

Vectos Microsim

Holt Road VISSIM Modelling

**Forecasting, Mitigation Proposals &
Summary Results**

September 2019

Contents

1	INTRODUCTION.....	1
	Background.....	1
	Methodology	2
	Model Scope	2
2	ADJUSTMENTS TO BASE MODEL	3
	Rationale	3
3	FORECAST DEMAND METHODOLOGY	8
	Do-Nothing Forecast Demand.....	9
	Do-Minimum Forecast Demand	10
4	KSS2 & KSS3 DEVELOPMENT SITES.....	17
	Location.....	17
	Traffic Demand	18
5	SCENARIO LIST	21
6	MODELLING RESULTS	22
	2023 Do-Nothing (2023 DN).....	22
	2023 Do-Minimum (2023 DM)	22
	2023 Do-Something (2023 DS)	23
	2028 Do-Nothing (2028 DN).....	26
	2028 Do-Minimum (2028 DM)	27
	2028 Do-Something 1 (2028 DS1).....	28
	2028 Do-Something 2 (2028 DS2).....	33
	Scenario Comparison.....	35
	Journey Time Corridor Comparison	35
	Junction Flow Comparison	38
7	SUMMARY	43
8	CONCLUSION	45

1 INTRODUCTION

Background

- 1.1 Vectos Microsim (VM) has been commissioned to undertake VISSIM testing in support of Wrexham's Local Development Plan. Two development sites have been specifically identified for inclusion in this testing; known as KSS2 (Policy SP5: Land east of Cefn Road, Wrexham) and KSS3 (Policy SP11: Land to the north of Bryn Lane, Wrexham Industrial Estate). The work is to be undertaken on behalf of a tri-party of stakeholders; Wrexham County Borough Council (WCBC), Barratt Homes/Bloor Homes (promoting the northern of the two sites that make up the KSS2 development site of primary interest), and Countryside Properties (promoting the southern KSS2 element).
- 1.2 VM has received a VISSIM Base model from WCBC, which was developed on their behalf by Integrated Transport Planning Ltd (ITP). This model was calibrated and validated to 2018 observed conditions and considered fit for purpose by WCBC. The model build process is documented in the accompanying LMVR¹.
- 1.3 In addition to the inclusion of KSS2 and KSS3 development sites, TEMPro forecasts have also been used to ensure the effects of growth in background traffic volumes are also accounted for within the assessment and identification of infrastructure.
- 1.4 VM developed a Method Statement for a series of tests carried out to determine the infrastructure requirements both for the end of the Local Plan year (2028), and a 5 year build-out horizon year of 2023². The purpose of the +5 year test is to establish any immediate infrastructure requirements necessary for the early phases of the development build out, whilst the end of plan assessment is intended to identify the full suite of interventions necessary to enable the delivery of the Local Plan proposals and will likely be adopted within the Infrastructure Delivery Plan (IPD) which will accompany the Local Plan. The methodology which has been adopted is summarised below.

¹ 2563 Wrexham VISSIM R001_LMVR_V1-1.pdf

² VM180223.TN001 Method Statement_Rev2.pdf

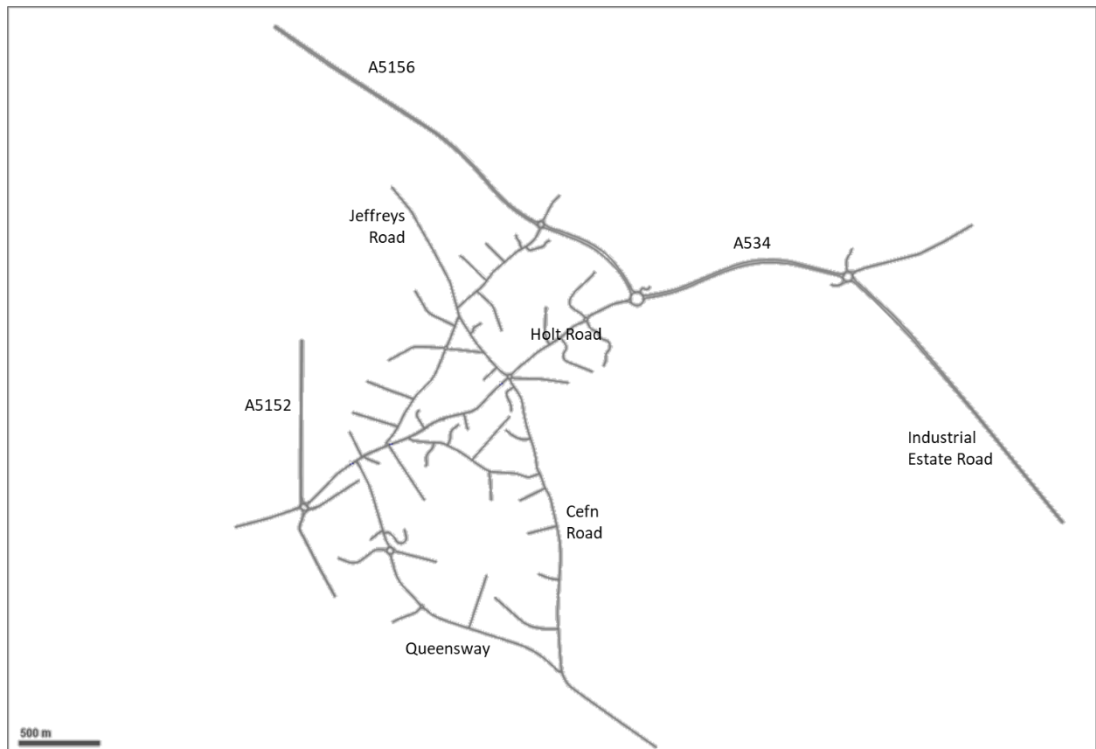
Methodology

- 1.5 VM proposed to develop a 5 year test in the first instance to determine any interim off-site mitigation necessary prior to the link road being operational.
- 1.6 Following the inclusion of a suitable mitigation strategy for 2023, the testing will move to 2028, by which time the link road will be delivered alongside the full development build out, and any additional off-site mitigation requirements can be developed.
- 1.7 The demand matrices for the 2023 and 2028 were based on the most recent trajectory for each site within KSS2, along with the KSS3 site, and finally an element of background growth informed by TEMPro. The detailed forecasting methodology will be documented in Chapter 3.

Model Scope

- 1.8 The base model extent is shown in Figure 1 below:

Figure 1: VISSIM Base Model Extent



2 ADJUSTMENTS TO BASE MODEL

Rationale

- 2.1 Following receipt of the appropriate VISSIM model files, it was noted that significant queues were observed on the A5156 southbound approach to Borrás Park Road roundabout. As queue lengths were not used as a calibration or validation measure in the development of the Base, these queue lengths were not reported in the LMVR.
- 2.2 The reason for the queuing was a very low circulatory speed at the roundabout which restricted throughput from the north to a level far below that which might be expected, and overly-prescriptive hesitancy parameters on Borrás Park Road southbound where traffic calming measures are in place on street. This created queue lengths of approximately 500-600m during the AM peak hour in 2018; this is widely regarded as unrealistic.
- 2.3 Early iterations of future year testing showed that this queue becomes significantly worse following the addition of growth traffic, which not only exacerbates unrealistic queues observed in the Base but also undermines the robustness of any impact assessment, as traffic intended to travel through the network is constrained by and held on this approach.
- 2.4 Whilst it was undesirable to make changes to the Base model, the efficacy of the testing relied on the ability of the Borrás Park Road approach to accommodate the southbound traffic levels in a realistic manner, and this was not the case in the original model received by VM. Through dialogue with all stakeholders it was agreed that changes should be made to the behaviour at this location.
- 2.5 The specific changes made were:
 - Borrás Park Road Roundabout: circulatory speed distribution changed from 6-15mph to 20-25mph (new distribution added, estimated based on the size, number of lanes and trajectory of the roundabout)
 - Borrás Park Road eastbound and westbound approaches: approach speed distribution changed from 9-15mph to 15-20mph (new distribution added, estimated based on the approach visibility and local knowledge of approaching vehicle behaviour)

- A534/A5156 Roundabout and A534/Industrial Estate Road Roundabout: new distribution added, estimated based on the size, number of lanes and trajectory of the roundabout). In the existing base model, no speed controls were included on either roundabout, meaning vehicles were allowed to traverse the roundabouts at speeds in excess of what would be considered realistic.

- 2.6 These three roundabouts (along with Greyhound Roundabout) are arguably the key junctions to the east of Wrexham and certainly the areas of primary interest in regards to the inclusion of KSS2 and KSS3 and the impact on the local network. As a result it was considered necessary to ensure behaviour at these locations was as accurate as possible before the testing progressed. This means, in this case, encouraging throughput at Borrass Park Road roundabout in-line with known conditions at the roundabout, but also reducing speeds at the other two roundabouts in response to the observed conditions in the model.
- 2.7 To ensure these limited changes did not materially impact the accuracy of the model, quantitative analysis conducted by ITP during development of the Base model was replicated by re-running the Base after these alterations had been made.
- 2.8 Excerpts from the Base model LMVR³ are provided below, detailing the turn count calibration statistics for the AM and PM Base models:

Table 1: Original ITP Base model AM and PM Turn and Link Count Calibration

Table 5-1: Total Traffic Flow Calibration (Peak Hours)				
Modelled Period	Link Counts (99)		Turn Counts (147)	
	% GEH Criteria (<5)	% Flow Criteria	% GEH Criteria (<5)	% Flow Criteria
AM Peak Hour (08:00 – 09:00)	95%	95%	92%	99%
PM Peak Hour (16:30 – 17:30)	84%	86%	88%	96%

³ 2563 Wrexham VISSIM R002_Forecasting Report_V1-1, page 23

- 2.9 Following the minor alterations described, the revised Base model turn count calibration statistics were as follows:

Table 2: Revised VM Base model AM and PM Turn and Link Count Calibration

Modelled Period	Link Counts (99)		Turn Counts (147)	
	% GEH Criteria (<5)	% Flow Criteria	% GEH Criteria (<5)	% Flow Criteria
AM Peak Hour (08:00-09:00)	94%	93%	92%	99%
PM Peak Hour (16:30-17:30)	82%	86%	87%	97%

- 2.10 In the AM period, only 1 fewer link counts fall within the GEH <5 criteria and 2 fewer fall within the % Flow criteria, and both remain well within permitted tolerances. All turn count results remain the same as the originally reported model. In the PM period, only 2 fewer link counts fall within the GEH <5 criteria whilst the % Flow criteria achieves the same standard as the original. 2 fewer turn counts fall within the GEH <5 criteria, but 1 additional turn count falls within the % Flow criteria.
- 2.11 The following excerpts from the Base model relate to journey time comparisons in the AM and PM peak base models:

Table 3: Original ITP Base model AM Journey Time Validation

Table 6-2: AM peak journey time analysis						
Route	Direction	Observed (secs)	Modelled (secs)	Difference (%)	Difference (secs)	Result
Corridor 1	Southbound	250	295	18%	-45	PASS
	Northbound	236	272	15%	-36	PASS
Corridor 2	Southbound	228	253	11%	-25	PASS
	Northbound	244	261	7%	-17	PASS
Corridor 3	Eastbound	103	110	7%	-7	PASS
	Westbound	116	113	-3%	3	PASS
Corridor 4	Southbound	110	129	18%	-19	PASS
	Northbound	104	154	48%	-50	PASS

Table 4: Original ITP Base model PM Journey Time Validation**Table 6-3: PM peak journey time analysis**

Route	Direction	Observed (secs)	Modelled (secs)	Difference (%)	Difference (secs)	Result
Corridor 1	Southbound	262	318	21%	-56	PASS
	Northbound	272	307	13%	-35	PASS
Corridor 2	Southbound	229	258	13%	-29	PASS
	Northbound	261	261	0%	0	PASS
Corridor 3	Eastbound	99	101	3%	-2	PASS
	Westbound	120	167	39%	-47	PASS
Corridor 4	Southbound	121	159	31%	-38	PASS
	Northbound	118	201	70%	-83	FAIL

2.12 The tables below show the results following the minor alterations:

Table 5: Revised VM Base model AM Journey Time Validation

Route	Direction	Observed (s)	Modelled (s)	Difference (%)	Difference (s)	Result
Corridor 1	Southbound	250	276	10%	-26	PASS
	Northbound	236	266	13%	-30	PASS
Corridor 2	Southbound	228	252	10%	-24	PASS
	Northbound	244	270	11%	-26	PASS
Corridor 3	Eastbound	103	115	12%	-12	PASS
	Westbound	116	115	-1%	1	PASS
Corridor 4	Southbound	110	112	2%	-3	PASS
	Northbound	104	122	17%	-17	PASS

Table 6: Revised VM Base model PM Journey Time Validation

Route	Direction	Observed (s)	Modelled (s)	Difference (%)	Difference (s)	Result
Corridor 1	Southbound	262	289	10%	-27	PASS
	Northbound	272	305	12%	-33	PASS
Corridor 2	Southbound	229	257	12%	-27	PASS
	Northbound	261	265	2%	-4	PASS
Corridor 3	Eastbound	99	105	6%	-6	PASS
	Westbound	120	140	17%	-20	PASS
Corridor 4	Southbound	121	110	-10%	12	PASS
	Northbound	118	133	13%	-15	PASS

- 2.13 Journey time results show the model maintains a 100% pass rate for journey time validation during the AM peak. In the PM peak, where the original model showed northbound corridor 4 (Borras Park Road from Jeffreys Road to A5156 Roundabout) failed to meet DMRB criteria, the revised model achieves a 100% pass rate. This demonstrates that the measures taken to improve accuracy at the Borras Park Road roundabout have been effective.
- 2.14 It should also be noted that corridor 3 (between Borras Park Road roundabout and Industrial Estate Road roundabout) also shows a closer correlation between modelled and observed journey times (westbound differences between observed and modelled fall from 39% to just 17%). This further indicates that the model has benefitted from the alterations.
- 2.15 In summary, the results show no significant difference between the original and revised models and, whilst the existing LMVR is still applicable to the revised model, the changes described above should be recorded as the latest calibration and validation statistics.

3 FORECAST DEMAND METHODOLOGY

3.1 Forecast traffic growth for the various modelled scenarios has been informed by TEMPro growth rates for the years between the Base (2018) and the two forecast years (2023 and 2028).

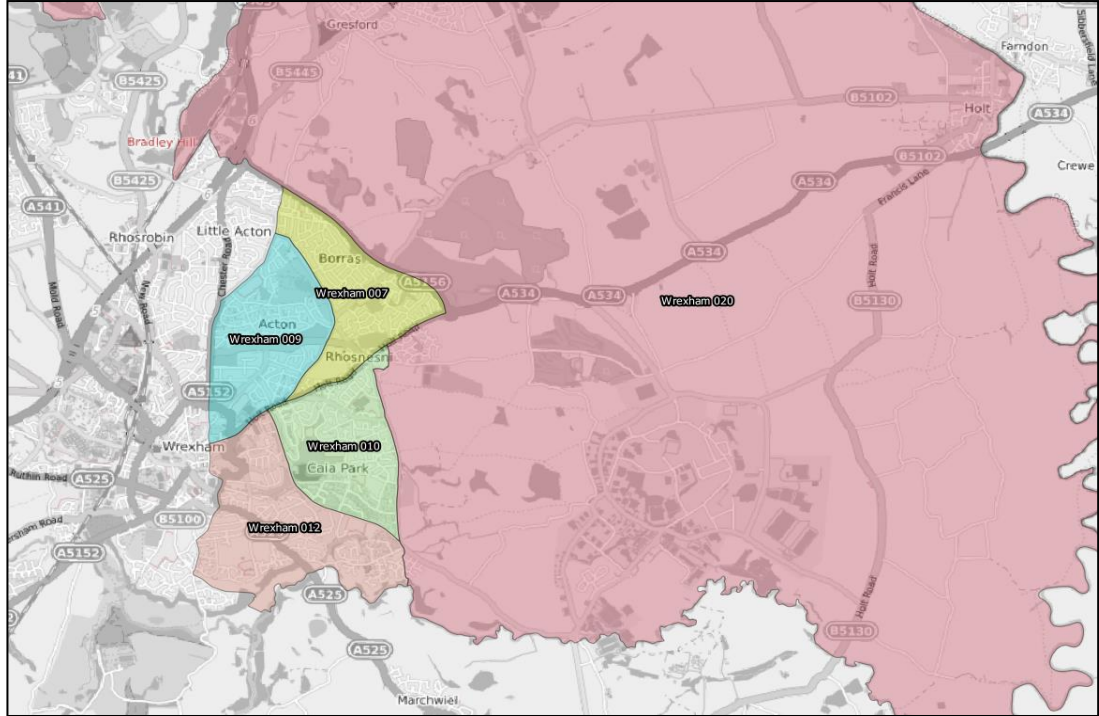
3.2 For each year, the following scenarios have been developed (these will be explained in further detail in Chapter 5):

- Do-Nothing – assumes no KSS2 and KSS3, growth solely informed by TEMPro growth assumptions
- Do-Minimum – assumes appropriate level of KSS2 and KSS3 demand for each year, with TEMPro growth also added but adjusted for the inclusion of these two sites to ensure no double-counting
- Do-Something – assumes the same level of demand as the Do-Minimum, but with the additional highway mitigation measures

Do-Nothing Forecast Demand

- 3.3 The following Figure presents the Middle-Super-Output-Areas (MSOAs) that cover the model extent:

Figure 2: MSOA Map



- 3.4 The TEMPro rates used for 2023 and 2028 are provided below:

Table 7: TEMPro Growth Rates

MSOA Number	MSOA Name	AM Peak		PM Peak	
		2018-2023 Growth	2018-2028 Growth	2018-2023 Growth	2018-2028 Growth
W02000084	Wrexham 007	1.0461	1.0894	1.0453	1.0900
W02000086	Wrexham 009	1.0527	1.0981	1.0509	1.0963
W02000087	Wrexham 010	1.0676	1.1240	1.0710	1.1321
W02000089	Wrexham 012	1.0555	1.1015	1.0517	1.0965
W02000420	Wrexham 020	1.0331	1.0654	1.0329	1.0650
Authority	Wrexham	1.0472	1.0885	1.0469	1.0893

- 3.5 Each internal zone in the model is assigned an MSOA based on its relative position. The corresponding TEMPro growth rate is then assigned to all trips in the model to provide 2018-2023/2028 forecast demand.
- 3.6 As per the original agreed forecasting methodology, certain zones on the edges of the model extent were selected as 'external' zones. Trips between these zones are assumed to be through trips, growth in these trips is both less certain and less likely to be affected by the internal growth assumptions within the model. As a result growth in external trips was informed by the wider Wrexham growth rate. These zones are 7 (A5152 Fardon Street), 9 (A5152 Bodhyfyrd), 17 (A5156) and 21 (A534 Wrexham Road)⁴.
- 3.7 The application of the various TEMPRO growth rates across the model demands resulted in the following net growth levels within 2023 and 2028 AM and PM modelled peak hours:

Table 8: 2023 and 2028 Total Network Growth Rates (Do-Nothing Scenarios)

AM Peak		PM Peak	
2018-2023 Growth	2018-2028 Growth	2018-2023 Growth	2018-2028 Growth
4.8%	9.2%	4.6%	8.8%

Do-Minimum Forecast Demand

- 3.8 In the Do-Minimum demand set, TEMPro forecasts are adjusted to account for the household and jobs that are to be delivered as part of KSS2 and KSS3 as these trips are now explicitly included within the model. These adjustments are necessary to avoid double-counting as the Local Plan now provides more certainty around where the housing and jobs will be delivered.
- 3.9 For 2023, TEMPro assumes housing growth, from 2018, of 785 dwellings. The KSS2 housing site assumes a build out trajectory of 250 dwellings on the northern site and 460 dwellings on the southern site by 2023/24; a total of 710 dwellings. These are therefore removed from the housing growth assumptions and only the residual housing number is re-entered into TEMPro to create a revised growth rate.

⁴ 2563 Wrexham VISSIM R002_Forecasting Report_V1-1, page 6 para. 3.2

- 3.10 By 2028, TEMPro assumes a housing growth of 1599 dwellings. The KSS2 site will deliver a total of 1680 dwellings. Therefore, all housing growth was removed from the TEMPro assumptions to derive a revised growth rate.
- 3.11 Similarly for the employment adjustment, KSS3 is expected to deliver job growth in excess of that predicted by TEMPro. In 2023, TEMPro predicts job growth of 194 by 2023 and 415 by 2028; KSS3 is assumed to deliver at least 500 and 1000 jobs by each respective year. Therefore any additional growth in jobs has been removed from the TEMPro assumptions, but only for the MSOA that covers the KSS3 site (i.e. Wrexham 020). Job growth predictions in the areas outside of the specific KSS3 MSOA remain; this reflects the uncertainty of future employment sites across the full extent of the model which ensures the forecasting methodology remains robust.
- 3.12 The following table presents the housing and job growth assumptions that underpin the TEMPro growth rates used for the Do-Nothing demands alongside a summary of the adjustments and resulting growth rates applied within the Do-Minimum scenarios to reflect 'background growth'.

Table 9: Do-Nothing and Do-Minimum 2023 TEMPro Growth Rates – Internal Trips

Do-Nothing 2023								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0461	1.0453	2377	965	2487	979	110	14
Wrexham 009	1.0527	1.0509	2377	1794	2487	1810	110	16
Wrexham 010	1.0676	1.0710	3118	965	3263	973	145	7
Wrexham 012	1.0555	1.0517	4013	4353	4200	4406	187	53
Wrexham 020	1.0331	1.0329	5868	16081	6100	16275	232	194
Do-Minimum 2023 (inc. Job and Housing Adjustments for KSS2 and KSS3)								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0234	1.0186	2377	965	2392	979	15	14
Wrexham 009	1.0357	1.0330	2377	1794	2392	1810	15	16
Wrexham 010	1.0451	1.0443	3118	965	3137	973	20	7
Wrexham 012	1.0383	1.0340	4013	4353	4039	4406	25	53
Wrexham 020	1.0098	1.0092	5868	16081	5868	16081	0	0

Table 10: Do-Nothing and Do-Minimum 2028 TEMPro Growth Rates – Internal Trips

Do-Nothing 2028								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0894	1.0900	2377	965	2602	993	225	28
Wrexham 009	1.0981	1.0963	2377	1794	2602	1835	225	42
Wrexham 010	1.1240	1.1321	3118	965	3413	986	296	21
Wrexham 012	1.1015	1.0965	4013	4353	4394	4468	381	115
Wrexham 020	1.0654	1.0650	5868	16081	6340	16497	472	415
Do-Minimum 2028 (inc. Job and Housing Adjustments for KSS2 and KSS3)								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0355	1.0267	2377	965	2377	993	0	28
Wrexham 009	1.0572	1.0534	2377	1794	2377	1835	0	42
Wrexham 010	1.0698	1.0678	3118	965	3118	986	0	21
Wrexham 012	1.0602	1.0539	4013	4353	4013	4468	0	115
Wrexham 020	1.0168	1.0158	5868	16081	5868	16081	0	0

- 3.13 A similar process was undertaken to inform the growth in external trips within the model. TEMPro contains assumptions in relation to job and housing growth across the whole Wrexham Authority; these can be revised in accordance with the known delivery of KSS2 and KSS3, along with the total Local Plan housing assumptions for each year.
- 3.14 As with the internal trips, KSS2 housing delivery is assumed to be 710 dwellings by 2023 and 1680 dwellings by 2028. The assumed level of job growth from delivery of KSS3 is 500 jobs by 2023 and 1000 by 2028.

- 3.15 Prior to any deductions from the housing numbers assumed by TEMPro, the housing projection for both 2023 and 2028 can be updated in accordance with the Local Plan Housing number to ensure that the TEPRO numbers align with those that are expected to come forward as a result of adopting the Local Plan.
- 3.16 WCBC Local Development Plan states that *“the housing requirement [...] has been established as 7750 units”*⁵. This therefore overwrites the current assumption in TEMPro as the projected housing growth up to 2028.
- 3.17 Table 18 of the same document provides an overview of the anticipated completions per year, which reads as follows:

Table 11: Local Plan Housing Delivery Projections

Year	Anticipated Completions	Cumulative
2017-2018	414	-
2018-2019	484	898
2019-2020	571	1469
2020-2021	781	2250
2021-2022	803	3053
2022-2023	841	3894
2023-2024	820	<u>4714</u>
2024-2025	748	5462
2025-2026	717	6179
2026-2027	761	6940
2027-2028	751	7691
Total	<u>7691</u>	

- 3.18 The result of these adjustments is detailed in the following Tables:

⁵ Wrexham Local Development Plan (2013-2028) BP08, page 8

Table 12: Do-Nothing and Do-Minimum 2023 TEMPro Growth Rates – External Trips

Do-Nothing 2023								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0472	1.0469	60437	65166	63180	66101	2743	934
Local Plan Housing Adjustment								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0623	1.0633	60437	65166	65151	66101	4714	934
Do-Minimum 2023 (inc. Job and Housing Adjustments for KSS2 and KSS3)								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0526	1.0535	60437	65166	64441	65601	4004	434

Table 13: Do-Nothing and Do-Minimum 2028 TEMPro Growth Rates – External Trips

Do-Nothing 2028								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0885	1.0893	60437	65166	66023	67015	5586	1849
Local Plan Housing Adjustment								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.1052	1.1074	60437	65166	68187	67015	7750	1849
Do-Minimum 2028 (inc. Job and Housing Adjustments for KSS2 and KSS3)								
	AM Peak	PM Peak	Base HH	Base Jobs	FY HH	FY Jobs	Growth HH	Growth Jobs
Wrexham 007	1.0836	1.0854	60437	65166	66507	66015	6070	849

- 3.19 When these rates are applied across all zones in the model the cumulative growth within the Do-Minimum scenario is as follows:

Table 14: 2023 and 2028 Total Network Growth Rates (Do-Minimum/Do-Something Scenarios)

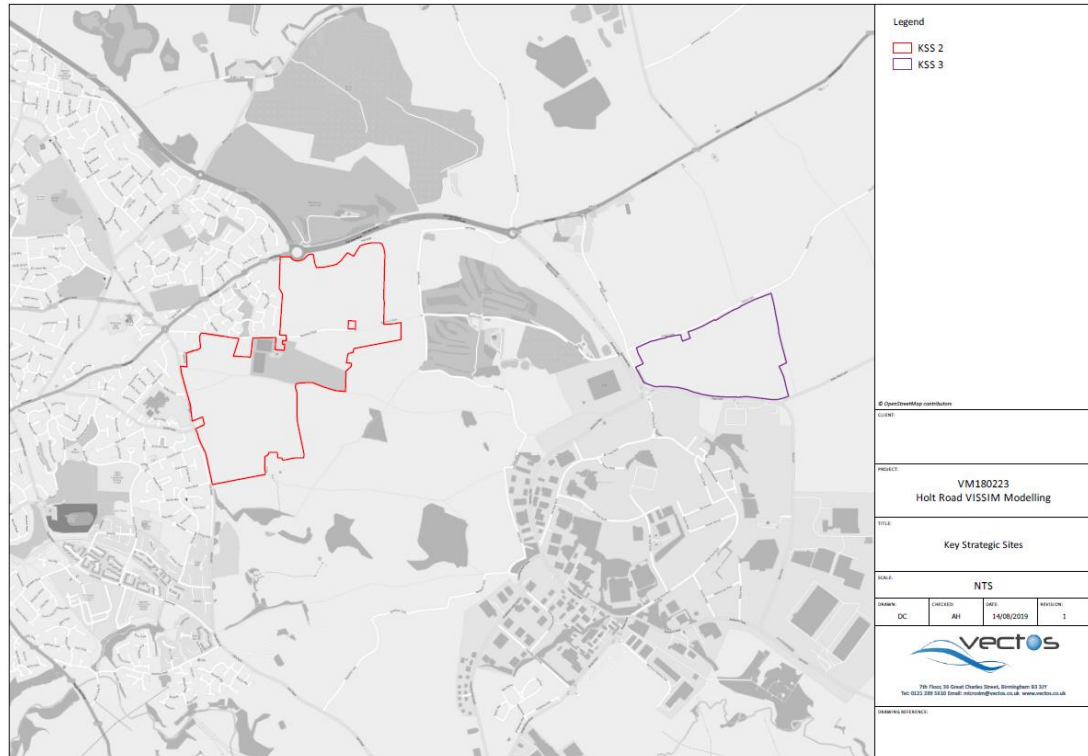
	AM Peak		PM Peak	
	2023	2028	2023	2028
KSS2 Growth	4.6%	10.8%	5.1%	12.0%
KSS3 Growth	3.7%	7.5%	3.1%	6.3%
TEMPro Growth (Background)	3.1%	4.8%	2.8%	4.5%
Total	11.4%	23.1%	11.0%	22.7%

4 KSS2 & KSS3 DEVELOPMENT SITES

Location

- 4.1 Both KSS2 and KSS3 sites fall within, or just outside of the model extent. The location of the sites is illustrated in the Figure below.

Figure 3: KSS2 and KSS3 Site Locations



- 4.2 KSS2 is split between northern and southern sites, which are promoted by Barratt Homes/Bloor Homes and Countryside Properties respectively.
- 4.3 KSS2 traffic is assigned into the model via the inclusion of new zones and associated accesses onto the existing road network; a southern access via a new priority junction with Cefn Road and a northern access via new arm to the south of the existing A5156/A534 roundabout.
- 4.4 For KSS3, traffic is assigned via existing Zone 22 which represents the existing Industrial Estate Road.

Traffic Demand

4.5 Trip rates to inform traffic demands for northern and southern KSS2 sites were agreed between ITP and WCBC in the Modelling Methodology Technical Note⁶ in August 2018. Trip distributions were set out in Vectos' December 2018 Note⁷

4.6 The trip rates for private and affordable dwellings are provided below:

Table 15: TRICS Trip Rates – KSS2 Private and Affordable Dwellings

	Affordable			Private		
	Arr.	Dep.	Two-Way	Arr.	Dep.	Two-Way
07:00-08:00	0.041	0.099	0.140	0.069	0.292	0.361
08:00-09:00	0.170	0.251	0.421	0.134	0.403	0.537
09:00-10:00	0.205	0.222	0.427	0.148	0.166	0.314
16:00-17:00	0.211	0.181	0.392	0.323	0.179	0.502
17:00-18:00	0.275	0.175	0.450	0.370	0.180	0.550

4.7 The above trip rates are used to calculate arriving and departing vehicle numbers for each 15-minute time interval during the AM and PM peak and shoulder periods, based on an assumed split of 20% affordable and 80% private.

4.8 The table below summarises the total peak hour trip generation for each site in each test year:

Table 16: KSS2 Trip Generation

		2023			2028		
		Northern Site	Southern Site	Total	Northern Site	Southern Site	Total
No. of Units		250	460	710	600	1080	1680
AM	Peak Hour Arrivals	35	65	100	85	152	237
	Peak Hour Departures	93	171	265	224	402	626
PM	Peak Hour Arrivals	81	150	231	195	352	547
	Peak Hour Departures	45	82	127	108	194	301

⁶ Wrexham KSS2 – TN001 Rev A Modelling Methodology, 17th August 2018

⁷ KSS2 Wrexham Southern Site VISSIM Matrix Estimation Methodology, December 2018

4.9 All KSS2 vehicles are assumed to be Lights.

4.10 The trip rates for KSS3 are provided in the table below. These are based on rates derived from the TRICS database using large sites in the Industrial Estate (TRICS output can be found in Appendix A):

Table 17: TRICS Trip Rates (per hectare) – KSS3

	All Vehicles			Heavies		
	Arr.	Dep.	Two-Way	Arr.	Dep.	Two-Way
07:30-08:00	7.974	1.789	9.763	0.281	0.257	0.538
08:00-08:30	7.471	2.537	10.008	0.281	0.292	0.573
08:30-09:00	4.969	2.280	7.249	0.269	0.210	0.479
09:00-09:30	4.513	2.712	7.225	0.398	0.327	0.725
16:00-16:30	2.385	5.027	7.412	0.269	0.281	0.555
16:30-17:00	3.648	4.548	8.196	0.210	0.257	0.467
17:00-17:30	1.333	8.477	9.810	0.105	0.117	0.222
17:30-18:00	1.076	4.712	5.788	0.117	0.094	0.211

4.11 The above trip rates are used to calculate arriving and departing vehicle numbers for each 15-minute interval during the AM and PM peak and shoulder periods, based on the Local Plan development area of 28.5 hectares.

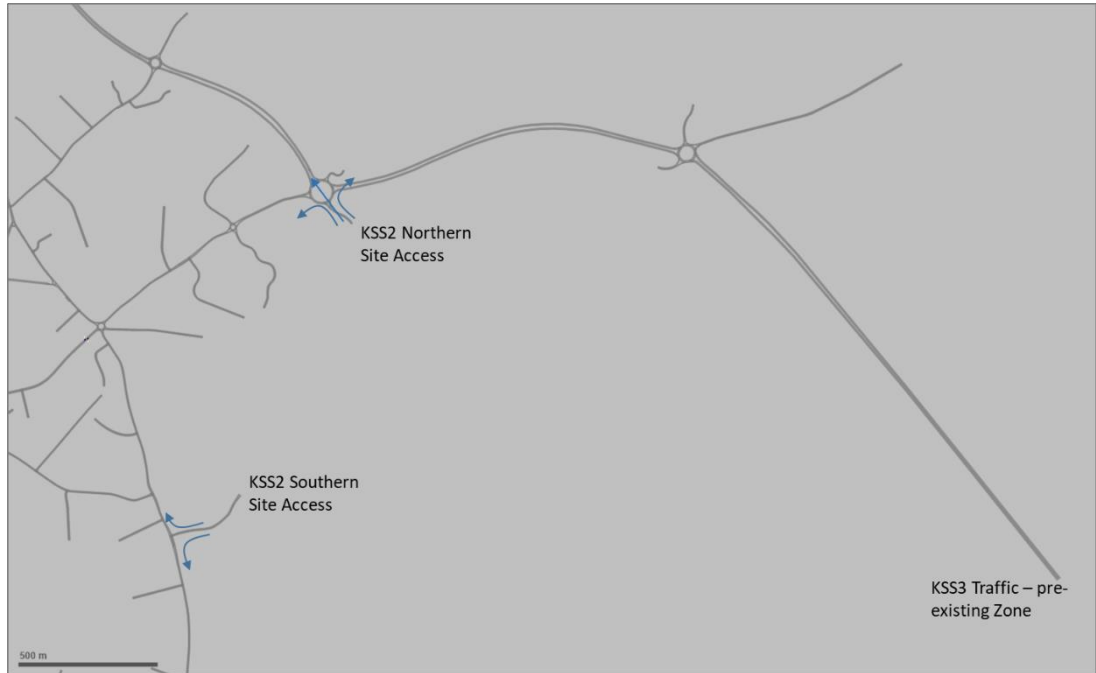
4.12 The table below presents the KSS3 trip generation, split between Light and Heavy vehicles:

Table 18: KSS3 Trip Generation

		2023			2028		
		Lights	Heavies	Total	Lights	Heavies	Total
AM	Peak Hour Arrivals	169	8	177	339	16	355
	Peak Hour Departures	61	7	69	123	14	137
PM	Peak Hour Arrivals	66	4	71	133	9	142
	Peak Hour Departures	180	5	186	361	11	371

- 4.13 In the scenarios, prior to the introduction of the Link Road (i.e. up to and including the 2028 Do-Minimum scenario), KSS2 and KSS3 traffic was assigned into the VISSIM network as is illustrated within the following Figure:

Figure 4: KSS2 and KSS3 Traffic Demand Loading Points (pre Link Road)



5 SCENARIO LIST

5.1 The following provides a summary of the scenarios included in this assessment:

Table 19: Scenario List & Inclusions

	Traffic Demands	Network
Base	Base demands, as per ITP Base model	Base network, as per ITP Base model with minor alterations as described in Chapter 2
2023 Do-Nothing	Base demands, plus TEMPro informed growth to 2023	As per Base
2023 Do-Minimum	Base demands, plus KSS2 and KSS3 2023 trip generation plus adjusted TEMPro informed growth to 2023	Base, plus site access arrangements at Cefn Road for Southern Site and A5156/A534 roundabout for Northern Site
2023 Do-Something	As per 2023 Do-Minimum	As per 2023 Do-Minimum, plus off-site mitigation proposals (to be discussed)
2028 Do-Nothing	Base demands, plus TEMPro informed growth to 2028	As per Base
2028 Do-Minimum	Base demands, plus KSS2 and KSS3 2028 trip generation plus adjusted TEMPro informed growth to 2028	As per 2023 Do-Something. Mitigation proposals for 2023 are carried forward to 2028
2028 Do-Something 1	As per 2028 Do-Minimum	As per 2028 Do-Minimum, plus Link Road through KSS2 Southern and Northern Sites
2028 Do-Something 2	As per 2028 Do-Minimum	As per 2028 Do-Something 1, plus further off-site mitigation proposals (to be discussed)

6 MODELLING RESULTS

- 6.1 Each scenario will be discussed in detail in the following section. Comprehensive network statistics, journey times and queue length data are provided in Appendix B.

2023 Do-Nothing (2023 DN)

- 6.2 Model results show that following inclusion of TEMPro growth to 2023 (4.8% in the AM and 4.6% in the PM), average delay increases by approximately 3 seconds and 8 seconds respectively.
- 6.3 No significant issues are reported in the AM peak period, suggesting the current network has residual capacity which can accommodate the level of growth predicted to occur by 2023.
- 6.4 In the PM, queue length increases (~100m, or approximately 17 vehicles) and journey time increases (~30s) are observed on Industrial Estate Road exit from Wrexham Industrial Estate. *N.B. This is without the specific inclusion of KSS3 but with a level of growth applied to the Industrial Estate informed by TEMPro forecasts.*
- 6.5 This issue is specific to that approach only and has little effect on the operation of the network as a whole.

2023 Do-Minimum (2023 DM)

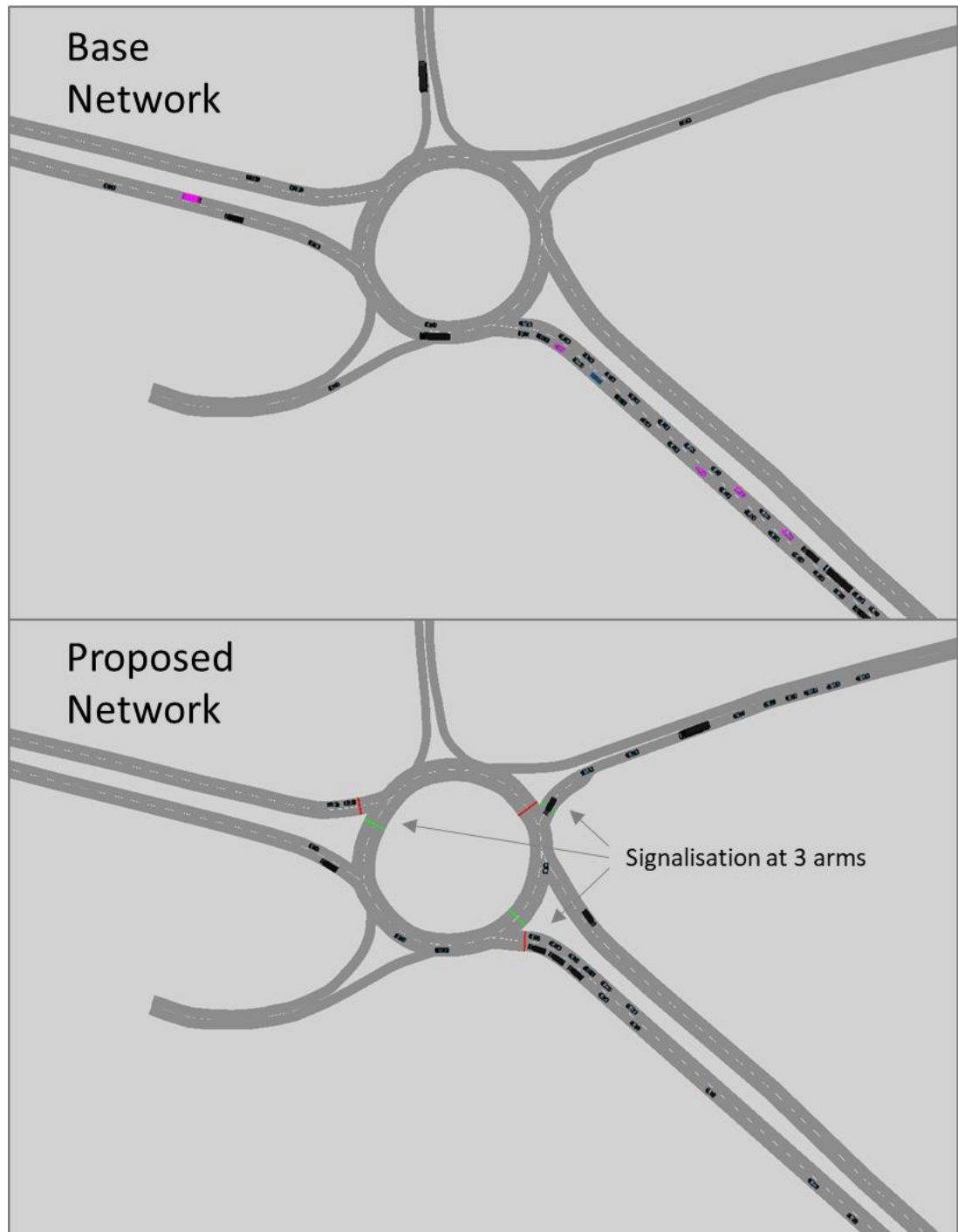
- 6.6 Following inclusion of KSS2 and KSS3 development demands for 2023, alongside the adjusted TEMPro background growth, the results reveal that the increased traffic levels has a detrimental effect on the network.
- 6.7 During the AM peak, average delay per vehicle increases by approximately 17 seconds compared with the DN. Whilst there are some queue and journey time increases, including around Greyhound roundabout, A5156 southbound approach to A534 roundabout and A534 Wrexham Road approach to Industrial Estate Road roundabout, model observations show that queues do not persist for prolonged periods and dissipate quickly enough to ensure the network continues to operate efficiently. As such it is considered that conditions at Greyhound in the Do-Minimum do not require local mitigation at 2023.

- 6.8 During the PM peak however a higher level of impact is observed, with average delay per vehicle increasing by over 40 seconds compared with the DN (a rise of almost 50%). This delay is almost exclusively attributable to extended delays on Industrial Estate Road exit from the Wrexham Industrial Estate. Queues increase from an average of ~200m to ~750m (an increase of approximately 96 vehicles), and journey times increase from almost 3 minutes to almost 5 minutes.
- 6.9 Whilst the impacts are not considered to be excessive in the AM peak, the impacts in the PM indicate that mitigation should be considered to ensure traffic leaving Wrexham Industrial Estate (including KSS3 traffic), is able to access the wider network without the delays observed in the DM.

2023 Do-Something (2023 DS)

- 6.10 Two individual scheme improvements were proposed in response to the issues observed within the 2023 Do Minimum scenario.
- 6.11 Firstly, in order to better regulate traffic from Industrial Estate Road, signals were proposed at the roundabout. The signals were coded into VISSIM using the VISVAP function that allows demand-responsive signalling based on queuing conditions at the roundabout. The intention is to better control queue lengths across all approaches and prevent the excessive queuing on one arm demonstrated in the PM DM scenario.
- 6.12 The following Figure provides a screenshot of the Base layout and the proposed layout at A534/Industrial Estate Road roundabout:

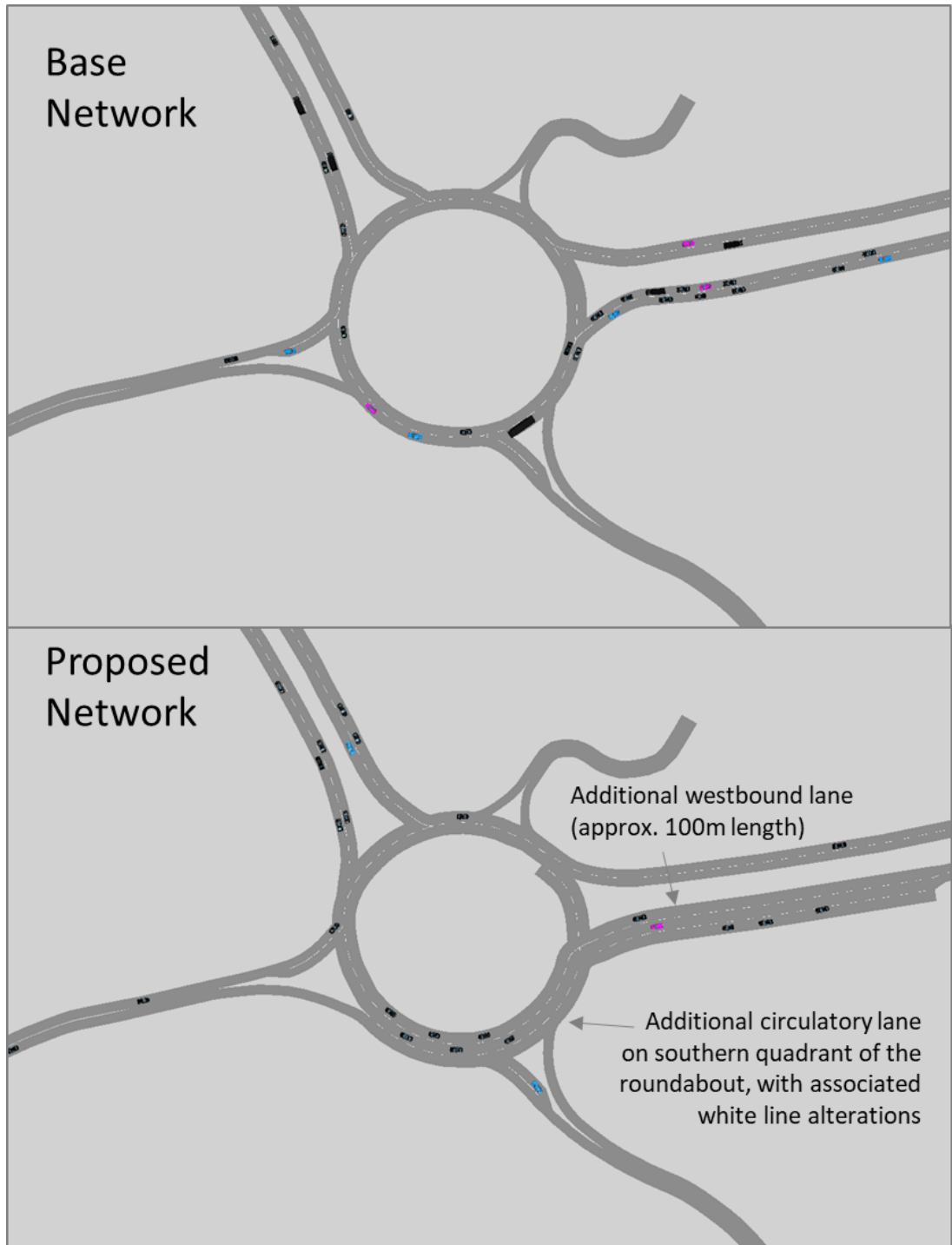
Figure 5: A534/Industrial Estate Road Roundabout – 2023 Proposed Scheme



- 6.13 In addition, following a scheme which would allow more traffic out of Wrexham Industrial Estate, it was also necessary to enhance the A5156/A534 roundabout westbound arm.
- 6.14 Iterative VISSIM testing demonstrated that without enhancements at this location, queues previously observed on Industrial Estate Road simply were relocated onto the westbound approach to A5156/A534 roundabout.

- 6.15 The Figure below provides a screenshot of the Base layout and the proposed layout at A5156/A534 roundabout:

Figure 6: A5156/A534 Roundabout – 2023 Proposed Scheme



- 6.16 Results show that average delay per vehicle in the PM DS scenario decreases by approximately 35 seconds, compared with the DM. Journey times on Industrial Estate Road northbound decrease from almost 5 minutes to less than 2 minutes; lower than journey times in both the 2023 Do-Nothing and the 2018 Base. This provides evidence that the signal scheme is successful at regulating traffic out of Wrexham Industrial Estate following partial delivery of KSS3.
- 6.17 Improvements on the westbound approach to the A5156/A534 roundabout are sufficient to accommodate the additional traffic being released from the east, with journey times showing a reduction compared with the DM of approximately 15 seconds despite an additional c. 200 vehicles approaching the roundabout during the PM peak hour.
- 6.18 Whilst there are minor increases in journey times beyond this roundabout towards Greyhound Roundabout along Holt Road westbound, the increases are considered acceptable and do not result in any concerns over network performance. Average queue lengths for example increase from ~10m to ~50m; an increase of approximately 7 vehicles. Maximum queue lengths increase from 110m to 250m (approximately 24 vehicles); however maximum queue values represent the largest recorded queue length across the whole hour and average queues alongside model observations show this queue dissipates quickly.

2028 Do-Nothing (2028 DN)

- 6.19 The 2028 Do-Nothing tests rely solely on TEMPro for forecasting, with growth percentages of 9.2% and 8.8% applied across the network in the AM and PM peak respectively. This scenario assumes no KSS2 or KSS3 traffic, and no network improvements.
- 6.20 The AM model shows an increase in delay of approximately 10 seconds per vehicle compared with the Base. There are some localised journey time increases on Borrass Park Road eastbound (resulting from the increased traffic levels travelling westbound on the A5156), and on Dean Road southbound towards Greyhound Roundabout.
- 6.21 Across the network however, there appears to be enough residual capacity in the network to accommodate 2028 TEMPro forecast demands during the AM peak.
- 6.22 The PM model shows an increase in delay of approximately 30 seconds per vehicle compared with the Base. As demonstrated in the 2023 DN and DM scenarios, the vast majority of delay is attributed to the Industrial Estate Road exit from Wrexham Industrial Estate. Average

queues increase from approximately 100m in the Base to approximately 500m in the DN (approximately 70 vehicles), and journey times increase from almost 2 minutes to almost 4 minutes.

- 6.23 There are also some minor queue increases around the A5152/Holt Road roundabout and Greyhound roundabout.

2028 Do-Minimum (2028 DM)

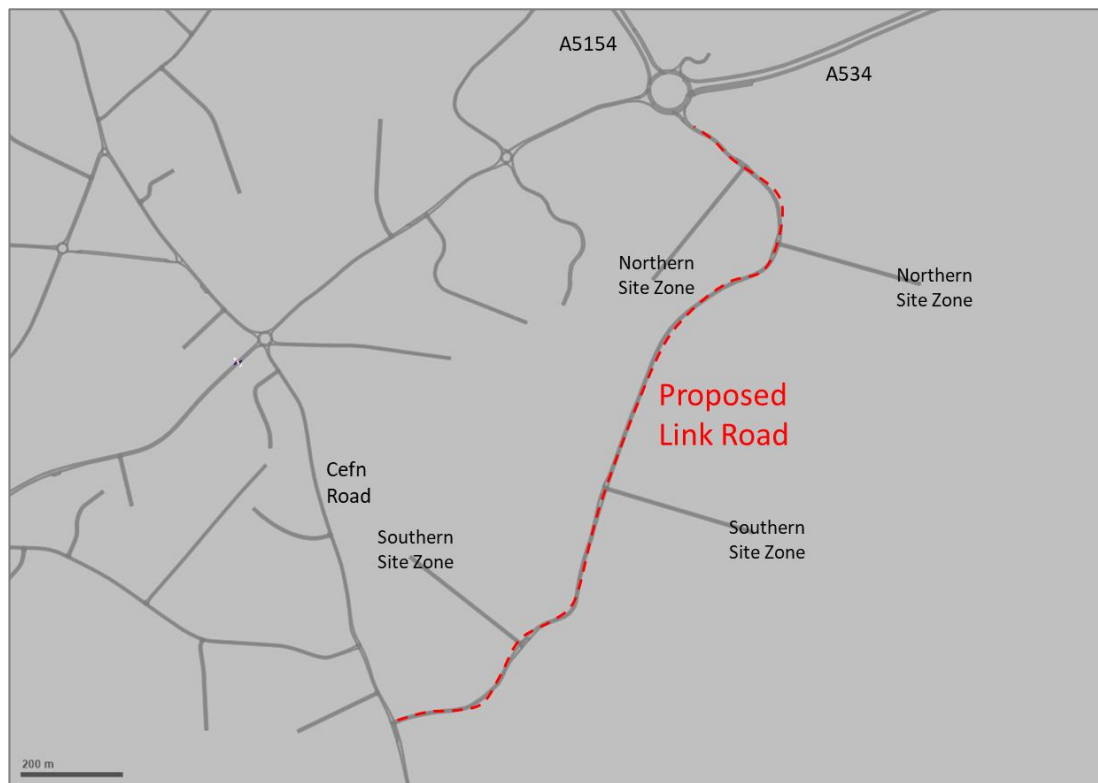
- 6.24 The 2028 DM scenario assumes that the mitigation schemes devised during the 2023 testing are in situ by 2028, under the assumption that KSS2 and KSS3 are delivered in full in this 2028 DM scenario and therefore the interim mitigation will have already have been delivered.
- 6.25 The AM model shows a significant increase in average delay per vehicle compared with the 2028 DN, from just over 1 minute to over 7 minutes.
- 6.26 The vast majority of the delay increase is caused by congestion on the southbound approach to A5156/A534 roundabout, which creates queues that propagate back through the Borrás Park Road roundabout to the edge of the model extent.
- 6.27 This queuing, along with the impact of additional KSS2 traffic exiting the northern site during the AM peak, creates queues on the eastbound Holt Road as circulatory speeds at the roundabout reduce due to the levels of traffic traversing the roundabout. In turn, this eastbound Holt Road queuing impacts upon the exit capacity away from Greyhound Roundabout, causing significant queues at all approaches and exacerbating the Cefn Road queues that result from KSS2 traffic from the southern site travelling northbound.
- 6.28 Model results for the AM DM scenario are highly unstable due to the congestion and the propensity for the model to 'lock' around Greyhound Roundabout where approaching and exiting traffic cause the junction operation to fail. Even with the interim mitigation, the AM 2028 DM model indicates that additional mitigation is necessary simply to enable the network to operate.
- 6.29 The PM model also experiences an increase in average delay per vehicle compared with the 2028 DN, from almost 2 minutes to over 3 ½ minutes. These results also suggest the network is still over capacity in the PM peak under the 2028 DM scenario.

- 6.30 The proposals carried forward from 2023 are sufficient to accommodate the traffic from Wrexham Industrial Estate. There are however queue and journey time increases towards the west of the model area, including the A5152 southbound approach to the Holt Road roundabout, and the eastbound Holt Road exit. Pedestrian crossings and right turning vehicles from Holt Road eastbound create slow moving traffic away from the A5152/Holt Road roundabout towards the end of the PM peak period.
- 6.31 There are also queues and journey time increases on many approaches to Greyhound Roundabout as this junction forms a key route for both KSS2 and KSS3 traffic to and from central Wrexham.

2028 Do-Something 1 (2028 DS1)

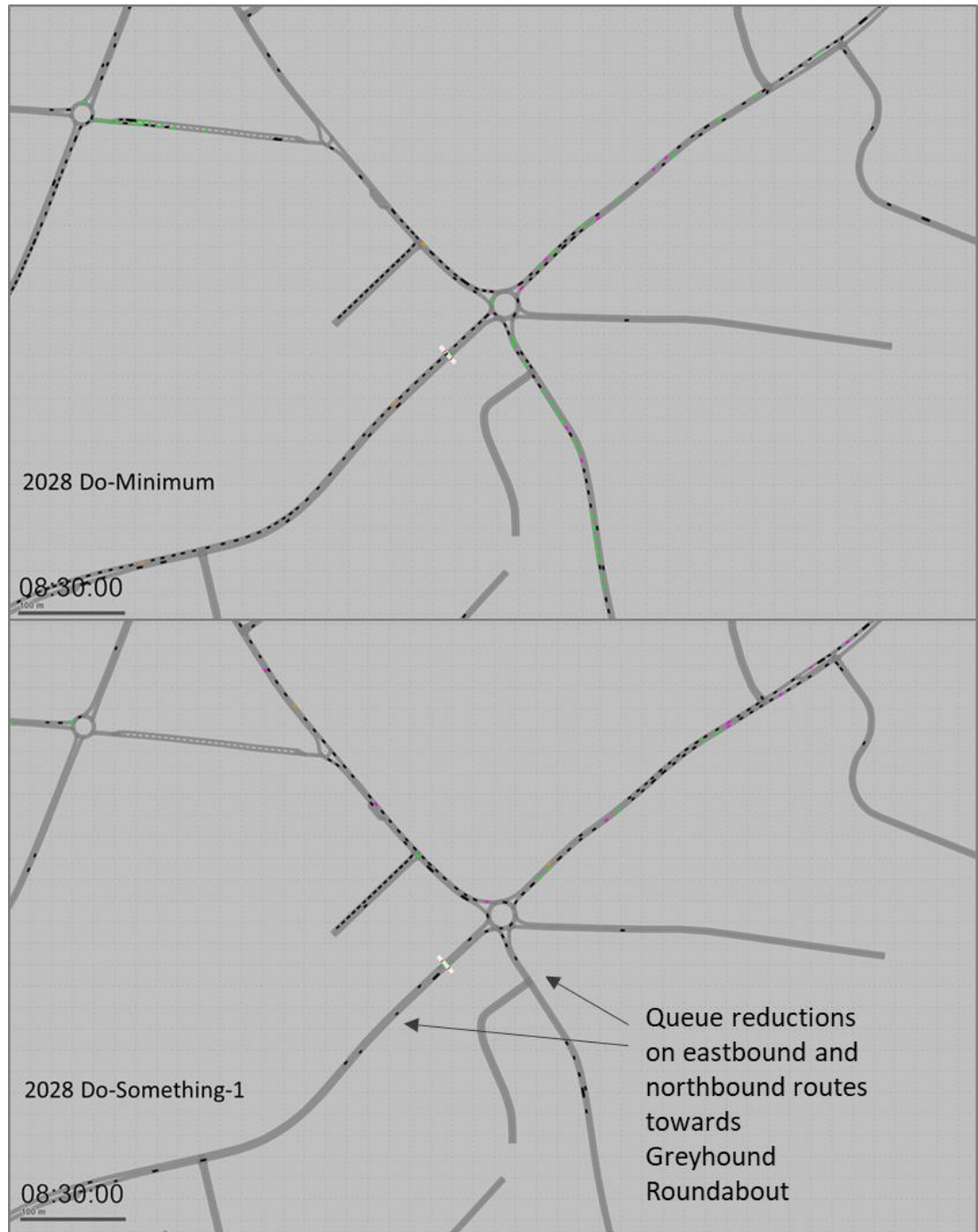
- 6.32 The 2028 Do-Something 1 scenario introduces the link road through the KSS2 northern and southern sites, connecting the A5152/A534 Roundabout to Cefn Road. The following Figure illustrates the revised VISSIM network including the proposed link road:

Figure 7: Link Road Alignment and KSS2 Internal Zone Layout



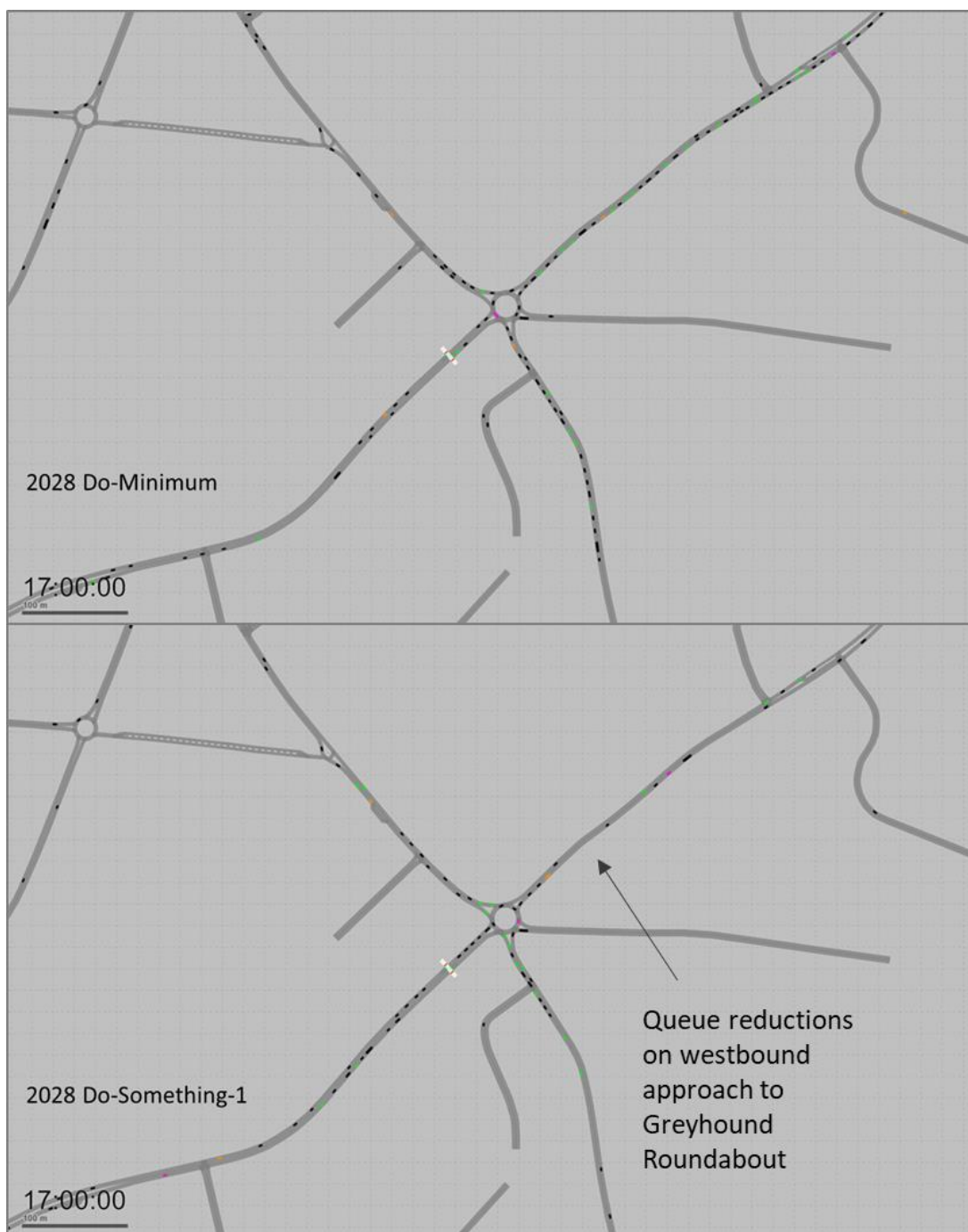
- 6.33 Both northern and southern sites are split across 2 VISSIM zones each, with demands assigned equally between the two. The exact alignment of the link road, and exact location of the internal accesses are yet to be determined and so this represents an indicative layout.
- 6.34 The AM peak shows a moderate improvement following inclusion of the link road, with average delay per vehicle reducing from just over 7 minutes in the 2028 DM to approximately 5 ½ minutes in the 2028 DS1.
- 6.35 Inclusion of the link road provides an alternative route from the south to the A5156/A534 roundabout. This means that traffic from the southern KSS2 site travelling to the A5156/A534 no longer has to travel northbound on Cefn Road towards Greyhound Roundabout but can use the link road instead. This also applies to base level trips, background growth and KSS3 trips as well, all of which are afforded an alternative route which avoids passing through Greyhound Roundabout.
- 6.36 Likewise, traffic travelling towards Cefn Road south from the north or east of the model can use the link road southbound rather than travelling westwards towards Greyhound then southbound along Cefn Road.
- 6.37 Use of this alternative route has impacts on the rest of the network, with minor queue and journey time reductions around the west of the model as lower traffic levels are confined to the routes available prior to inclusion of the link road.
- 6.38 The following screenshots illustrate the benefit of the link road in the AM peak.

Figure 8: AM Greyhound Roundabout Screenshots – 2028 DM vs 2028 DS1



- 6.39 Whilst the link road has demonstrable benefits in the AM, the network is still congested along two key routes:
- A5156 southbound to A5156/A534 roundabout – queues extending back through Borrass Park Road roundabout and beyond
 - Holt Road eastbound to A5156/A534 roundabout – a result of the A5156 queues and additional traffic from the northern site access, both of which create slow moving traffic on the circulatory. These queues are visible in Figure 8 above, having knock-on impacts on Dean Road and Jeffreys Road in particular.
- 6.40 The PM peak shows a greater level of improvement following inclusion of the link road, with average delay per vehicle reducing from just approximately 3 ½ minutes in the 2028 DM to approximately 2 ½ minutes in the 2028 DS1.
- 6.41 Traffic from the north and east travelling to the south in the PM (including the southern KSS2 housing site) also utilises the new link road rather than travelling westbound along Holt Road to Greyhound Roundabout then travelling southbound on Cefn Road.
- 6.42 Improvements also occur to the west of the model, the easing of congestion at and around Greyhound Roundabout improves the eastbound Holt Road away from the A5152 roundabout. Furthermore, some vehicles from the west now choose the Queensway-Cefn Road-Link Road route to the east rather than the more direct Holt Road route, which further eases the congestion observed at the end of the PM peak in the DM scenario.
- 6.43 The following screenshots illustrate the benefit of the link road in the PM peak.

Figure 9: PM Greyhound Roundabout Screenshots – 2028 DM vs 2028 DS1



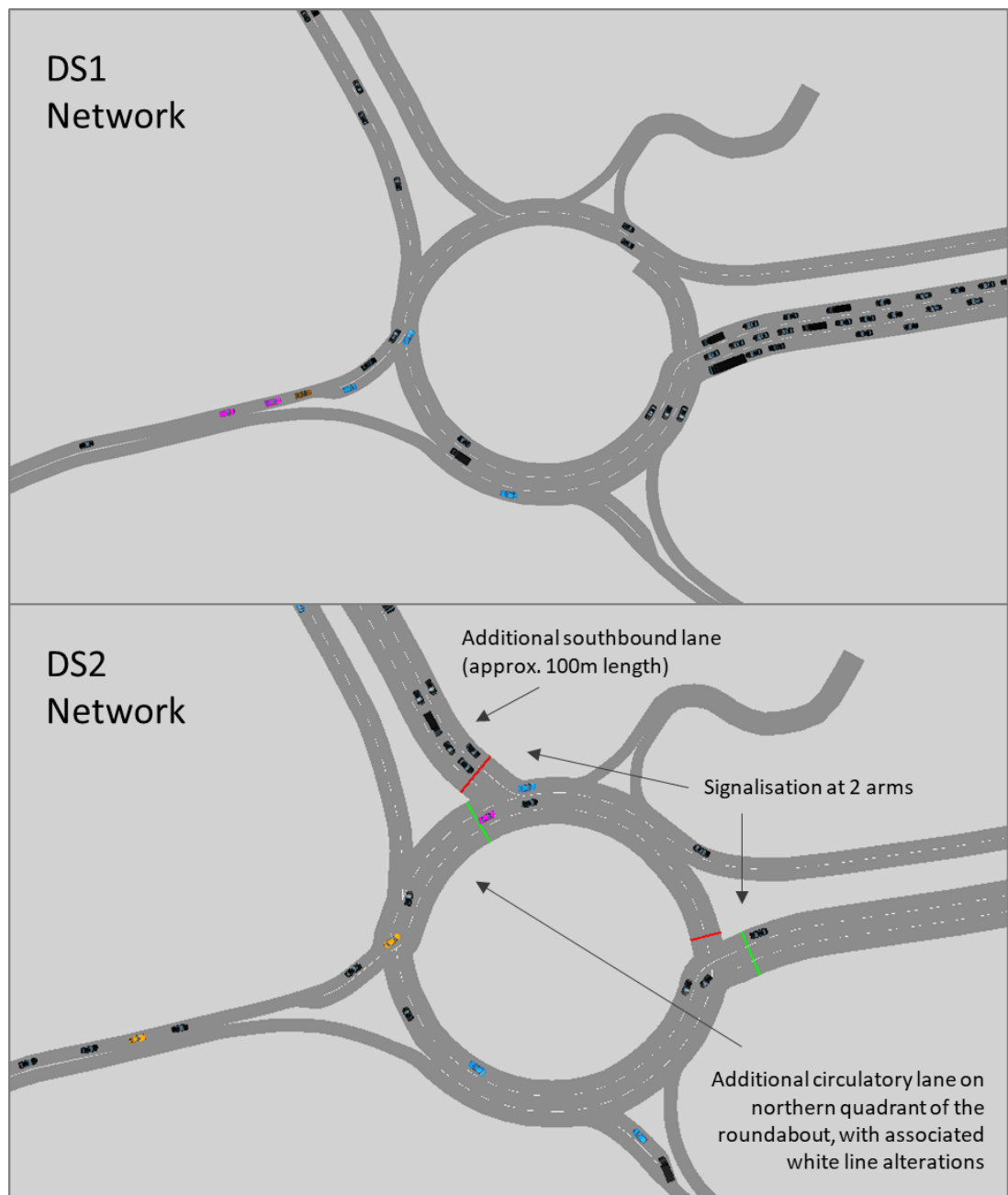
- 6.44 The inclusion of the link road has significant benefits, however particularly in the AM, further mitigation is required to reduce network delay, principally on the A5156 southbound link.

2028 Do-Something 2 (2028 DS2)

6.45 In response to the observed queuing in the AM DS1 scenario, improvements are required at the A5156/A534 roundabout to further improve throughput beyond the level of improvements identified through the interim scheme proposals.

6.46 The following Figure provides a screenshot of the proposed improvements for 2028:

Figure 10: A5156/A534 Roundabout – 2028 Proposed Scheme



- 6.47 Inclusion of signals and widening on the approach to, and at the A5156/A534 Roundabout has significant benefits in the AM peak. Average delay per vehicle reduces from 5 ½ minutes in the DM to just over 1 minute in the DS2.
- 6.48 The majority of this delay saving is on the A5156 southbound link, between Gresford Roundabout and A5156/A534 Roundabout. The additional lane and inclusion of signals formalises the junction and allows better queue balancing and increased circulatory speeds as signals reduce the level of hesitancy on the approach. In turn, eastbound Holt Road queues reduce and the issues reported on Jeffreys Road and Dean Road are removed.
- 6.49 Compared with the 2028 DN, average delay per vehicle in the DS2 scenario increases by only 13 seconds. This is despite over 1000 more completed trips during the AM peak period.
- 6.50 The PM benefits of the A5156/A534 roundabout are less pronounced, but average delay per vehicle reduces from 2 ½ minutes in the DM to just over 2 minutes in the DS2.
- 6.51 Following the signalisation of the A5156/A534 roundabout, the link road becomes a more attractive route as the signals allow for more gaps in the traffic flows that conflicts with the northern site access road. This encourages more traffic from the south and west, taking more traffic away from Greyhound roundabout.
- 6.52 As in the DS1 scenario, this encourages vehicles from central Wrexham to choose the Queensway-Cefn Road-Link Road route to the east rather than the more direct Holt Road route, which alleviates congestion at the A5152 roundabout and eastbound Holt Road to an even greater degree than reported in DS1.
- 6.53 Compared with the 2028 DN, average delay per vehicle in the DS2 scenario increases by only 14 seconds, despite over ~950 more completed trips during the PM peak period.

Scenario Comparison

- 6.54 This section provides an overview of comparisons between each scenario in relation to journey times and flow differences at key junctions.

Journey Time Corridor Comparison

- 6.55 Four journey time corridors have been selected to determine overall journey time differences across all scenarios for key routes through the network. These corridors are in line with previous analysis undertaken by ITP.
- 6.56 The routes are shown in Figure 11 below:

Figure 11: Journey Time Corridors



- 6.57 The tables below show journey time results for each corridor and each direction, followed by a comparison of results for 2023 and 2028, both in terms of actual journey time difference and percentage journey time difference between the Do-Nothing and the corresponding Do-Something scenario.

Table 20: AM Journey Time Corridor Comparison (seconds)

Route	Dir.	AM Base	AM 2023 DN	AM 2023 DM	AM 2023 DS	AM 2028 DN	AM 2028 DM	AM 2028 DS1	AM 2028 DS2
A	EB	250	257	273	270	261	703	450	291
	WB	260	263	289	295	276	350	376	305
B	NB	252	247	293	278	256	583	292	252
	SB	238	253	271	269	268	472	385	262
C	EB	107	108	124	155	113	288	278	129
	WB	99	99	102	98	100	105	99	100
D	EB	119	137	141	148	153	145	163	201
	WB	111	106	108	108	125	119	362	111

Table 21: AM Journey Time Corridor Comparison, Do-Nothing vs Do-Something (seconds)

Route	Dir.	2023		2028	
		DN vs DS (n)	DN vs DS (%)	DN vs DS (n)	DN vs DS (%)
A	EB	13	5%	30	12%
	WB	31	12%	29	11%
B	NB	30	12%	-4	-1%
	SB	17	7%	-6	-2%
C	EB	47	43%	16	15%
	WB	-2	-2%	0	0%
D	EB	11	8%	48	31%
	WB	2	2%	-13	-11%

- 6.58 Results show that during the AM, following inclusion of development and mitigation at 2023 journey times remain stable compared with the Do-Nothing scenario. Moderate journey time increases of 47 seconds are exhibited on A5156 to Industrial Estate Road corridor owing to the additional traffic levels approaching the Industrial Estate following inclusion of KSS3, whilst all other corridors exhibit increases no higher than 12%.
- 6.59 In 2028 comparisons show less of an impact, with no increases over 15% observed other than the Borrass Park eastbound corridor, which is the result of additional traffic levels on northbound A5156 conflicting the eastbound movement.
- 6.60 The tables below show the results for the PM peak.

Table 22: PM Journey Time Corridor Comparison (seconds)

Route	Dir.	PM Base	PM 2023 DN	PM 2023 DM	PM 2023 DS	PM 2028 DN	PM 2028 DM	PM 2028 DS1	PM 2028 DS2
A	EB	287	297	326	365	320	548	481	376
	WB	272	268	273	319	283	400	280	282
B	NB	252	252	262	275	261	335	283	253
	SB	242	247	252	254	251	270	261	250
C	EB	98	98	98	99	98	99	100	103
	WB	128	110	128	115	113	158	131	126
D	EB	127	126	157	147	130	152	152	154
	WB	108	126	148	160	140	149	130	124

Table 23: PM Journey Time Corridor Comparison, Do-Nothing vs Do-Something (seconds)

Route	Dir.	2023		2028	
		DN vs DS (n)	DN vs DS (%)	DN vs DS (n)	DN vs DS (%)
A	EB	68	23%	56	17%
	WB	51	19%	-1	0%
B	NB	23	9%	-8	-3%
	SB	7	3%	-2	-1%
C	EB	1	1%	5	5%
	WB	5	5%	13	11%
D	EB	21	16%	25	19%
	WB	34	27%	-16	-12%

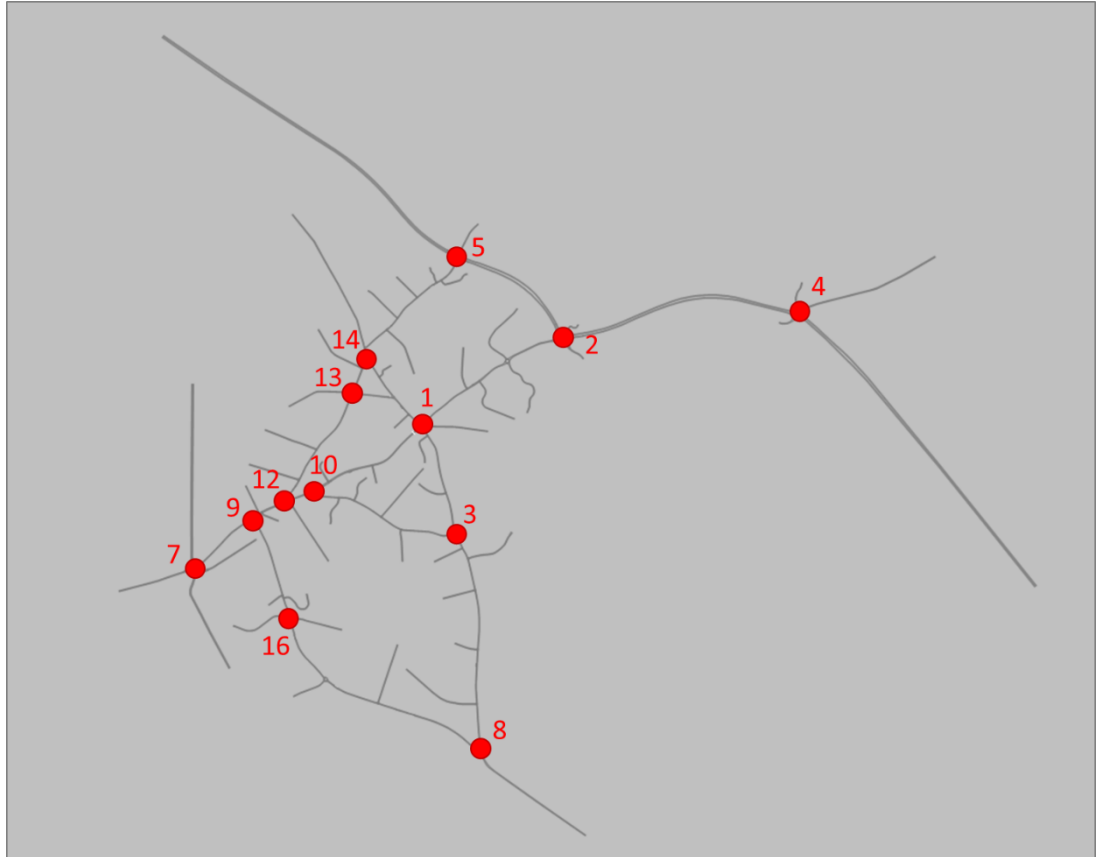
6.61 Results show that during the PM, following inclusion of development and mitigation at 2023 journey times remain relatively stable compared with the Do-Nothing scenario. Moderate journey time increases are exhibited on Holt Road eastbound corridor, and on Borrass Park Road westbound, however both corridors show increases of only ~25%.

6.62 In 2028 comparisons show less of an impact, with no increases over 20% observed.

Junction Flow Comparison

6.63 Figure 12 below presents the junctions identified for assessing modelled junction turn counts.

Figure 12: Turn Counts - Junction Locations



6.64 The tables overleaf provide a summary of AM junction turn counts across the network at these locations, followed by comparisons of the Do-Nothing and Do-Something scenarios for 2023 and 2028 both in vehicle numbers and percentages.

Table 24: AM Turn Count Comparison (vehicles)

Junction No.	Junction Name	AM Base	AM 2023 DN	AM 2023 DM	AM 2023 DS	AM 2028 DN	AM 2028 DM	AM 2028 DS1	AM 2028 DS2
1	Greyhound Roundabout	1953	2037	2228	2232	2132	2069	2208	2215
2	A5156/A534	3053	3241	3658	3648	3381	3905	4305	4149
3	Cefn Road/Hullah Lane	734	718	917	900	760	868	740	714
4	A534/ Industrial Estate Road	2591	2721	3024	3039	2840	3186	3282	3411
5	A5156/Borras Park Road	2884	3011	3239	3208	3143	3345	3508	3536
7	Tesco Roundabout	1703	1792	1854	1852	1866	1813	1948	1998
8	Cefn Road/ Queensway	720	747	800	786	785	922	945	902
9	Holt Road/ Montgomery Road	1280	1343	1407	1411	1397	1370	1491	1529
10	Holt Road/ Hullah Lane	1104	1228	1282	1260	1268	1184	1260	1340
12	Holt Road/ Borras Road/ Archer's Way	1292	1312	1381	1388	1364	1408	1439	1496
13	Rhosnesni Lane/ Borras Road	854	695	720	735	739	919	806	831
14	Jeffrey's Road/ Borras Road	1103	1060	1076	1116	1120	936	1199	1284
16	Queensway/ Montgomery Road/ Smithfield Road	558	622	606	611	648	723	671	608

Table 25: AM Turn Count Comparison, Do-Nothing vs Do-Something (vehicles / %)

Junction No.	Junction Name	2023		2028	
		DN vs DS (vehs)	DN vs DS (%)	DN vs DS (vehs)	DN vs DS (%)
1	Greyhound Roundabout	195	10%	83	4%
2	A5156/A534	407	13%	768	23%
3	Cefn Road/Hullah Lane	182	25%	-46	-6%
4	A534/Industrial Estate Road	318	12%	571	20%
5	A5156/Borras Park Road	197	7%	393	13%
7	Tesco Roundabout	60	3%	132	7%
8	Cefn Road/Queensway	39	5%	117	15%
9	Holt Road/Montgomery Road	68	5%	132	9%
10	Holt Road/Hullah Lane	32	3%	72	6%
12	Holt Road/Borras Road/ Archer's Way	76	6%	132	10%
13	Rhosnesni Lane/Borras Road	40	6%	92	12%
14	Jeffrey's Road/Borras Road	56	5%	164	15%
16	Queensway/Montgomery Road/ Smithfield Road	-11	-2%	-40	-6%

6.65 AM turn count comparisons show that an additional ~1600 vehicle movements are recorded in the Do-Something scenario compared with the Do-Nothing in 2023, and an additional ~2500 vehicle movements in 2028, highlighting both the additional traffic levels generated by KSS2 and KSS3 compared with assumptions contained within TEMPro and the extra capacity created by the scheme proposals.

6.66 The largest AM increases in 2023 are shown at Cefn Road/Hullah Lane, Greyhound Roundabout, A5156/A534 Roundabout and A534 Industrial Estate Road Roundabout. These increases are a result of the focussed growth from KSS2 and KSS3 as opposed to the more generic growth applied via TEMPro. In 2028, increases are exhibited at most locations as more vehicles traverse the network. In contrast to 2023, reductions are shown at Cefn Road/Hullah Lane resulting from inclusion of the Link Road providing an alternative route to Cefn Road.

Table 26: PM Turn Count Comparison (vehicles)

Junction No.	Junction Name	PM Base	PM 2023 DN	PM 2023 DM	PM 2023 DS	PM 2028 DN	PM 2028 DM	PM 2028 DS1	PM 2028 DS2
1	Greyhound Roundabout	2088	2132	2184	2291	2072	2438	2267	2030
2	A5156/A534	2889	2908	3102	3276	2812	3687	3756	3770
3	Cefn Road/Hullah Lane	839	807	990	964	808	1203	929	691
4	A534/ Industrial Estate Road	2750	2797	2915	3136	2728	3410	3422	3410
5	A5156/Borras Park Road	2693	2753	2941	3020	2699	3270	3308	3257
7	Tesco Roundabout	2532	2655	2709	2713	2518	2589	2683	2823
8	Cefn Road/ Queensway	928	964	1030	1020	983	1096	1174	1216
9	Holt Road/ Montgomery Road	1558	1622	1723	1687	1523	1701	1672	1771
10	Holt Road/ Hullah Lane	1296	1267	1259	1341	1191	1385	1354	1361
12	Holt Road/ Borras Road/ Archer's Way	1486	1528	1641	1593	1439	1608	1598	1617
13	Rhosnesni Lane/ Borras Road	605	630	806	639	628	673	770	702
14	Jeffrey's Road/ Borras Road	1090	1186	1241	1220	1170	1172	1282	1193
16	Queensway/ Montgomery Road/ Smithfield Road	825	879	894	883	859	909	837	936

Table 27: PM Turn Count Comparison, Do-Nothing vs Do-Something (vehicles / %)

Junction No.	Junction Name	2023		2028	
		DN vs DS (vehs)	DN vs DS (%)	DN vs DS (vehs)	DN vs DS (%)
1	Greyhound Roundabout	159	7%	-42	-2%
2	A5156/A534	368	13%	958	34%
3	Cefn Road/Hullah Lane	157	19%	-117	-14%
4	A534/Industrial Estate Road	339	12%	682	25%
5	A5156/Borras Park Road	267	10%	558	21%
7	Tesco Roundabout	58	2%	305	12%
8	Cefn Road/Queensway	56	6%	233	24%
9	Holt Road/Montgomery Road	65	4%	248	16%
10	Holt Road/Hullah Lane	74	6%	170	14%
12	Holt Road/Borras Road/Archer's Way	65	4%	178	12%
13	Rhosnesni Lane/Borras Road	9	1%	74	12%
14	Jeffrey's Road/Borras Road	34	3%	23	2%
16	Queensway/Montgomery Road/ Smithfield Road	4	0%	77	9%

- 6.68 PM turn count comparisons show that an additional ~1600 vehicle movements are recorded in the Do-Something scenario compared with the Do-Nothing in 2023, and an additional ~3300 vehicle movements in 2028.
- 6.69 A similar pattern of increases is observed in the PM, with the largest in 2023 located at the Cefn Road and Greyhound Roundabout junctions, and at the A5156 and A534 junctions to the east of the model. Again this is the result of focussing the location of growth in the Do-Something models compared with the TEMPro-informed Do-Nothing.
- 6.70 2028 shows large increases across the network as additional traffic levels are released from Wrexham Industrial Estate and onto the wider network. Greyhound Roundabout and Cefn Road show moderate reductions in traffic levels compared with the Do-Nothing following inclusion of the Link Road which takes traffic away from these junctions.

7 SUMMARY

- 7.1 Vectos Microsim (VM) has been commissioned by Wrexham County Borough Council (WCBC), Barratt Homes, Bloor Homes and Countryside Properties to carry out VISSIM testing in Wrexham.
- 7.2 VM has been instructed to include specific trip generation for two sites; KSS2 and KSS3, along with some background growth informed by TEMPro.
- 7.3 As part of the KSS2 development, a link road will be delivered through the north and south plots that make up the whole site that will connect the existing A5156/A534 roundabout to Cefn Road. It is anticipated this link road will be delivered during the course of the KSS2 build out.
- 7.4 VM has included the following scenarios in the assessment:
- Base
 - 2023 Do-Nothing
 - 2023 Do-Minimum
 - 2023 Do-Something
 - 2028 Do-Nothing
 - 2028 Do-Minimum
 - 2028 Do-Something 1
 - 2028 Do-Something 2
- 7.5 The purpose of the assessment is to determine what, if any, off-site mitigation is required at 2023 before a link road through the site is delivered, and what, if any, off-site mitigation is required at 2028 when the full sites and link road are delivered.
- 7.6 Results of the testing show that without intervention, extensive queuing can be expected in 2023 on Industrial Estate Road during the PM peak. Signalising the A534/Industrial Estate Road roundabout helps alleviate this problem, but would result in excessive queues on the westbound approach to A5156/A534 roundabout without further intervention. Westbound approach and southern-quadrant circulatory widening is sufficient to mitigate against these issues in 2023.

- 7.7 In 2028, the link road has demonstrable benefits in both AM and PM peaks, but particularly the PM as vehicles are afforded an additional route both away from the KSS3 employment site and towards the KSS2 (southern) housing site. The link road takes traffic away from Greyhound roundabout which becomes highly congested in the Do-Minimum scenario with full development but without the link road.
- 7.8 Whilst it is not expected that full development build outs would occur *without* the link road, a comparison of the 2028 Do-Minimum with the 2028 Do-Something 1 allows the benefits of the link road to be fully understood.
- 7.9 The 2028 scenario however still exhibited significant queuing during the AM peak, on A5156 southbound and Holt Road eastbound approaches to the A5156/A534 roundabout, with other associated queuing issues. A further scheme is proposed whereby additional widening is applied to the A5156/A534 roundabout on the northern quadrant and a third lane is added to the southbound approach. Both eastbound and southbound approaches are also signalised to better regulate queue conditions around the roundabout in both peaks.
- 7.10 Results suggest that this package of measures is sufficient to mitigate against the impact of full delivery of KSS2 and KSS3 sites, along with additional background growth up to 2028.
- 7.11 Approximately 1000 additional trips are accommodated during both AM and PM peak periods, with only a minor increase in average delay per vehicle. The economic benefits therefore are considered to outweigh the minor increases in travel times through the network.

8 CONCLUSION

8.1 The modelling indicates that by 2023 the following highway mitigation measures will be required to maintain an acceptable level of network operation:

- Part signalisation of A534/Industrial Estate Road roundabout; and
- Additional third lane on westbound approach to A5156/A534 roundabout (approximately 100m in length), and widening of the southern part of the circulatory to allow 3 circulating lanes.

8.2 Modelling of the link road through the site, in 2028, reveals that there are significant benefits to a number of road users, not just the KSS2 traffic. Testing also reveals that, in 2028, as well as the link road the following mitigation measures will be necessary to ensure that the network can accommodate the additional growth in traffic associated with the Local Plan proposals:

- Part signalisation of A5156/A534 roundabout, additional third lane on southbound approach to A5156/A534 roundabout (approximately 100m in length), and widening of the northern part of the circulatory to allow 3 circulating lanes.

8.3 Analysis reveals that the implementation of these schemes will mitigate the major impacts which may arise as a result of the growth in traffic, both Local Plan and general background traffic increases.

8.4 Through discussions with all stakeholders⁸ including WCBC, Barratt Homes, Bloor Homes and Countryside Properties, these measures and timescales for delivery are considered to be an appropriate response to the issues reported in the pre-mitigation scenarios, and model results along with conclusions drawn from watching the models during simulation suggest that the package of measures is commensurate with the developments' highway impacts.

⁸ Meetings at WCBC, 11.07.2019 and 08.08.2019

Appendix A

Calculation Reference: AUDIT-751701-190612-0632

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT
Category : D - INDUSTRIAL ESTATE
VEHICLES

Selected regions and areas:

03	SOUTH WEST	
	CW CORNWALL	1 days
	DC DORSET	1 days
06	WEST MIDLANDS	
	WO WORCESTERSHIRE	1 days
11	SCOTLAND	
	AG ANGUS	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Secondary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter:	Site area
Actual Range:	12.46 to 30.07 (units: hect)
Range Selected by User:	10 to 50 (units: hect)

Parking Spaces Range: All Surveys Included

Public Transport Provision:

Selection by: Include all surveys

Date Range: 01/01/11 to 27/06/18

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	2 days
Tuesday	2 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	4 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaken using machines.

Selected Locations:

Edge of Town	2
Neighbourhood Centre (PPS6 Local Centre)	1
Free Standing (PPS6 Out of Town)	1

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Village	1
Out of Town	2
No Sub Category	1

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

Not Known	1 days
B1	1 days
B2	2 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Secondary Filtering selection (Cont.):

Population within 1 mile:

1,000 or Less	1 days
5,001 to 10,000	2 days
10,001 to 15,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

25,001 to 50,000	3 days
50,001 to 75,000	1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	1 days
1.1 to 1.5	3 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	4 days
----	--------

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	4 days
-----------------	--------

This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1	AG-02-D-02	INDUSTRIAL ESTATE	ANGUS
	A933 WESTWAY		
	ARBROATH		
	HOSPITALFIELD		
	Edge of Town		
	No Sub Category		
	Total Site area:	30.07 hect	
	Survey date: TUESDAY	25/04/17	Survey Type: MANUAL
2	CW-02-D-03	IND. ESTATE	CORNWALL
	LONG ROCK ROAD		
	NEAR PENZANCE		
	LONG ROCK		
	Neighbourhood Centre (PPS6 Local Centre)		
	Village		
	Total Site area:	12.46 hect	
	Survey date: MONDAY	03/10/11	Survey Type: MANUAL
3	DC-02-D-20	INDUSTRIAL ESTATE	DORSET
	OLD BARN FARM ROAD		
	NEAR BOURNEMOUTH		
	THREE LEGGED CROSS		
	Free Standing (PPS6 Out of Town)		
	Out of Town		
	Total Site area:	16.00 hect	
	Survey date: MONDAY	24/03/14	Survey Type: MANUAL
4	WO-02-D-03	INDUSTRIAL ESTATE	WORCESTERSHIRE
	MILLENNIUM WAY		
	EVESHAM		
	Edge of Town		
	Out of Town		
	Total Site area:	27.00 hect	
	Survey date: TUESDAY	26/06/18	Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

MANUALLY DESELECTED SITES

Site Ref	Reason for Deselection
WK-02-D-01	Logistics
WK-02-D-02	Logistics

CBO Transport Ltd Fountain Street Manchester

Licence No: 751701

TRIP RATE for Land Use 02 - EMPLOYMENT/D - INDUSTRIAL ESTATE

VEHICLES

Calculation factor: 1 hect

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 00:30									
00:30 - 01:00									
01:00 - 01:30									
01:30 - 02:00									
02:00 - 02:30									
02:30 - 03:00									
03:00 - 03:30									
03:30 - 04:00									
04:00 - 04:30									
04:30 - 05:00									
05:00 - 05:30									
05:30 - 06:00									
06:00 - 06:30									
06:30 - 07:00									
07:00 - 07:30	4	21.38	3.075	4	21.38	1.602	4	21.38	4.677
07:30 - 08:00	4	21.38	7.974	4	21.38	1.789	4	21.38	9.763
08:00 - 08:30	4	21.38	7.471	4	21.38	2.537	4	21.38	10.008
08:30 - 09:00	4	21.38	4.969	4	21.38	2.280	4	21.38	7.249
09:00 - 09:30	4	21.38	4.513	4	21.38	2.712	4	21.38	7.225
09:30 - 10:00	4	21.38	3.344	4	21.38	2.245	4	21.38	5.589
10:00 - 10:30	4	21.38	3.297	4	21.38	2.409	4	21.38	5.706
10:30 - 11:00	4	21.38	3.215	4	21.38	2.350	4	21.38	5.565
11:00 - 11:30	4	21.38	3.274	4	21.38	2.444	4	21.38	5.718
11:30 - 12:00	4	21.38	3.449	4	21.38	3.133	4	21.38	6.582
12:00 - 12:30	4	21.38	3.110	4	21.38	3.823	4	21.38	6.933
12:30 - 13:00	4	21.38	3.297	4	21.38	3.554	4	21.38	6.851
13:00 - 13:30	4	21.38	3.917	4	21.38	3.741	4	21.38	7.658
13:30 - 14:00	4	21.38	3.964	4	21.38	3.168	4	21.38	7.132
14:00 - 14:30	4	21.38	3.192	4	21.38	3.940	4	21.38	7.132
14:30 - 15:00	4	21.38	2.257	4	21.38	3.250	4	21.38	5.507
15:00 - 15:30	4	21.38	2.549	4	21.38	4.373	4	21.38	6.922
15:30 - 16:00	4	21.38	2.479	4	21.38	3.917	4	21.38	6.396
16:00 - 16:30	4	21.38	2.385	4	21.38	5.027	4	21.38	7.412
16:30 - 17:00	4	21.38	3.648	4	21.38	4.548	4	21.38	8.196
17:00 - 17:30	4	21.38	1.333	4	21.38	8.477	4	21.38	9.810
17:30 - 18:00	4	21.38	1.076	4	21.38	4.712	4	21.38	5.788
18:00 - 18:30	4	21.38	0.690	4	21.38	2.373	4	21.38	3.063
18:30 - 19:00	4	21.38	1.274	4	21.38	1.836	4	21.38	3.110
19:00 - 19:30									
19:30 - 20:00									
20:00 - 20:30									
20:30 - 21:00									
21:00 - 21:30									
21:30 - 22:00									
22:00 - 22:30									
22:30 - 23:00									
23:00 - 23:30									
23:30 - 24:00									
Total Rates:			79.752			80.240			159.992

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: $COUNT/TRP*FACT$. Trip rates are then rounded to 3 decimal places.

The survey data, graphs and all associated supporting information, contained within the TRICS Database are published by TRICS Consortium Limited ("the Company") and the Company claims copyright and database rights in this published work. The Company authorises those who possess a current TRICS licence to access the TRICS Database and copy the data contained within the TRICS Database for the licence holders' use only. Any resulting copy must retain all copyrights and other proprietary notices, and any disclaimer contained thereon.

The Company accepts no responsibility for loss which may arise from reliance on data contained in the TRICS Database. [No warranty of any kind, express or implied, is made as to the data contained in the TRICS Database.]

Parameter summary

Trip rate parameter range selected:	12.46 to 30.07 (units: hect)
Survey date range:	01/01/11 - 27/06/18
Number of weekdays (Monday-Friday):	4
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	1
Surveys manually removed from selection:	2

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are shown. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

CBO Transport Ltd Fountain Street Manchester

Licence No: 751701

TRIP RATE for Land Use 02 - EMPLOYMENT/D - INDUSTRIAL ESTATE

TAXIS

Calculation factor: 1 hect

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 00:30									
00:30 - 01:00									
01:00 - 01:30									
01:30 - 02:00									
02:00 - 02:30									
02:30 - 03:00									
03:00 - 03:30									
03:30 - 04:00									
04:00 - 04:30									
04:30 - 05:00									
05:00 - 05:30									
05:30 - 06:00									
06:00 - 06:30									
06:30 - 07:00									
07:00 - 07:30	4	21.38	0.012	4	21.38	0.000	4	21.38	0.012
07:30 - 08:00	4	21.38	0.012	4	21.38	0.012	4	21.38	0.024
08:00 - 08:30	4	21.38	0.047	4	21.38	0.023	4	21.38	0.070
08:30 - 09:00	4	21.38	0.012	4	21.38	0.023	4	21.38	0.035
09:00 - 09:30	4	21.38	0.047	4	21.38	0.070	4	21.38	0.117
09:30 - 10:00	4	21.38	0.012	4	21.38	0.012	4	21.38	0.024
10:00 - 10:30	4	21.38	0.012	4	21.38	0.012	4	21.38	0.024
10:30 - 11:00	4	21.38	0.023	4	21.38	0.023	4	21.38	0.046
11:00 - 11:30	4	21.38	0.012	4	21.38	0.000	4	21.38	0.012
11:30 - 12:00	4	21.38	0.000	4	21.38	0.000	4	21.38	0.000
12:00 - 12:30	4	21.38	0.012	4	21.38	0.012	4	21.38	0.024
12:30 - 13:00	4	21.38	0.000	4	21.38	0.000	4	21.38	0.000
13:00 - 13:30	4	21.38	0.023	4	21.38	0.023	4	21.38	0.046
13:30 - 14:00	4	21.38	0.000	4	21.38	0.012	4	21.38	0.012
14:00 - 14:30	4	21.38	0.023	4	21.38	0.000	4	21.38	0.023
14:30 - 15:00	4	21.38	0.000	4	21.38	0.023	4	21.38	0.023
15:00 - 15:30	4	21.38	0.000	4	21.38	0.000	4	21.38	0.000
15:30 - 16:00	4	21.38	0.000	4	21.38	0.000	4	21.38	0.000
16:00 - 16:30	4	21.38	0.012	4	21.38	0.000	4	21.38	0.012
16:30 - 17:00	4	21.38	0.012	4	21.38	0.012	4	21.38	0.024
17:00 - 17:30	4	21.38	0.035	4	21.38	0.035	4	21.38	0.070
17:30 - 18:00	4	21.38	0.023	4	21.38	0.012	4	21.38	0.035
18:00 - 18:30	4	21.38	0.035	4	21.38	0.023	4	21.38	0.058
18:30 - 19:00	4	21.38	0.012	4	21.38	0.023	4	21.38	0.035
19:00 - 19:30									
19:30 - 20:00									
20:00 - 20:30									
20:30 - 21:00									
21:00 - 21:30									
21:30 - 22:00									
22:00 - 22:30									
22:30 - 23:00									
23:00 - 23:30									
23:30 - 24:00									
Total Rates:			0.376			0.350			0.726

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.

TRIP RATE for Land Use 02 - EMPLOYMENT/D - INDUSTRIAL ESTATE

OGVS

Calculation factor: 1 hect

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 00:30									
00:30 - 01:00									
01:00 - 01:30									
01:30 - 02:00									
02:00 - 02:30									
02:30 - 03:00									
03:00 - 03:30									
03:30 - 04:00									
04:00 - 04:30									
04:30 - 05:00									
05:00 - 05:30									
05:30 - 06:00									
06:00 - 06:30									
06:30 - 07:00									
07:00 - 07:30	4	21.38	0.199	4	21.38	0.140	4	21.38	0.339
07:30 - 08:00	4	21.38	0.281	4	21.38	0.257	4	21.38	0.538
08:00 - 08:30	4	21.38	0.281	4	21.38	0.292	4	21.38	0.573
08:30 - 09:00	4	21.38	0.269	4	21.38	0.210	4	21.38	0.479
09:00 - 09:30	4	21.38	0.398	4	21.38	0.327	4	21.38	0.725
09:30 - 10:00	4	21.38	0.327	4	21.38	0.187	4	21.38	0.514
10:00 - 10:30	4	21.38	0.362	4	21.38	0.339	4	21.38	0.701
10:30 - 11:00	4	21.38	0.292	4	21.38	0.304	4	21.38	0.596
11:00 - 11:30	4	21.38	0.257	4	21.38	0.199	4	21.38	0.456
11:30 - 12:00	4	21.38	0.292	4	21.38	0.433	4	21.38	0.725
12:00 - 12:30	4	21.38	0.538	4	21.38	0.398	4	21.38	0.936
12:30 - 13:00	4	21.38	0.316	4	21.38	0.234	4	21.38	0.550
13:00 - 13:30	4	21.38	0.316	4	21.38	0.374	4	21.38	0.690
13:30 - 14:00	4	21.38	0.339	4	21.38	0.374	4	21.38	0.713
14:00 - 14:30	4	21.38	0.292	4	21.38	0.409	4	21.38	0.701
14:30 - 15:00	4	21.38	0.234	4	21.38	0.234	4	21.38	0.468
15:00 - 15:30	4	21.38	0.257	4	21.38	0.327	4	21.38	0.584
15:30 - 16:00	4	21.38	0.374	4	21.38	0.339	4	21.38	0.713
16:00 - 16:30	4	21.38	0.269	4	21.38	0.281	4	21.38	0.550
16:30 - 17:00	4	21.38	0.210	4	21.38	0.257	4	21.38	0.467
17:00 - 17:30	4	21.38	0.105	4	21.38	0.117	4	21.38	0.222
17:30 - 18:00	4	21.38	0.117	4	21.38	0.094	4	21.38	0.211
18:00 - 18:30	4	21.38	0.012	4	21.38	0.129	4	21.38	0.141
18:30 - 19:00	4	21.38	0.105	4	21.38	0.105	4	21.38	0.210
19:00 - 19:30									
19:30 - 20:00									
20:00 - 20:30									
20:30 - 21:00									
21:00 - 21:30									
21:30 - 22:00									
22:00 - 22:30									
22:30 - 23:00									
23:00 - 23:30									
23:30 - 24:00									
Total Rates:			6.442			6.360			12.802

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.

TRIP RATE for Land Use 02 - EMPLOYMENT/D - INDUSTRIAL ESTATE

PSVS

Calculation factor: 1 hect

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 00:30									
00:30 - 01:00									
01:00 - 01:30									
01:30 - 02:00									
02:00 - 02:30									
02:30 - 03:00									
03:00 - 03:30									
03:30 - 04:00									
04:00 - 04:30									
04:30 - 05:00									
05:00 - 05:30									
05:30 - 06:00									
06:00 - 06:30									
06:30 - 07:00									
07:00 - 07:30	4	21.38	0.012	4	21.38	0.105	4	21.38	0.117
07:30 - 08:00	4	21.38	0.000	4	21.38	0.117	4	21.38	0.117
08:00 - 08:30	4	21.38	0.012	4	21.38	0.035	4	21.38	0.047
08:30 - 09:00	4	21.38	0.012	4	21.38	0.023	4	21.38	0.035
09:00 - 09:30	4	21.38	0.129	4	21.38	0.000	4	21.38	0.129
09:30 - 10:00	4	21.38	0.023	4	21.38	0.023	4	21.38	0.046
10:00 - 10:30	4	21.38	0.023	4	21.38	0.023	4	21.38	0.046
10:30 - 11:00	4	21.38	0.000	4	21.38	0.047	4	21.38	0.047
11:00 - 11:30	4	21.38	0.012	4	21.38	0.035	4	21.38	0.047
11:30 - 12:00	4	21.38	0.047	4	21.38	0.023	4	21.38	0.070
12:00 - 12:30	4	21.38	0.000	4	21.38	0.023	4	21.38	0.023
12:30 - 13:00	4	21.38	0.082	4	21.38	0.012	4	21.38	0.094
13:00 - 13:30	4	21.38	0.047	4	21.38	0.023	4	21.38	0.070
13:30 - 14:00	4	21.38	0.000	4	21.38	0.000	4	21.38	0.000
14:00 - 14:30	4	21.38	0.000	4	21.38	0.047	4	21.38	0.047
14:30 - 15:00	4	21.38	0.012	4	21.38	0.035	4	21.38	0.047
15:00 - 15:30	4	21.38	0.012	4	21.38	0.058	4	21.38	0.070
15:30 - 16:00	4	21.38	0.035	4	21.38	0.012	4	21.38	0.047
16:00 - 16:30	4	21.38	0.035	4	21.38	0.000	4	21.38	0.035
16:30 - 17:00	4	21.38	0.070	4	21.38	0.035	4	21.38	0.105
17:00 - 17:30	4	21.38	0.035	4	21.38	0.035	4	21.38	0.070
17:30 - 18:00	4	21.38	0.070	4	21.38	0.012	4	21.38	0.082
18:00 - 18:30	4	21.38	0.117	4	21.38	0.012	4	21.38	0.129
18:30 - 19:00	4	21.38	0.117	4	21.38	0.023	4	21.38	0.140
19:00 - 19:30									
19:30 - 20:00									
20:00 - 20:30									
20:30 - 21:00									
21:00 - 21:30									
21:30 - 22:00									
22:00 - 22:30									
22:30 - 23:00									
23:00 - 23:30									
23:30 - 24:00									
Total Rates:			0.902			0.758			1.660

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.

TRIP RATE for Land Use 02 - EMPLOYMENT/D - INDUSTRIAL ESTATE

CYCLISTS

Calculation factor: 1 hect

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 00:30									
00:30 - 01:00									
01:00 - 01:30									
01:30 - 02:00									
02:00 - 02:30									
02:30 - 03:00									
03:00 - 03:30									
03:30 - 04:00									
04:00 - 04:30									
04:30 - 05:00									
05:00 - 05:30									
05:30 - 06:00									
06:00 - 06:30									
06:30 - 07:00									
07:00 - 07:30	4	21.38	0.117	4	21.38	0.035	4	21.38	0.152
07:30 - 08:00	4	21.38	0.164	4	21.38	0.000	4	21.38	0.164
08:00 - 08:30	4	21.38	0.140	4	21.38	0.012	4	21.38	0.152
08:30 - 09:00	4	21.38	0.047	4	21.38	0.000	4	21.38	0.047
09:00 - 09:30	4	21.38	0.035	4	21.38	0.023	4	21.38	0.058
09:30 - 10:00	4	21.38	0.000	4	21.38	0.000	4	21.38	0.000
10:00 - 10:30	4	21.38	0.023	4	21.38	0.035	4	21.38	0.058
10:30 - 11:00	4	21.38	0.082	4	21.38	0.082	4	21.38	0.164
11:00 - 11:30	4	21.38	0.000	4	21.38	0.012	4	21.38	0.012
11:30 - 12:00	4	21.38	0.035	4	21.38	0.023	4	21.38	0.058
12:00 - 12:30	4	21.38	0.012	4	21.38	0.035	4	21.38	0.047
12:30 - 13:00	4	21.38	0.035	4	21.38	0.012	4	21.38	0.047
13:00 - 13:30	4	21.38	0.023	4	21.38	0.023	4	21.38	0.046
13:30 - 14:00	4	21.38	0.058	4	21.38	0.023	4	21.38	0.081
14:00 - 14:30	4	21.38	0.012	4	21.38	0.023	4	21.38	0.035
14:30 - 15:00	4	21.38	0.023	4	21.38	0.070	4	21.38	0.093
15:00 - 15:30	4	21.38	0.023	4	21.38	0.246	4	21.38	0.269
15:30 - 16:00	4	21.38	0.035	4	21.38	0.047	4	21.38	0.082
16:00 - 16:30	4	21.38	0.023	4	21.38	0.070	4	21.38	0.093
16:30 - 17:00	4	21.38	0.035	4	21.38	0.058	4	21.38	0.093
17:00 - 17:30	4	21.38	0.023	4	21.38	0.187	4	21.38	0.210
17:30 - 18:00	4	21.38	0.047	4	21.38	0.117	4	21.38	0.164
18:00 - 18:30	4	21.38	0.164	4	21.38	0.070	4	21.38	0.234
18:30 - 19:00	4	21.38	0.047	4	21.38	0.000	4	21.38	0.047
19:00 - 19:30									
19:30 - 20:00									
20:00 - 20:30									
20:30 - 21:00									
21:00 - 21:30									
21:30 - 22:00									
22:00 - 22:30									
22:30 - 23:00									
23:00 - 23:30									
23:30 - 24:00									
Total Rates:			1.203			1.203			2.406

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: $COUNT/TRP*FACT$. Trip rates are then rounded to 3 decimal places.

Appendix B

	AM							
	AM Base	AM 2023 DN	AM 2023 DM	AM 2023 DS	AM 2028 DN	AM 2028 DM	AM 2028 DS1	AM 2028 DS2
Average Delay per Vehicle in the Network (s)	49.7	52.5	68.1	74.0	59.6	339.7	270.8	71.7
Overall Delay per Vehicle (including time off network) (s)	53.2	56.3	73.4	79.7	64.0	428.7	328.2	77.2
Total Travel Time (hrs)	521.1	547.8	625.5	636.3	588.4	1392.3	1245.3	706.4
Average Travel Time (s)	246.2	247.0	263.2	267.5	254.1	519.0	461.5	267.9
Average Speed per Vehicle (mph)	30.0	29.8	28.3	27.8	28.9	13.5	15.8	28.3
Vehicles Active in the Network	503	522	606	605	568.0	1897.0	1280.0	662.0
Vehicle Trips Completed	7116	7463	7950	7957	7768.0	7760.0	8434.0	8831.0
Latent Demand at end of Simulation	0	0	0	0	0	74	16	0
Total Input Vehicle Numbers	7619	7985	8556	8562	8336	9731	9730	9493
Total Delay (hrs)	105.1	116.5	161.9	176.0	137.9	909.2	730.8	189.1
Latent Delay (hrs)	0.1	0.1	0.1	0.1	0.1	14.8	38.2	0.2

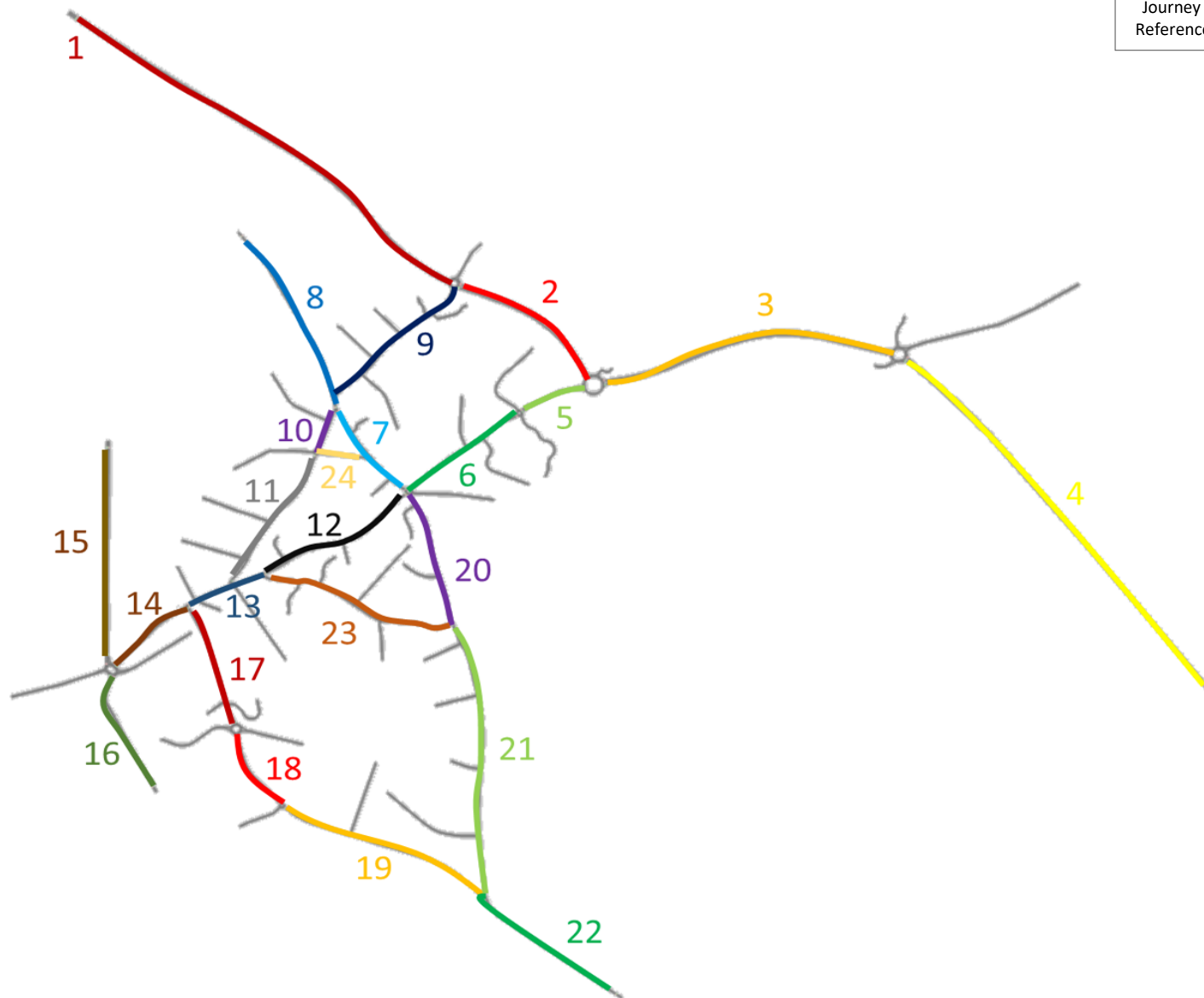
	PM							
	PM Base	PM 2023 DN	PM 2023 DM	PM 2023 DS	PM 2028 DN	PM 2028 DM	PM 2028 DS1	PM 2028 DS2
Average Delay per Vehicle in the Network (s)	75.6	82.3	119.7	89.8	102.3	181.6	134.2	113.9
Overall Delay per Vehicle (including time off network) (s)	82.4	90.1	133.7	98.3	113.1	214.6	151.6	127.1
Total Travel Time (hrs)	615.0	653.7	791.1	715.0	726.4	1017.7	911.8	853.6
Average Travel Time (s)	272.5	277.5	315.2	285.2	295.9	371.0	329.3	308.2
Average Speed per Vehicle (mph)	27.0	26.2	22.9	25.9	24.3	19.6	22.5	24.1
Vehicles Active in the Network	668	728	944	780	837.1	1255.0	1111.0	1029.0
Vehicle Trips Completed	7456	7752	8092	8246	8000.1	8621.0	8858.0	8941.0
Latent Demand at end of Simulation	0	2	0	0	0	138	21	0
Total Input Vehicle Numbers	8124	8482	9036	9026	8838	10014	9990	9970
Total Delay (hrs)	170.5	193.8	300.3	225.1	251.1	498.3	371.7	315.4
Latent Delay (hrs)	0.1	0.2	0.2	0.2	0.2	15.7	1.2	0.2

PEAK HOUR JOURNEY TIMES (SECONDS)

		Direction	AM Base	AM 2023 DN	AM 2023 DM	AM 2023 DS	AM 2028 DN	AM 2028 DM	AM 2028 DS1	AM 2028 DS2
1	A5156: Between Gresford Interchange and Borras Road Roundabout	SB	85	86	88	89	88	505	591	92
		NB	75	76	76	76	75	76	76	76
2	A5156: Between Borras Road Roundabout and A534 Roundabout	SB	41	42	54	90	45	223	213	59
		NB	36	36	37	37	37	37	37	39
3	A534: Between A5156 Roundabout and Industrial Estate Road Roundabout	EB	66	66	70	66	68	66	65	70
		WB	63	63	65	61	64	68	62	62
4	Industrial Estate Road	SB	76	76	77	78	76	78	78	79
		NB	79	79	79	78	80	79	79	79
5	Stryt Holt: Between A534 Roundabout and Birkdale Road Roundabout	WB	24	23	24	25	23	54	27	23
		EB	27	28	31	29	29	54	77	47
6	Stryt Holt: Between Birkdale Road Roundabout and Greyhound Roundabout	WB	62	64	80	90	69	123	103	70
		EB	57	58	62	63	58	143	166	63
7	Dean Road: Between Greyhound Roundabout and Jeffreys Road Roundabout	NB	54	53	53	53	54	75	71	56
		SB	67	80	91	89	92	283	209	89
8	Jeffreys Road	NB	76	78	77	76	77	81	81	78
		SB	83	85	84	84	86	94	317	88
9	Borras Park Road	EB	110	137	141	148	153	145	163	201
		WB	111	106	108	108	125	119	362	111
10	Borras Road: Between Dean Road Roundabout and Rhosnesni Lane	NB	22	22	22	22	23	25	44	25
		SB	20	20	20	20	20	43	21	20
11	Borras Road: Between Rhosnesni Lane and Stryt Holt	SB	138	129	129	134	131	418	138	141
		NB	105	102	102	101	103	113	131	102
12	Stryt Holt: Between Greyhound Roundabout and Hullah Lane	EB	73	75	77	77	76	376	104	76
		WB	69	71	75	72	76	66	127	93
13	Stryt Holt: Between Hullah Lane and Ffordd Montgomery	WB	56	56	62	59	60	58	70	69
		EB	53	55	60	59	57	85	60	63
14	Stryt Holt: Between Ffordd Montgomery and A5152 Roundabout	WB	48	48	49	49	49	49	49	51
		EB	41	41	42	42	41	46	42	43
15	A5152 North	SB	75	75	76	76	76	76	76	76
		NB	75	75	75	75	75	75	75	75
16	A5152 South	SB	43	43	43	43	43	43	43	43
		NB	49	49	49	49	49	49	49	50
17	Ffordd Montgomery: Between A534 and Smithfield Road Roundabout	SB	62	62	62	62	62	65	62	62
		NB	68	70	69	71	70	83	78	75
18	Queensway: Between Smithfield Road Roundabout and Whitegate Road Roundabout	SB	58	58	62	59	60	69	61	57
		NB	54	59	57	57	58	65	65	58
19	Queensway: Between Whitegate Road Roundabout and Cefn Road	EB	127	132	131	131	134	145	140	133
		WB	143	148	148	147	153	184	222	152
20	Cefn Road: Between Greyhound Roundabout and Hullah Lane	SB	55	55	59	59	56	60	55	55
		NB	77	75	118	104	81	276	101	75
21	Cefn Road: Between Hullah Lane and Queensway	SB	116	117	120	121	119	128	121	119
		NB	120	119	122	121	121	232	121	121
22	Cefn Road South of Queensway	NB	43	43	43	43	43	43	43	43
		SB	62	62	63	63	62	62	62	63
23	Hullah Lane	WB	214	214	223	224	218	268	306	234
		EB	212	203	193	202	210	258	221	197
24	Rhosnesni Lane	WB	24	22	22	22	22	115	23	23

		Direction	PM Base	PM 2023 DN	PM 2023 DM	PM 2023 DS	PM 2028 DN	PM 2028 DM	PM 2028 DS1	PM 2028 DS2
1	A5156: Between Gresford Interchange and Borras Road Roundabout	SB	82	85	86	86	85	90	87	91
		NB	75	75	76	76	75	77	77	77
2	A5156: Between Borras Road Roundabout and A534 Roundabout	SB	37	37	37	37	37	38	38	40
		NB	38	42	46	49	43	66	49	57
3	A534: Between A5156 Roundabout and Industrial Estate Road Roundabout	EB	61	61	61	61	61	62	62	63
		WB	90	68	82	67	69	91	82	69
4	Industrial Estate Road	SB	70	70	71	71	70	72	72	72
		NB	135	170	279	105	227	144	149	157
5	Stryt Holt: Between A534 Roundabout and Birkdale Road Roundabout	WB	27	26	26	31	27	51	24	26
		EB	31	35	52	34	35	86	54	30
6	Stryt Holt: Between Birkdale Road Roundabout and Greyhound Roundabout	WB	73	71	72	99	74	159	65	66
		EB	55	55	56	55	54	69	57	53
7	Dean Road: Between Greyhound Roundabout and Jeffreys Road Roundabout	NB	52	54	55	54	55	53	57	55
		SB	67	72	77	76	75	88	81	70
8	Jeffreys Road	NB	80	80	80	80	80	80	81	81
		SB	82	84	84	83	85	84	84	83
9	Borras Park Road	EB	127	126	157	147	130	152	152	154
		WB	108	126	148	160	140	219	130	124
10	Borras Road: Between Dean Road Roundabout and Rhosnesni Lane	NB	21	21	22	22	21	21	22	22
		SB	19	19	19	19	19	19	19	19
11	Borras Road: Between Rhosnesni Lane and Stryt Holt	SB	136	148	170	141	155	142	148	145
		NB	99	101	106	102	100	96	96	99
12	Stryt Holt: Between Greyhound Roundabout and Hullah Lane	EB	77	81	80	79	80	80	85	80
		WB	70	69	69	74	72	74	73	74
13	Stryt Holt: Between Hullah Lane and Ffordd Montgomery	WB	54	54	57	65	61	68	68	66
		EB	80	79	86	102	90	115	111	101
14	Stryt Holt: Between Ffordd Montgomery and A5152 Roundabout	WB	49	49	49	50	50	48	50	50
		EB	45	47	52	94	61	199	174	113
15	A5152 North	SB	78	78	78	82	79	484	248	111
		NB	76	76	76	76	76	77	76	77
16	A5152 South	SB	43	43	43	43	43	43	43	43
		NB	53	53	54	53	53	58	58	66
17	Ffordd Montgomery: Between A534 and Smithfield Road Roundabout	SB	63	64	66	64	65	63	62	69
		NB	80	72	77	97	81	191	127	113
18	Queensway: Between Smithfield Road Roundabout and Whitegate Road Roundabout	SB	67	78	83	69	78	69	68	93
		NB	59	60	58	62	61	64	59	61
19	Queensway: Between Whitegate Road Roundabout and Cefn Road	EB	134	139	140	136	137	135	138	149
		WB	188	187	186	194	204	204	228	251
20	Cefn Road: Between Greyhound Roundabout and Hullah Lane	SB	56	55	55	57	56	59	55	53
		NB	78	75	80	97	82	154	97	70
21	Cefn Road: Between Hullah Lane and Queensway	SB	119	120	120	121	120	123	126	126
		NB	122	123	128	124	125	128	129	128
22	Cefn Road South of Queensway	NB	44	44	44	44	45	45	46	46
		SB	63	63	63	63	63	63	63	63
23	Hullah Lane	WB	213	220	232	198	209	183	225	208
		EB	226	191	236	223	196	243	232	226
24	Rhosnesni Lane	WB	22	22	23	22	22	22	23	22

Journey Times
Reference Map



AVERAGE QUEUE LENGTHS (METRES)											
Junction	Site	Arm	Description	AM Base	AM 2023 DN	AM 2023 DM	AM 2023 DS	AM 2028 DN	AM 2028 DM	AM 2028 DS1	AM 2028 DS2
4	Site 4	Arm A	Sandy Lane	0	0	0	0	0	0	0	0
4	Site 4	Arm B	A534 Bypass	1	1	2	19	1	20	19	29
4	Site 4	Arm C	Borras Hall Lane	1	2	5	1	2	1	1	1
4	Site 4	Arm D	A534 Wrexham Rd	8	16	55	21	20	22	27	26
4	Site 4	Arm E	Industrial Estate Rd	0	0	1	3	1	3	3	3
5	Site 5	Arm A	Borras Rd	0	0	0	0	0	8	6	1
5	Site 5	Arm B	A5156 East	1	1	2	1	1	1	3	5
5	Site 5	Arm C	Borras Park Rd	7	5	4	5	8	6	18	3
5	Site 5	Arm D	A5156 West	7	9	12	15	13	1507	1791	20
1	Site 1	Arm A	Holt Rd North	6	9	36	59	14	336	109	20
1	Site 1	Arm B	Bryn Estyn Rd	0	0	0	1	0	5	0	0
1	Site 1	Arm C	Cefn Rd	24	21	112	79	32	720	54	25
1	Site 1	Arm D	Holt Rd South	3	4	7	7	6	690	39	5
1	Site 1	Arm E	Dean Rd	3	21	39	39	45	260	592	44
7	Site 7	Arm A	Holt Rd	1	1	2	2	2	2	2	2
7	Site 7	Arm B	Tesco	0	0	0	0	0	2	0	0
7	Site 7	Arm C	Fardon Rd	1	1	1	1	1	7	1	1
7	Site 7	Arm D	Holt St	0	0	0	0	0	2	0	0
7	Site 7	Arm E	A5152 Main	0	0	0	0	0	13	0	0
7	Site 7	Arm F	A5152 Left Slip	0	0	0	0	0	13	0	1
8	Site 8	Arm A	Cefn Rd Right Turn	0	0	0	0	0	1	2	1
8	Site 8	Arm C	Queensway Right Turn	0	0	0	0	0	1	0	0
2	Site 2	Arm A	A5156	4	6	42	158	11	700	689	57
2	Site 2	Arm C	A534 Bypass	5	5	8	1	6	52	2	4
2	Site 2	Arm C	Holt Road	1	2	3	4	2	210	471	55
2	Site 2	Arm C	Northern Site Access Exit	N/A	N/A	0	0	N/A	6	22	12

Junction	Site	Arm	Description	PM Base	PM 2023 DN	PM 2023 DM	PM 2023 DS	PM 2028 DN	PM 2028 DM	PM 2028 DS1	PM 2028 DS2
4	Site 4	Arm A	Sandy Lane	1	1	1	0	2	0	0	0
4	Site 4	Arm B	A534 Bypass	1	1	1	7	1	7	8	8
4	Site 4	Arm C	Borras Hall Lane	0	0	0	0	0	0	0	0
4	Site 4	Arm D	A534 Wrexham Rd	0	0	0	35	14	66	68	83
4	Site 4	Arm E	Industrial Estate Rd	92	214	746	76	488	272	292	332
5	Site 5	Arm A	Borras Rd	0	0	0	0	2	2	0	4
5	Site 5	Arm B	A5156 East	6	15	25	29	18	107	33	64
5	Site 5	Arm C	Borras Park Rd	3	1	4	5	2	2	7	5
5	Site 5	Arm D	A5156 West	3	5	7	7	28	41	10	47
1	Site 1	Arm A	Holt Rd North	9	10	10	52	74	311	6	7
1	Site 1	Arm B	Bryn Estyn Rd	0	0	0	0	5	0	0	0
1	Site 1	Arm C	Cefn Rd	23	20	31	57	76	182	65	17
1	Site 1	Arm D	Holt Rd South	6	12	12	10	11	11	19	10
1	Site 1	Arm E	Dean Rd	4	9	14	14	72	37	21	7
7	Site 7	Arm A	Holt Rd	3	3	3	3	3	2	3	4
7	Site 7	Arm B	Tesco	0	1	1	1	24	1	1	1
7	Site 7	Arm C	Fardon Rd	2	2	3	2	44	6	11	16
7	Site 7	Arm D	Holt St	1	1	1	1	32	17	13	4
7	Site 7	Arm E	A5152 Main	1	1	1	2	68	596	379	98
7	Site 7	Arm F	A5152 Left Slip	1	1	2	13	71	653	416	112
8	Site 8	Arm A	Cefn Rd Right Turn	0	6	1	1	1	1	4	4
8	Site 8	Arm C	Queensway Right Turn	0	1	0	1	1	1	1	1
2	Site 2	Arm A	A5156	0	0	0	0	5	0	0	4
2	Site 2	Arm C	A534 Bypass	90	14	58	11	73	103	58	24
2	Site 2	Arm C	Holt Road	7	10	31	9	11	127	39	6
2	Site 2	Arm C	Northern Site Access Exit	N/A	N/A	4	0	N/A	2	21	18

MAXIMUM QUEUE LENGTHS (METRES)											
Junction	Site	Arm	Description	AM Base	AM 2023 DN	AM 2023 DM	AM 2023 DS	AM 2028 DN	AM 2028 DM	AM 2028 DS1	AM 2028 DS2
4	Site 4	Arm A	Sandy Lane	4	5	4	4	5	4	4	4
4	Site 4	Arm B	A534 Bypass	38	45	65	125	50	118	120	173
4	Site 4	Arm C	Borras Hall Lane	17	20	29	16	21	18	18	19
4	Site 4	Arm D	A534 Wrexham Rd	54	80	147	87	91	89	103	104
4	Site 4	Arm E	Industrial Estate Rd	21	19	22	32	20	35	38	36
5	Site 5	Arm A	Borras Rd	12	12	12	12	11	27	25	13
5	Site 5	Arm B	A5156 East	23	26	33	32	32	26	39	50
5	Site 5	Arm C	Borras Park Rd	69	55	52	52	69	50	85	39
5	Site 5	Arm D	A5156 West	90	92	114	111	118	1807	2010	161
1	Site 1	Arm A	Holt Rd North	90	92	166	210	120	554	338	132
1	Site 1	Arm B	Bryn Estyn Rd	10	10	10	13	11	20	13	13
1	Site 1	Arm C	Cefn Rd	118	115	253	213	131	953	151	103
1	Site 1	Arm D	Holt Rd South	49	59	78	77	75	916	126	71
1	Site 1	Arm E	Dean Rd	54	104	157	169	167	410	807	191
7	Site 7	Arm A	Holt Rd	38	37	44	43	44	36	43	42
7	Site 7	Arm B	Tesco	14	14	16	14	16	23	15	15
7	Site 7	Arm C	Fardon Rd	25	22	20	20	22	43	24	28
7	Site 7	Arm D	Holt St	6	7	8	7	8	12	8	8
7	Site 7	Arm E	A5152 Main	16	16	17	17	17	47	14	16
7	Site 7	Arm F	A5152 Left Slip	19	21	24	21	22	53	23	24
8	Site 8	Arm A	Cefn Rd Right Turn	13	18	22	21	17	31	47	32
8	Site 8	Arm C	Queensway Right Turn	10	12	13	13	13	22	19	14
2	Site 2	Arm A	A5156	76	83	178	315	110	789	790	186
2	Site 2	Arm C	A534 Bypass	46	51	60	28	53	132	35	42
2	Site 2	Arm C	Holt Road	38	50	86	88	65	566	776	240
2	Site 2	Arm C	Northern Site Access Exit	N/A	N/A	8	4	N/A	27	106	93

Junction	Site	Arm	Description	PM Base	PM 2023 DN	PM 2023 DM	PM 2023 DS	PM 2028 DN	PM 2028 DM	PM 2028 DS1	PM 2028 DS2
4	Site 4	Arm A	Sandy Lane	11	12	11	9	13	10	10	10
4	Site 4	Arm B	A534 Bypass	26	27	30	58	26	57	57	57
4	Site 4	Arm C	Borras Hall Lane	7	7	7	8	8	7	7	7
4	Site 4	Arm D	A534 Wrexham Rd	17	21	17	131	37	181	188	202
4	Site 4	Arm E	Industrial Estate Rd	355	488	1079	287	785	598	625	657
5	Site 5	Arm A	Borras Rd	7	9	8	8	11	12	8	13
5	Site 5	Arm B	A5156 East	68	106	136	159	115	272	156	219
5	Site 5	Arm C	Borras Park Rd	34	24	40	46	27	29	49	42
5	Site 5	Arm D	A5156 West	46	64	72	72	103	137	85	136
1	Site 1	Arm A	Holt Rd North	121	114	110	251	206	647	77	95
1	Site 1	Arm B	Bryn Estyn Rd	9	9	10	10	16	11	8	9
1	Site 1	Arm C	Cefn Rd	129	125	138	179	190	347	218	92
1	Site 1	Arm D	Holt Rd South	73	93	89	87	84	92	104	90
1	Site 1	Arm E	Dean Rd	57	74	98	98	167	150	129	73
7	Site 7	Arm A	Holt Rd	55	51	58	47	55	39	52	70
7	Site 7	Arm B	Tesco	17	20	18	20	45	19	24	20
7	Site 7	Arm C	Fardon Rd	42	38	49	34	88	77	86	127
7	Site 7	Arm D	Holt St	21	23	23	28	59	79	72	45
7	Site 7	Arm E	A5152 Main	19	20	21	34	99	743	545	202
7	Site 7	Arm F	A5152 Left Slip	35	34	37	74	123	791	571	233
8	Site 8	Arm A	Cefn Rd Right Turn	26	43	27	36	32	33	67	63
8	Site 8	Arm C	Queensway Right Turn	15	22	23	24	20	22	29	29
2	Site 2	Arm A	A5156	13	9	13	11	18	18	19	37
2	Site 2	Arm C	A534 Bypass	217	109	198	96	185	283	209	114
2	Site 2	Arm C	Holt Road	61	82	134	74	79	320	159	55
2	Site 2	Arm C	Northern Site Access Exit	N/A	N/A	17	6	N/A	17	48	72

QUEUE SITE REFERENCE MAP

