My name is Steve Heath and I am a resident of Newton Longville. My background is in electronics and software. I worked for Motorola Semiconductors for over 20 years during which I wrote mobile phone traffic models which were submitted to standards bodies and formed the basis of several patent application. The fact that your mobile phones work is due in a small part to my efforts.

I was a visiting lecturer to the Universities of Bath and Bedfordshire and part of my responsibilities was to mark dissertations from the students I was teaching. I have written over 20 electronics books of which several are now university course texts.

While not a qualified traffic expert, I, none the less, have the background of an informed layman who is comfortable in looking at data and its analysis. I have been looking at this application since 2015.

While this could be considered an enquiry into the technical aspects of this application, it should be remembered that is not about this and that but what the effect will be on the residents and those that would move here if it goes ahead. Against that, the developer wishes to maximise profits and financially the less he has to do the better for him and his shareholders.

In my experience, along with the many engineers I have worked with, the key to any modelling or forecasting, is getting the basic data and model right. That involves exposing the detail so it can be scrutinised and repeated by others to confirm its validity. It is the foundation on which everything sits. You will hear from the various witnesses about the detail but I wish to draw your attention to the basics methodology presented and how it fails on numerous levels.

1 What was the justification for not defending the 2016 TA and MKC rejecting their officers advice?

Simple. The quality of the work was shoddy and this gave no confidence that the derived results were reliable, robust or even correct.

- The data they measured from the data flow diagrams was not the same as they entered into the models. It was typically reduced by factors upto 80%. No explanation was given.
- The models were incorrect and created lanes that did not exist, turning counts that were nonsensical and many other errors. However both BCC and MKC Highways stated that there were no problems.
- When a MKC Highways officer repeated part of the work for another planning application and came up very different results, AVDC suggested that they use the WSP (then Mouchel) models and data “as it had already been approved” in an attempt to save face. That application was eventually refused.
- Validation comprised of two pages of tiny Google Traffic screenshots that were unreadable and were portrayed to the Newton Longville villagers at a public meeting, as the type of modern technology the appelant used to prove that there was no impact. After showing that Google was quite capable of showing long traffic queues based on the movement of a supermarket delivery van, the Appelants left the meeting early.

I could go on but the parties have agreed that they will not rely on that documents. As a layman, I find that bizarre because the appeal is against that decision that was based on that planning evidence, and not the 2020 TA and technical notes that have been drip fed since the appeal

deadlines. The original application was turned down because it was insufficient which is not surprising, given the errors and mistakes that it contained.

2 The 2020 TA and the sequels.

The 2020TA was a big improvement. It started with an extensive traffic survey in February 2020. It should have been delayed because of road closures in Milton Keynes impacting the traffic flows but as the appellant only had a few months in which to appeal, this advice was ignored. The appellant claims that there was no effect but they provide no evidence that this was true. For the local residents however, there was a major change in driving behaviour. My occasional journey to Stony Stratford and alternatives were blocked. This journey is the same way to the Kiln Farm and other industrial areas. Going through Whaddon was blocked because the linking road to V4 was closed. Similarly going up V4 was not possible because V4 was shut. The best route was to go south through Bletchley and pick up the A5 then go north. This means that myself and many others did not go North and in fact went out of the survey area completely and were never registered as part of the data. In other words, the traffic flow was disrupted. WSP in MJM8 state that the traffic coming into MK was consistant and that is not surprising as people still had to go to work despite the road closures. This does not mean that the traffic flow after they had entered was not disrupted.

With hindsight, maybe we should have got some evidence but who in the right mind would take a traffic survey with significant road closures and diversions in the area? WSP could not delay in fear of missing the appeal deadline so ignored the fact the counts were not representative. Missing the appeal deadline does not excuse ignoring the accepted practice.

Like the 2016 TA, the raw data was never made available in the documents. As a layman, this is bizarre as all other planning applications include it in the documents or at the very least, describe how it can be obtained, including other TAs from WSP. Why would WSP not want people to see it? How can the public scrutinise the application without it? It is the easiest part of the data to look at and understand. This is fundamental to any scrutiny. If this was a thesis, failure to supply the source data would be enough to warrant an immediate fail.

Because of its importance to any scrutiny, Iceni asked for a copy and were sent it, only to be followed by representations from WSP that this was an error and it should be destroyed. Why? What was so sensitive that WSP did not want it in the public domain? Iceni wanted it to check the WSP work. Eventually common sense was applied and WSP stated it could be retained and used. Why have WSP not submitted it to the Core Documents list as all of their work is based on it?

The importance of the raw data is shown when the work is analysed. The process used can be summarised as :

- measure the traffic density, flow and queuing.
- Load into model of the junction and compare results.
- Use the differences to identify model improvements e.g geometry etc.

This is the process that WSP should have followed or at least portrayed that they have.

2.1 The next question: is the data consistant?

The answer is a conditional yes. The explanation in the 2020TA of how the data was processed to provide the single traffic figure in the model is vague at best. I spent a lot of time trying to understand it but gave up as generally while the data is in the right ball park, it is not an exact match

in many cases but yes it is an improvement.
Is the traffic data described in the flow diagrams, the same as used in the models? Yes. By and large as WSP have so many model versions and updates in the 50kg plus of documents that the resulting paper chase is incredible and contrary to general principles. In principle, yes it is. So far this is a big improvement. However this is only applicable to the traffic flow as will be explained later.

2.2 However it is not all good news:

- There appears to be two sets of traffic data. This was endemic in the 2016 TA where the traffic data was mysteriously modified when transferred to the models.

In MJP4, WSP compared the ATC 08 site results[1] with a nearby BC fixed ATC. WSP claimed that this close correlation – typically 2% - was justification that the the survey was taken in a neutral month. Firstly I get suspicious that a tube based ATC can get to 2% accuracy when the manufacturers indicate 5 to 10% but equally WSP could have got lucky. They actually supplied the data to allow it to be checked including the Site 08 data printout which matches well. However when you look at the corresponding report in the raw data[2], the MJM8 data is a fabrication as it does not match the data that was reported (figures 1 and 2). Initial reaction was maybe they have called up the wrong file, but after extensive searching in the raw data I could find no match. This is not a simple typo as all the cells are wrong. It might be due to a simple file error. Indeed the MJM4 data has the correct references and looked exactly like that from the raw data except that every cell was different from the version supplied with the raw data.

This raises questions:

- Why would WSP publish a completely different set of data to that from the survey yet claim it was the same?
- What other major discrepancies are there that they have not told us about?
- If the raw data they supplied was wrong, why did they keep quiet about it when they knew that others would be using it for analysis and as a result end up with work which was of no value at the expence of their clients.

  Bear in mind that they did this in the 2016 TA as well. This is not an isolated example in this case.

Again it throws up doubts of how reliable their analysis actually is.

There are other examples where whole days of the traffic survey ATC data are simply missing with no mention or explanation. As this is used within the data processing, this again throws doubt on the accuracy.

- All the models were done in isolation with no consideration of how one junction impacted another.

Their models show queues that back up and block others including the Buckingham Road exit. Easy to check for anyone: take the predicted queue length, multiply by the assumed car length

1 Pages 114 to 149 SWMK- Updated Proof of Martin Paddle – Appendices_Part1of 2.pdf
2 24458-008 A421 Eastbound.xlsx, 24458-008 A421 Westbound.xlsx from the Raw data ATC folder

and use the measure distance function on Google Earth.

- A universal peak hour was applied to all junctions, based on analysis of the traffic survey data.

Local knowledge says that the peak hour varies across the network depending and due to the levels of congestion is often a peak 2-3 hours with the traffic levels being comparable across that period. This was confirmed by the raw traffic data where many of the junctions did not have a peak hour but a peak 2 to 3 hours. Examples include J1Sherwood Drive, J5 Tattenhoe and J6 Bottle dump roundabouts. Looking at the traffic entering these junctions, the maximum i.e. peak traffic is actually 30 minutes earlier. The selected peak hour is not even the second but the third highest hourly total. It is definitely NOT the PEAK hour. What is fascinating is that by choosing the 0745-0845 peak hour, it misses the increase in queues between 0845 to 0900. This may be co-incidence but reduced traffic and queues means that the model would report a lower than the true peak would which is very advantageous for the appellant.

3 Traffic profiles

One other thing that stands out is that the raw data traffic queues are pretty well flat across the morning period. The hourly periods from 0700 to 0900 are within 10% of each other. For all intents and purposes, they indicate a flat traffic flow during the AM period. The queuing starts at around 7 and continues to 9:30 where it starts to fall away. That shows an extremely high level of congestion and is very different from the sharp peak and large fallaway that is given as a typical traffic profile.

This leads to the Junctions models themselves. The models were set up to use the One Hour profile. This takes a peak value for the traffic and synthesizes – makes up in layman's terms – the traffic flow. If this made up traffic flow matches that measured then there is no problem. If it doesn't, Junctions states that the results are unreliable and not robust. It goes further to state that this method should not be used and the detailed data describing the traffic flow should be used and it describes the way to do it. They had the data so why didn't they use it? Why did they ignore the traffic flow data in favour of a made up version which the Junctions software itself explicitly warns against.

This is not my personal opinion but the advice of TRL who wrote Junctions. I quickly found it by googling the Junction user manual for One Hour profile. Sixty seconds of checking and it shows that the entire modelling is according to TRL is unreliable. Flawed. Anything but robust. I would have expected that doing the models as recommended would take extra time and that time was not on WSP's side as they only had a few months to submit the new evidence. However that is no excuse. This type of work has to be accurate because the end results will affect people's lives.

Example: The hourly total count on an arm for, say, 08:00-09:00 is entered as 1000 PCU/hr, and a ONE HOUR (ODTAB) profile selected.

ARCADY will synthesise a peak demand profile that covers the central hour plus an extra 15-minute block either side of the central hour. The demand synthesised by ARCADY for each 15-minute time segment will therefore look something like this:

07:45-08:00 753 PCU/hr
08:00-08:15 899
08:15-08:30 1101
08:30-08:45 1101
08:45-09:00 899
09:00-09:15 753

The average over the central hour, i.e. 08:00-09:00, is (899+1101+1101+899) / 4 = 1000, which is the entered hourly count.

The average over the whole 90 minutes is slightly less: 918 PCU/hr. In other words, the average over the whole 90 minutes is slightly less than the entered hourly count because the synthesised profile includes a period either side of the central hour where the traffic demand is assumed to be lower than that measured during the central hour.

Using this profile type implies a number of assumptions, and of course the real demand profile at the junction may be completely different. For this reason, the ONE HOUR (ODTAB) profile should only be used if you know that the traffic profile at the junction follows a normal, typical peak period pattern.

For the absence of doubt all the Junctions modelling that WSP has done has contravened the recommendations from TRL and as a result, is not robust, unreliable and flawed.

Using the correct methodology would have addressed the problems WSP then describe with lane data and propotions as they had used lane simulation. WSP generated/estimated individual lane data from reviewing videos and applying tweeking factors based on a Barbara Chard methodology. Googling that states that additional modelling needs to be done to calculate the factors. WSP have not shown their workings but simply applied factors where no one has any idea of where and how they were calculated. Oversight or deliberate I do not know but it does mean that no one can check what they did. There is also the question of somebody in WSP would have known that this data was available from the raw data. WSP's description implies that the people working on this were not aware of this data existance or at least were but could not use it hence the undocumented tweek.

The next obvious question is why did WSP not consider loading the models setup with the 2-3 hour period to see where the worst case impacts would occur. The data was there so why not use it? I suspect that they had the appeal deadline approaching but that has not stopped them drip feeding new data over the last few months.

The traffic survey was comprehensive: each junction arm has about 2000 measurements that described the flow and volume very accurately over two 3 hour peak periods down to individual lanes and turning counts. Yet, the WSP models did not use this data and relied on single data points and a made up traffic flow. Why? Perhaps they did not have time to create the models correctly. Again not an acceptable excuse.

Previously the 2016 TA used google screenshots as their validation methodology. WSP were proud to state that at a public meeting where it was also totally debunked. This prompted the queue measurements taken at the same time as the traffic flow. This is to be welcomed. Their first

attempts at using this data were heavily criticised by Mr Bedingfield of BC who had been a Junctions trainer in the past. The new methodology was agreed with him and then applied to validate/calibrate the model results.

Armed with this, the notes TN2 and TN3 show how WSP altered the models to give the results they needed. In my experience, I am very weary of any model that has wholesale tweaks/adjustments applied without very good justification. Looking at the summaries in TN3, the model reported very large queues on Buckingham Road at Junction 1 of 149 queues[3]. WSP reported the queue as 30 and then proceeded to adjust the model to get it to agree(figure 6), by presumably adding more capacity than was actually there. This looks reasonable until you look at the raw queue data.

The queues were measured using video cameras which limits the length of the queue that can be measured to the total number of vehicles it can see. This will depend on the size(mix) of vehicles. Common sense really. The traffic survey data marked the limited measurements with a +[4]. WSP ignored this distinction and simply treated the queue length as an actual. For absence of doubt the report stated that the queue was longer than the length quoted but could not say how long it was. WSP treated the number as an actual rather than a greater than (figure 4).

Remember the model originally predicted queues of 149 vehicles which are commonly experienced by drivers and residents.

4 ATC to the rescue

Fortunately the traffic survey provides the answer. ATC 41 data on Buckingham road about 1km from J1 and ATC-40 showed[5] (figure 3) that the speed of traffic passing it slowed down to 10-15mph for the two hour period that coincided with + queues. Obviously something was slowing vehicles down: it is reasonable to assume it was the J1 traffic queue and that vehicles were slowing down as a result (figure 5). Again this confirms that the queue measurements were correct in saying they were greater than 27 vehicles – how much we don't know but large enough to affect the ATC speeds taken 1 km before. A queue length of 30 cars would not be visible to the early ATC so would not have triggered the dramatic slow down.

The evidence indicates that the queues were significantly longer than could be measured. So what do WSP do? Ignore this and adjust the model to match their incorrect data. In doing so, it reduces the congestion level on which everything is based. Their conclusion that the mittigation they have proposed might be suitable is based on a base model that has been tweaked to reduce congestion and queue measurements. Their predicted future queues and congestion are wrong and probably lower than they should be. There is no justification for this at all. For a developer there might be in that anything that helps to reduce the mitigation they would have to pay for is extra profit. The experts are going to discuss the finer details but the underlying point is the model has been manipulated to reduce the congestion with no real justification or logical thought. The queue length has been made up and is not accurate. This would be treated in other professions as a serious matter; a sackable offence if deliberate. It should be treated here on the same basis.

The appellant loves the term robust and frequently uses it to emphasize that what they have presented is accurate and can be relied upon. This is wrong. The robustness of any model is

3 Section 2 page 7 210129 TRN3 Final_Part 1of 2.pdf

4 24458 South West Milton Keynes MCC1 Queue Lengths Wednesday 5th February 2020.xlxs, 24458 South West Milton Keynes MCC1 Queue Lengths Thursday 6th February 2020.xlxs and 24458 South West Milton Keynes MCC1 Queue Lengths Tuesday 4th February 2020.xlxs from the MCC raw data.

5 Updated TA App A to I page 46 showing ATC sites

determined on how the model is created and the data is used. It is most important to get the basics right. If these are wrong then the more detailed results cannot be relied on, especially as the base results are multiplied up to create the forecast. Without an accurate base model, any subsequent forecasts are unreliable and nothing more than guesses with little or nothing to back them up.

In the 2016 TA, the appellant presented modelling data that was incorrect, unreliable and simply full of obvious errors. They hid behind the claim that they were the experts and us mere mortals couldn't understand this stuff. The fact that both BCC and MKC highways had no problems with their work was one of their main defences, effectively implying that they knew better. What was more remarkable was their failure to see these mistakes as they were in plain view and could easily be uncovered with a couple of minutes reading and comparison. But that was 2016.

With the 2020TA, some of the fundamental errors have been removed only to be replaced with others. The basics of data consistency, transparency and the ability to repeat the work are still not there making the analysis unsound and unreliable. The forecasts and mitigation that are built on this, inherit this unreliability as well. If the data claimed to be from the traffic survey is not, then any conclusions that use it are simply wrong and untrustworthy. Fundamental point of logic. If your bank says you are overdrawn because they missed some deposits, then the interest and charges based on that are flawed and wrong.

The 2020TA for all its complexity and detail is based on the incorrect use of the models and the over simplification of what they were trying to measure. The traffic survey provided detailed information that used correctly would have provided a more robust foundation for the future analysis. The appellant has not done this and therefore there is serious doubt over its conclusions.

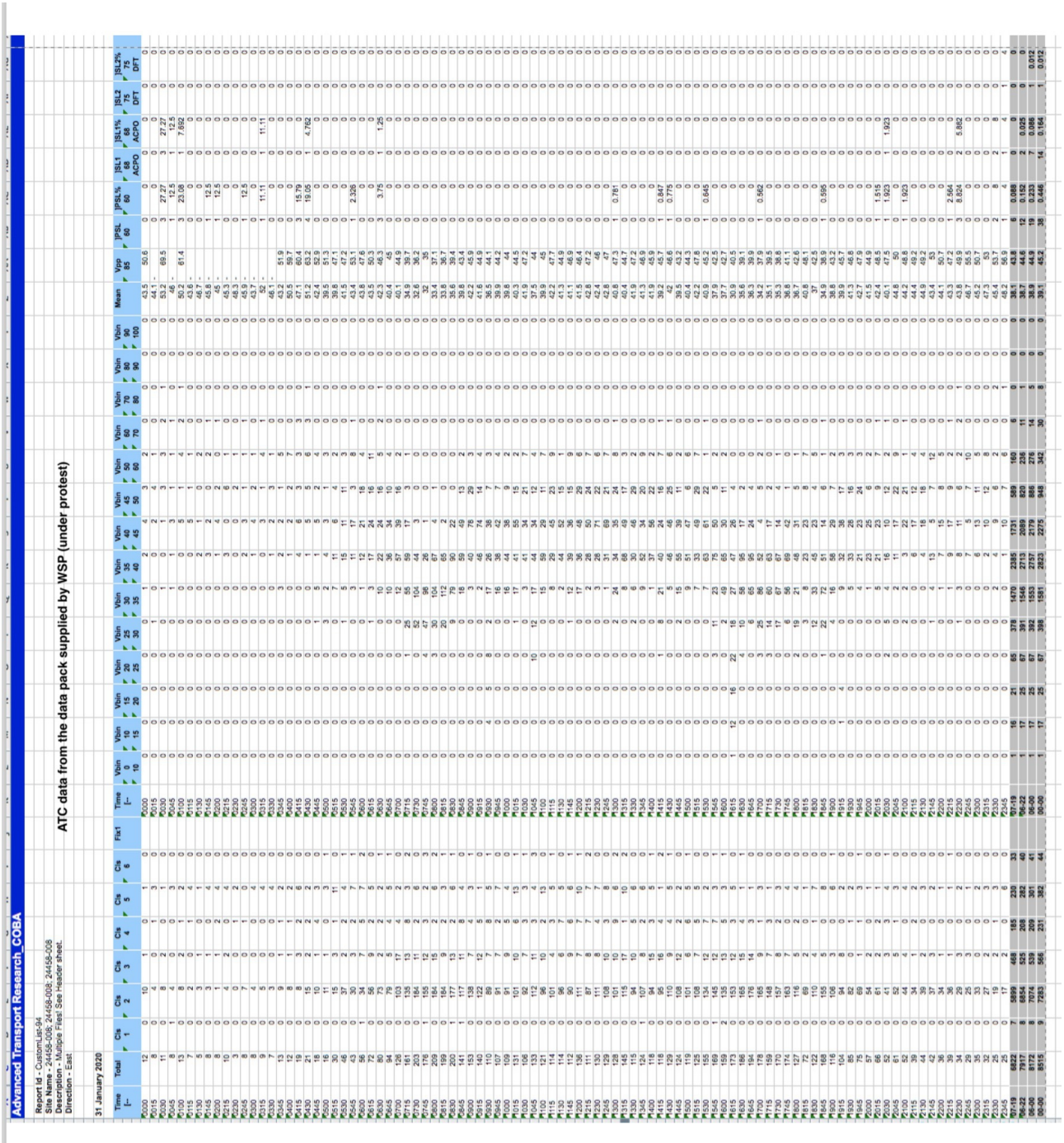
The question is why WSP took this opportunity to show what a shoddy job they could do.

5 In summary:

WSP do an extensive traffic survey ignoring the fact that major roads were closed in the area and then extract a single traffic peak value for each junction arm; ignoring the 2000+ data points per junction arm from the survey, that they could have used to create the model; which is configured despite TRL recommendations not to do it with a made-up traffic flow; that bears no relationship to the flow that they measured; which is then adjusted to be compatible with a truncated queue length which was limited by the technology used to measure it in circumstances where far longer queues were seen; and further adjusted using lane estimation from the Barbara Chard method 2 without supplying the detailed calculation with data estimated from video; when the data they needed had already been captured in the traffic survey that no-one remember being taken. No wonder it has little relationship with reality. That doesn't sound like something that could be relied on.

If I caught a student or saw a standards submission doing this, there would be hell to pay as it is an wrong on so many levels. This is far from reliable and it is not clear if this was intentional or simply incompetance. Either way, it would have simply been dismissed.

Figures 1 and 2 ATC 08 data discrepancy.



Advanced Transport Research_COBA

Report Id - CustomList-1420
Site Name - 24458-008; 24458-008; 24458-008
Direction - East

ATC data from xSWMK- Updated Proof of Martin Paddle - Appendices_Part1of2.pdf (page 114 of 149)

31 January 2020

Time [--	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Fix1	Time [--	Vbin 0 10	Vbin 10 15	Vbin 15 20	Vbin 20 25	Vbin 25 30	Vbin 30 35	Vbin 35 40	Vbin 40 45	Vbin 45 50	Vbin 50 60	Vbin 60 70	Vbin 70 80	Vbin 80 90	Vbin 90 100	Mean	Vpp 85	]PSL 60	]PSL% 60	]SL1 68 ACPO	]SL1% 68 ACPO	]SL2 75 DFT	]SL2% 75 DFT
0000	12	0	10	1	0	1	0		0000	0	0	0	0	0	1	2	4	3	2	0	0	0	0	43.5	50.6	0	0	0	0	0	0
0015	10	0	6	0	1	3	0		0015	0	0	0	0	1	0	0	3	5	1	0	0	0	0	44 -		0	0	0	0	0	0
0030	12	0	9	2	0	1	0		0030	0	0	0	0	0	1	0	1	4	3	2	1	0	0	52.6	69.2	3	25	3	25	0	0
0045	9	1	4	0	0	4	0		0045	0	0	0	0	0	1	1	4	1	1	1	0	0	0	45.4 -		1	11.11	1	11.11	0	0
0100	13	0	8	2	1	2	0		0100	0	0	0	0	0	0	0	5	1	4	2	1	0	0	50.2	61.4	3	23.08	1	7.692	0	0
0115	7	0	2	0	1	4	0		0115	0	0	0	0	0	0	0	5	1	1	0	0	0	0	43.6 -		0	0	0	0	0	0
0130	5	0	3	1	0	1	0		0130	0	0	0	0	0	0	2	1	0	2	0	0	0	0	46.7 -		0	0	0	0	0	0
0145	8	0	3	1	0	4	0		0145	0	0	0	0	0	0	3	2	0	2	1	0	0	0	45.8 -		1	12.5	0	0	0	0
0200	9	0	2	1	2	4	0		0200	0	0	0	0	0	0	1	5	2	0	1	0	0	0	45 -		1	11.11	0	0	0	0
0215	12	0	5	2	1	4	0		0215	0	0	0	0	0	0	3	0	7	2	0	0	0	0	46.2	53	0	0	0	0	0	0
0230	3	0	0	0	1	2	0		0230	0	0	0	0	0	0	0	0	2	1	0	0	0	0	48.3 -		0	0	0	0	0	0
0245	8	0	7	0	1	0	0		0245	0	0	0	0	0	0	2	3	1	1	1	0	0	0	45.9 -		1	12.5	0	0	0	0
0300	8	0	4	0	0	4	0		0300	0	0	0	0	0	0	1	4	2	1	0	0	0	0	43.7 -		0	0	0	0	0	0
0315	10	0	6	0	0	4	0		0315	0	0	0	0	0	0	0	4	1	4	1	0	0	0	50.9 -		1	10	1	10	0	0
0330	8	0	4	0	0	4	0		0330	0	0	0	0	0	0	1	3	3	1	0	0	0	0	45.8 -		0	0	0	0	0	0
0345	13	0	9	1	1	2	0		0345	0	0	0	0	0	3	2	2	1	5	0	0	0	0	43.2	51.9	0	0	0	0	0	0
0400	12	0	8	1	1	2	0		0400	0	0	0	0	0	0	1	2	2	7	0	0	0	0	50.5	59.7	0	0	0	0	0	0
0415	20	0	8	3	2	7	0		0415	0	0	0	0	0	0	5	6	3	3	3	0	0	0	46.7	59.7	3	15	0	0	0	0
0430	22	0	16	2	2	2	0		0430	0	0	0	0	0	0	1	5	6	6	3	1	0	0	51	63.1	4	18.18	1	4.545	0	0
0445	22	0	13	1	4	3	1		0445	0	0	0	0	2	5	1	8	2	4	0	0	0	0	42	52	0	0	0	0	0	0
0500	22	0	15	3	0	3	1		0500	0	0	0	0	4	3	6	5	1	3	0	0	0	0	38.7	49.3	0	0	0	0	0	0
0515	39	0	22	4	2	11	0		0515	0	0	0	0	0	12	15	6	4	2	0	0	0	0	38.6	46.2	0	0	0	0	0	0
0530	67	0	56	2	3	4	2		0530	0	0	0	0	2	8	30	13	11	3	0	0	0	0	40.1	46.4	0	0	0	0	0	0
0545	57	0	44	3	2	7	1		0545	0	0	0	0	0	7	13	21	4	10	2	0	0	0	43.2	53.6	2	3.509	0	0	0	0
0600	79	1	56	8	5	7	2		0600	0	0	0	0	0	2	18	32	23	4	0	0	0	0	43.2	47.2	0	0	0	0	0	0
0615	98	0	80	11	2	5	0		0615	0	0	0	0	1	8	23	38	17	11	0	0	0	0	42.4	48.6	0	0	0	0	0	0
0630	125	0	114	4	3	2	2		0630	0	0	0	0	0	21	37	34	25	5	2	1	0	0	41.2	46.1	3	2.4	1	0.8	0	0
0645	145	0	124	9	4	6	2		0645	0	0	0	0	0	17	64	47	13	4	0	0	0	0	39.8	44	0	0	0	0	0	0
0700	208	0	180	21	5	2	0		0700	0	0	0	0	0	21	101	65	19	2	0	0	0	0	39.5	44	0	0	0	0	0	0
0715	276	0	245	17	8	4	2		0715	0	0	0	5	56	84	94	32	4	1	0	0	0	0	34.6	39.7	0	0	0	0	0	0
0730	332	0	311	12	2	6	1		0730	0	0	0	1	88	177	61	5	0	0	0	0	0	0	32.3	35.7	0	0	0	0	0	0
0745	303	2	280	13	3	2	3		0745	3	0	1	5	88	170	35	1	0	0	0	0	0	0	31.4	34.7	0	0	0	0	0	0
0800	325	1	291	19	4	8	2		0800	0	0	0	5	58	157	94	9	2	0	0	0	0	0	33.2	37	0	0	0	0	0	0
0815	327	1	308	11	2	4	1		0815	0	0	0	0	36	193	95	3	0	0	0	0	0	0	33.5	36.6	0	0	0	0	0	0
0830	327	2	296	18	3	7	1		0830	0	0	0	0	12	142	138	34	1	0	0	0	0	0	35.5	39.4	0	0	0	0	0	0
0845	246	2	217	14	8	5	0		0845	0	0	0	0	1	35	122	70	16	2	0	0	0	0	39.1	42.5	0	0	0	0	0	0
0900	257	0	237	10	5	4	1		0900	0	0	0	0	2	10	86	115	41	3	0	0	0	0	41.3	45.1	0	0	0	0	0	0
0915	238	0	215	17	5	1	0		0915	0	0	0	0	0	9	83	119	23	4	0	0	0	0	41	44.5	0	0	0	0	0	0
0930	209	0	181	11	9	7	1		0930	0	7	8	13	6	48	56	54	14	3	0	0	0	0	35.7	43.3	0	0	0	0	0	0
0945	175	0	153	10	3	9	0		0945	0	0	0	0	0	22	70	69	9	5	0	0	0	0	39.8	43.8	0	0	0	0	0	0
1000	186	0	158	16	7	5	0		1000	0	0	0	0	0	28	83	59	13	3	0	0	0	0	39.3	43.7	0	0	0	0	0	0
1015	219	1	176	18	7	16	1		1015	0	0	0	0	1	34	76	86	20	2	0	0	0	0	39.8	43.7	0	0	0	0	0	0
1030	182	0	163	11	4	3	1		1030	0	0	0	1	1	9	82	57	25	7	0	0	0	0	40.6	45.7	0	0	0	0	0	0
1045	215	0	188	15	4	5	3		1045	0	0	0	15	23	40	70	49	14	4	0	0	0	0	36.7	43.2	0	0	0	0	0	0
1100	189	1	158	14	2	14	0		1100	0	0	0	0	0	29	97	41	13	9	0	0	0	0	39.2	43.3	0	0	0	0	0	0
1115	185	0	170	6	3	5	1		1115	0	0	0	0	0	15	59	70	32	9	0	0	0	0	41.4	46	0	0	0	0	0	0
1130	201	0	179	10	7	5	0		1130	0	0	0	0	0	5	97	76	22	1	0	0	0	0	40.5	44.6	0	0	0	0	0	0
1145	197	0	169	13	6	8	1		1145	0	0	0	0	1	23	84	54	23	12	0	0	0	0	40.4	46.1	0	0	0	0	0	0
1200	237	0	207	11	7	10	2		1200	0	0	0	2	0	28	79	82	40	6	0	0	0	0	40.5	45.5	0	0	0	0	0	0
1215	175	0	148	10	8	7	2		1215	0	0	0	0	0	2	60	75	31	7	0	0	0	0	41.9	46.5	0	0	0	0	0	0
1230	216	0	186	13	8	8	1		1230	0	0	0	0	0	6	58	118	27	7	0	0	0	0	41.7	45.3	0	0	0	0	0	0
1245	203	0	176	14	5	8	0		1245	0	0	0	0	0	1	61	104	30	7	0	0	0	0	42.1	45.8	0	0	0	0	0	0
1300	223	1	185	17	11	7	2		1300	0	0	0	0	3	52	68	54	34	11	1	0	0	0	39.7	46.5	1	0.448	0	0	0	0
1315	269	2	225	26	2	11	3		1315	0	0	0	0	1	17	140	80	28	3	0	0	0	0	39.9	43.8	0	0	0	0	0	0
1330	208	0	175	20	6	7	0		1330	0	0	0	2	5	19	64	78	35	5	0	0	0	0	40.5	46.2	0	0	0	0	0	0
1345	209	1	185	12	4	7	0		1345	0	0	0	0	1	23	108	43	25	9	0	0	0	0	40	45.5	0	0	0	0	0	0
1400	204	1	169	20	6	7	1		1400	0	0	0	0	0	9	79	79	34	3	0	0	0	0	41.1	45.7	0	0	0	0	0	0
1415	191	0	160	21	5	3	2		1415	0	0	0	1	12	34	70	44	22	7	1	0	0	0	38.7	45.1	1	0.524	0	0	0	0
1430	229	1	205	11	5	6	1		1430	0	0	0	0	0	23	88	76	33	8	1	0	0	0	41	45.4	1	0.437	0	0	0	0
1445	238	0	210	21	4	3	0		1445	0	0	0	0	3	42	117	60	14	2	0	0	0	0	38.5	42.1	0	0	0	0	0	0
1500	224	0	200	8	10	5	1		1500	0	0	0	0	0	21	114	70	12	7	0	0	0	0	39.7	44	0	0	0	0	0	0
1515	193	0	173	10	5	5	0		1515	0	0	0	0	1	13	65	70	36	8	0	0	0	0	41.4	46.8	0	0	0	0	0	0
1530	250	0	224	16	8	2	0		1530	0	0	0	0	1	22	105	94	26	1	1	0	0	0	40.1	43.9	1	0.4	0	0	0	0
1545	274	1	242	18	8	4	1		1545	0	0	0	7	22	41	119	77	6	2	0	0	0	0	37.3	41.9	0	0	0	0	0	0
1600	276	2	246	17	6	4	1		1600	0	0	1	0	6	99	107	49	12	2	0	0	0	0	36.9	41.9	0	0	0	0	0	0
1615	298	0	273	17	3	5	0		1615	1	15	21	27	32	67	87	43	5	0	0	0	0	0	32	40.4	0	0	0	0	0	0
1630	316	0	286	22	5	2	1		1630	0	0	0	10	12	112	158	22	2	0	0	0	0	0	35.3	38.7	0	0	0	0	0	0
1645	321	1	296	18	4	2	0		1645	0	0	0	0	15	121	146	35	4	0	0	0	0	0	35.8	39.6	0	0	0	0	0	0
1700	303	1	288	10	1	3	0		1700	0	0	0	5	60	138	85	6	6	2	1	0	0	0	33.5	37.4	1	0.33	0	0	0	0
1715	289	0	274	11	3	1	0		1715	0	0	0	12	27	120	99	29	2	0	0	0	0	0	34.5	39.3	0	0	0	0	0	0
1730	268	0	253	8	2	5	0		1730	0	0	0	3	27	105	108	19	5	1	0	0	0	0	34.9	38.6	0	0	0	0	0	0
1745	287	1	268	12	1	5	0		1745	0	0	0	0	16	98	117	53	3	0	0	0	0	0	36.3	40.7	0	0	0	0	0	0
1800	205	0	192	6	3	4	0		1800	0	0	0	5	32	50	74	38	5	1	0	0	0	0	35.7	41	0	0	0	0	0	0
1815	110	0	107	2	0	1	0		1815	0	0	0	1	5	11	39	36	10	8	0	0	0	0	40.1	47.1	0	0	0	0	0	0
1830	196	0	179	6	1	10	0		1830	0	0	0	0	24	52	70	39	5	6	0	0	0	0	36.6	41.9	0	0	0	0	0	0
1845	256	0	239	8	0	9	0		1845	0	0	0	2	43	111	71	19	8	1	1	0	0	0	34.3	38.3	1	0.391	0	0	0	0
1900	172	0	157	8	0	6	1		1900	0	0	0	0	7	27	84	43	9	2	0	0	0	0	38.3	42.9	0	0	0	0	0	0
1915	158	0	147	9	0	2	0		1915	0	1	5	0	3	20	48	53	25	3	0	0	0	0	39.5	45.7	0	0	0	0	0	0
1930	133	0	129	1	1	2	0		1930	0	0	0	1	10	57	43	19	3	0	0	0	0	0	40.5	45.4	0	0	0	0	0	0
1945	96	0	90	1	1	3	1		1945	0	0	0	0	0	6	32	26	29	3	0	0	0	0	42.1	47.7	0	0	0	0	0	0
2000	74	0	71	2	0	1	0		2000	0	0	0	0	0	1	32	33	6	2	0	0	0	0	41.2	44.3	0	0	0	0	0	0
2015	93	0	87	3	2	1	0		2015	0	0	0	0	0	8	29	34	14	7	1	0	0	0	41.9	48.1	1	1.075	0	0	0	0
2030	72	0	60	3	3	5	1		2030	0	0	0	2	10	6	23	13	15	2	1	0	0	0	39.1	46.9	1	1.389	1	1.389	0	0
2045	81	0	72	5	1	3	0		2045	0	0	0	0	1	5	14	24	25	12	0	0	0	0	44	50	0	0	0	0	0	0
2100	69	0	60	4	1	4	0		2100	0	0	0	0	2	5	7	30	23	1	1	0	0	0	43.4	47.7	1	1.449	0	0	0	0
2115	55	0	49	2	2	2	0		2115	0	0	0	0	0	0	12	24	14	5	0	0	0	0	43.7	49	0	0	0	0	0	0
2130	54	0	48	2	1	3	0		2130	0	0	0	0	0	0	7	24	18	5	0	0	0	0	44.4	49.2	0	0	0	0	0	0
2145	51	0	45	4	0	2	0		2145	0	0	0	0	1	7	17	6	8	12	0	0	0	0	42.3	51.9	0	0	0	0	0	0
2200	47	0	45	1	0	1	0		2200	0	0	0	0	0	3	10	19	9	6	0	0	0	0	43.4	50	0	0	0	0	0	0
2215	51	0	48	1	0	1	1		2215	0	0	0	0	2	1	14	22	9	2	1	0	0	0	42	47.1	1	1.961	0	0	0	0
2230	44	0	39	3	0	2	0		2230	0	0	0	0	2	5	9	14	7	4	2	1	0	0	43.2	50.6	3	6.818	2	4.545	0	0
2245	38	0	33	4	0	1	0		2245	0	0	0	0	0	0	9	10	9	10	0	0	0	0	45.7	55	0	0	0	0	0	0
2300	45	0	42	0	1	2	0		2300	0	0	0	0	0	1	8	16	14	6	0	0	0	0	44.9	50	0	0	0	0	0	0
2315	34	0	29	2	0	3	0		2315	0	0	0	0	0	0	2	10	13	9	0	0	0	0	47.4	52.9	0	0	0	0	0	0
2330	25	0	19	2	1	3	0		2330	0	0	0	0	0	2	4	9	6	2	0	2	0	0	45.4	53.7	2	8	2	8	0	0
2345	30	0	22	2	0	6	0		2345	0	0	0	0	0	0	1	11	9	8	0	1	0	0	48.6	59.2	1	3.333	1	3.333	1	3.333
07-19	**11465**	**22**	**10246**	**661**	**228**	**271**	**37**		**07-19**	**4**	**22**	**31**	**122**	**721**	**2688**	**4239**	**2660**	**791**	**181**	**6**	**0**	**0**	**0**	**37.6**	**43.1**	**6**	**0.052**	**0**	**0**	**0**	**0**
06-22	**13020**	**23**	**11635**	**737**	**254**	**325**	**46**		**06-22**	**4**	**23**	**36**	**124**	**747**	**2831**	**4743**	**3164**	**1074**	**262**	**11**	**1**	**0**	**0**	**38**	**43.6**	**12**	**0.092**	**2**	**0.015**	**0**	**0**
06-00	**13334**	**23**	**11912**	**752**	**256**	**344**	**47**		**06-00**	**4**	**23**	**36**	**124**	**751**	**2843**	**4800**	**3275**	**1150**	**309**	**14**	**5**	**0**	**0**	**38.1**	**43.8**	**19**	**0.142**	**7**	**0.052**	**1**	**0.007**
00-00	**13742**	**24**	**12176**	**782**	**281**	**427**	**52**		**00-00**	**4**	**23**	**36**	**124**	**760**	**2884**	**4890**	**3387**	**1217**	**378**	**31**	**8**	**0**	**0**	**38.3**	**44.1**	**39**	**0.284**	**14**	**0.102**	**1**	**0.007**

Figure 3: ATC locations

296

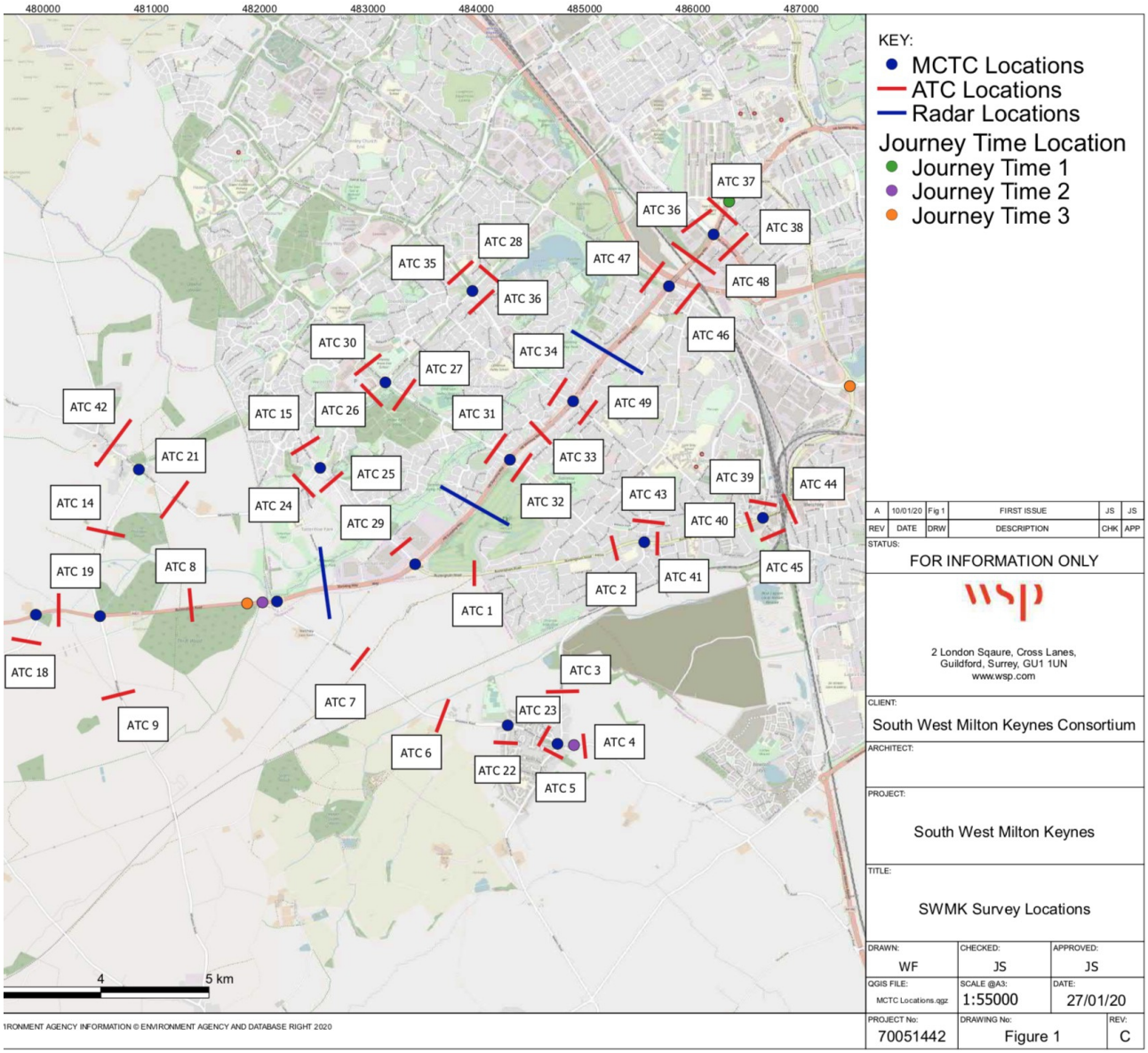

480000
481000
482000
483000
484000
485000
486000
487000
ATC 37
ATC 36
ATC 38
ATC 28
ATC 35
ATC 47
ATC 48
ATC 36
ATC 46
ATC 30
ATC 34
ATC 27
ATC 42
ATC 15
ATC 26
ATC 31
ATC 49
ATC 21
ATC 33
ATC 25
ATC 39
ATC 44
ATC 14
ATC 24
ATC 32
ATC 43
ATC 29
ATC 40
ATC 19
ATC 8
ATC 41
ATC 45
ATC 2
ATC 1
ATC 18
ATC 3
ATC 7
ATC 23
ATC 9
ATC 4
ATC 6
ATC 22
ATC 5
4
5 km
IRONMENT AGENCY INFORMATION © ENVIRONMENT AGENCY AND DATABASE RIGHT 2020
KEY:
MCTC Locations
ATC Locations
Radar Locations
Journey Time Location
Journey Time 1
Journey Time 2
Journey Time 3
A 10/01/20 Fig 1 FIRST ISSUE JS JS
REV DATE DRW DESCRIPTION CHK APP
STATUS:
FOR INFORMATION ONLY
wsp
2 London Sqaure, Cross Lanes,
Guildford, Surrey, GU1 1UN
www.wsp.com
CLIENT:
South West Milton Keynes Consortium
ARCHITECT:
PROJECT:
South West Milton Keynes
TITLE:
SWMK Survey Locations
DRAWN: WF
CHECKED: JS
APPROVED: JS
QGIS FILE: MCTC Locations.qgz
SCALE @A3: 1:55000
DATE: 27/01/20
PROJECT No: 70051442
DRAWING No: Figure 1
REV: C

Figure 4: queue measurements for Junction 1

Advanced Transport Research — *Job Number & Name:* 24458 South West Milton Keynes
MCC1 - Buckingham Road/Water Eaton Road — *Client:* WSP
Queue Lengths — *Date:* Thursday 06 February 2020

	Sherwood Drive				Queensway				Water Eaton Road				Buckingham Road			
	Lane 1		Lane 2		Lane 1		Lane 2		Lane 1		Lane 2		Lane 1		Lane 2	
Times	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
07:00 - 07:05	0	2	0	1	0	1	0	1	0	4	0	1	0	2	0	1
07:05 - 07:10	0	2	0	1	0	3	0	1	0	1	0	2	0	2	0	1
07:10 - 07:15	0	1	0	1	0	2	0	0	0	1	0	1	0	0	0	1
07:15 - 07:20	0	1	0	2	0	3	0	0	0	2	0	1	0	3	0	2
07:20 - 07:25	0	3	0	1	0	1	0	2	0	0	0	1	0	3	0	2
07:25 - 07:30	0	4	0	2	0	2	0	1	0	2	0	2	0	7	0	1
07:30 - 07:35	0	3	0	2	0	2	0	0	0	4	0	2	0	3	0	1
07:35 - 07:40	0	3	0	2	0	3	0	4	0	2	0	1	0	25	0	2
07:40 - 07:45	0	7	0	3	0	3	0	1	0	3	0	2	0	27+	0	2
07:45 - 07:50	0	3	0	2	0	5	0	4	0	4	0	1	13+	27+	0	4
07:50 - 07:55	0	3	0	1	0	5	0	4	0	4	0	3	19+	27+	0	5
07:55 - 08:00	0	12+	0	4	0	2	0	6	0	4	0	3	20+	27+	0	2
08:00 - 08:05	0	7	0	3	0	3	0	2	0	3	0	2	12+	26+	0	4
08:05 - 08:10	0	7	0	2	0	3	0	4	0	8	0	4	12+	27+	0	2
08:10 - 08:15	0	7	0	3	0	4	0	3	0	7	0	1	18+	27+	0	1
08:15 - 08:20	0	8	0	4	0	3	0	2	0	7	0	3	19+	27+	0	1
08:20 - 08:25	0	12+	0	4	0	3	0	2	0	3	0	2	7+	27+	0	2
08:25 - 08:30	0	11+	0	2	0	5	0	2	0	4	0	4	0	23+	0	2
08:30 - 08:35	0	9	0	4	0	8	0	3	0	7	0	3	15+	27+	0	2
08:35 - 08:40	0	12+	0	3	0	9	0	3	0	8	0	4	19+	26+	0	3
08:40 - 08:45	0	5	0	3	0	3	0	3	0	10	0	4	19+	27+	0	3
08:45 - 08:50	0	8	0	3	0	5	0	4	0	6	0	3	16+	27+	0	2
08:50 - 08:55	0	6	0	2	0	2	0	5	0	3	0	4	18+	27+	0	2
08:55 - 09:00	0	2	0	2	0	3	0	14	0	4	0	5	22+	25+	0	7
09:00 - 09:05	0	5	0	4	0	2	0	6	0	5	0	3	20+	25+	0	4
09:05 - 09:10	0	11+	0	4	0	3	0	3	0	1	0	2	11+	27+	0	4
09:10 - 09:15	2	12+	0	2	0	4	0	1	0	2	0	2	0	9	0	3
09:15 - 09:20	0	9	0	3	0	3	0	1	0	2	0	1	0	27+	0	3
09:20 - 09:25	0	4	0	1	0	1	0	0	0	1	0	2	0	9	0	1

Figure 5 ATC – 41 data

06 February 2020

Time [--	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Fix1	Time [--	Vbin 0 10	Vbin 10 15	Vbin 15 20	Vbin 20 25	Vbin 25 30	Vbin 30 35	Vbin 35 40
0000	3	0	3	0	0	0	0		0000	0	0	0	1	2	0	0
0015	4	0	4	0	0	0	0		0015	0	0	0	1	1	0	1
0030	5	0	5	0	0	0	0		0030	0	0	0	0	3	1	1
0045	1	0	1	0	0	0	0		0045	0	0	0	1	0	0	0
0100	2	0	2	0	0	0	0		0100	0	0	0	0	1	1	0
0115	2	0	2	0	0	0	0		0115	0	0	0	0	1	0	1
0130	1	0	1	0	0	0	0		0130	0	0	0	0	1	0	0
0145	3	0	3	0	0	0	0		0145	0	0	0	1	0	2	0
0200	1	0	1	0	0	0	0		0200	0	0	0	0	1	0	0
0215	1	0	1	0	0	0	0		0215	0	0	0	0	1	0	0
0230	0	0	0	0	0	0	0		0230	0	0	0	0	0	0	0
0245	2	0	1	1	0	0	0		0245	0	0	1	0	0	0	1
0300	4	0	2	1	0	1	0		0300	0	0	1	2	0	0	0
0315	0	0	0	0	0	0	0		0315	0	0	0	0	0	0	0
0330	3	0	3	0	0	0	0		0330	0	0	0	0	3	0	0
0345	3	0	2	1	0	0	0		0345	0	0	0	0	2	1	0
0400	2	0	2	0	0	0	0		0400	0	0	0	0	1	1	0
0415	3	0	3	0	0	0	0		0415	0	0	0	1	1	1	0
0430	6	1	3	1	1	0	0		0430	1	0	1	0	1	3	0
0445	7	0	7	0	0	0	0		0445	0	0	0	1	5	1	0
0500	16	0	13	0	2	1	0		0500	0	0	0	2	8	5	1
0515	12	1	9	2	0	0	0		0515	0	0	0	0	7	5	0
0530	25	0	22	1	2	0	0		0530	0	0	0	4	14	6	1
0545	41	0	36	3	0	0	2		0545	0	0	1	6	21	10	1
0600	46	0	41	3	2	0	0		0600	0	0	2	10	17	13	4
0615	53	1	47	3	2	0	0		0615	0	1	0	9	29	11	3
0630	74	0	69	3	0	1	1		0630	0	0	4	14	34	17	5
0645	84	2	72	9	0	0	1		0645	1	5	5	14	42	16	0
0700	69	0	63	4	1	0	1		0700	0	0	1	17	39	9	3
0715	114	2	106	2	4	0	0		0715	1	1	9	35	54	10	4
0730	162	2	145	13	2	0	0		0730	2	11	24	58	55	10	0
0745	135	2	124	7	1	1	0		0745	3	13	12	45	51	11	0
0800	112	0	106	4	1	0	1		0800	0	6	8	30	64	4	0
0815	134	3	114	8	2	4	3		0815	79	18	15	12	9	1	0
0830	111	4	107	0	0	0	0		0830	80	23	6	2	0	0	0
0845	100	0	91	6	2	1	0		0845	91	4	3	2	0	0	0
0900	84	0	75	7	1	1	0		0900	47	18	5	11	3	0	0
0915	108	1	97	7	2	0	1		0915	1	12	15	44	28	8	0
0930	100	0	93	6	1	0	0		0930	0	0	1	48	42	8	0
0945	102	0	93	7	0	1	1		0945	0	4	12	44	40	2	0
1000	85	0	81	2	1	1	0		1000	0	0	7	37	36	5	0
1015	90	0	82	7	1	0	0		1015	0	1	4	33	42	9	1

Figure 6: Model adjustment

2.1.2. **Table 2-1** provides a summary of the results of this calibration identification exercise with arms of junctions coded amber where the difference in maximum mean interval queue length was found to be greater than the notional five vehicle threshold and green where it was found to be less.

Table 2-1: Model Calibration Identification

Junction	Location	Arm Description	Arm	AM Peak (07:45-08:45)			PM (17:00-18:00)		
				Observed Queue	Modelled Queue	Diff(O-M)	Observed Queue	Modelled Queue	Diff(O-M)
1	Buckingham Road/Water Eaton Road (lane simulation)	A - Sherwood Drive	A	12	34	-22	13	13	0
		B - B4034	B	11	3	8	38	67	-29
		C - Water Eaton Road	C	10	1	8	13	3	9
		D - B4034 Buckingham Road	D	30	149	-119	19	6	12
2	Buckingham Rd Shenley Rd Newton Rd	2E - Buckingham Road/ Shenley Road - A - Shenley Road	A	3	2	0	3	2	1