South Heywood Economic Corridor:

Transport Assessment

M62 J19 Operational Assessment Report

November 2010

Produced for
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1.1 Introduction

In order to test the impact of the South Heywood development proposal, including the proposed Link road, on the operation of M62 Junction 19 and address issues likely to be raised by the Highway Agency, a VISSIM micro-simulation model was developed for M62 Junction 19 and the motorway slip roads.

1.2 Site Inspection

In order to obtain a first hand understanding of existing traffic conditions and operation, as well as a feel for the layout of the network and vehicle behaviour, a site inspection of Junction 19 and the surrounding highway network was undertaken on Wednesday 22 September 2010.

During the visit, manual observations were made of queue lengths on the motorway slip roads approaching the junction as well as the A6046 approaches from the north (Middleton Road) and south (Hollin Lane). It was observed that no significant queues develop on the motorway slip roads during either the AM Peak (08:00-09:00) and PM Peak (17:00-18:00).

However, it was observed that the most significant queues build on the A6046 Middleton Road approach from the north during the AM Peak. Between 08:00-08:30, queuing was observed on this approach to the roundabout but was relatively short lived. By 09:00, the approach was observed to be operating relatively freely.

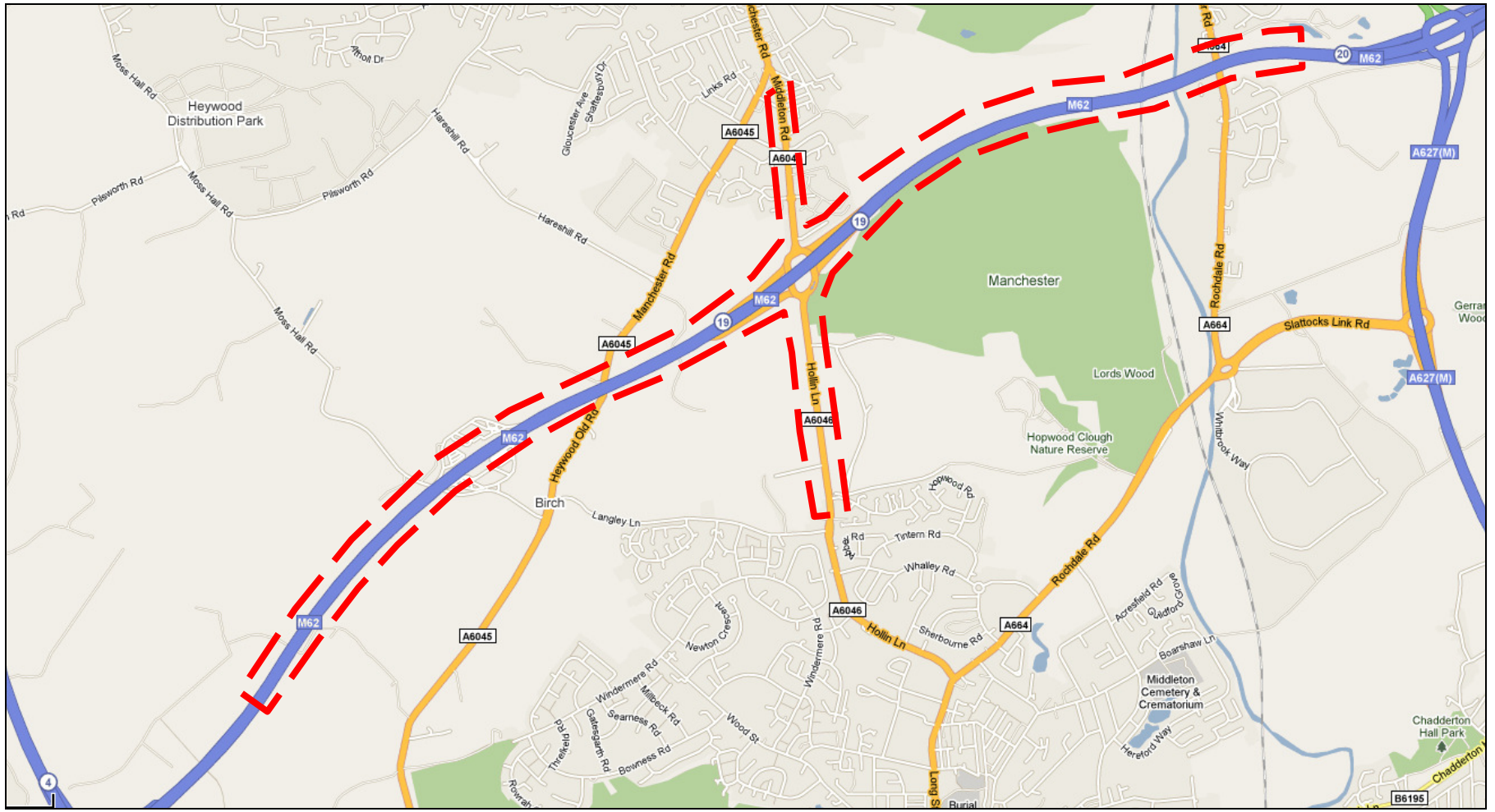
In addition to traffic and queue observations, link speeds were also measured and recorded on all approaches to the roundabout as well as along the circulatory carriageway.

1.3 Modelled Network

As the VISSIM model was primarily concerned with the assessment of Junction 19, the model includes the M62 mainline from east of Junction 18 to just west of Junction 20, including the slip roads at Junction 19. The A6046 Middleton Road was also included from the junction with Langley Lane to the south to the junction with Withington Street to the north of Junction 19, in order to model the full extent of any queues. The VISSIM modelled network coverage is shown in Figure 1-1.

OS AutoCAD mapping was used as a basis to accurately code the VISSIM base network and identify lane width, road length and general road alignment. Aerial photography from Google Maps was used for lane markings, give-way markings and stop lines, junction coding, lane discipline and to determine the exact location of a lane drop or lane gain.

Figure 1-1 *VISSIM Model Network Coverage*



1.4 Matrix Development

As the traffic flow data input into the VISSIM models were extracted from the South Heywood SATURN Model, the VISSIM models were developed for the same time periods, namely 08:00-09:00 (AM Peak) and 17:00-18:00 (PM Peak). However, a 15-minute "warm-up" period was added to ensure that traffic was allowed to reach a steady-state before congestion occurs. Therefore the modelled time periods were as follows;

- AM Peak – 07:45-09:00;
- PM Peak – 16:45-18:00

An Inter-Peak model was not developed as it was felt there would be no operational concerns at Junction 19 during this period.

In order to develop Origin-Destination matrices for input into the VISSIM model, the SATURN model was cordoned around the VISSIM model network coverage as shown in Figure 1-1. This process output 2008 cordoned matrices for both the AM Peak (08:00-09:00) and PM Peak (17:00-18:00) hours, disaggregated by Car, LGV and HGV. The SATURN pcu matrices were then converted to vehicle matrices for input into VISSIM.

As the traffic profile within the SATURN Model is flat, and in the absence of any disaggregated (15-minute interval) local traffic data for Junction 19, a flat hourly profile was assumed for the VISSIM matrices.

1.5 Traffic Assignment

The base matrices were subsequently assigned to the modelled network using Dynamic Assignment which allows route choice to be modelled. Within a dynamic assignment model, VISSIM determines the multiple routes through the network and identifies a number of most likely routes for each origin and destination pair dependent upon the generalised cost of the route. The assignment is then done dynamically over time by an iterated application of the simulation.

The iteration of simulation runs was continued until a stable state was reached, in that traffic volumes and travel times across the network did not change significantly from one iteration to the next. At this point the model had converged.

1.6 Model Calibration/ Validation

Once the models had converged, the calibration of the base year traffic models was undertaken using a standard approach where the network and behavioural characteristics were adjusted to ensure that there was no adverse driving behaviour such as unnecessary lane changing and weaving. The AM peak model was initially calibrated and was then used as a starting point when undertaking the calibration of the PM peak model.

The VISSIM models were then validated to ensure that the models represented an accurate picture of traffic in the modelled area by comparing journey times generated

by the model with average observed journey times extracted from the Trafficmaster database (average for April/May/June/September/October 2008). The journey time validation was based on the Design Manual for Roads and Bridges (DMRB) Volume 12, Section 2, Part 1 which states that modelled journey times along a route should be within 15% of the observed journey times.

The random seed number is used to select a sequence of random numbers that are used throughout the simulation run to make decisions such as the time that a vehicle enters the modelled network and perturbation of vehicle driver behaviour characteristics. Five model runs were carried out for each time period using a different seed number for each run, with the validation being measured against the average value from the runs.

Journey time validation was undertaken for the M62 mainline from east of Junction 18 to Just west of J20, in both directions. For the A6046, the validation was undertaken for the section between Sycamore Avenue to the north of Junction 19 to Hollins Drive to the south of junction 19, in both directions. Each of the routes were broken down into two sections and are shown in Figure 1-2 to 1-4 below.

The journey time validation was undertaken between 08:00-09:00 for the AM peak and 17:00-18:00 for the PM peak, and a comparison of the observed and modelled journey times are presented in Table 1-1 and Table 1-2 below for the AM and PM peak respectively. The tables show that both models validate well against observed journey times and meet DMRB criteria. The only route that does not meet the criteria is Route 1 (M62 Westbound) during the AM peak. This is due to heavy congestion/delays at M60 J18 and the junctions further west during the AM peak which subsequently block back and impact on the M62 mainline through Junction 19. As these junctions further west are not included in the VISSIM model, the associated delays/queues cannot be modelled leading to the modelled journey times being lower than the observed.

For queue length validation. DMRB does not provide guidance on the validation criteria and states that “precise validation of the queue lengths can be difficult because of the volatility of the observed data”. However, during the validation process, visual checks of the model were made at regular intervals to ensure both the AM and PM peak models closely replicated the queuing that was observed during the site inspection. In summary, no significant queues formed on either of the slip roads at Junction 19 during either of the peak periods, with the heaviest queues forming on the A6046 northern approach during the morning peak.

The above model validation demonstrates that both the AM and PM peak models accurately represent journey times and queues across the modelled area. Therefore, both models are considered robust and suitable for testing the future options incorporating the Heywood Link Road.

Table 1-1 *Journey Time Validation Results – AM Peak (08:00-09:00)*

Route	Section	Observed JT (secs)	Modelled JT (secs)	% Difference	Pass DMRB
1- M62 EB	1	121	127	4.9	✓
	2	108	119	9.0	✓
1 – M62 WB	1	163	113	-43.8	×
	2	189	127	-48.8	×
2 – A6046 NB	1	82	81	-1.3	✓
	2	83	76	-8.7	✓
2 – A6046 SB	1	72	66	-9.3	✓
	2	102	98	-4.4	✓

Table 1-2 *Journey Time Validation Results – PM Peak (17:00-18:00)*

Route	Section	Observed JT (secs)	Modelled JT (secs)	% Difference	Pass DMRB
1- M62 EB	1	140	129	-8.6	✓
	2	120	120	-0.2	✓
1 – M62 WB	1	117	115	-1.8	✓
	2	121	128	5.2	✓
2 – A6046 NB	1	79	81	2.1	✓
	2	76	88	13.8	✓
2 – A6046 SB	1	71	67	-6.4	✓
	2	95	98	2.8	✓

Figure 1-2 *Journey Time Route 1*

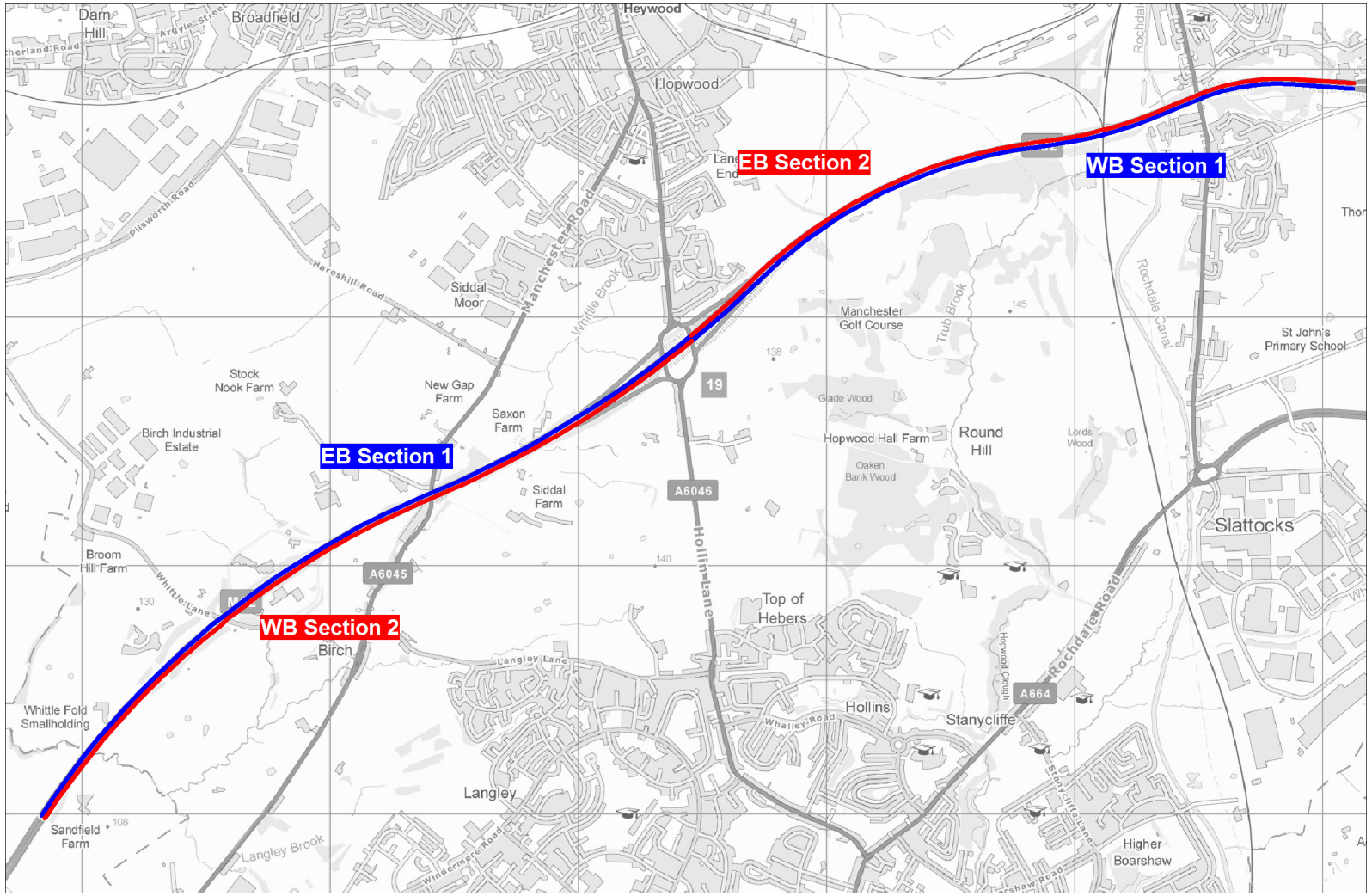


Figure 1-3 *Journey Time Route 2 – NB*

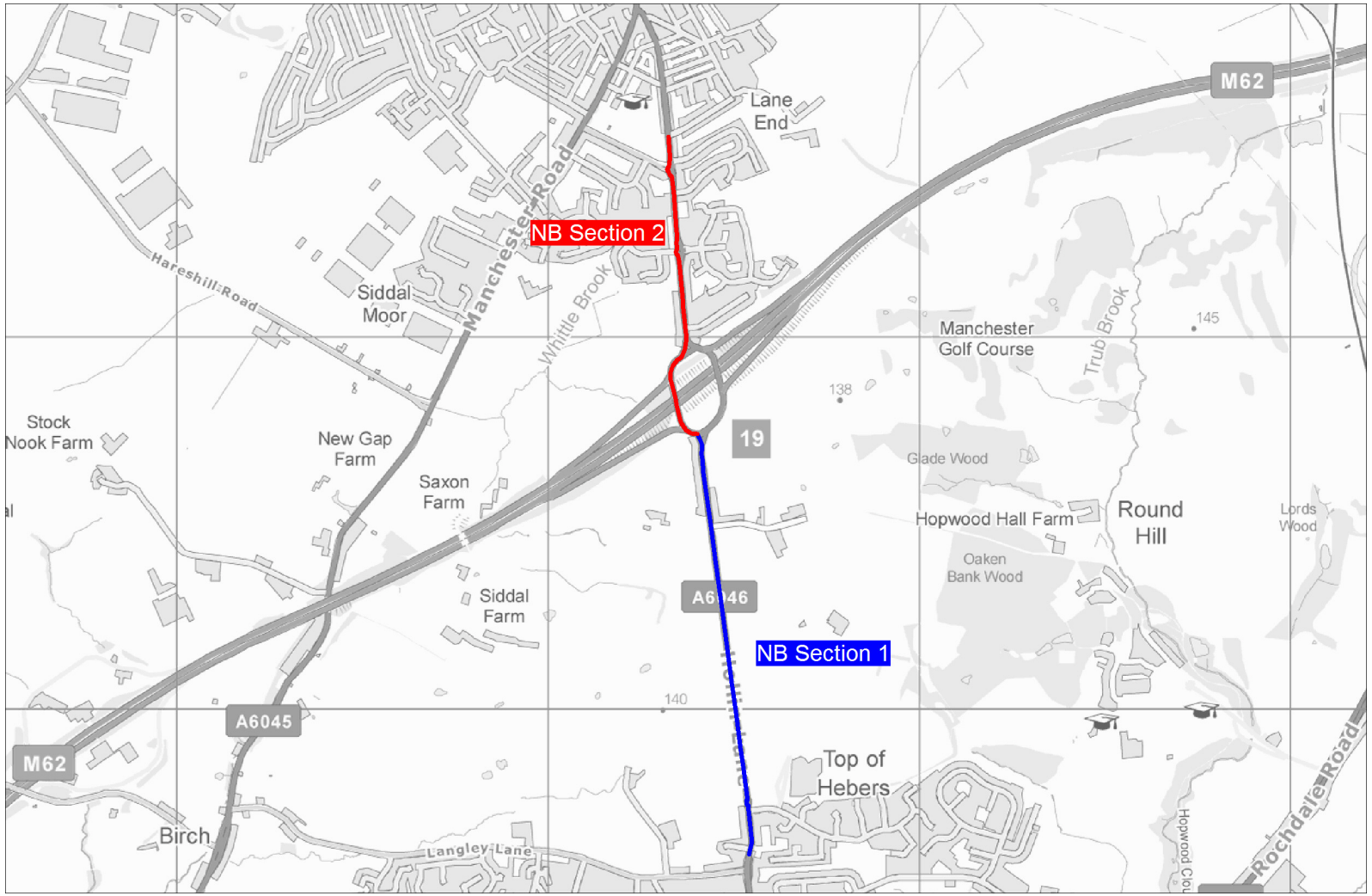
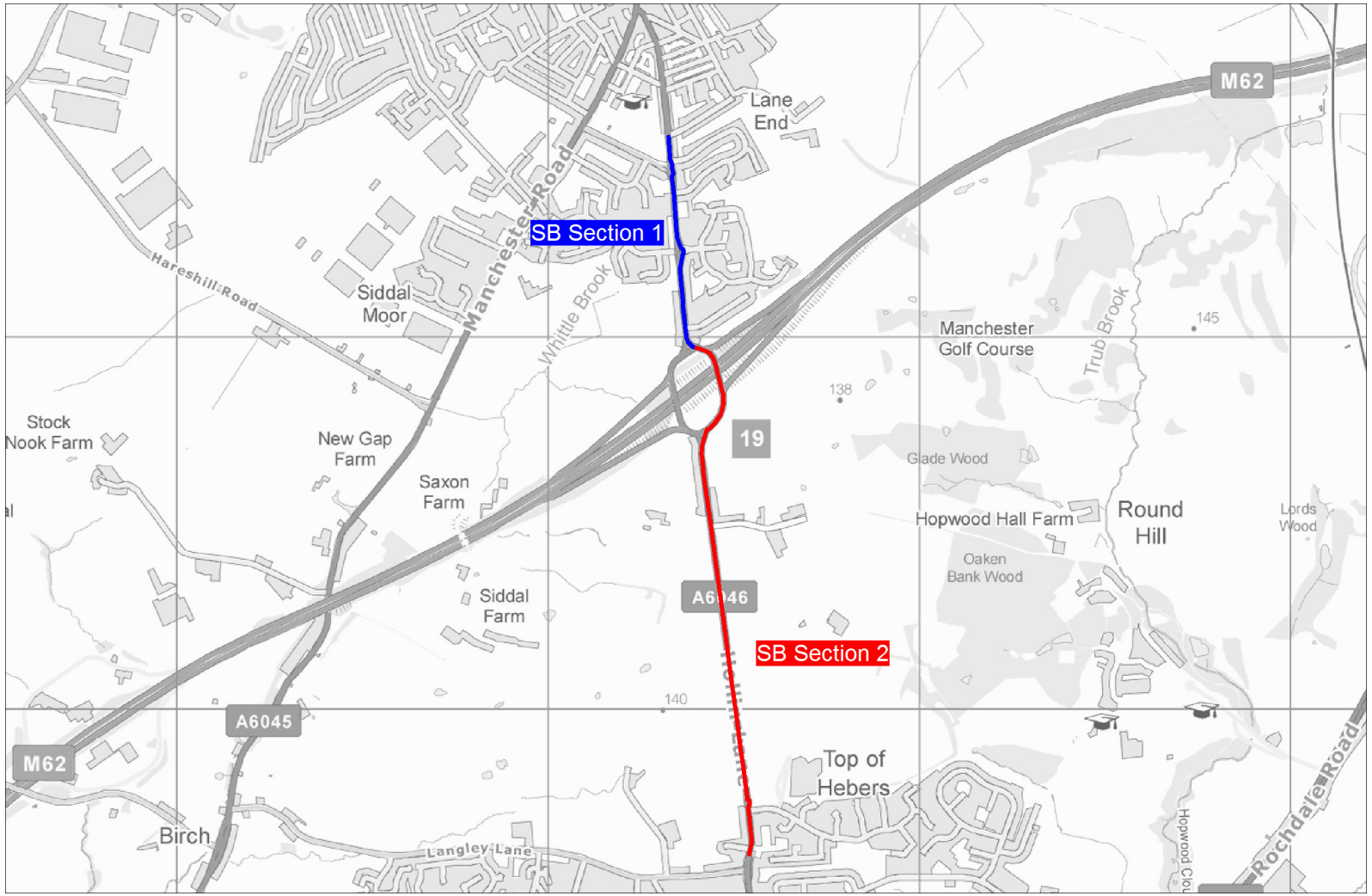


Figure 1-4 *Journey Time Route 2 – SB*



1.7 Option Testing

A single “worst case” Do-Something scenario was tested for a Design Year of 2023, which incorporated both the Heywood Link Road and the proposed South Heywood development. The testing was initially undertaken using the local SATURN Model in order to test the wider area impact of the scheme.

In order to test the impact of the link road and development traffic on the operation of Junction 19, the VISSIM model network was extended to include the Heywood Link Road, including the junction with A6045 Manchester Road/ Hareshill Road in order to test any blocking back issues related to this junction. The Do-Something network coverage is shown in Figure 1-5.

Optimised signal timings from the SATURN model were extracted for the Junction 19 roundabout and also the A6045 Manchester Road/ Hareshill Road junction and input into the VISSIM models.

As with the base models, cordoned matrices were extracted from the 2023 Do-Something SATURN models for 08:00-09:00 (AM Peak) and 17:00-18:00 (PM Peak), disaggregated by Car, LGV and HGV, and converted from pcu to vehicle matrices before input into VISSIM. Again a flat profile was assumed for the VISSIM matrices.

The forecast matrices were assigned to the forecast networks using Dynamic Assignment until the models converged. Five model runs were then carried out for each time period using a different seed, with the results averaged over the five runs.

A comparison of queue lengths on the various approach arms at Junction 19 for the Base and Do-Something models are presented in Table 1-3 and Table 1-4 for the AM and PM peak respectively. The tables show that both average and maximum queues increase on most approach arms between the Base and Do-Something scenarios, including the queues along the motorway slip roads. However, the average queues are relatively small and even the maximum queues are within the queuing capacities of the slip roads and do not impact on the operation of the motorway.

Queues on the A6046 Middleton Road and Hollin Road approaches also increase between the Base and Do-Something scenarios especially on the southbound approach to Junction 19 during the AM peak. Queues along the link road approach are also well within the capacity of the link. The average queues at the signal stop line along the circulatory carriageway are also relatively short. However the maximum queue during both the AM and PM peak does extend as far back as the westbound on-slip.

Figure 1-5 *Do-Something Network Coverage*

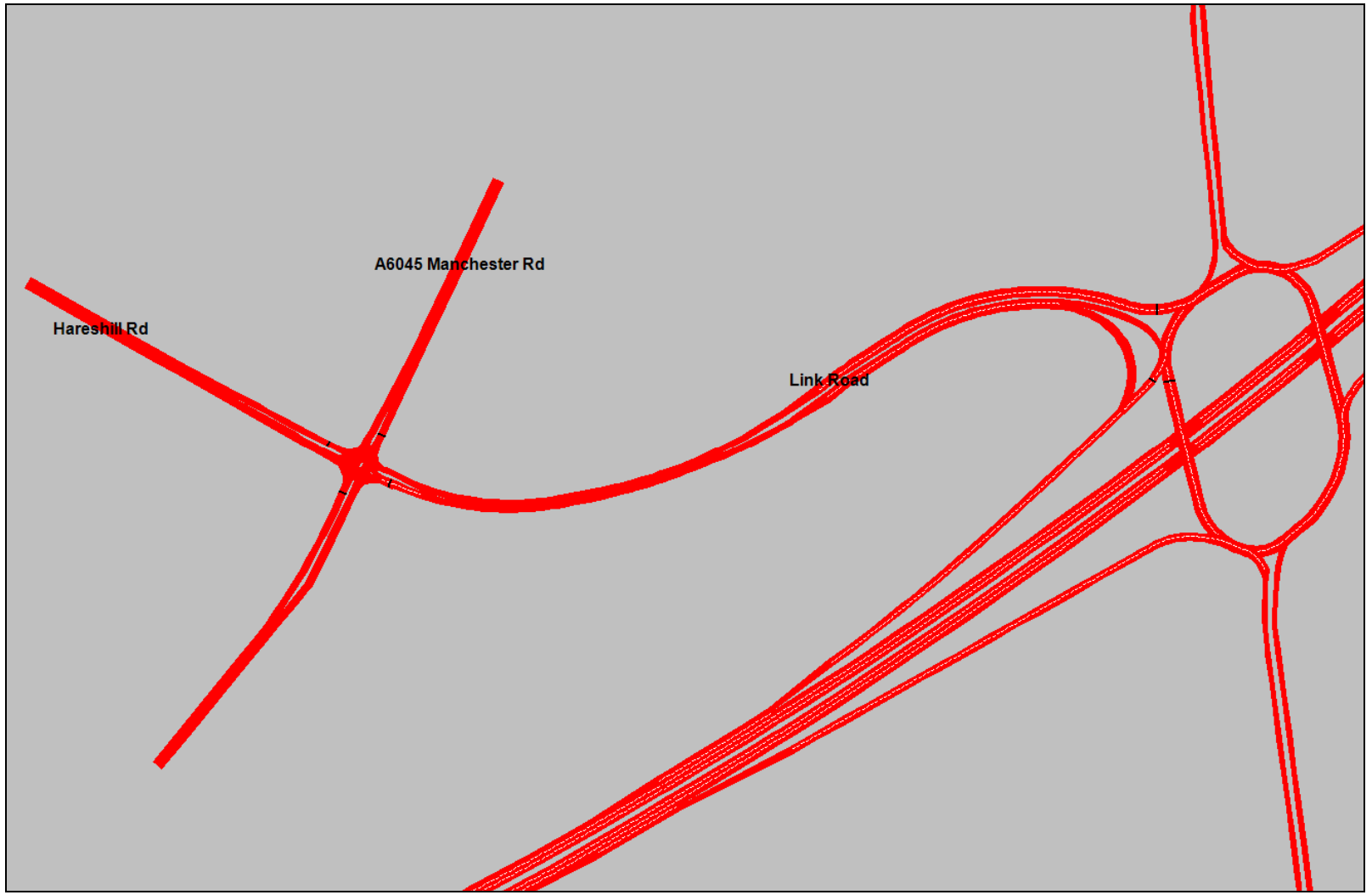


Table 1-3 *Queue Length Comparison - AM Peak (08:00-09:00)*

	Base (2008)		Do-Something (2023)	
Approach	**Average Q (metres)**	**Maximum Q (metres)**	**Average Q (metres)**	**Maximum Q (metres)**
M62 EB off-slip	1.0	19.4	14.0	92.8
M62 WB off-slip	1.6	44.2	75.4	205.6
A6046 NB	2.4	62.8	19.8	152.2
A6046 SB	3.6	173.0	41.4	304
Link Road	-	-	44.4	191.4
Circulatory carriageway	-	-	31.6	138.4

Table 1-4 *Queue Length Comparison - PM Peak (17:00-18:00)*

	Base (2008)		Do-Something (2023)	
Approach	**Average Q (metres)**	**Maximum Q (metres)**	**Average Q (metres)**	**Maximum Q (metres)**
M62 EB off-slip	1.2	38.2	15.0	120.6
M62 WB off-slip	1.8	45.4	7.2	82.0
A6046 NB	3.2	91.0	25.6	198.4
A6046 SB	1.0	41.4	2.8	91.8
Link Road	-	-	22.2	85.6
Circulatory carriageway	-	-	54.2	184.2

1.8 Sensitivity Testing

A number of sensitivity tests were carried out on the Do-Something scenario. Three sensitivity tests were undertaken using both the AM and PM peak models including;

a) Removing the bypass lane linking the eastbound off-slip with the Link road;

b) removing the signal control at Junction 19 and changing both the eastbound off-slip and Link road approaches to give-way;

c) Incorporating both (a) and (b) above.

The above sensitivity tests were only undertaken using the VISSIM models in order to provide an initial assessment of their impact on queuing and congestion. A complete analysis would require the above options to be initially tested using the SATURN model to test the wider area reassignment, and then tested in VISSIM using the matrices output from the SATURN models.

A comparison of queue lengths on the various approach arms at Junction 19 for each of the three scenarios compared to the Do-Something models are presented in Table 1-5 and Table 1-6 for the AM and PM peak respectively.

From the results for Test (a), it can be seen that queuing on the eastbound off-slip does increase during both the AM and PM peak due to the removal of the bypass lane. However, the average queues remain relatively small with the maximum queue within the queuing capacity of the slip road and not impacting on the operation of the motorway.

For Test (b), the summary tables show that the removal of signal control at Junction 19 will lead to very heavy queues building on the A6046 southbound approach during the AM peak. This is because the signal control previously created short breaks in the circulatory traffic which allowed the A6046 traffic to enter the roundabout. However, queuing on the slip roads falls during both peak periods compared to the Do-Something scenario.

The queue length results for Test (c) show that removing both the bypass lane and signal control at Junction 19 will have a significant impact on queues along the eastbound off-slip during the PM peak, with large queues forming along the nearside lane of traffic wanting to use link road. The maximum queue also stretches as far back as the mainline and affects the operation of the motorway.

1.9 Summary and Conclusions

In summary, M62 Junction 19 operates relatively efficiently in the 2023 Do-Something scenario, with relatively short average queues forming on both the slip roads during both the AM and PM peak. The maximum queues that form on both slip roads are within the queuing capacity of the slip roads and do not impact on the operation of the motorway. Some queuing does develop along the circulatory carriageway at the junction with the eastbound off-slip due to the traffic signals, during both the AM and PM peak and stretches as far back as the westbound on-slip.

The sensitivity tests that have been undertaken show that removing the bypass lane linking the eastbound off-slip with the Link road will lead to a small increase in queues along the eastbound slip road but not sufficient to stretch back to the motorway mainline. However, the other sensitivity tests undertaken which have included the removal of signal control at Junction 19 will lead to significant queues forming on various approach arms during different peak periods..

In order to fully assess the impact of the above sensitivity tests, they initially need to be modelled using the SATURN model to assess the wider area reassignment, and then tested in VISSIM using matrices output from the SATURN model. In addition, the operation of the roundabout could be further improved by undertaking signal optimisation within VISSIM and then making manual adjustments based on observations on the model.

Overall, the above tests suggest that there is some flexibility in the final design and operation of M62 Junction 19. Further testing could help identify potential cost savings and the phasing in of the highway improvements.

Table 1-5 *Sensitivity Tests - Queue Length Comparison - AM Peak (08:00-09:00)*

	Do-Something (2023)		Option (a)		Option (b)		Option (c)	
Approach	**Av. Q (m)**	**Max. Q (m)**	**Av. Q (m)**	**Max. Q (m)**	**Av. Q (m)**	**Max. Q (m)**	**Av. Q (m)**	**Max. Q (m)**
M62 EB off-slip	14.0	92.8	16.0	92.6	1.8	46.3	1.8	40.0
M62 WB off-slip	75.4	205.6	69.2	183.8	65.8	184.5	58.8	177.8
A6046 NB	19.8	152.2	20.0	151.2	18.3	141.3	20.3	149.8
A6046 SB	41.4	304.0	49.0	360.4	326.5	515.5	293.8	511.5
Link Road	44.4	191.4	49.8	210.0	6.8	100.0	7.5	119.3
Circulatory carriageway	31.6	138.4	30.2	126.6	-	-	-	-

Table 1-6 *Sensitivity Tests - Queue Length Comparison - PM Peak (17:00-18:00)*

	Do-Something (2023)		Option (a)		Option (b)		Option (c)	
Approach	**Av. Q (m)**	**Max. Q (m)**	**Av. Q (m)**	**Max. Q (m)**	**Av. Q (m)**	**Max. Q (m)**	**Av. Q (m)**	**Max. Q (m)**
M62 EB off-slip	15.0	120.6	28.6	160.8	6.6	109.0	368.4	516.0
M62 WB off-slip	7.2	82.0	6.2	69.0	8.0	89.4	6.2	67.2
A6046 NB	25.6	198.4	26.2	207.0	12.0	132.2	13.0	143.2
A6046 SB	2.8	91.8	2.2	87.6	3.8	147.4	2.2	92.8
Link Road	22.2	85.6	43.8	138.0	3.4	59.8	2.2	50.0
Circulatory carriageway	54.2	184.2	53.8	187.2	-	-	-	-