

Technical note

Project	Wycombe Local Development Framework	Date	21 June 2010
Note	TN4 – Transport Modelling Individual Site Tests Daws Hill, Abbey Barn South - Mitigation Tests	Ref	TN4
Author			

1 *Introduction*

1.1 The Wycombe Local Development Framework (LDF) is now proceeding from the analysis of the Core Strategy to the investigation of individual site allocations. The Wycombe Transport Model provides a tool to assess the impact of growth arising from the major developments proposed in the town. At the Core Strategy stage the model was used to assess a series of illustrative scenarios related to the LDF. A second phase of testing involved assessing the impact of each individual site by dropping each site/ or groups of sites from the Core Strategy. These were reported in 'TN1 - Individual Site Tests Summary' and 'TN2 – Individual Site Tests M40 Gateway Alternatives', 26 June 2009. The model has been used to assess the impact of the Wycombe Coachway and development at the Sports Centre.

1.2 The Wycombe District Council Delivery and Site Allocations (DSA) Update Consultation Development Plan Document (June 2009) updated the proposals regarding individual sites, the mix of development in the town including town centre Masterplan, and elements of the transport strategy, including Smarter Choices.

1.3 This round of tests updates the 2026 scenario to reflect the proposed DSA and focuses on Daws Hill and Abbey Barn South developments. Technical note 'TN3 – Individual Site Tests, Daws Hill, Abbey Barn South Sensitivity Tests' assessed the impact of the Daws Hill and Abbey Barn South sites by dropping each site from the full DSA proposals. In this note we focus on potential mitigation measures that might accompany the developments.

2 *Options for Testing*

2.1 The modelling work undertaken in these M40 Gateway tests involves an assessment of the full set of potential development sites that could come forward compatible with the DSA and also included the Smarter Choices elements of the transport strategy.

2.2 In the initial round of testing three tests were undertaken and reported in TN3:

- Test 1 – 2026 full DSA proposals
- Test 2- 2026 full DSA proposals but without the Abbey Barn South site;
- Test 3 – 2026 full DSA proposals but without both the Abbey Barn South and Daws Hill sites.

These tests did not include any associated network mitigation measures.

2.3 In this note we examine the impact of potential mitigation measures that might accompany the M40 Gateway sites (based on Test 1). In the mitigation tests, two packages of measures have been assessed:

- Mitigation 1- amendments to local school drop offs in the Daws Hill area with junction improvements on Daws Hill Lane and Abbey Barn Road (as per Buchanan’s improvements reported in TN2);
- Mitigation 2 – as Mitigation 1 but with an additional improvement at the Marlow Hill/ Daws Hill junction to allow the right turn from Daws Hill Lane into Marlow Hill

Further details of these are in section 3.

2.4 As reported in TN3 the land use allocations for the main sites within the DSA consultation and are used for these mitigation tests.

Site Name	Quantum of Development
Cressex Island	Car showroom 2,800m ² + parking Large format Commercial Use 12,000 m ²
Sports Centre Site/Highways Dept	Sport Centre 11,000m ² 150 bed hotel, Business 33,105m ² Coachway/Park and Ride incl. 550 parking spaces
Terriers Farm	400 dwellings Small Community building Care home, Park and Ride
Gomm Valley	400 Dwellings 4,000 m ² . B1 offices 1,000 m ² . Community/retail use
Ashwells	100 dwellings
Former Compair Broomwade	672 student bedrooms 495sqm Business start up units 15,800 sqm retirement community 10,000m ² offices, 3,100 m ² distribution 10 flats
Former De la Rue	120 dwellings 2,437m ² B1(c) light industrial
RAF Daws Hill	550 dwellings (483 net) 3,000 m ² . B1 offices, 800 m ² retail 700 m ² A1-A5 uses Primary school
Abbey Barn South	550 dwellings, 7,000 m ² B1 Community Centre
Abbey Barn North	100 dwellings

Table 1: Assumptions for Individual Site Allocations

2.5 Other assumptions in the town centre are reported in Table 2.

Site	New land use assumptions
Wellesbourne campus (Kingshill Road)	238 dwellings (update from 156 – traffic zone 46)
John North Hall, Marlow Hill	106 dwellings (update 25 – traffic zone 60)
Johnson and Johnson	13,620 sq m of additional B1 office (traffic zone 66)
ADDITIONAL TOWN CENTRE SITES:	
All sites except the hotel element of the Octagon Parade development rely on implementation of Masterplan, including removal of Abbey Way and downgrading of Archway.	
Swan Frontage (Scenario A)	13,062 sq m office 1750 sq m A1 shops 9 x 2-bed flats 4 x 1-bed flats Total Parking Provision = 141 spaces
Suffield Road	11 dwellings
Archway/Dovecot	3,640 sq m B1 office 1,799 sq m A1 shops 22 flats, 2,460 sq m hotel
Octagon Parade	3,416 sq m hotel, 8980 sq m A1 shops 5928 sq m B1 office No additional parking provided.

Table 2: Land Use Assumptions – Changes from previous Core Strategy Tests

3 Assumptions

3.1 Based on the information provided by Wycombe District Council table 3 shows the land use data for the Wycombe model area used by the transport model for the various forecasts. The table shows that in the Core Strategy the number of households is increased to 43,671 with 54,423 jobs. .

Test	Test Description	Population	Households	Employed Residents	Jobs
	2006	87,510	36,744	44,970	46,790
1	2026 full DSA proposals	103,889	43,671	53,674	54,423

Table 3: Land Use Information – Forecast Scenarios

Planning Data Assumptions- External area Reference Case

3.2 The current tests make use of Temprow version 6.2 programme for deriving trip growth outside of the Wycombe District with the Temprow 5.4 dataset. The Temprow inputs have been adjusted to take account of the SE Plan as adopted in May 2009. The external trip growth is fed from Temprow through the regional model to the local model.

Network Assumptions for 2026 base case

3.3 These are as reported in TN3 (Test 1) but includes some minor updates to the network. To avoid confusion this will be called **Test 1A** and the mitigation runs described will be compared with this. The differences between this and Test 1 in TN3 will not be reported.

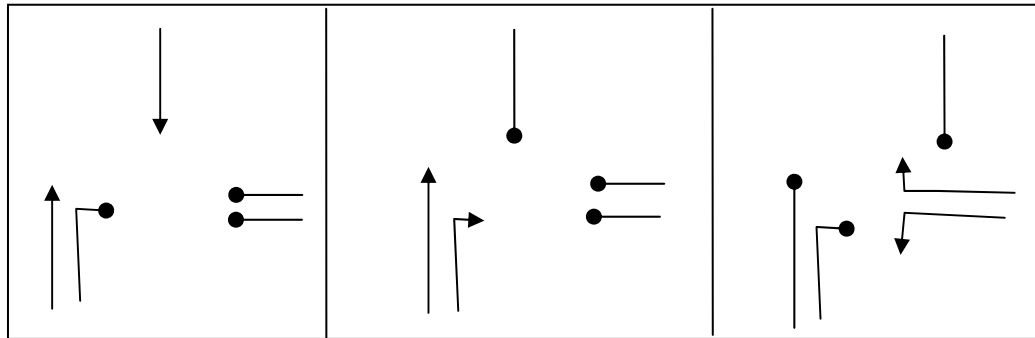
Network Assumptions for Mitigation Tests

3.4 The network assumptions in the M40 Gateway area for the mitigation tests are shown in the table below. Other assumptions are as reported in TN3 (section 4.3 to 4.6).

	Basic Improvements
Land use changes (common to both Mitigation Run 1 and 2)	Move school drop off traffic for St Bernards and St Augustine. Assume drop off is at HA depot, accessed via Sports Centre junction only Assume school staff traffic still going to school entering via current access road from Daws Hill Lane
Network changes (common to both Mitigation Run 1 and 2)	Abbey Barn Rd/London Rd & Ford St/London Rd Ford St - one lane southbound. Abbey Barn Rd - two lanes northbound, one for right turn, one for left turn.
	Abbey Barn Lane/Kingsmead Rd Straightening out kink over railway line and change priority with Kingsmead Rd Kingsmead/ Abbey Barn Lane junction converted to signals
	Abbey Barn Lane/Heath End Rd Junction improvement to roundabout
	Dedicated bus route to Coachway Bus only link from the Bus priority exit from the Daws Hill development, west along Daws Lea, through part of HA depot and links with Sports Ctr access rd
	Heath End Rd/ Winchbottom Lane Safety improvements for right turning traffic into Winchbottom Lane.
Options to be tested	
	Daws Hill Lane/Marlow Hill
Mitigation Run 1	Two left turn (southbound) lanes out of Daws Hill Lane
Mitigation Run 2	Two lanes to incorporate right turn (northbound) from Daws Hill Lane onto Marlow Hill (see Glanville plan 290362-sk04A.PDF)

Network Changes for the Mitigation tests

3.5 Mitigation Run 2 requires an amendment to the signal staging at the Daws Hill/Marlow Hill junction. The assumed stages are identified below. This means that the northbound Marlow Hill traffic has to be held in order to allow the right turning traffic from Daws Hill Lane.



Staging – Daws Hill/ Marlow Hill (Mitigation Run 2)

4 **Trip Rates**
 These are as reported in TN3.

5 **Smarter Choices**
 These are as reported in TN3.

6 **Overall Results**

6.1 The results are presented for the network as a whole before assessing each local area in more detail later in this report.

Network Summary Statistics

6.2 The traffic growth forecast within the various DSA scenarios is 16%. In the local area there is transfer to park and ride and a modest transfer to bus. The traffic growth equates to an annual average growth rate of 1%. We have not assumed any additional demand management or smarter choices measures to accompany these option tests to that outlined previously.

6.3 Tables 4, 5, and 6 show the summary statistics obtained from the model for each of the modelled periods for these tests. Table 7 provides a summary for the 12-hour period (0700-1900) which combines the periods. These include the total travel time and distance spent within the modelled periods as well as the free moving time. The difference between the total time and the freemove time provides the amount of congestion. This is reflected in a congestion index which is taken as the ratio of the total time and the free move time. The tables also provide the network speed for the whole modelled area (which includes the rural area outside Wycombe) and a generalised cost index (taken as total time + distance/100). The latter is taken as a proxy indicator for use in benefit calculations. It should be noted that the information includes the buffer area and the M40 motorway hence the base year speeds appear to be higher than an urban speed limit.

6.4 Table 4 shows that there is an increase in morning peak travel in 2026, resulting in increased queues and delays. The table shows that the network congestion index is 1.21 in the Test 1A. The Congestion Index is increased to 1.22 with the Mitigation Run 1 as the increase in total time is greater than the reduction in free moving time. The congestion index remains at 1.21 in Mitigation Run 2 with a lower travel. There is also an increase in distance travelled in the network with the Mitigation Runs.

	Free moving Time	Total time	Distance	Speed	Queues	Congestion Index	GC Index
2006	19,796	22,503	1,562,269	69.4	12,089	1.14	24,066
Test 1A - 2026 DSA	23,130	28,078	1,798,299	64.0	25,727	1.21	46,061
Mitigation Run 1	23,123	28,121	1,799,673	64.0	25,599	1.22	46,118
Mitigation Run 2	23,135	28,041	1,800,163	64.2	25,282	1.21	46,043

Table 4: Local Model Summary statistics- Morning Peak

6.5 Table 5 shows that there is an increase in inter peak travel in 2026, resulting in increased queues and delays. In each test the congestion index is 1.13. With the Mitigation Runs the travel time is reduced and distance travelled increases.

	Free moving Time	Total time	Distance	Speed	Queues	Congestion Index	GC Index
2006	30,387	33,326	2,424,698	72.8	2,802	1.10	35,750
Test 1A - 2026 DSA	35,895	40,577	2,825,165	69.6	5,059	1.13	68,829
Mitigation Run 1	35,835	40,526	2,826,097	69.7	4,981	1.13	68,787
Mitigation Run 2	35,826	40,488	2,825,619	69.8	4,927	1.13	68,745

Table 5: Local Model Summary statistics- Inter Peak

6.6 Table 6 shows that there is an increase in evening peak travel in 2026, resulting in increased queues and delays. The table shows that the network congestion index is 1.25 in Test 1A, as it is for mitigation Run 1, although there is a slight increase in Run 2 (due to the small reduction in total time). In both cases the generalised cost index is reduced.

	Free moving Time	Total time	Distance	Speed	Queues	Congestion Index	GC Index
2006	21,492	24,266	1,726,557	71.2	11,554	1.13	25,993
Test 1A - 2026 DSA	25,719	32,261	2,017,119	62.5	35,728	1.25	52,432
Mitigation Run 1	25,609	31,940	2,015,824	63.1	33,723	1.25	52,098
Mitigation Run 2	25,661	32,214	2,016,019	62.6	35,505	1.26	52,374

Table 6: Local Model Summary statistics- Evening Peak

6.7 Table 7 shows that there is an overall change in 12-hour travel conditions in 2026, resulting in increased queues and delays. The table shows that the network congestion index is 1.19 in all of the 2026 runs. Overall, Mitigation Run 1 has the lower travel time and distance.

	Free moving Time	Total time	Distance	Speed	Queues	Congestion Index	GC Index
2006	71,675	80,095	5,713,524	71.3	26,444	1.12	85,809
Test 1A - 2026 DSA	84,741	100,916	6,640,582	65.8	66,514	1.19	167,321
Mitigation Run 1	84,569	100,587	6,641,595	66.0	64,303	1.19	167,003
Mitigation Run 2	84,621	100,744	6,641,800	65.9	65,714	1.19	167,162

Table 7: Local Model Summary statistics- 12-hour

6.8 In the AM peak period Mitigation Run 1 does not perform as well as Run 2 or Test 1A without mitigation in either congestion index or generalised cost index, although there is a reduction in queues. In the interpeak and PM periods, both mitigation runs improve on Test 1A, with Run 1 performing better than Run 2 in the PM. Over the 12-hour period, Mitigation Run 1 has improved network statistics than Run 2 and Test 1A.

6.9 It should be noted that further investigation of key hotspots of congestion may identify additional improvements to junctions which could improve the congestion indices as in this round of testing not all of the signals have been optimised.

6.10 The previous 2026 LDF land use and town centre masterplan proposals (TN1) had a congestion index of 1.23 and Generalised Cost Index of 179,525. The biggest impact on this is the Smarter Choice factor, but also a function of revised land use employment allocations with increased employment in the town centre.

Flows Across Cordons and Screenlines

6.11 Table 8 compares the traffic flows across a series of cordons and screenlines within the town. Flows are given for the peak hours, the average interpeak hour and the 12-hour daily flow. The locations include:

- Outer Cordon (equates to the BCC monitoring cordon)
- Railway screenline (equates to the BCC cordon)
- Handy Cross (excludes slip between A404 south and M40 west)
- Town Centre

6.12 The table shows that there is a forecast growth in 12 hour daily traffic of 10 to 12% across the Outer Cordon depending on the direction compared to 2006. There is an increased growth across the Railway Screenline in a northbound direction (18%) due in part to local re-routing. Inbound traffic into the town centre is forecast to grow by 10% across the day. With the mitigation runs there is a small reduction in town centre traffic.

	2006 Base	Test 1A - 2026 DSA	Mitigation 1	Mitigation 2
12 hr				
Outer Screenline - Inbound Direction	94,694	105,208	101,644	99,177
Outer Screenline - Outbound Direction	91,603	104,401	104,982	105,153
Railway Screenline – Northbound	46,323	54,602	54,574	54,612
Railway Screenline – Southbound	48,674	55,211	55,074	55,040
Handy Cross- Inbound	75,788	81,514	81,027	80,137
Town Centre- Inbound	84,897	93,647	92,753	92,960
Town Centre- Outbound	80,921	94,173	93,285	93,446
Am Hour (0800-0900)				
Outer Screenline - Inbound Direction	10,038	11,829	11,484	11,111
Outer Screenline - Outbound Direction	8,763	9,749	9,702	9,682
Railway Screenline – Northbound	4,123	4,504	4,602	4,521
Railway Screenline – Southbound	6,330	7,019	7,125	7,115
Handy Cross- Inbound	7,668	8,562	8,416	8,321
Town Centre- Inbound	9,799	11,045	10,975	11,101
Town Centre- Outbound	7,221	8,513	8,459	8,572
Average Interpeak Hr				
Outer Screenline - Inbound Direction	7,276	7,844	7,560	7,331
Outer Screenline – Outbound Direction	6,852	7,859	7,910	7,903
Railway Screenline – Northbound	3,413	4,157	4,169	4,183
Railway Screenline – Southbound	3,455	3,910	3,919	3,922
Handy Cross- Inbound	5,495	5,587	5,541	5,492
Town Centre- Inbound	6,198	6,826	6,767	6,759
Town Centre- Outbound	6,086	7,053	6,983	6,972

	2006 Base	Test 1A - 2026 DSA	Mitigation 1	Mitigation 2
PM Hour (1700-1800)				
Outer Screenline - Inbound Direction	9,395	10,048	9,824	9,723
Outer Screenline – Outbound Direction	10,737	11,945	12,085	12,108
Railway Screenline – Northbound	5,686	6,623	6,564	6,488
Railway Screenline – Southbound	4,267	5,044	4,928	4,941
Handy Cross- Inbound	8,179	8,955	8,977	8,686
Town Centre- Inbound	7,861	8,624	8,542	8,306
Town Centre- Outbound	9,311	10,854	10,610	10,660

Table 8: Flow difference – Cordons and Screenlines

6.13 The table shows that in the 12 hour period there is a reduction in traffic crossing the Outer Cordon with the Mitigation Runs (Abbey Barn Lane is outside the outer screenline). There is also a small increase in traffic crossing the town centre cordon in the 12 hour day. In the morning peak there is a similar pattern with a reduction in traffic crossing the outer cordon but increased traffic crossing the town centre cordon. In the evening peak there is little change in town centre flows but reductions at the outer cordon.

Delays at junctions

6.14 The model can provide forecast delays on each junction approach within the study area. Appendix A shows a series of diagrams showing the level of delays in the morning and evening peak periods for each test. These diagrams show junctions where an arm has delays in excess of a series of thresholds. The thresholds adopted are:

- 60 to 120 seconds
- 120 to 180 seconds
- 180 to 240 seconds
- Over 240 seconds

6.15 Typically a traffic signal junction has a cycle time between 60 and 120 seconds. Therefore, a delay of 60 seconds would equal half of a 120 second cycle so a vehicle arriving at the queue would wait for half the cycle before leaving the junction. With delays in excess of 120 seconds the vehicle would still be queued at the end of the green phase and would need to wait for the next green phase. A delay of 240 seconds would need at least two green phases before the vehicle clears the junction.

6.16 In Test 1A (full DSA proposals no mitigation) the areas with the largest delays are:

- Pedestal (Am)
- West Wycombe/ Chapel Lane/ Plumer Hill area (AM & PM)
- Handy Cross (AM & PM)
- West Wycombe Rd/ Pastures (PM)

- Hughenden Valley (AM)
- Marlow Hill/ Daws Hill Lane junction (AM & PM)
- Terriers (AM & PM)
- Cressex (AM & PM)
- Abbey Way ring junction (AM & PM)
- London Road (Abbey Barn RD and Micklefield Rd area (AM)
- Rayners Avenue (AM)
- Winchbottom Lane (AM)
- Flackwell Heath (AM & PM)
- Treadway Hill/ Station Road (AM & PM)
- Desborough Road/ Desborough Avenue (PM)
- Amersham Hill/ Hamilton Rd (PM)

6.17

The locations with Mitigation Run 1 where the largest changes in delay are:

Decreases (due to increased capacity at Daws Hill Lane/Marlow Hill junction, less queues)

- Daws Hill Lane (at Marlow Hill)
- Winchbottom Lane

Increases

- Abbey Barn Lane/ Kingsmead Rd
- Spring Lane
- Treadaway Hill
- Flackwell Heath
- Suffield Road

6.18

The locations with Mitigation Run 2 where the largest changes in delay are:

Decreases (due to increased capacity at Daws Hill Lane/Marlow Hill junction, less queues)

- Daws Hill Lane (at Marlow Hill)
- Winchbottom Lane

Increases

- Marlow Hill (at Daws Hill) *(due to northbound traffic inclusion in the signals to allow for right turn from Daws Hill Lane)*
- Abbey Barn Lane/ Kingsmead Rd
- Spring Lane
- Treadaway Hill
- Flackwell Heath
- Suffield Road
- Desborough Road
- Desborough Avenue
- Mill End Road

7 Local Junction Analysis

7.1 A more localised analysis has been undertaken for the junctions in the vicinity of the M40 Gateway. The changes in flow at **Handy Cross** are shown below in Tables 9-12. These show that in the morning peak with the full DSA proposals run there is an increase in flow to 8,562 (this is lower than previous core strategy runs). The inclusion of Mitigation Run 1 reduces the flow to 8,416 with the largest changes being the flows from the motorway slip roads. In Mitigation Run 2 there is a larger reduction to 8,321 vehicles entering the junction with increased flow on the A404 but reductions on the motorway slip roads, and Marlow Old Road. There is an increase in traffic entering the junction on Marlow Hill which is as a result of the junction improvement at Daws Hill in that more traffic can exit Daws Hill Lane. Some traffic is diverted from Winchbottom Lane onto Daws Hill and thus enters Handy Cross from the north.

7.2 The outbound flows on table 10 show clearly that the main reduction in flow is traffic leaving the junction on the A404 Marlow Hill. This is as a result of the junction change at Daws Hill. In Run 1 there is increased traffic on Daws Hill Lane entering Marlow Hill which causes some traffic to divert away from Marlow Hill. In Run 2 the northbound flow on Marlow Hill is held to allow the right turn from Daws Hill which adds to delay on Marlow Hill causing traffic to divert away from this route.

Route	Observed	2008	Test 1A - 2026 DSA	Mitigation 1	Mitigation 2
A4094 John Hall Way	869	966	1,069	1,059	1,068
Marlow Road	714	714	701	703	725
A404 Marlow Hill	914	914	1,172	1,214	1,264
M40 Westbound off slip	1,639	1,639	2,128	2,043	1,999
A404 Marlow bypass	1,254	1,254	999	1,107	1,059
Marlow old Road	753	753	889	732	707
M40 Eastbound off slip	1,336	1,336	1,604	1,558	1,499
Total	7,479	7,576	8,562	8,416	8,321

Table 9: Flow Changes- Handy Cross- Am Peak Hour Inbound

Route	Observed	2008	Test 1A - 2026 DSA	Mitigation 1	Mitigation 2
A4094 John Hall Way	1,190	1,315	1,637	1,635	1,647
Marlow Road	721	609	713	694	699
A404 Marlow Hill	1,132	1,143	1,581	1,370	1,088
M40 Westbound off slip	1,418	1,594	1,591	1,614	1,673
A404 Marlow bypass	2,268	2,260	2,268	2,238	2,354
Marlow old Road	498	434	560	623	607
M40 Eastbound off slip	252	297	212	242	253
	7,479	7,652	8,562	8,416	8,321

Table 10: Flow Changes- Handy Cross- Am Peak Hour Outbound

7.3 In the PM peak there is little change in the total demand entering Handy Cross as a result of Mitigation Run 1. There is an increase on Marlow Hill with a reduction on Marlow Old Road. Some traffic is diverted from Winchbottom Lane onto Daws Hill and thus enters Handy Cross from the north. In Run 2 there is a reduction to 8,686 vehicles entering the junction with increased flow on the A404 but reductions on the motorway slip roads, and Marlow Old Road.

7.4 The outbound flows on table 12 show clearly that the main reduction in flow is traffic leaving the junction on the A404 Marlow Hill in Run 2. This is as a result of the junction change at Daws Hill. In Run 1 there is increased traffic on Daws Hill Lane entering Marlow Hill which causes some traffic to divert away from Marlow Hill. In Run 2 the northbound flow on Marlow Hill is held to allow the right turn from Daws Hill which adds to delay on Marlow Hill causing traffic to divert away from this route. In Run 1 there is little difference with the DSA run.

Route	Observed	2008	Test 1A - 2026 DSA	Mitigation 1	Mitigation 2
A4094 John Hall Way	1,427	1,486	1,711	1,729	1,704
Marlow Road	728	796	813	814	813
A404 Marlow Hill	1,129	1,191	1,498	1,592	1,602
M40 Westbound off slip	1,514	1,530	1,678	1,705	1,648
A404 Marlow bypass	1,418	1,455	1,529	1,547	1,444
Marlow old Road	635	638	607	455	368
M40 Eastbound off slip	972	1,015	1,119	1,135	1,106
Total	7,823	8,112	8,955	8,977	8,686

Table 11: Flow Changes- Handy Cross- Pm Peak Hour Inbound

Route	Observed	2008	Test 1A - 2026 DSA	Mitigation 1	Mitigation 2
A4094 John Hall Way	1,174	1,126	1,302	1,267	1,361
Marlow Road	669	724	548	553	478
A404 Marlow Hill	1,074	1,199	1,421	1,439	1,187
M40 Westbound off slip	1,606	1,668	1,885	1,856	1,828
A404 Marlow bypass	2,270	2,302	2,405	2,426	2,403
Marlow old Road	492	461	801	768	807
M40 Eastbound off slip	538	632	592	669	622
	7,823	8,112	8,955	8,977	8,686

Table 12: Flow Changes- Handy Cross- Pm Peak Hour Outbound

7.5 Table 13 provides the morning peak hour delays at Handy Cross. In Mitigation Run 1 these show increases in delay in the morning peak on Marlow Hill, with reductions on the other arms. In Mitigation Run 2 there are increases on all the northern entries into the junction with reductions on the southern entries. There is also less traffic entering the junction in Run 2.

Route	2008	Test 1A - 2026 DSA	Mitigation 1	Mitigation 2
A4094 John Hall Way	37	95	84	87
Marlow Road	48	79	71	92
A404 Marlow Hill	89	90	127	118
M40 Westbound off slip	40	22	19	18
A404 Marlow bypass	55	212	174	133
Marlow old Road	31	116	90	53
M40 Eastbound off slip	23	39	35	35

Table 13: Average delays per vehicle (AM Peak Hour)

7.6

Table 14 provides the peak hour delays for the evening peak. In Mitigation Run 1 these show increases in delay on Marlow Hill, and Marlow Road with a reduction on the Marlow bypass. In Mitigation Run 2 there are increases further increases in delay on Marlow Hill, and Marlow Road with a further reduction on the Marlow bypass.

Route	2008	Test 1A - 2026 DSA	Mitigation 1	Mitigation 2
A4094 John Hall Way	21	37	34	30
Marlow Road	51	59	69	82
A404 Marlow Hill	96	52	96	100
M40 Westbound off slip	53	21	20	20
A404 Marlow bypass	34	103	93	53
Marlow old Road	32	31	23	22
M40 Eastbound off slip	22	35	35	36

Table 14: Average delays per vehicle (PM Peak Hour)

7.7

Table 15 shows the change in traffic flows on **Daws Hill Lane** for each test. The table shows that with the improvements there is greater flow on Daws Hill Lane, particularly westbound. With the improvement in Mitigation run 1 there is an additional 4,200 vehicles on Daws Hill Lane westbound with a small reduction eastbound. With the improvement in Mitigation Run 2 there is a further additional 2,200 westbound vehicles compared to Run1 and a reduction eastbound.

Test	AM Peak hr		PM Peak hr		12-hr	
	East	West	East	West	East	West
Test 1A DSA	804	636	800	626	9,545	7,601
Mitigation 1	796	1,014	798	984	9,393	11,868
Mitigation 2	852	1,364	777	1,127	8,798	14,048

Table 15: Flows on Daws Hill Lane

7.8

Table 16 shows the **Marlow Hill** flows in each test. The table shows that north of the junction there is a small increase in southbound flow with Mitigation Run1 and a small reduction in southbound flow with Run 2. However this is a function of the town centre network being able to feed traffic to Marlow Hill. In the northbound direction there is an increase in traffic with Mitigation Run 1 but a reduction in Mitigation Run 2 as a result of traffic diverting away from Marlow Hill. To the south of the junction there is an increase in traffic in both directions in mitigation Run 1 as a result of the increased throughput from Daws Hill. In Mitigation Run 2 there is a reduction in northbound traffic due to re-routing and a small increase in southbound traffic as a result of increased throughput from Daws Hill.

	AM Peak hr		PM Peak hr		12-hr	
Test	North	South	North	South	North	South
Marlow Hill (north of Daws Hill)						
Test 1A DSA	1,803	1,888	1,934	1,791	19,131	19,068
Mitigation 1	1,760	1,785	1,979	1,637	20,033	18,525
Mitigation 2	1,725	1,888	1,800	1,662	18,894	18,610
Marlow Hill (south of Daws Hill)						
Test 1A DSA	2,251	2,224	2,426	2,122	24,539	22,712
Mitigation 1	2,220	2,530	2,482	2,305	25,460	26,392
Mitigation 2	1,697	2,547	1,861	2,049	18,731	23,648

Table 16: Flows on Marlow Hill at Daws Hill Lane junction

7.9

The delays at the Daws Hill Lane / Marlow Hill junction are shown in table 17. This shows that on Daws Hill Lane there is a reduction in delay as a result of changes on the Daws Hill Lane approach. In Mitigation Run 1 there is a large second reduction in morning peak delay but more traffic is attracted to Daws Hill Lane. In Mitigation Run 2 there is a further reduction in delays for left turning traffic but an increase for right turning traffic. A similar pattern is evident in the evening peak. On the A404 southbound traffic has no additional delay in Mitigation Run 1 but in Mitigation Run 2 there is an average 5-7 second increase in delay, as a result of having to provide an additional stage to allow right turning traffic from Daws Hill Lane. For northbound traffic there is no additional delay on A404 in Mitigation Run 1 but in Mitigation Run 2 there is delay as this traffic has to be held to allow the right turn traffic from Daws Hill. There is also an issue with right turning traffic from the A404 to Daws Hill Lane in that in Mitigation Run 2 they suffer increased delay due to accommodating the other right turn. Further signal optimisation could be undertaken but at present the aim has been to minimise delays on the A404 movements.

	AM Peak hr	PM Peak hr	AM Peak hr	PM Peak hr	AM Peak hr	PM Peak hr
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Test	Daws Hill westbound	Daws Hill westbound	A404 northbound	A404 northbound	A404 southbound	A404 southbound
Test 1A DSA	428	248	0 ahead 121 right	0 ahead 145 right	11	11
Mitigation 1	139	82	0 ahead 244 right	0 ahead 232 right	11	10
Mitigation 2	68 left 158 right	36 left 109 right	6 ahead 385 right	6 ahead 350 right	18	16

Table 17: Delays (sec/veh) Daws Hill Lane at Marlow Hill

7.10

Table 18 shows the change in traffic flows on **Abbey Barn Road (south of Wycombe Marsh link)** for each test. The table shows that the mitigation measures, even though there is an improvement, create a reduction in northbound traffic. This traffic is tending to use the improved Daws Hill Lane rather than Abbey Barn Lane. There is a southbound increase in traffic on Abbey Barn Road some of which in turn is making use of Daws Hill Lane.

Test	AM Peak hr		PM Peak hr		12-hr	
	North	South	North	South	North	South
Test 1A DSA	866	902	889	637	7,116	6,101
Mitigation 1	894	897	877	708	6,337	6,432
Mitigation 2	852	900	873	729	6,116	6,930

Table 18: Flows on Abbey Barn Road

7.11

The following table shows the flows, delays and queues on **London Road at the junction with Abbey Barn Road**. The table shows that eastbound traffic on the A40 has a small increase during the day. Westbound traffic on the A40 at Abbey Barn Rd is reduced as some traffic diverts to use Abbey Barn Lane. There is increased delay to traffic on the A40 as a result of the additional signals. Further optimisation of the performance of these junctions could be undertaken to improve the 'green wave' on the A40.

Test 1	AM Peak hr			PM Peak hr			12 hr		
	Flow (veh)	Delay (sec/veh)	Queue (veh)	Flow (veh)	Delay (sec/veh)	Queue (veh)	Flow (veh)	Delay (sec/veh)	Queue (Av)
London Rd eastbound	765	37	3	864	16	1	9378	15	4
London Rd turning right into Abbey Barn Rd	327	54	8	128	29	4	902	20	4
London Rd westbound	1,004	15	13	1,114	40	13	12,092	36	11
Abbey Barn Rd northbound	417	42	6	441	51	7	2,914	36	3
Mitigation 1									
London Rd eastbound	790	59*	7*	894	40*	4*	10,270	27*	3*
London Rd turning right into Abbey Barn Rd	163	65*	10*	31	43*	10*	272	39*	7*
London Rd westbound	843	56*	17*	980	59*	20*	10,651	34*	13*
Abbey Barn Rd northbound	488	30	5	474	30	4	2,878	22	2
Mitigation 2									
London Rd eastbound	794	53*	7	868	43*	3*	10,292	26*	4*
London Rd turning right into Abbey Barn Rd	170	62*	9	45	43*	10*	291	38*	7*
London Rd westbound	831	63*	19	989	68*	21*	10,117	48*	14*
Abbey Barn Rd northbound	466	30	4	463	32	5	2,830	22	2

Table 18: Flows, delays and queues on Abbey Barn Ln and London Rd

* combined delays or queues at the two junctions with Abbey Barn Rd and Ford Rd

7.12

Table 19 shows the delays in **the town centre at the Marlow Hill/ London Road junction**. The table shows that the mitigation measures increase flows on Marlow Hill leading to increased delays and queues. This trend is more noticeable with Mitigation Run 2.

Test 1A DSA	AM Peak hr			PM Peak hr			12 hr
	Flow (veh)	Delay (sec/veh)	Queue (veh)	Flow (veh)	Delay (sec/veh)	Queue (veh)	Flow (veh)
Marlow Hill northbound	1,868	70	109	1,872	118	135	20,118
New Abbey Way eastbound	1,147	31	12	1,081	87	45	12,213
Abbey Way westbound	1,529	177	112	1,542	75	54	18,435
Mitigation 1							
Marlow Hill northbound	1,822	115	157	1,907	111	131	20,689
New Abbey Way eastbound	1,175	66	30	1,049	67	37	12,049
Abbey Way westbound	1,550	132	86	1,522	64	52	18,151
Mitigation 2							
Marlow Hill northbound	1,901	194	221	1,920	163	179	21,385
New Abbey Way eastbound	1,126	64	33	1,045	68	38	11,934
Abbey Way westbound	1,508	122	87	1,463	61	53	17,470

Table 19: Flows, delays and queues on Abbey Way and Marlow Hill

School Traffic

- 7.13 As part of the mitigation runs, a proposal is included for allowing school drop off traffic (for St Bernard and St Augustine school) to use a route from the Sports Centre access road to the schools. Traffic surveys in the vicinity of the school were undertaken during the peak periods. These included a traffic count on Daws Hill Lane and parking beats on neighbouring roads to assess the amount of school traffic.
- 7.14 Parking beat information at the schools suggests that the number of staff trips by car were as follows (based on cars parked at 930). These trips would continue to use Daws Hill Lane under the proposals.
- St Augustine 48 cars
 - St Bernards 22 cars
- 7.15 Traffic survey data from a turning movement count at the school entrance on Daws Hill Lane suggests the following movements:
- Traffic turning from Daws Hill Lane west 179 cars and Lgvs
 - Traffic turning from Daws Hill Lane east 58 cars
 - Total Traffic entering school 237 cars and Lgvs
 -
 - Traffic turning to Daws Hill Lane west 119 cars and Lgvs
 - Traffic turning to Daws Hill Lane east 49 cars
 - Total Traffic leaving school 158 cars and Lgvs
- 7.16 Based on the above count the split of traffic in the peak hour can be identified as:
- Staff turning 70 cars and Lgvs
 - School drop-off traffic 167 cars
 - Total Traffic entering school 237 cars and Lgvs
- 7.17 The forecast based on traffic entering the school at 167 vehicles is slightly higher than the 158 counted leaving the site but is reasonably close.
- 7.18 In addition to the above traffic, parking beat surveys were carried out on the streets near to the school. These recorded the number of vehicles parked every beat, but the survey did not record registration plates so it is not possible to cross reference how many vehicles were re-observed each patrol. However, the data has been used to provide an estimate of school related parked vehicles. A total of 35 vehicles are estimated to be school related in the morning peak. The total number of school related trips is estimated as 202 vehicles, of which 66% would arrive from the west and 34% from the east.
- 7.19 The model represents travel across a 12-hour day from 0700 to 1900. Demands are estimated by trip purpose so that in order to estimate the impact of the school drop-off

mitigation measure, the home based education trips are forecast to use a link from the Sports Centre route. The morning peak modelled flow between 0800 and 0900 using the Sports Centre access road is 160 vehicles each way. Table 20 shows the impact at the **Sports Centre junction**. This shows little change in the PM peak with the additional flow in the morning peak. This extra flow does not generate a large increase in delay on the Sports Centre Access road.

	AM Peak hr			PM Peak hr		
	Flow (veh)	Delay (sec/veh)	Queue	Flow (veh)	Delay (sec/veh)	Queue
Test 1A						
Marlow Hill- n of junction northbound	1,578	-	-	1,684	-	-
Marlow Hill- n of junction southbound	1,629	29 ahead 9 left	10 ahead 2 left	1,276	29 ahead 7 left	9 ahead 1 left
Sports Centre access eastbound	832	-	-	405	-	-
Sports Centre access westbound	317	10 left 22 right	0 left 1 right	835	13 left 23 right	2 left 3 right
Marlow Hill- s of junction northbound	1,604	9 ahead 32 right	3 ahead 3 right	1,429	8 ahead 26 right	3 ahead 1 right
Marlow Hill- s of junction southbound	1,164	-		1,455		
Mitigation Run 1						
Marlow Hill- n of junction northbound	1,452	-	-	1,683	-	-
Marlow Hill- n of junction southbound	1,767	30 ahead 13 left	9 ahead 3 left	1,363	29 ahead 7 left	9 ahead 1 left
Sports Centre access eastbound	1,008	-	-	408	-	-
Sports Centre access westbound	482	10 left 23 right	0 left 2 right	831	13 left 23 right	2 left 3 right
Marlow Hill- s of junction northbound	1,398	9 ahead 33 right	3 ahead 3 right	1,438	9 ahead 26 right	3 ahead 1 right
Marlow Hill- s of junction southbound	1,204	-		1,534		

Table 20: Sports Centre Junction

Flows on Links

7.20

Table 21 - 24 shows the flows over a selection of roads around the M40 Gateway area.

Route	Test 1A DSA	Mitigation Run 1	Mitigation Run 2
Winchbottom Lane junction with Marlow Old Rd - eastbound	125	133	119
Winchbottom Lane junction with Marlow Old Rd - westbound	414	309	291
Heath End Rd - eastbound	608	680	618
Heath End Rd - westbound	729	958	1,065
Abbey Barn Ln - north	632	1006	936
Abbey Barn Ln - south	629	804	826
Kingsmead Rd - eastbound	271	416	413
Kingsmead Rd - westbound	549	202	237
Treadaway Hill - northbound	638	829	804
Treadaway Hill-southbound	701	569	583
Sheepridge Lane- Northbound	482	346	425
Sheepridge Lane- Southbound	106	206	175
Boundary Rd - eastbound	404	477	466
Boundary Rd - westbound	608	455	482
Station Rd junction with A40 - northbound	820	885	860
Station Rd junction with A40 - southbound	597	583	575

Table 21: Flows for AM Peak hr (8-9am)

Route	Test 1A DSA	Mitigation Run 1	Mitigation Run 2
Winchbottom Lane - eastbound	276	206	245
Winchbottom Lane - westbound	330	167	111
Heath End Rd - eastbound	587	576	602
Heath End Rd - westbound	717	948	959
Abbey Barn Ln - north	574	786	785
Abbey Barn Ln - south	592	792	826
Kingsmead Rd - eastbound	239	228	231
Kingsmead Rd - westbound	428	412	435
Treadaway Hill - northbound	609	555	531
Treadaway Hill-southbound	693	692	686
Sheepridge Lane- Northbound	488	515	507
Sheepridge Lane- Southbound	125	104	94
Boundary Rd - eastbound	434	395	395
Boundary Rd - westbound	647	576	612
Station Rd junction with A40 - northbound	835	818	791
Station Rd junction with A40 - southbound	569	583	549

Table 22: Flows for PM Peak hr (5-6pm)

Route	Test 1A DSA	Mitigation Run 1	Mitigation Run 2
Winchbottom Lane – eastbound	1,473	1,459	1,876
Winchbottom Lane – westbound	2,776	1,031	537
Heath End Rd - eastbound	7,958	7,622	7,345
Heath End Rd – westbound	6,708	9,598	10,161
Abbey Barn Ln - north	4,206	5,581	5,222
Abbey Barn Ln – south	4,834	5,807	6,389
Kingsmead Rd - eastbound	2,561	2,282	2,238
Kingsmead Rd – westbound	4,223	2,433	2,609
Treadaway Hill – northbound	7,923	7,098	6,956
Treadaway Hill-southbound	6,843	7,069	7,106
Sheepridge Lane- Northbound	3,201	3,644	4,061
Sheepridge Lane- Southbound	2,107	1,711	1,589
Boundary Rd – eastbound	3,697	3,740	3,721
Boundary Rd – westbound	4,815	4,640	4,791
Station Rd junction with A40 - northbound	6,743	6,410	6,220
Station Rd junction with A40 - northbound	4,902	4,653	4,478

Table 22: Flows for 12hr period

8

Summary

8.1

In the AM peak period Mitigation Run 1 does not perform as well as Run 2 or Test 1A without mitigation in either congestion index or generalised cost index, although there is a reduction in queues. In the interpeak and PM periods, both mitigation runs improve on Test 1A, with Run 1 performing better than Run 2 in the PM.

8.2

Over the 12-hour period, Mitigation Run 1 has improved network statistics than Run 2 and Test 1A. However, the mitigation measures do not bring the overall statistics back to the levels reported without the development sites, although there are some localised improvements.

8.3

Further improvements could be achieved by work on optimising the performance of junctions including signal timings.

8.4

Impacts of the measures in Mitigation Run 1 are as follows:

- Flows on Daws Hill Lane are increased, particularly westbound. There is a reduction in delays on Daws Hill Lane at the junction with Marlow Hill but the reduction pulls in traffic from other routes, particularly London Road and Abbey Barn Lane
- Traffic is diverted from Winchbottom Lane westbound
- Traffic flows into Handy Cross are reduced in AM peak although there is more traffic on the Marlow Hill approach
- There are increased delays in Flackwell Heath

- There is increased delays on London Road at the junctions with Abbey Barn Road (due to change in traffic patterns and the additional signals on Ford Street)

8.5

Impacts of the measures in Mitigation Run 2 are as follows:

- Flows on Daws Hill Lane are increased, particularly westbound. There is a reduction in delays on Daws Hill Lane at the junction with Marlow Hill but the reduction pulls in traffic from other routes, particularly London Road and Abbey Barn Lane
- The introduction of the right turn on Daws Hill Lane means that there is additional delay on Marlow Hill and so traffic flows are reduced. Traffic diverts onto other routes leading to delays in other parts of the town centre
- Traffic is diverted from Winchbottom Lane westbound (more than in Mitigation Run 1) onto Daws Hill Lane
- Traffic flows into Handy Cross are reduced in both AM and PM peaks although there is more traffic on the Marlow Hill approach
- There is additional delay in Flackwell Heath due to the increase in westbound traffic on Heath End Road. This is more than in Mitigation Run 1.
- There is increased delays on London Road at the junctions with Abbey Barn Road (due to change in traffic patterns and the additional signals on Ford Street)

Appendix A - Average Vehicle Delays

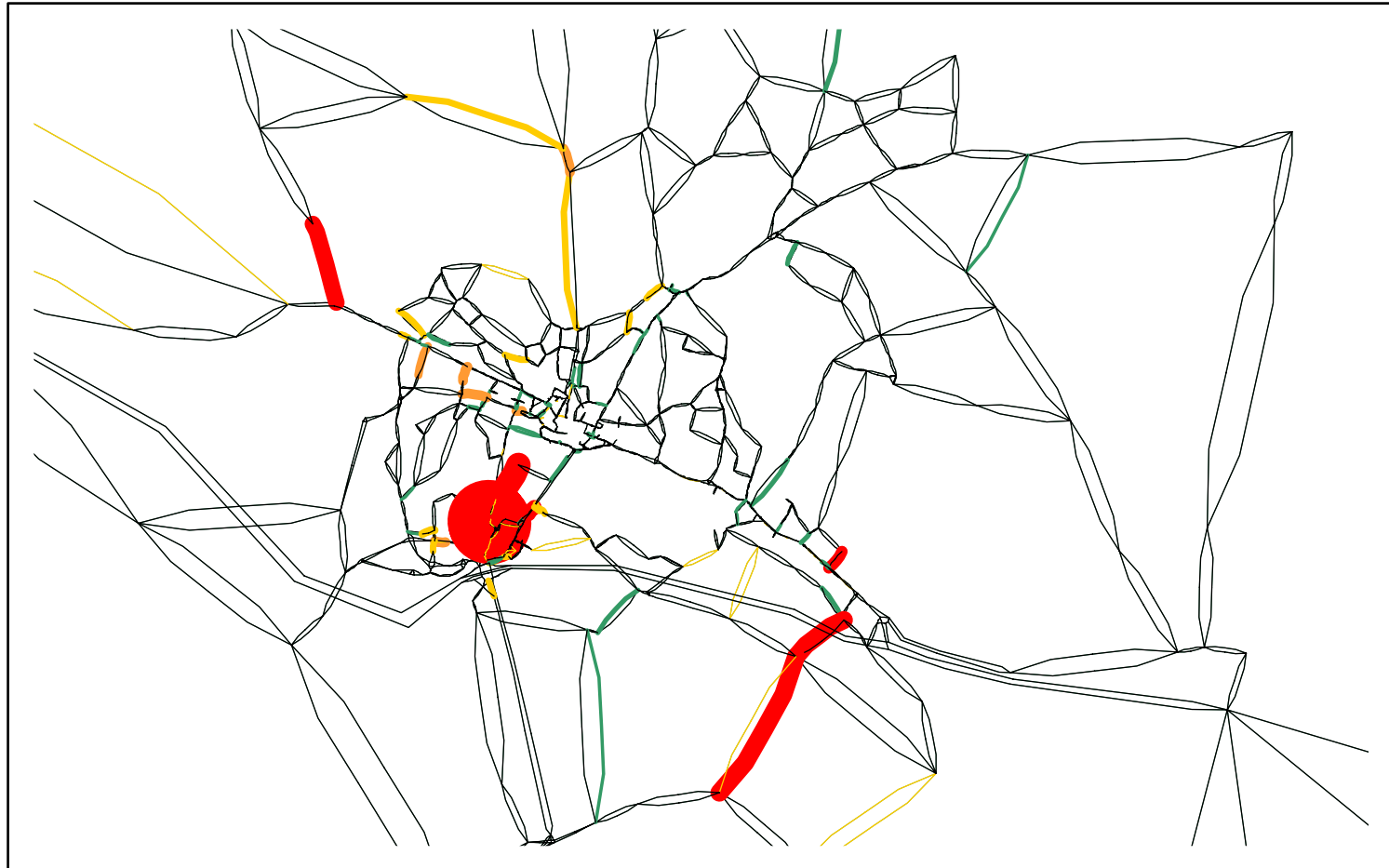
AM Peak Hour - Test 1A



Am Peak Hour – Mitigation Run 1



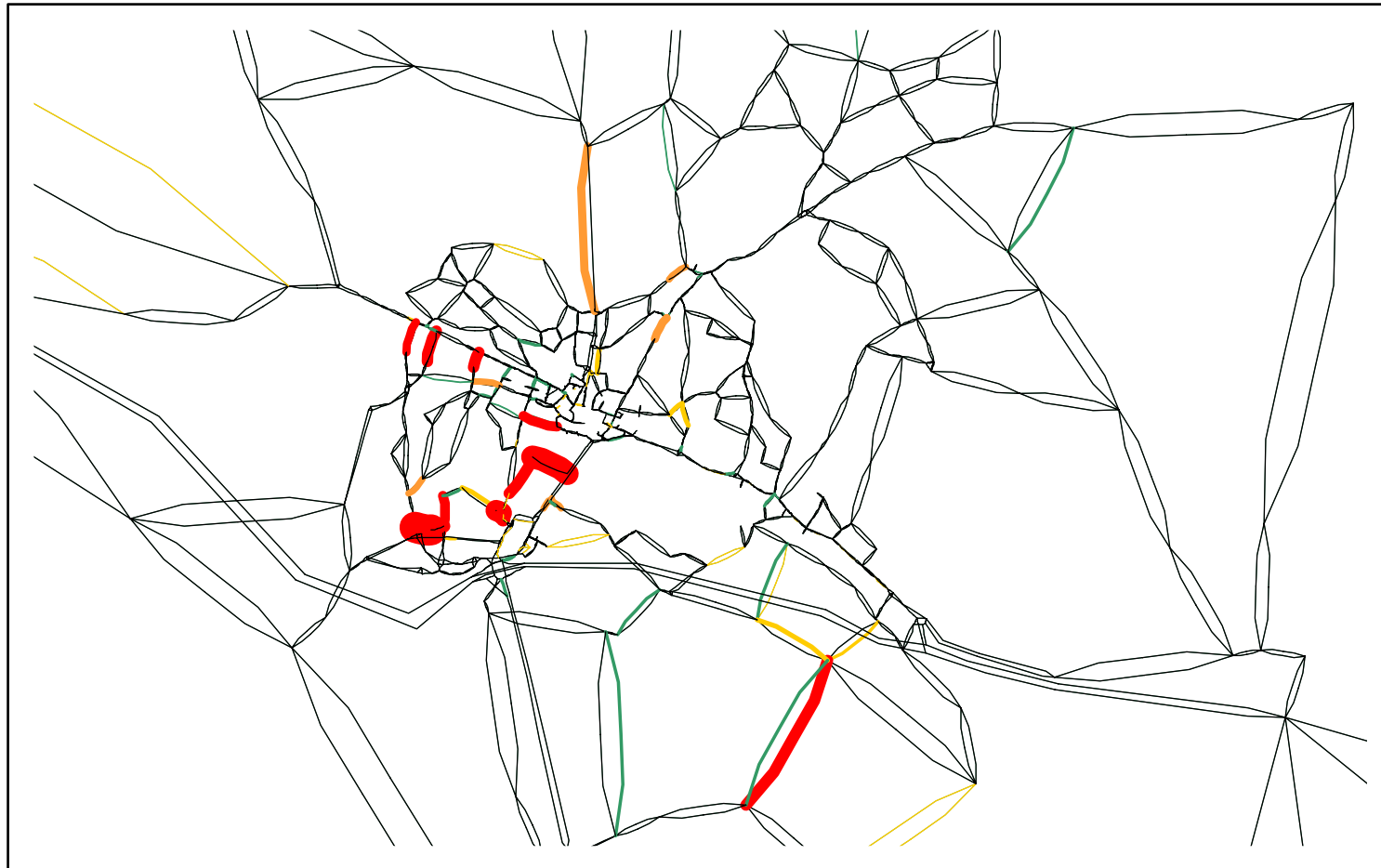
AM Peak – Mitigation Run 2



PM Peak - Test 1A



PM Peak – Mitigation Run 1



PM Peak – Mitigation Run 2

