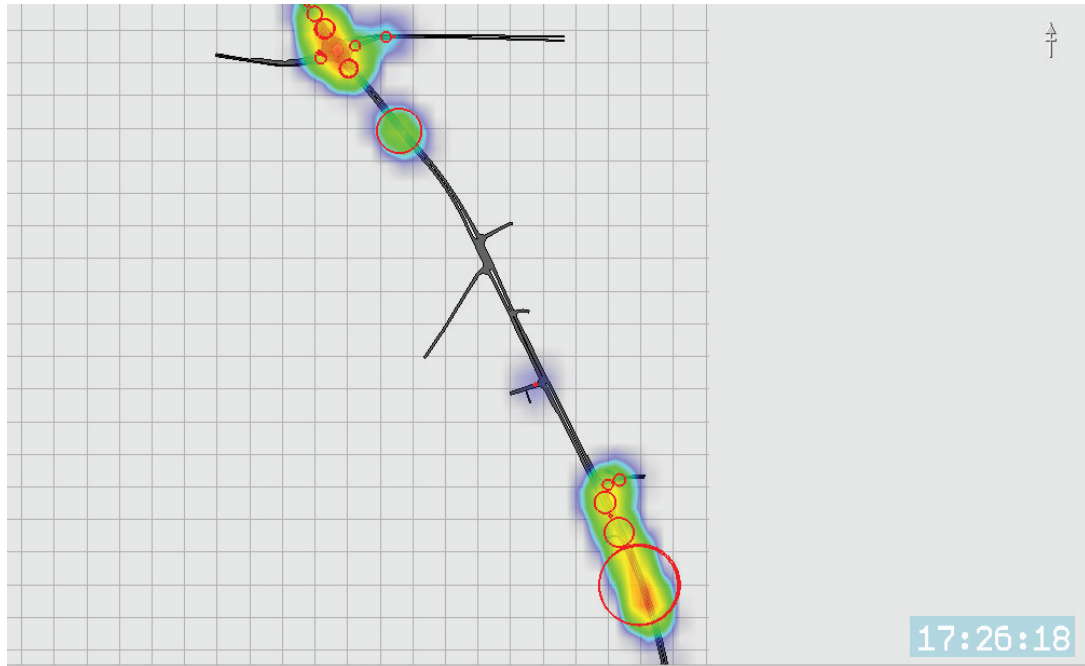
7. Forecast Traffic Demand Spreadsheet Model

7.1 Introduction

TAG Unit M4 Forecasting and Uncertainty gives practical guidance for producing traffic demand forecasts including developing a core scenario and producing an uncertainty log. TAG Unit M4 guidance has been followed in the development of the forecast matrix in order to provide a traffic forecast that is consistent with general practise that will also allow the appraisal of a transport intervention in accordance with Central Government requirements.

7.2 Scenarios

7.2.1 Core Scenario

TAG requires a Core Scenario which is based on the most unbiased and realistic set of assumptions that form the central case that is presented in appraisal. It should represent the best basis for decision-making given current evidence. The Core Scenario is based on:

- NTEM growth in demand

- Developments that are more than likely to occur

- Appropriate modelling assumptions.

A core scenario is presented for 2022, which is 5 years after the base model year and 2037 which is 20 years after the base model year. The Core Scenario contains the developments identified within the LDP with planning permissions and is constrained to NTEM growth.

7.3 Uncertainty and the Uncertainty Log

There are two potential sources of forecast error. These are uncertainty in inputs such as size of new housing and errors in model parameters and specification. This section summarises all known assumptions and uncertainties in the modelling and forecasting approach in an uncertainty log and includes an assessment of the likelihood for future change. The purpose of the uncertainty log is to record the central forecasting assumptions that underpin the Core Scenario and record the degree of uncertainty around these central assumptions.

The uncertainty log includes an assessment of the uncertainty of each individual input by placing it into one of four categories as shown in Table 7.1.

Table 7.1 Classification of Uncertainty Log Inputs

Probability of the input	Status
Near certain: The outcome will happen, or there is a high probability it will happen	Intent announced by proponent to regulatory agencies Approved development proposals Project under construction
More than likely: The outcome is likely to happen, but there is some uncertainty	Submission of planning or consent application imminent Development application within the consent process
Reasonably foreseeable: The outcome may happen, but there is significant uncertainty	Identified within a development plan Not directly associated with the transport strategy/scheme, but may occur if the strategy/scheme is implemented Development conditional upon the transport strategy/scheme proceeding A committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty
Hypothetical: There is considerable uncertainty whether the outcome will ever happen	Conjecture based upon currently available information Discussed on a conceptual basis One of a number of possible inputs in an initial consultation process A policy aspiration

All relevant developments have been collated and presented in this uncertainty log. The log is broken down into demand and supply, where 'supply' is transport schemes which alter network capacity, and 'demand' relates to new developments which have the potential to generate new trips on the transport network.

The key role of the uncertainty log is to detail the forecasting assumptions that form the core scenario, which is the most unbiased and realistic set of assumptions that will form the central case of the scheme appraisal. Only assumptions that are considered to be near certain or more than likely are included in the core scenario.

7.3.1   Transport Schemes Log

Table 7.2   Transport Schemes Log

Ref	Scheme	Year	Assumption	Uncertainty
T1	A4119/Unnamed Road/Arthur Llywelyn Jenkins Staggered Junction	Pre 2022	Included in Opening Year Model	Granted planning permission

7.3.2   Development Sites Log

The RCT LDP includes a proposals map which presents the areas of land which have been specifically allocated for development. The proposals map has been analysed in order to identify the developments that are likely to generate traffic that will impact upon the A4119 corridor. The developments identified are illustrated in Figure 7.1.

Figure 7.1   Proposals Map Development Sites
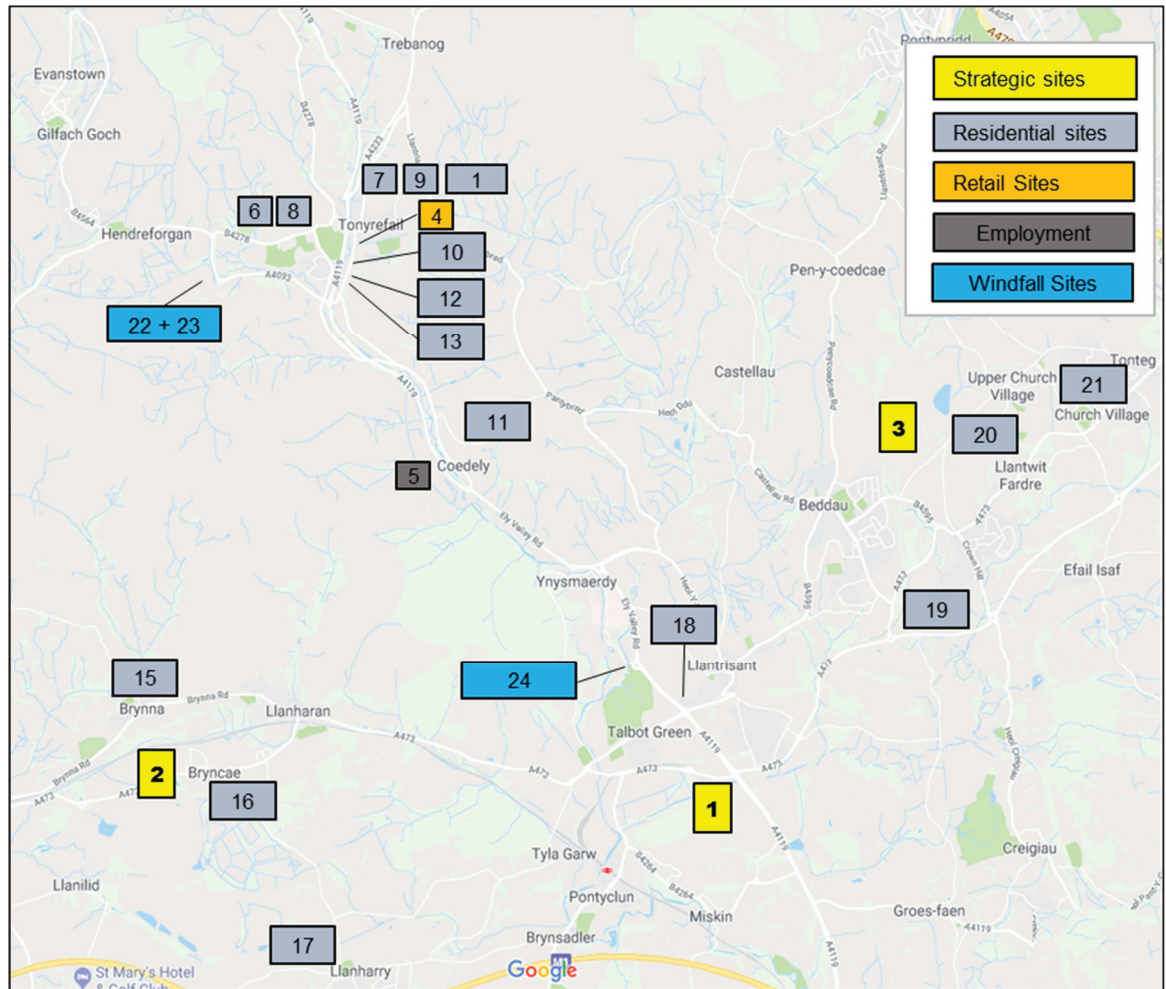
Google

Figure 7.1 shows that there is a total of 21 development sites that are likely to generate traffic that will impact upon the A4119 corridor. The sites consist of strategic, residential, retail and employment sites at various locations within the SSA. Discussions were held with RCTCBC Development Control department in order to classify sites in accordance with Table 3.1 above. Sites already constructed were also identified and removed from the study. The resulting site classification is presented in table 7.3.

Table 7.3   *Development Site Details*

Site No	Name	Location	Scale	Planning Status
Strategic Sites				
1	Mwyndu SSA 8	Talbot Green	500 dwellings, 15 hectares employment, 23,400m² retail floor space, 10,000m² leisure floor space, primary school, library/community space	Approved
2	Former OCC Site Llanhilid	Llanharan	1950 - 2100 dwellings, 2500m² retail floor space, medical centre, library/community centre, primary school	Approved
3	Cwm Colliery and Coking Works Site	Beddau	800 - 950 dwellings, 1.9 hectares of employment land, primary school	Approved
Retail Sites				
As (2) above	Former OCC Site Llanhilid	Llanharan	As specified above - 2500m²	Approved
4	Land east of Mill Street	Tonyrefail	2000m²	Approved
Employment Sites				
5	Coedely Employment Site	Tonyrefail	14.32 hectares	Approved
General Housing Allocations				
6	Trane Farm SSA 10.2	Tonyrefail	700 dwellings	Approved
7	Collenna Farm SSA 10.3	Tonyrefail	25 dwellings	Allocation only
8	Bryngolau SSA 10.4	Tonyrefail	50 dwellings	Approved
9	Hillside Club SSA 10.5	Tonyrefail	40 dwellings	Allocation only
10	Mill Street SSA 10.6	Tonyrefail	100 dwellings	Allocation only
11	Gwern Heulog Coedely SSA 10.7	Coedely	150 dwellings	Approved
12	Tylcha Wen Tce SSA 10.8	Tonyrefail	30 dwellings	Allocation only
13	Tylcha Ganol Farm SSA 10.9	Tonyrefail	85 dwellings	Allocation only
14	Hafod Wen SSA 10.10	Tonyrefail	100 dwellings	Allocation only
15	Brynna Road SSA 10.11	Brynna	200 dwellings	Allocation only
16	Dolau County SSA 10.12	Brynna	130 dwellings	Allocation only
17	Llechau SSA 10.13	Llanharry	90 dwellings	Allocation only
18	Penygawsi SSA 10.14	Llantrisant	40 dwellings	Allocation only
19	Brynteg Court SSA 10.15	Beddau	150 dwellings	Allocation only
20	Link Site SSA 10.16	Church village	160 dwellings	Approved
21	The Riddings SSA 10.18	Church Village	500 dwellings	Allocation only
Windfall Sites				
22	Parc Eirin	Tonyrefail	200 dwellings	Approved
23	Parc Eirin	Tonyrefail	3500m² employment	Approved
24	Magden Park	Talbot Green	2500m² retail	Approved

7.4 Forecast Matrix Development

7.4.1 Core Scenario

Planning Assumptions

TAG Unit M4 requires that growth in travel demand is constrained to growth in the National Trip End Model (NTEM) for the core scenario. NTEM forecasts growth in origin-destinations for use in transport modelling and considers national projections of population, employment, housing, car ownership, and trip rates. The NTEM dataset represents the DfT standard assumptions about growth in demand. NTEM guidance states that information about planned dwellings is derived from local authority plans and monitoring reports and based on targets/plans for the whole control area.

In order to constrain growth to NTEM and the area with development sites that will influence traffic demand on the A4119 the following NTEM zones have been used.

- W0200274
- W0200275
- W0200278
- W0200279
- W0200280
- W0200281
- W0200282

Figure 7.2   A4119 Area of Influence NTEM Zones
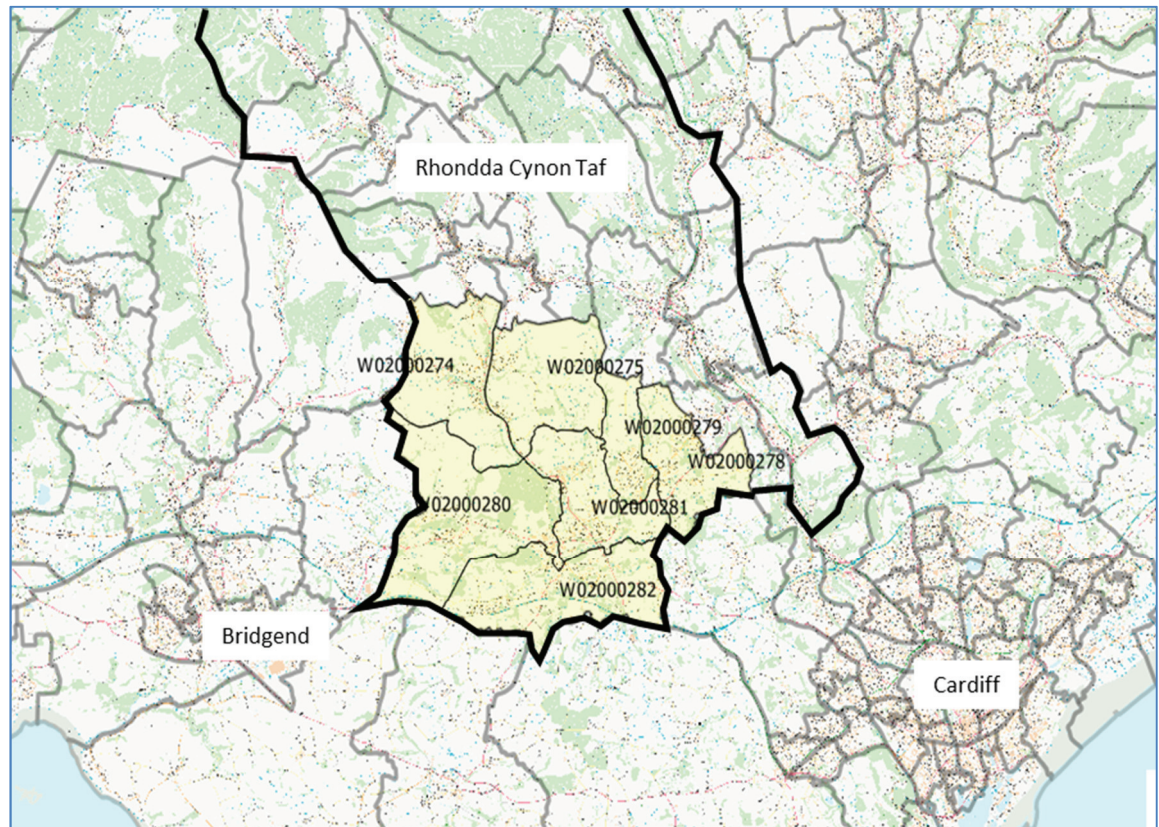
For the period from the base model year (2018) to the future assessment years 2022 and 2037 NTEM contains the following demographic projections for the zones identified above.

Table 7.4 NTEM Planning Projections

Year	Population	Households	Jobs	Workers
2018	59366	25234	27576	28289
2022	60126	25808	28014	28355
2037	59568	26607	29215	28097
Change 2018 - 2022	+760	+574	+438	+66.6
Change 2018 - 2037	+201	+1373	+1639	-192

A review of the LDP allocated development sites within the study area indicated that there are 5280 dwellings, 31 hectares of employment land and 27900m² of retail land to be developed. However, discussions with RCTCBC Development Control Department and a review of recent development completions in the area indicated that this is unlikely to be achieved within the assessed time period.

In order to estimate the likely number of future households an annual household build rate of 150 dwellings has been used. This is based on discussion with RCTCBC Development Control department as well as forecast household increase in NTEM for this area which is 72 households per year. This calculates to a forecast household increase of 2850 dwellings by 2037 which is closer to NTEM and recent completion levels. In addition, only the large employment development site (Site No 5 – Coedely Development Site) was included in the assessment, and the smaller employment sites and retail sites have been excluded. It has been assumed that Site 5 will be 50% constructed by 2022 and fully constructed by 2037.

7.4.2 Adjusting NTEM to incorporate land use developments

NTEM makes no assumptions about individual land use developments although adjustments can be made that remove them from NTEM trip end growth rates so that they can be included specifically within the transport model. As such the study area NTEM zones have had the relevant household and employment increase removed to provide an adjusted background growth. The resulting background growth rates are provided in table 7.5.

Table 7.5 NTEM and Adjusted Growth

Year	AM		PM	
	NTEM	Adjusted	NTEM	Adjusted
2018 – 2022	3.986%	2.767%	3.788%	2.423%
2018 – 2037	16.110%	12.853%	15.392%	11.800%

7.4.3 Development Trip Rates & Distribution

Where available, the traffic generated by the development sites identified above has been taken from the associated Transport Assessment. Alternatively, traffic generation has been estimated using industry standard software TRICS. A trip rate for each land use based on a suburban location outside London parameter has been produced using TRICS and is presented in Table 7.6. The full TRICS output is provided in Appendix E.

Table 7.6   *TRICS Trip Generation*

Land Use	Residential Trip Rates			Employment (Industrial Estate) Trip Rates		
	Arrivals	Departures	Total	Arrivals	Departures	Total
AM						
07:00-08:00	0.06	0.25	0.31	11.12	3.05	14.17
08:00-09:00	0.12	0.35	0.48	12.16	6.89	19.05
09:00-10:00	0.14	0.15	0.29	7.97	6.46	14.43
3 Hr Total	0.33	0.76	1.08	31.24	16.40	47.65
PM						
16:00-17:00	0.25	0.16	0.40	5.95	11.01	16.96
17:00-18:00	0.29	0.17	0.46	2.45	9.54	11.99
18:00-19:00	0.25	0.17	0.42	1.76	3.57	5.33
3 Hr Total	0.79	0.49	1.28	10.17	24.11	34.28

The trips estimated from development have been assigned onto the A4119 road network utilising first principles and the ANPR survey data. An estimate of the proportion of trips distributed to the A4119 corridor for each of the developments has been developed based on the proximity of the development to the A4119 corridor. For example, only 30% of trips generated at Site 2 (Former OCC Site – Llanharan) have been distributed to the A4119 as the site is over four miles from the A4119 corridor and the A473/Junction 35 of the M4 provides a feasible alternative access to the surrounding local and strategic road network.

The resulting trips are presented for 2022 and 2037 in tables 7.7 and 7.8 respectively.

Table 7.7   *LDP Development Site Trips - 2022*

Site No	Name	Location	Scale	Scale (adjusted to build rate)	% Travelling to A4119	Resulting Trips			
						AM		PM	
						In	Out	In	Out
Strategic Sites									
1	Mwyndu SSA 8	Talbot Green	500 dwellings	83	80	22	50	53	33
2	Former OCC Site Llanhilid	Llanharan	1950 dwellings	324	30	32	74	205	48
3	Cwm Colliery and Coking Works Site	Beddau	800 dwellings	133	30	13	182	32	20
Employment Sites									
5	Coedely Employment Site	Tonyrefail	14.32 hectares	7.16	100	224	235	73	173
General Housing Allocations									
6	Trane Farm SSA 10.2	Tonyrefail	700 dwellings	116	80	30	70	74	46
8	Bryngolau SSA 10.4	Tonyrefail	50 dwellings	8	80	2	5	5	3
11	Gwern Heulog Coedely SSA 10.7	Coedely	150 dwellings	25	80	6	15	16	10
20	Link Site SSA 10.16	Church village	160 dwellings	27	30	3	6	6	4
Windfall Sites									
22	Parc Eirin	Tonyrefail	200 dwellings	33	80	9	20	21	13
Total				750+(7.16 h)		340	657	484	348

Table 7.8   *LDP Development Site Trips - 2037*

Site No	Name	Location	Scale	Scale (adjusted to build rate)	% Travelling to A4119	Resulting Trips			
						AM		PM	
						In	Out	In	Out
Strategic Sites									
1	Mwyndu SSA 8	Talbot Green	500 dwellings	333	80	86	201	210	131
2	Former OCC Site Llanhilid	Llanharan	1950 dwellings	1297	30	126	295	820	191
3	Cwm Colliery and Coking Works Site	Beddau	800 dwellings	532	30	52	182	126	78
Employment Sites									
5	Coedely Employment Site	Tonyrefail	14.32 hectares	14.32	100	447	235	146	345
General Housing Allocations									
6	Trane Farm SSA 10.2	Tonyrefail	700 dwellings	466	80	121	282	294	183
8	Bryngolau SSA 10.4	Tonyrefail	50 dwellings	33	80	9	20	21	13
11	Gwern Heulog Coedely SSA 10.7	Coedely	150 dwellings	100	80	26	60	63	39
20	Link Site SSA 10.16	Church village	160 dwellings	106	30	10	24	25	16
Windfall Sites									
22	Parc Eirin	Tonyrefail	200 dwellings	133	80	35	81	84	52
Total				3000+ (14.32 h)		913	1380	1789	1048

The trips calculated above have been distributed to the A4119 corridor in accordance with the origin and destination patterns identified within the ANPR survey data.

7.4.4   Total Growth

Following the addition of background growth and development trips to the demand matrix a comparison has been made between the final growth rate produced and the NTEM forecast growth. The differences are presented in tables 7.9 and 7.10.

Table 7.9   Manual and NTEM growth comparison (2018 – 2022)

	Manual Growth	NTEM Growth	Difference
AM	8.0%	3.9%	4.1%
PM	6.0%	3.8	2.2%

Table 7.10   Manual and NTEM growth comparison (2018 – 2037)

	Manual Growth	NTEM Growth	Difference
AM	26.1%	16.1%	10.0%
PM	25.3%	15.4%	9.9%

Table 7.9 and 7.10 show that the growth in traffic demand produced using the manual addition methodology results in a higher growth rate. As such the manual growth rate has been factored down so that it is constrained to NTEM growth in accordance with WebTAG guidance. It should be noted that these growth rates assume that there is no significant change in the generalised cost of travel that could be caused by significant congestion for example.

8. Forecast A4119 Corridor Operation

The forecast demand matrices have been assigned to the microsimulation model and the operation of the model has been reviewed in order to understand how the A4119 corridor will operate in 2022 (base + 5 years' time) and 2037 (base + 20 years' time).

8.1 2022 Future Assessment Year

8.1.1 AM Peak Hour (08:00 – 09:00)

Journey Times

The zone to zone journey times within the model have been analysed in order to identify journeys that have increased in duration. The journey time comparison is presented in table 8.1. A conditional format has been applied to the table based on a red colour scale so that the largest numbers are highlighted in dark red (not including the row and column Zone numbers).

Table 8.1   Zone to zone journey time comparison – AM 2018-2022 (difference in seconds)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	0	-1	54	23	74	0	36	61	28	76	3	0	274	119	0	0	10	-18	0	-34	0	13	3	78	55	17	-77
2	-1	0	26	22	73	-7	45	52	82	180	0	0	217	154	0	-22	23	44	0	62	0	39	22	40	18	52	21
3	-2	1	0	0	-11	24	27	26	66	96	79	0	230	108	0	0	35	25	0	0	0	1	51	0	33	1	-23
4	2	0	0	0	0	24	0	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	26	0	0	-5	0
5	13	0	5	-7	0	17	17	12	20	0	94	0	136	55	0	0	4	18	0	0	0	11	-2	0	-3	6	9
6	-10	18	-10	0	-1	0	21	18	-6	70	25	0	140	27	0	0	4	15	0	-1	0	0	-10	0	0	0	1
7	-3	-4	4	37	4	14	0	46	5	49	34	0	134	66	0	0	-19	7	0	-3	0	0	4	5	-5	19	9
8	32	33	23	0	-13	43	20	0	-11	69	0	0	146	16	0	-5	-31	22	0	-15	0	-5	1	20	35	-11	42
9	67	28	47	0	28	56	73	16	0	61	15	0	112	35	0	24	3	-7	0	25	0	0	40	64	43	68	101
10	44	91	64	0	61	46	49	45	28	0	0	0	99	54	0	72	40	38	0	0	0	0	74	0	9	80	94
11	0	0	0	0	47	162	0	21	33	0	0	0	111	3	-19	0	19	40	0	0	0	0	96	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	115	96	125	0	113	112	142	97	53	44	17	2	0	75	24	88	31	98	0	16	0	80	114	116	123	139	117
14	64	126	79	0	76	87	119	106	46	29	10	0	59	0	11	0	38	49	0	0	0	0	133	127	60	70	64
15	136	122	93	0	0	98	0	58	17	0	0	0	136	0	0	0	37	0	0	0	0	0	0	0	0	100	0
16	0	0	0	0	0	0	163	56	42	133	0	0	147	0	0	0	83	0	0	0	0	0	0	0	0	0	0
17	144	141	137	0	108	152	108	86	56	107	79	0	203	94	0	89	0	106	0	110	0	0	139	116	126	98	100
18	-11	-17	22	0	0	-9	8	0	9	84	77	0	145	13	0	2	-3	0	0	-21	0	0	17	-5	-11	6	11
19	0	-16	0	0	52	48	3	-26	-3	100	0	0	200	54	0	0	-13	14	0	0	0	0	109	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	10	0	15	0	-3	-5	-39	25	0	0	0	147	0	0	0	1	0	0	0	0	0	12	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	2	-9	5	-8	3	2	9	17	-7	104	24	0	153	30	0	0	2	-123	0	-18	0	-13	0	0	-6	-6	12
24	0	0	0	0	-35	0	-82	-6	-9	0	0	0	230	0	0	0	68	-8	0	0	0	0	-2	0	96	0	-42
25	8	-47	-8	0	58	0	-2	0	11	0	0	0	0	0	0	0	-3	0	0	0	0	0	-3	0	0	0	0
26	50	18	0	-5	-35	7	2	18	36	70	0	0	144	44	0	53	13	22	0	0	44	32	0	34	0	22	
27	-24	10	9	-11	25	23	36	19	30	87	19	0	188	50	0	0	57	39	0	0	-30	22	10	26	-19	0	

The following journey time patterns are identified in Table 8.1:

- Journeys to and from Zone 13 are forecast to experience the largest increase in journey time with all journeys experiencing an increase. This is primarily due to the signalised junction that is proposed at the Cardiff Road/Arthur Llywelyn Jenkins access staggered junction. However, increased queues and delay that are generated as a result of the increased number of vehicles travelling to zone 13 will also contribute to this.

- Journeys from Zone 17 (A473 East) are forecast to experience a moderate to large increase in journey time. This is due to the proposed development and associated traffic demand that is forecast to originate at this location.

- Journeys from zones 1, 2 and 3 to 8, 9 and 10 are forecast to experience a moderate increase in journey time. This is due to the additional demand from zones near Tonyrefail and the congestion that is generated near Junction 2 (Tonyrefail) and Junction 3 (Coedely).

- There are a small number of journeys which benefit from a marginally reduced journey time. This is due to improved access to the network in cases such as Zone 10, where the junction has become signalised, and at zone 5, where vehicles benefit from the upstream or downstream junction blocking back and vehicles allowing courtesy let-out manoeuvres into the network.

A comparison of major route journey time has been undertaken and is presented in table 8.2.

Table 8.2   Major Route Journey Time Comparison – AM 2022

Route	2018 Journey Time	2022 Journey Time	Difference (s)	Difference (%)
North (Jct 1) To Middle (Jct 10)	767	814	47	6%
Middle (Jct 10) to North (Jct 1)	551	579	28	5%
Middle (Jct 10) to South (M4)	420	709	289	69%
South (M4) to Middle (Jct 10)	264	293	29	11%

Table 8.2 shows that the largest increase is forecast to occur to journeys from the middle of the network (Junction 10) to the south (Jct 34 of M4) with an increase of 289 seconds (69%).

Queues

A review of the change in queue length was undertaken. It was found that the average maximum queue at the following locations are forecast to increase the most by 2022.
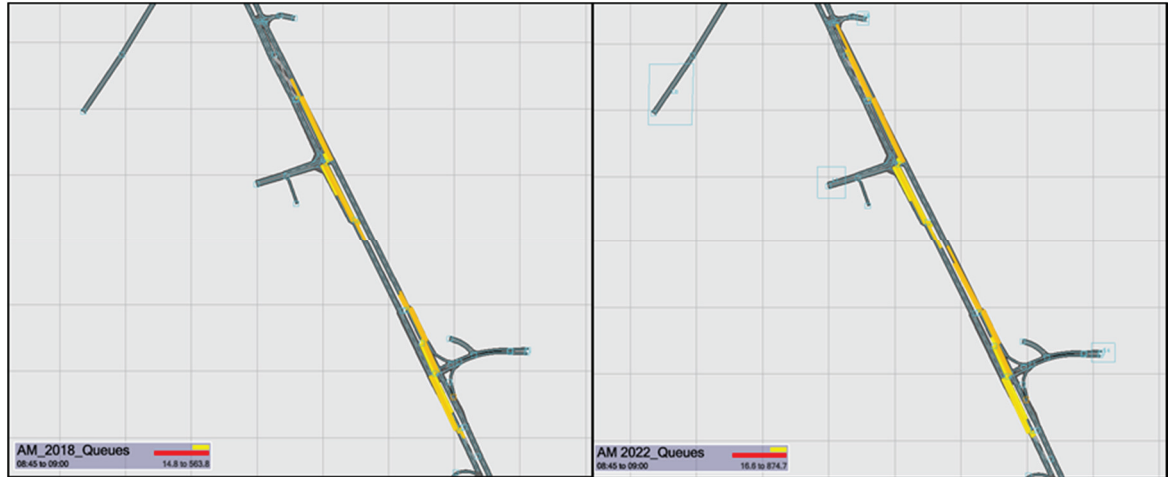
- A4119 Southbound approach to Junction 2 is forecast to increase by 4 vehicles.

Figure 8.1   A4119 Southbound approach to Junction 2 - AM Average Maximum Queue

- A4119 Southbound approach to Junctions 12 and 13 is forecast to increase by 7 and 5 vehicles respectively.

Figure 8.2   A4119 Southbound approach to Junctions 12 and 13 - AM Average Maximum Queue

8.1.2   PM Period (16:45 – 17:45)

Journey Times

The journey time comparison for the PM period is presented in table 8.3.

Table 8.3   Zone to zone journey time comparison – PM 2018-2022 (difference in seconds)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	0	2	1	12	13	0	-11	39	58	199	0	0	97	201	0	0	-30	71	0	38	0	74	10	0	-1	-2	-5
2	0	0	2	12	14	22	65	62	72	157	46	0	148	141	0	0	64	56	0	28	0	-4	20	14	0	-1	-3
3	2	-1	0	5	4	17	170	37	74	159	46	0	165	177	0	0	-18	88	0	50	0	0	4	0	0	3	20
4	91	88	91	0	0	0	0	-39	0	0	0	0	147	0	0	0	0	0	0	0	0	1	0	0	0	114	0
5	43	66	96	0	0	-39	-50	67	-13	-6	-11	0	-15	65	0	0	21	-46	0	0	0	-164	-43	0	0	-65	-20
6	233	252	310	0	0	0	183	171	159	348	185	0	129	207	0	0	236	168	0	141	0	0	136	0	0	0	206
7	188	166	122	102	46	69	0	48	41	204	110	0	72	154	0	55	-16	19	0	123	0	73	72	57	-68	146	70
8	73	137	127	0	7	9	2	0	-1	122	69	0	105	94	0	0	-1	23	0	57	0	0	-8	0	0	106	22
9	141	100	59	0	25	13	6	2	0	113	58	0	74	63	0	45	5	16	0	25	0	-27	3	0	0	105	46
10	110	68	93	31	33	1	72	55	9	0	0	0	11	42	0	-2	26	2	0	0	0	0	-47	-165	0	133	62
11	54	200	0	0	74	0	67	116	100	0	0	0	20	13	23	88	75	23	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	249	222	239	101	121	158	54	100	94	83	31	33	0	43	0	135	90	82	0	99	0	88	149	200	73	224	140
14	193	246	105	0	81	40	83	81	71	104	36	0	-5	0	0	0	87	82	0	84	0	0	40	0	0	177	128
15	180	166	169	0	0	0	80	72	54	20	0	0	0	0	0	0	40	0	0	0	0	0	83	0	0	255	32
16	0	236	263	0	0	0	0	94	33	167	0	0	93	76	0	0	62	100	0	0	0	0	0	0	0	0	97
17	135	76	126	0	19	32	32	25	25	138	80	0	83	86	0	52	0	25	0	77	0	54	50	0	0	243	30
18	90	104	151	0	45	21	13	18	8	136	65	0	87	80	0	0	13	0	0	154	0	251	-28	0	93	65	36
19	119	0	0	0	0	0	-31	20	13	128	0	0	80	85	0	0	-1	0	0	0	0	0	9	0	0	78	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	139	0	-4	0	-2	110	5	-38	0	0	0	116	65	0	0	12	-25	0	37	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	84	105	158	-52	4	4	40	8	32	156	0	0	109	108	0	0	42	24	0	5	0	2	0	-1	7	109	3
24	114	98	114	0	-8	0	11	0	46	0	0	0	100	145	0	0	48	78	0	44	0	0	0	0	0	0	5
25	114	130	111	0	17	0	18	118	-6	55	0	0	138	107	0	0	21	108	0	0	0	0	2	11	0	183	37
26	1	0	-2	7	0	0	45	21	48	165	0	0	104	62	0	0	-64	-60	0	7	0	40	10	0	12	0	36
27	41	95	143	0	2	5	27	117	107	158	0	0	101	120	0	0	73	80	0	32	0	-1	1	0	0	65	0

The following journey time patterns are identified in Table 8.3:

- Journeys to Zones 1, 2 and 3 are forecast to experience the largest increase in journey time with the vast majority of journeys experiencing a large increase. This is due to the congestion and delay that occurs at the A4119 northbound approach to Junction 2 at Tonyrefail and Junction 5 (Royal Glamorgan Hospital);

- Journeys from Zone 6 (Magden Park) are forecast to experience a significant increase in journey time. This is due to the increased traffic demand that is passing the entrance to the Magden Park business park reducing the opportunity for vehicles to exit;

- Journeys times to and from zones 10, 13 and 14 are forecast to increase at a moderate level. This is due to the signalised junction that is proposed at the Cardiff Road/Arthur Llywelyn Jenkins access staggered junction, and the increased queues and delay that are generated as a result of increased traffic travelling on the A4119 at this location; and

- There are a small number of journeys which benefit from a marginally reduced journey time. This is due to improved access to the network in cases such as Zone 10, where the junction has become signalised, and at zone 5, where vehicles benefit from the upstream or downstream junction blocking back and allowing courtesy let-out manoeuvres into the network.

A comparison of major route journey time for the PM peak hour is presented in table 8.4.

Table 8.4   Major Route Journey Time Comparison – PM 2022

| Route	2018 Journey Time	2022 Journey Time	Difference (s)	Difference (%)
North (Jct 1) To Middle (Jct 10)	691	766	22	3%
Middle (Jct 10) to North (Jct 1)	830	949	63	7%
Middle (Jct 10) to South (M4)	276	359	36	11%
South (M4) to Middle (Jct 10)	363	460	107	30%

Table 8.4 shows that the largest increase is forecast to occur to journeys from the south of the network (M4) to the middle (Junction 10) with an increase of 107 seconds (30%).

Queues

A review of the change in queue length was undertaken. It was found that the queue at the following locations are forecast to increase the most by 2022.

- The average queue at the A4119 northbound approach to Junction 2 is forecast to increase by 13 vehicles.

Figure 8.3   A4119 Northbound approach to Junction 2 - PM Average Maximum Queue
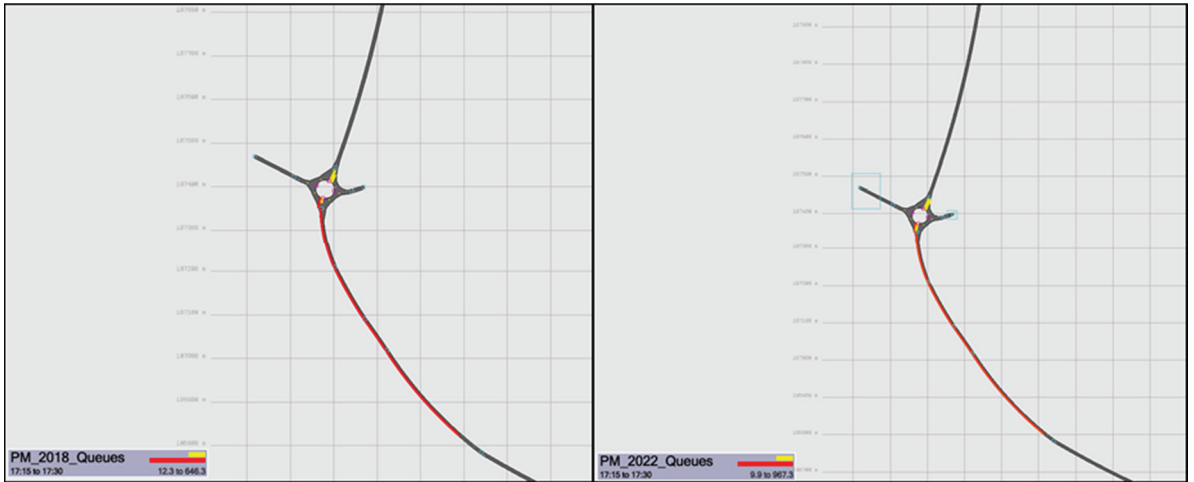

- The average queue at the A4119 southbound approach to Junctions 7 is forecast to increase by 15 vehicles

Figure 8.4   A4119 Southbound approach to Junction 7 - PM Average Maximum Queue

- The average queue at the A4119 northbound approach to Junctions 13 is forecast to increase by 13 vehicles.

Figure 8.5   *A4119 northbound approach to Junction 13 - PM Average Maximum Queue*
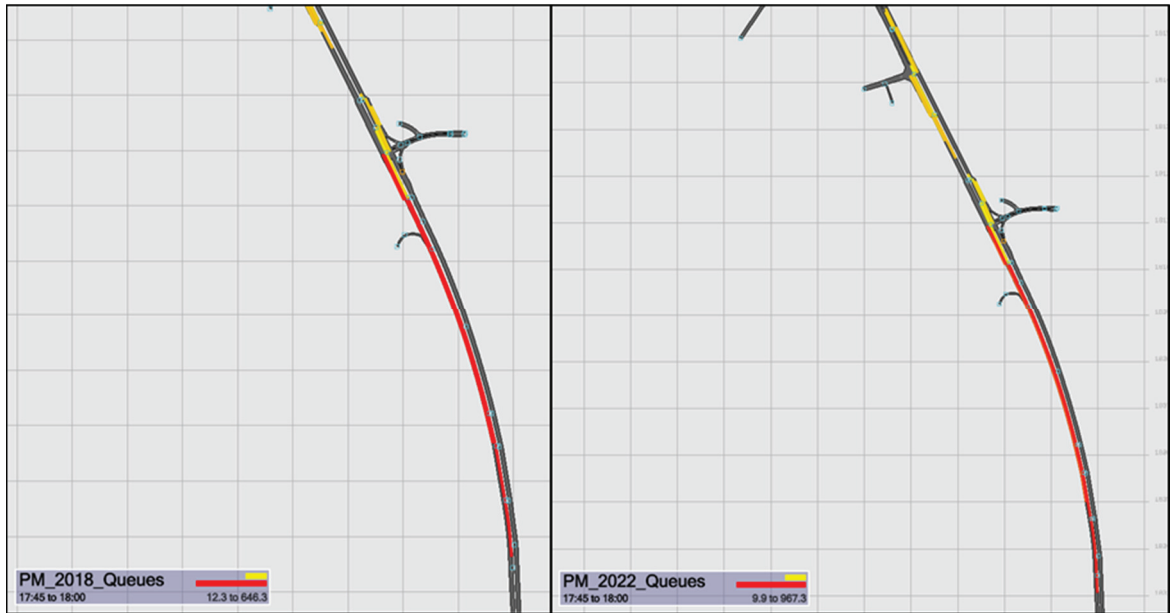
8.2   2037 Future Assessment Year

8.2.1   *AM Peak Hour (08:00 – 09:00)*

Journey Times

The journey time comparison for the 2037 AM peak hour is presented in table 8.5.

Table 8.5   *Zone to zone journey time comparison – AM 2018-2037 (difference in seconds)*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	0	355	339	503	704	0	687	767	924	1160	1751	0	1487	1393	0	0	743	748	0	998	0	704	619	581	614	415	339
2	70	0	317	432	593	510	586	829	842	1246	0		1716	1193	0	757	635	416	0	601	0	555	522	485	530	299	385
3	71	72	0	142	256	299	291	252	381	686	857	0	909	708	0	0	352	284	0	0	0	158	321	0	268	54	181
4	6	4	3	0	0	112	0	0	126	0	0	0	0	0	0	0	0	0	0	0	0	0	121	0	0	-2	0
5	86	18	44	75	0	9	16	11	22	0	612	0	740	498	0	0	70	-22	0	0	0	-9	1	0	1	34	183
6	138	151	91	0	1	0	23	-5	32	280	522	0	697	499	0	0	76	43	0	1	0	0	-10	0	0	0	29
7	100	97	70	65	54	68	0	61	74	242	429	0	743	499	0	0	67	38	0	67	0	0	53	59	62	103	85
8	112	101	109	0	62	50	23	0	49	243	0	0	796	506	0	236	25	47	0	158	0	183	57	46	62	134	165
9	197	146	204	0	196	174	189	139	0	185	234	0	608	353	0	150	24	108	0	119	0	0	129	134	129	135	323
10	273	258	161	0	228	183	122	94	61	0	0	0	442	197	0	113	62	163	0	0	0	0	114	0	97	114	143
11	0	0	0	0	160	316	0	120	87	0	0	0	383	169	123	0	167	363	0	0	0	0	427	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	789	663	726	0	680	686	711	639	520	415	416	294	0	794	457	476	484	667	0	574	0	657	759	700	815	767	757
14	447	380	481	0	466	445	353	399	296	175	151	0	355	0	105	0	258	353	0	0	0	0	509	355	393	428	406
15	221	178	260	0	0	241	0	158	42	0	0	0	424	0	0	0	47	0	0	0	0	0	0	0	0	191	0
16	0	0	0	0	0	0	698	632	365	296	0	0	1257	0	0	0	675	0	0	0	0	0	0	0	0	0	0
17	581	673	691	0	607	587	593	546	424	692	794	0	1185	883	0	837	0	588	0	612	0	0	605	648	638	610	567
18	39	69	103	0	54	1	3	7	43	244	403	0	697	508	0	217	78	0	0	13	0	0	38	20	9	124	69
19	0	274	0	0	227	120	-9	-9	36	188	0	0	628	545	0	0	55	4	0	0	0	0	0	33	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	192	0	46	0	-5	-29	10	30	0	0	0	797	0	0	0	83	0	0	0	0	0	31	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	47	10	62	84	-1	12	14	24	45	329	398	0	834	531	0	0	76	-95	0	33	0	-13	0	0	1	58	50
24	0	-40	0	0	-46	0	-93	-15	36	0	0	0	751	0	0	0	62	-28	0	0	0	0	25	0	34	0	9
25	65	23	66	0	128	0	77	0	26	0	0	0	1802	0	0	0	6	0	0	0	0	0	-19	0	0	0	0
26	26	-6	8	90	158	185	175	212	307	515	0	0	1036	720	0	610	296	202	0	0	0	270	194	0	176	0	90
27	55	31	44	47	148	157	160	131	177	482	400	0	863	611	0	0	189	196	0	0	0	108	137	98	118	134	0

The following journey time patterns are identified in Table 8.5:

- Journeys to and from Zone 13 are forecast to experience the largest increase in journey time with all journeys experiencing an increase. This is primarily due to the large increase in traffic that is forecast to travel towards Zone 13 (Junction 34 of M4) and the fact that a number of the junctions along this route are forecast to operate over capacity. It is also in-part due to the signalised junction that is proposed at the Cardiff Road/Arthur Llywelyn Jenkins access staggered junction, and the associated increased queues and delay.

- Journeys from zones 1, 2 and 3 are forecast to experience a significant increase in journey time. This is due to the additional demand from zones near Tonyrefail and the congestion that is generated near Junction 2 (Tonyrefail) and Junction 3 (Coedely).

- Journeys from Zone 17 (A473 East) are forecast to experience a moderate to large increase in journey time. This is due to the proposed development and associated traffic demand that is forecast to originate at this location and the operation of the A4119/A473 roundabout.

- There are a small number of journeys which benefit from a marginally reduced journey time. This is due to improved access to the network in cases such as Zone 10, where the junction has become signalised, and at zone 5, where vehicles benefit from the upstream or downstream junction blocking back and allowing courtesy let-out manoeuvres into the network.

A comparison of major route journey time for the AM peak in 2037 has been undertaken and is presented in table 8.6.

Table 8.6   Major Route Journey Time Comparison – AM 2037

Route	2018 Journey Time	2037 Journey Time	Difference (s)	Difference (%)
North (Jct 1) To Middle (Jct 10)	767	1441	674	88%
Middle (Jct 10) to North (Jct 1)	551	690	139	25%
Middle (Jct 10) to South (M4)	420	1115	695	165%
South (M4) to Middle (Jct 10)	264	711	447	169%

Table 8.6 shows that the largest increase in journey time is forecast to occur to journeys from the middle of the network (Junction 10) to the south (M4) and vice versa with an increase of 695 seconds (165%) and 447 (169%) respectively.

Queues

A review of the change in queue length was undertaken. It was found that during the AM peak hour the average maximum queue at the following locations are forecast to increase the most by 2037.

- A4119 southbound approach to Junction 2 and Junction 3 is forecast to increase by 32 vehicles and 14 vehicles respectively.

Figure 8.6   A4119 southbound approach to Junction 2 - AM Average Maximum Queue
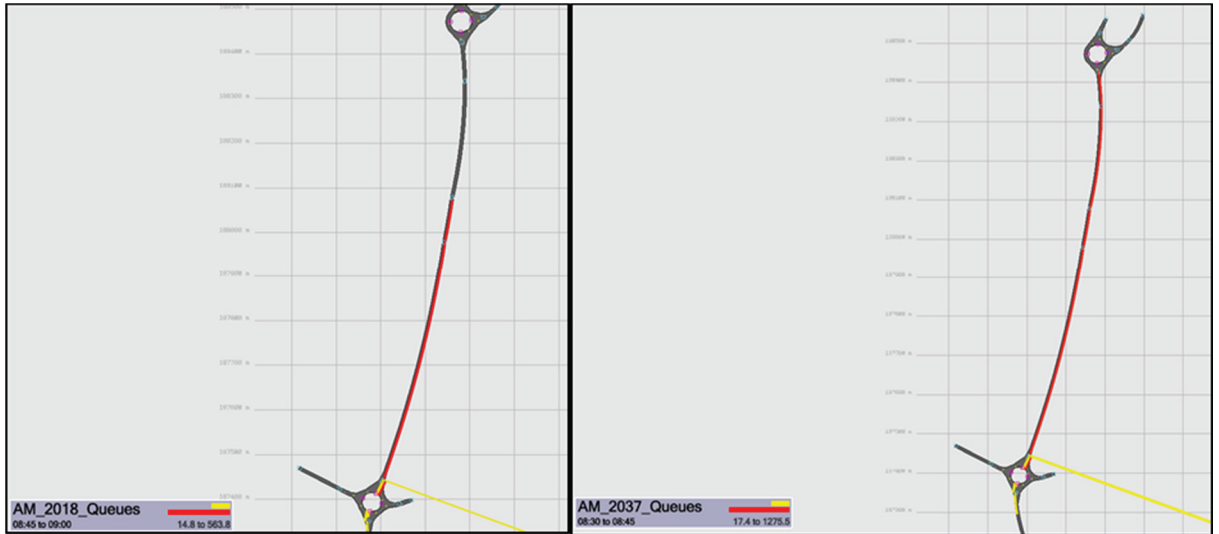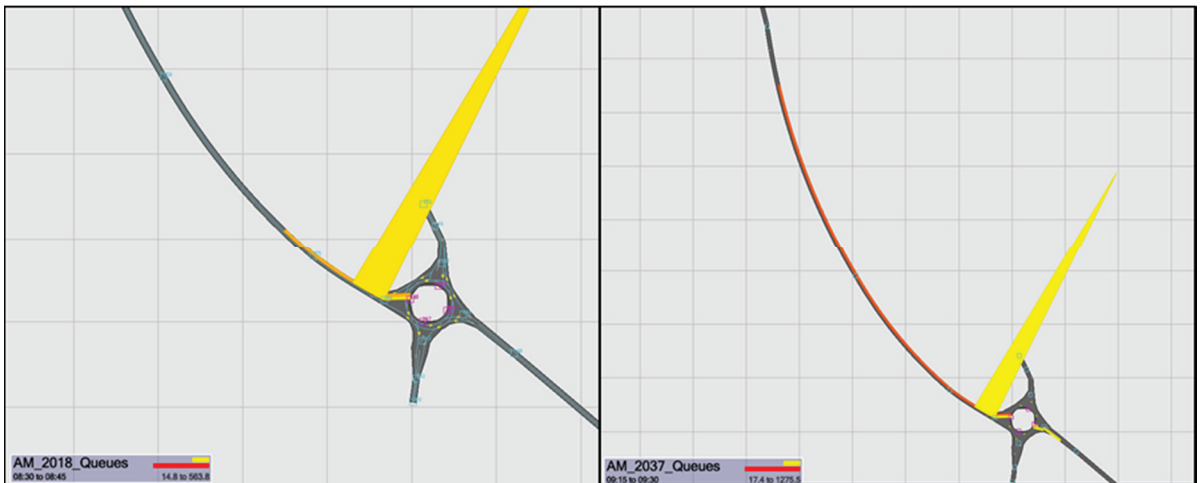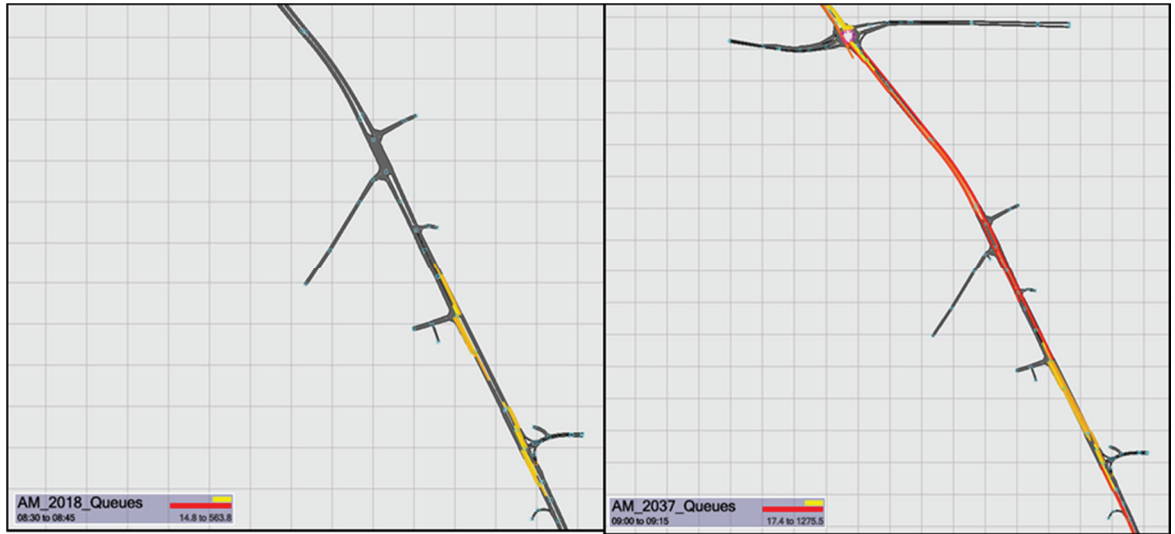

*Figure 8.7   A4119 southbound approach to Junction 3 - AM Average Maximum Queue*

- The average queue at the A4119 Southbound approach to Junctions 12 and 13 is forecast to increase by 43 and 46 vehicles respectively.

Figure 8.8   ***A4119 southbound approach to Junctions 12 and 13 - AM Average Maximum Queue***

- The number of vehicles queuing on the A4119 northbound approach to Junction 13 is forecast to increase by 16 vehicles.

Figure 8.9   ***A4119 northbound approach to Junction 13 - AM Average Maximum Queue***
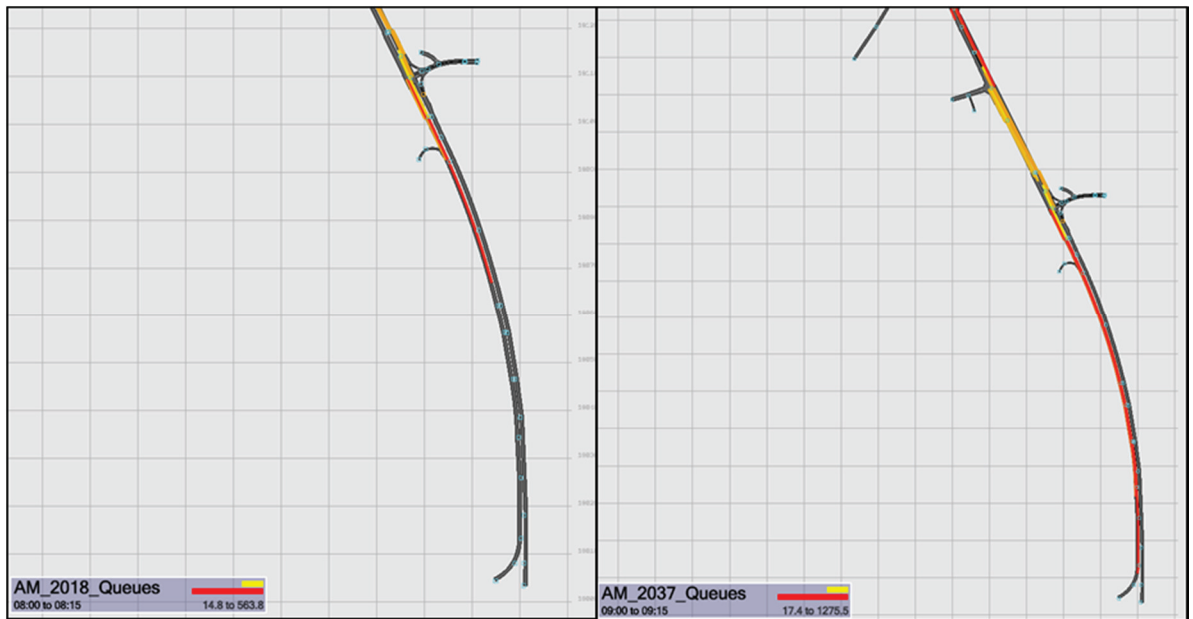
8.2.2   *PM Peak Hour (16:45 – 17:45)*

Journey Times

The journey time comparison for the PM period is presented in table 8.7.

Table 8.7   *Zone to zone journey time comparison – PM 2018-2037 (difference in seconds)*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	0	4	4	44	29	0	345	359	407	531	0	0	469	409	0	0	484	276	0	125	0	27	24	0	30	-1	27
2	0	0	6	39	40	194	274	360	422	542	455	0	552	581	0	0	411	307	0	204	0	4	38	46	0	1	38
3	0	1	0	41	32	221	383	327	382	525	597	0	531	655	0	0	286	235	0	186	0	0	36	0	0	11	44
4	371	369	374	0	0	0	0	235	0	0	0	0	489	0	0	0	0	0	0	0	0	21	0	0	0	403	1
5	531	720	629	0	0	352	353	290	512	567	625	0	531	569	0	0	625	270	0	0	0	125	166	0	0	629	318
6	912	931	944	0	0	0	522	507	572	779	733	0	668	763	0	0	646	495	0	421	0	0	527	0	0	0	484
7	747	609	573	225	223	200	0	145	248	338	245	0	350	395	0	375	264	104	0	142	0	269	251	233	43	681	225
8	1256	1045	1049	0	453	535	470	0	497	666	636	0	685	686	0	0	610	491	0	517	0	0	485	0	0	925	648
9	533	612	439	0	62	-10	-2	2	0	186	173	0	164	159	0	123	8	13	0	52	0	53	30	0	0	506	157
10	550	567	610	350	67	30	78	53	27	0	0	0	61	15	0	-12	27	46	0	0	0	0	80	-45	0	696	335
11	523	725	0	0	196	0	202	178	153	0	0	0	60	31	55	141	127	174	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1155	1324	1100	779	661	592	519	582	539	636	471	484	0	458	0	567	585	643	0	565	0	814	741	635	796	1218	742
14	1087	1039	880	0	439	365	419	449	469	422	347	0	340	0	0	0	425	451	0	433	0	0	521	0	0	814	673
15	605	632	674	0	0	0	131	128	89	26	0	0	0	0	0	0	78	0	0	0	0	0	144	0	0	709	208
16	0	636	572	0	0	0	0	129	120	175	0	0	132	121	0	0	88	40	0	0	0	0	0	0	0	0	202
17	911	798	892	0	423	321	282	332	357	392	380	0	395	419	0	321	0	324	0	438	0	441	398	0	0	1037	624
18	566	575	505	0	82	39	17	15	133	291	206	0	254	225	0	0	170	0	0	107	0	-62	40	0	73	503	169
19	658	0	0	0	0	0	-55	9	83	269	0	0	198	185	0	0	97	3	0	0	0	112	0	0	592	0	
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	501	0	141	0	40	151	183	618	0	0	0	441	337	0	0	231	67	0	408	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	476	460	513	62	6	54	192	201	299	422	0	0	417	428	0	0	356	112	0	169	0	14	0	2	25	448	110
24	467	454	471	0	-14	0	199	0	273	0	0	0	427	447	0	0	483	183	0	167	0	0	2	0	0	0	59
25	431	501	472	0	59	0	307	322	252	457	0	0	461	375	0	0	307	213	0	0	0	0	25	56	0	541	80
26	3	4	3	42	23	0	286	114	395	455	0	0	520	518	0	0	227	221	0	220	0	42	24	0	39	0	24
27	341	330	461	2	4	130	267	364	323	465	0	0	429	479	0	0	419	158	0	238	0	8	3	0	0	365	0

The following journey time patterns are identified in Table 8.7:

- Journeys to Zones 1, 2 and 3 are forecast to experience the largest increase in journey time with the vast majority of journeys experiencing a large increase. This is due to the congestion and delay that occurs at the A4119 northbound approach to Junction 2 at Tonyrefail and Junction 5 (Royal Glamorgan Hospital);

- Journeys from Zone 6 (Magden Park) are forecast to experience a significant increase in journey time. This is due to the increased traffic demand that is passing the entrance to the Magden Park business park reducing the opportunity for vehicles to exit.

- Journey times to and from zones 10, 13 and 14 are forecast to increase significantly. This is due to the increased traffic demand travelling to and from these locations and the fact that the junctions along the A4119 operate over capacity at this location. The signalised junction that is proposed at the Cardiff Road/Arthur Llywelyn Jenkins access staggered junction and the associated increase in queues and delay will also contribute to this.

- Journey times to zones 7, 8, 9 and 17 are forecast to experience a moderate increase. This is due to the increased congestion and delay that is forecast on the A4119 between the A4119/A473 roundabout (Junction 10) and the A4119/Talbot Road signalised crossroads (Junction 7).

- There are a small number of journeys which benefit from a marginally reduced journey time. This is due to improved access to the network in cases such as Zone 10, where the junction has become signalised, and at zone 5, where vehicles benefit from the upstream or downstream junction blocking back and allowing courtesy let-out manoeuvres into the network.

A comparison of major route journey time for the PM peak hour in 2037 is presented in table 8.8.

Table 8.8   *Major Route Journey Time Comparison – PM 2037*

Route	2018 Journey Time	2037 Journey Time	Difference (s)	Difference (%)
North (Jct 1) To Middle (Jct 10)	691	1143	399	54%
Middle (Jct 10) to North (Jct 1)	830	1364	478	54%
Middle (Jct 10) to South (M4)	276	477	154	48%
South (M4) to Middle (Jct 10)	363	626	273	77%

Table 8.8 shows that the largest increase is forecast to occur to journeys from the south of the network (M4) to the middle (Junction 10) with an increase of 273 seconds (77%).

Queues

A review of the change in queue length was undertaken. It was found that the queue at the following locations are forecast to increase the most by 2022.

- The average queue at the A4119 northbound approach to Junction 2 and Junction 3 is forecast to increase by 24 vehicles and 10 vehicles respectively.

Figure 8.10   *A4119 northbound approach to Junction 2 - PM Average Maximum Queue*
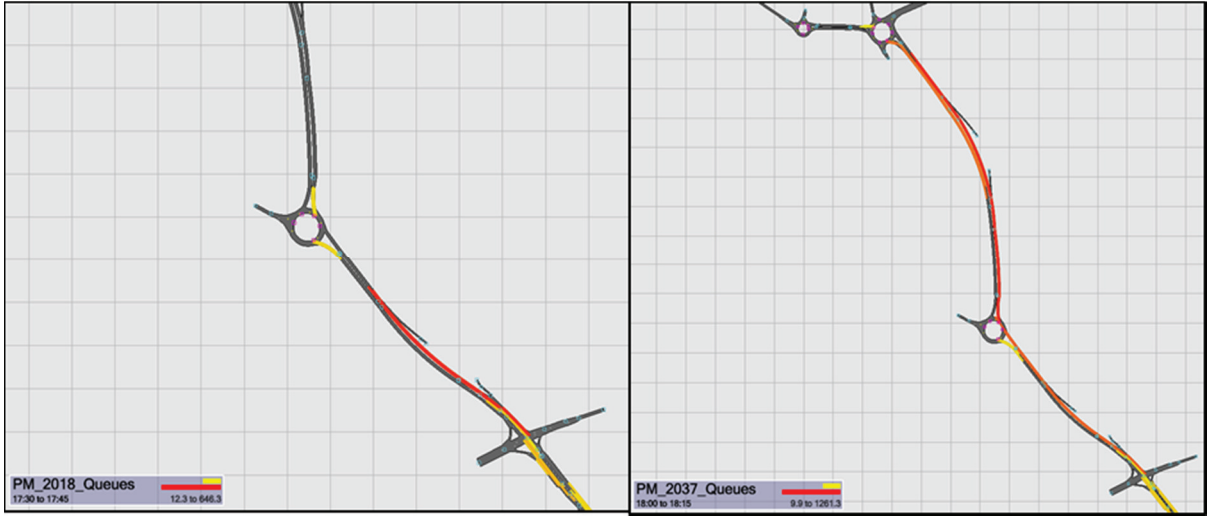

Figure 8.11   *A4119 northbound approach to Junction 3 - PM Average Maximum Queue*
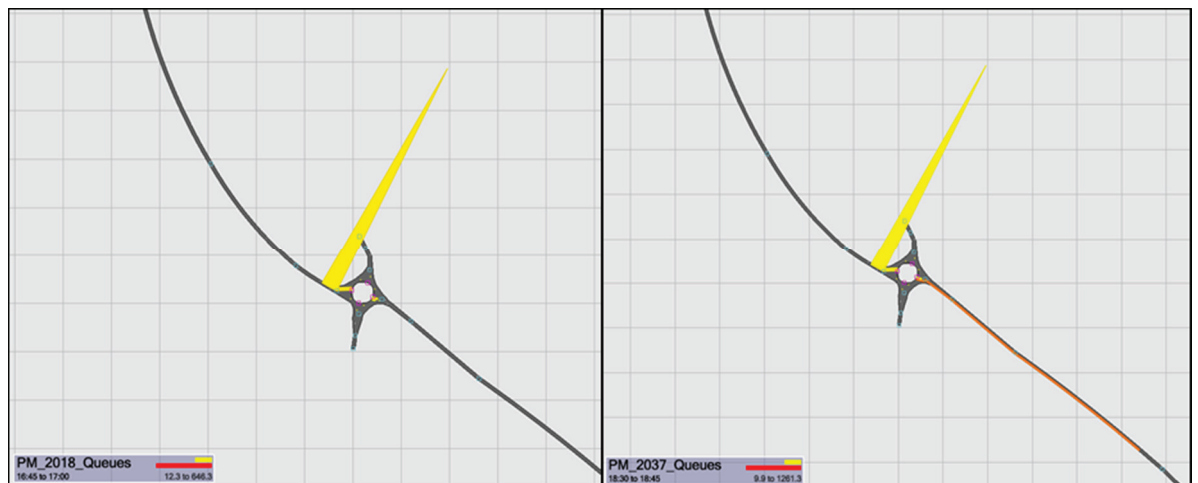
- The average queue at the A4119 southbound approach to Junction 7 is forecast to increase by 25 vehicles.

Figure 8.12   A4119 southbound approach to Junction 7 - PM Average Maximum Queue

- The average queue at the A4119 northbound approach to Junction 12 and Junction 13 is forecast to increase by 10 vehicles and 28 vehicles respectively.

9.   Summary

A series of junction models and a micro-simulation model of the A4119 corridor and associated junctions has been developed in order to gain an understanding of how the corridor is currently operating, and to forecast how it will operate in the future.

Each of the junctions along the corridor have been modelled in junction modelling packages and validated using queue data. The microsimulation model has been developed using OS CAD data and signal time information acquired from RCTCBC. The model has been calibrated and validated using surveyed turning movements and journey times in accordance with WebTAG.

During the AM peak hour the greatest delay and queues were identified at the following locations:

- A4119/A4093/Mill Street Roundabout (Junction 2);

- A4119/Ely Valley Road Roundabout (junction 3);

- A4119 Ely Valley Road between Coedely (Junction 3) and Royal Glamorgan Hospital Roundabout (Junction 5); and

- Junction 34 of the M4.

During the PM peak hour the greatest delay and queues were identified at the following locations:

- A4119/A4093/Mill Street Roundabout (Junction 2);

- A4119 Ely Valley Road between Coedely (Junction 3) and the Royal Glamorgan Hospital Roundabout (Junction 5);

- A4119/Talbot Road Signalised Crossroads;

- A4119 between Junction 34 of the M4 and the A4119/A473 roundabout.

Forecast traffic demand for the A4119 corridor has been developed for 2020 (base year + 5 years) and 2037 (base year + 20 years). The forecast traffic demand is based on allocated developments within RCTCBC LDP and NTEM growth in accordance with WebTAG Unit M4 'Forecasting and Uncertainty'.

The forecast model indicates that during the AM peak hour in 2022 the following journeys are likely to experience the greatest level of delay and congestion:

- Journeys to and from Zone 13 (Junction 34 of M4);

- Journeys from Zone 17 (A473 East); and

- Journeys from Zones 1,2 and 3 (A4119/A4233 and A4119/A4093 roundabouts in Tonyrefail) to Zones 8, 9 and 10 (Talbot Green);

The forecast model indicates that during the PM peak hour in 2022 the following journeys are likely to experience the greatest level of delay and congestion:

- Journeys to Zones 1, 2 and 3 (A4119/A4233 and A4119/A4093 roundabouts in Tonyrefail);

- Journeys from Zone 6 (Magden Park); and

- Journeys to and from Zones 10, 13 and 14

By 2037 the forecast model indicates that during the AM peak hour the following journeys are likely to experience and even greater level of delay and congestion:

- Journeys to and from Zone 13 (Junction 34 of M4);

- Journeys from Zone 17 (A473 East); and

- Journeys from Zones 1,2 and 3 (A4119/A4233 and A4119/A4093 roundabouts in Tonyrefail) to Zones 8, 9 and 10 (Talbot Green);

By 2037 the forecast model indicates that during the PM peak hour the following journeys are likely to experience and even greater level of delay and congestion:

- Journeys to Zones 1, 2 and 3 (A4119/A4233 and A4119/A4093 roundabouts in Tonyrefail);

- Journeys from Zone 6 (Magden Park);

- Journey to and from Zones 10, 13 and 14 (Cardiff Road, Junction 34 of M4 and Llantrisant Road);

- Journey to zones 7, 8, 9 and 17 (Talbot Green and the A473 East).

The model and forecast work undertaken now provides an opportunity to model and assess the benefit that may be gained by various infrastructure interventions on the A4119 corridor, and may provide the basis for cost benefit analysis to support future funding applications.