North Hampshire Transport Model Evidence Base
Reference number 102242 (103510)

01/02/2018

RUSHMOOR LOCAL PLAN – NHTM MODELLING

Hampshire County Council

SYSTRA

NORTH HAMPSHIRE TRANSPORT MODEL EVIDENCE BASE

RUSHMOOR LOCAL PLAN – NHTM MODELLING

IDENTIFICATION TABLE	
Client/Project owner	Rushmoor Borough Council
Project	North Hampshire Transport Model Evidence Base
Study	Rushmoor Local Plan – NHTM Modelling
Type of document	Model Outputs Summary Report
Date	01/02/2018
File name	NHTM_Rushmoor_LDP_Outline_Report_v5a
Reference number	102242 (103510)
Number of pages	65

APPROVAL				
Version	**Name**		**Date**	**Modifications**
1	Author	Emma Douglas	31/12/2015	Completions and Hard Commitments only
	Other Authors	Matt Lawrence		
	Checked by	Chris Whitehead	05/01/2016	
2	Author	Emma Douglas	23/02/2016	Updated in Response to RBC comments
	Other Authors	Matt Lawrence		
	Checked by	Chris Whitehead	24/02/2016	
3	Author	Emma Douglas	16/01/2017	Inclusion of Soft Commitments and update of Completions and Hard Commitments
	Checked by	Chris Whitehead	16/01/2017	
4	Author	Emma Douglas	24/05/2017	Updated in Response to RBC comments and HCC comments
	Checked by	Chris Whitehead	30/05/2017	
5	Author	Sam Carr	01/02/2018	Updated to include Chapter 5 -Stage 3 Mitigation Measures
	Checked by	Chris Whitehead	01/02/2018	

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1. INTRODUCTION

1.1 Study Background

1.1.1 Rushmoor Borough Council (RBC) is preparing a single Local Plan that will supersede the Rushmoor Core Strategy (adopted 2011) and the saved policies of the Rushmoor Local Plan Review (2000). The Local Plan will cover the period through to 2032. To help inform and evidence the Plan, HCC's North Hampshire Transport Model (NHTM) has been applied to assess the transport implications of the proposed land allocations.

1.1.2 The NHTM has limited forecast years (2019, 2026, 2031, 2036) of which the closest to the end of the Local Plan period is 2031. For this study all planning inputs to the model for Rushmoor represent 2032 but the underlying model year and associated model inputs outside of Rushmoor are for 2031.

1.1.3 This NHTM application was originally commissioned by RBC in September 2015 and has been completed in stages through to February 2018.

1.1.4 A glossary of technical terms specific to the NHTM and this commission is included as Appendix A.

1.2 Rushmoor Borough Council Development Scenarios

1.2.1 In response to the (expected) timescale for development of the Local Plan proposals this application of the NHTM has been undertaken in three Stages:

- Stage 1 – 2031 Do Minimum (completed late 2015 and updated January 2017)
- Stage 2 – 2031 Rushmoor Local Plan and Additional Developments (completed May 2017)
- Stage 3 – Transport Mitigation (completed in January 2018)

Stage 1 – 2031 Do Minimum (Rushmoor's Hard Commitments to 2032 only)

1.2.2 The Do Minimum forms the basis against which the proposed Local Plan development quantum will be assessed.

1.2.3 In this study the Do Minimum represents a scenario that includes all present day (at time of commissioning) completed development and infrastructure in Rushmoor up to 2016 in addition to all Hard Commitments (both development and infrastructure) from 2016 through to 2032. In the Do Minimum no allowance is made for the new Local Plan allocations with the exception of Wellesley or any other Soft Commitments in Rushmoor.

1.2.4 Stage 1 of this study is reported in detail in Chapter 3 of this Report.

Stage 2 – 2031 Rushmoor Local Plan and Additional Developments (Do Minimum + Rushmoor's Soft Commitments to 2032)

1.2.5 Stage 2 builds off of the Do Minimum scenario and includes for all proposed housing and employment allocations as identified in the Local Plan. By comparing Stage 2 to the Do Minimum, the transport impact resulting from the new development is isolated.

1.2.6 The outputs from the first two Stages of this commission form inputs to a Transport Assessment (TA) to assess the impact of the Local Plan proposals and determine appropriate mitigation if/ as necessary.

1.2.7 Stage 2 of this study is reported in Chapter 4 of this Report.

Stage 3 – Testing of Transport Mitigation

1.2.8 A TA/ Mitigation Measures study was completed (by Systra) utilising outputs from Stages 1 and 2 of the NHTM modelling. The TA identified, developed and tested (using individual junction models) mitigation measures appropriate to accommodate the forecast Local Plan growth. The TA/ Mitigation measures is reported in a separate document. The mitigation measures are now be included in a final NHTM model scenario as reported in Chapter 5 of this Report to identify any wider strategic impacts.

2. NORTH HAMPSHIRE TRANSPORT MODEL (NHTM) BACKGROUND

2.1 Model Development

2.1.1 In 2013, CH2MHill and SYSTRA Ltd along with Williamson Transport Planning (WTP) and David Simmonds Consultancy (DSC) were commissioned to support Hampshire County Council (HCC) with the development and application of a North Hampshire Transport Model Suite (NHTM).

2.1.2 The NHTM is used to support a wide-ranging set of interventions across the North Hampshire sub-region, and specifically is capable of:

- forecasting changes in travel demand, road traffic, public transport patronage and active mode use over time as a result changing economic conditions, land-use policies and development, and transport improvement and interventions;
- testing the impacts of land-use and transport policies and strategies within a relatively short model run time; and
- testing the impacts of individual transport interventions in the increased detail necessary for preparing submissions for inclusion in funding programmes within practical run times.

2.2 NHTM Context and Scope

2.2.1 The NHTM is an evidence based Land-Use and Transport Interaction model. It contains a suite of transport models and an associated Local Economic Impact Model (LEIM). The suite comprises the Main Demand Model (MDM), Road Traffic Model (RTM) and Public Transport Model (PTM).

2.2.2 Figure 1 shows the interaction of the various models within the NHTM. The LEIM takes transport costs from a converged run of the MDM and feeds back population and employment data, which is converted into demand matrices. The public transport and road traffic demand are assigned to the public transport and road traffic networks to estimate travel costs, which are then passed back to the MDM to re-estimate demand. The demand and cost calculations are run iteratively, until convergence is achieved.

2.2.3 The RTM has been developed to represent the base year demand, route choices and costs on the highway network. In terms of future scenarios, it represents the network impacts of different policy and infrastructure interventions.

2.2.4 It is important that the RTM includes the ability to model traffic behaviour at junctions, including flow metering downstream from bottlenecks as well as blocking-back through upstream junctions. SATURN was selected as the most appropriate software package to use as it includes detailed junction modelling in the simulation area of the model.

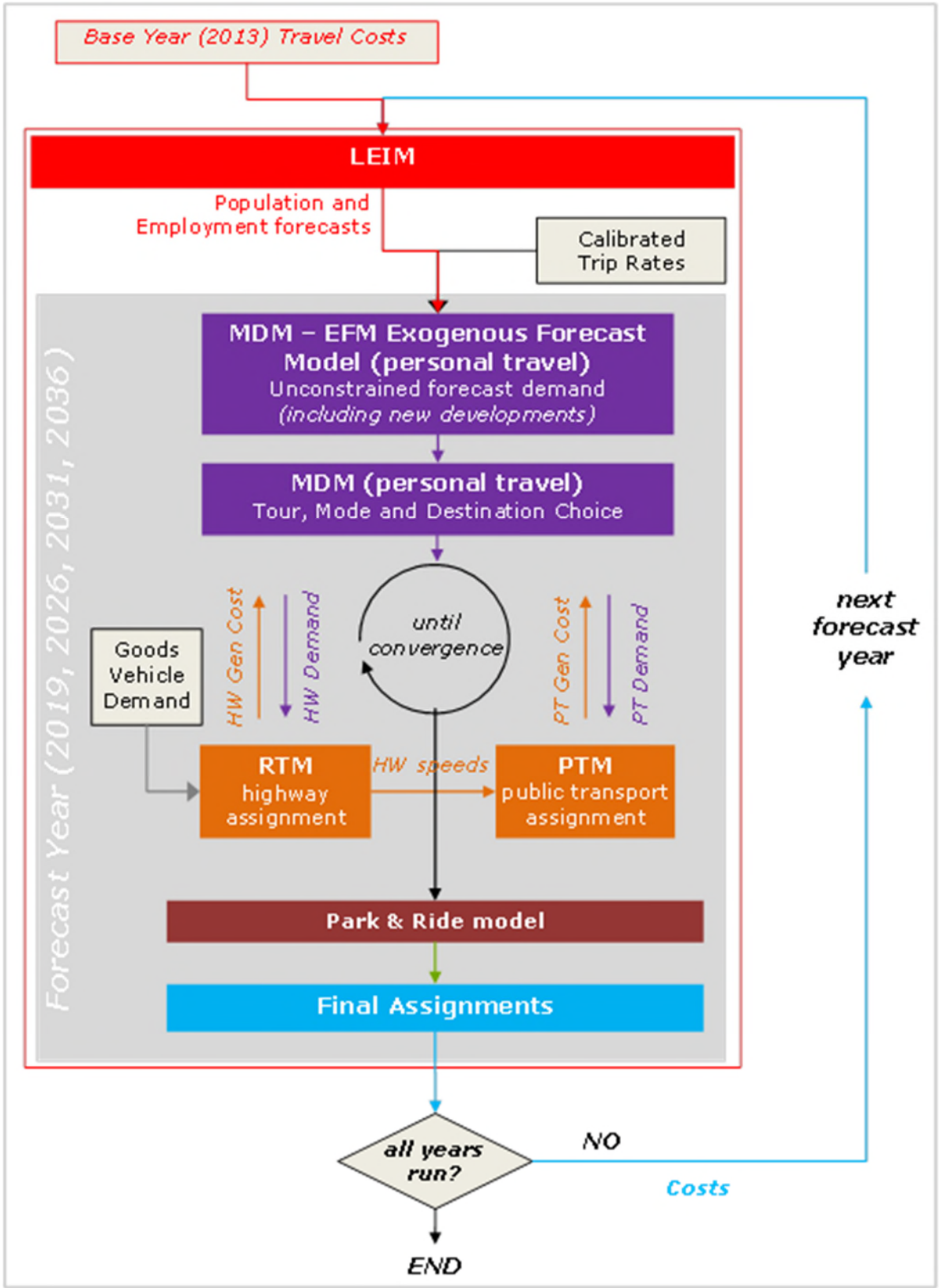


Figure 1. HCC North Hampshire Transport Model Structure

2.2.5 The modelled area of the NHTM is divided into four regions, shown in Figure 2, which differ by zone aggregation and modelling detail. Rushmoor Borough is within the Core Fully Modelled Area (i.e. the most detailed level of representation).

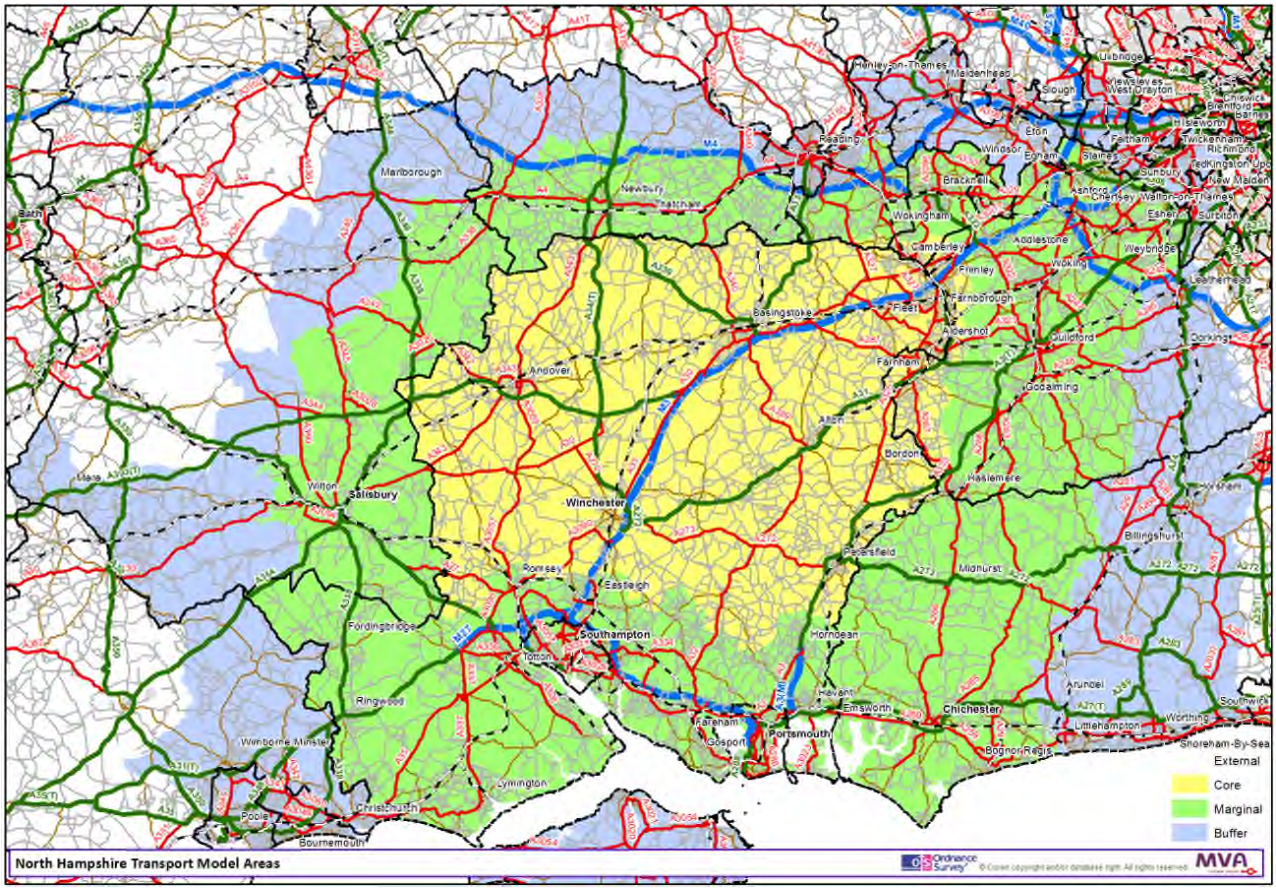


Figure 2. Study Area of the RTM

2.2.6 Travel in the model is aggregated into zones which therefore determine the spatial detail available. The definition of zones takes account of barriers (rivers, railways, motorways) as well as administrative and planning data boundaries. In addition, zones account for land use types, access points onto the road network as well as respecting screenlines for trip matrix validation. For public transport catchment areas for rail stations and bus stops fare boundaries were also considered.

2.2.7 The NHTM zone system uses 2011 Census Output Areas (COAs) as building blocks in the fully modelled area. Elsewhere, the zone system uses aggregations of Census Wards. In the fully modelled area, disaggregation was used to ensure that no zones have more than 400 highway trip origins or destinations per hour in the base year. Figure 3 shows the NHTM zone system for the full model and Figure 4 shows the zone system for Rushmoor Borough.

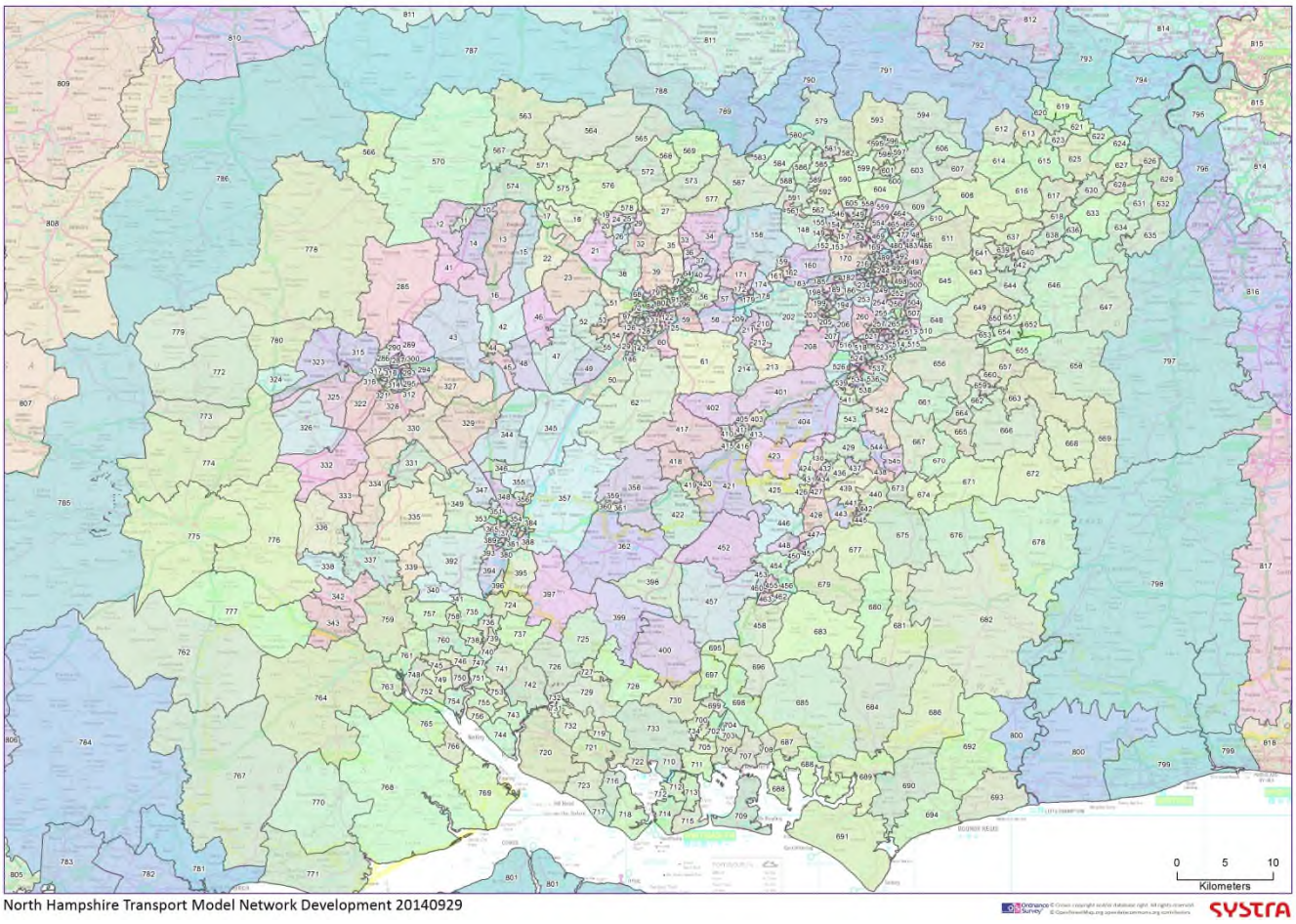


Figure 3. NHTM Zone System

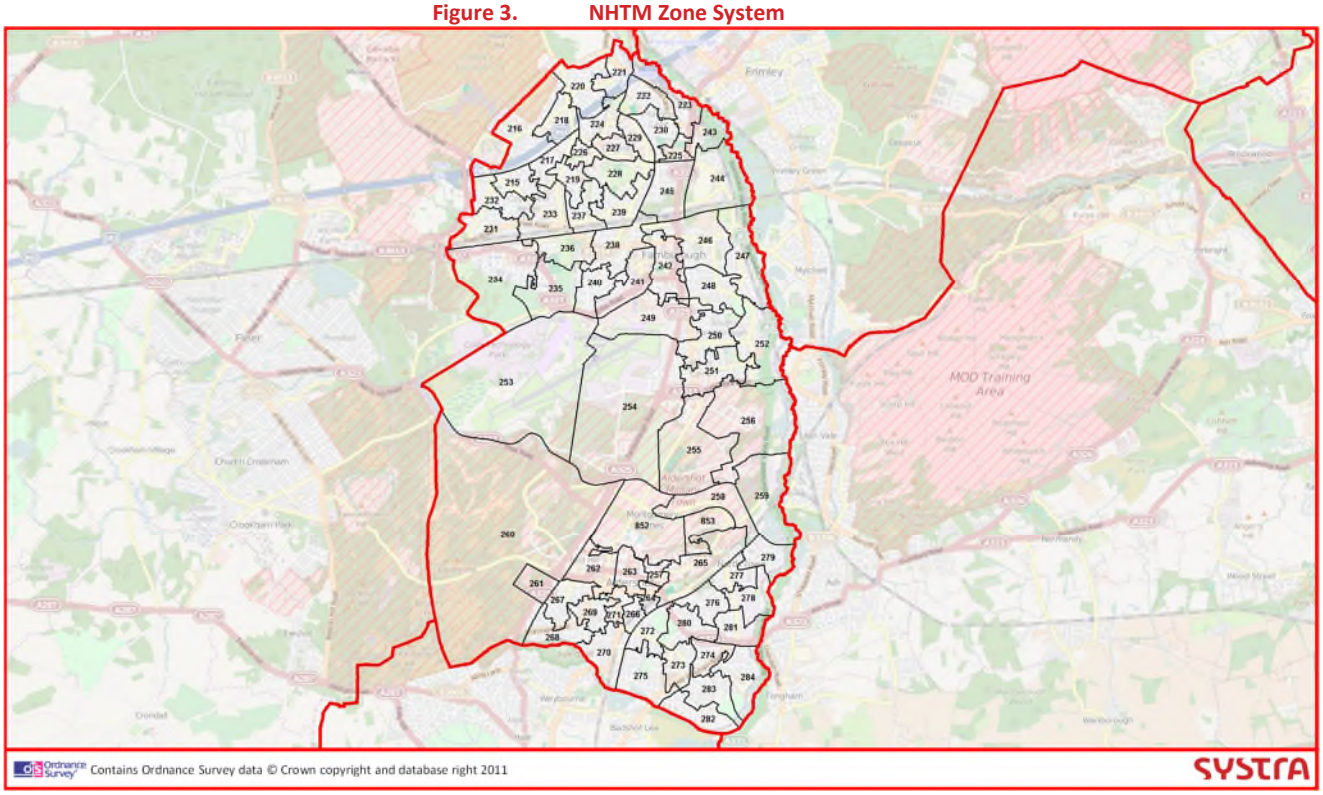


Figure 4. NHTM Zones - Rushmoor

2.2.8 Three weekday periods are modelled in the NHTM:

- AM peak;
- Inter peak; and
- PM peak.

2.2.9 These three periods cover a 12 hour period and allow the relative differentials in travel cost to be represented. The periods are defined in Table 1.

Table 1. Time Period Definitions

PERIOD	FULL PERIOD FOR DEMAND MODEL	RTM ASSIGNMENT PERIOD
AM peak	7:00-10:00	peak hour (factored from period)
Inter peak	10:00-16:00	average hour from full period
PM peak	16:00-19:00	peak hour (factored from period)

2.2.10 The NHTM assignments represent factored one-hour periods, based on the distributions of the broader period. For the inter peak this is an average hour whilst the AM and PM peak periods are represented by the peak hours. AM and PM peak matrices have been obtained from the period matrices, by applying peak hour factors which have been calculated from an analysis of count data. The peak hour factors are shown in Table 2 below.

Table 2. Peak Hour Factors

	AM PEAK	INTER PEAK	PM PEAK
Period to 1 Hr Factor	0.397	0.167	0.368

3. STAGE 1 – DO MINIMUM (WITHOUT NEW LOCAL PLAN DEVELOPMENT)

3.1 Introduction

3.1.1 This chapter summarises the development of, and outputs from, the NHTM model scenario representing Do Minimum conditions. The Do Minimum (DM) forms the benchmark against which the new Rushmoor Local Plan additional allocations will be compared in the later Chapters of this Report.

3.1.2 The sections below provide a breakdown of the key modelling processes, inputs and outputs. Committed development and infrastructure information was provided by Rushmoor Borough Council Officers in December 2016.

3.1.3 As noted in Section 1.1.2, the closest NHTM forecast year to the end of the Local Plan period is 2031. Whilst all input planning data for Rushmoor in this study is consistent with the 2032 Local Plan targets, the underlying model forecast year, and associated inputs for those areas outside of Rushmoor, is 2031.

3.2 NHTM Reference Case Committed Schemes and Developments

3.2.1 The NHTM has a base year of 2013 and forecasts conditions up to the year 2036. Known developments and committed highway schemes are included within the models' reference case scenarios (2019, 2026, 2031 and 2036) to provide the most accurate representation of future year conditions. A list of the known larger developments and committed (funded) highway schemes included in the Reference Cases is provided as Appendix B.

3.2.2 In addition to committed sites, "permissible" sites are included within the Reference Cases. These refer to those locations identified as suitable for future development but have not yet been subject to planning approval. The location and maximum land use quantum of the permissible sites are based on the inputs originally provided by each Local Planning Authority during original model development (2013). The take up of permissible developments is determined by the LEIM module of NHTM and is based on the local conditions (the relative 'attractiveness' of the development e.g. accessibility).

3.2.3 LEIM controls the level of overall development take-up within the model in accordance with TEMPRO employment and population targets for the sub-region which conforms with WEBTAG. This is equivalent to allowing for background traffic growth within the modelling process.

3.2.4 In this study the NHTM Reference Case inputs populate the Do Minimum scenario for all model areas except Rushmoor where the Reference Case inputs have been replaced as detailed in Section 3.3 below.

3.3 Rushmoor Borough Completions and Committed Development Landuse Assumptions

3.3.1 The starting point in the Do Minimum for all model data specific to Rushmoor District is to remove all the standard Reference Case inputs (2013-2036). In place of these, the recorded site completions post 2013 have been added plus hard committed future Rushmoor developments (up to 2032). The total completions and committed development (hard commitments) totals for Rushmoor Borough are summarised in Table 3 below and a breakdown by model zone is provided in Appendix C.

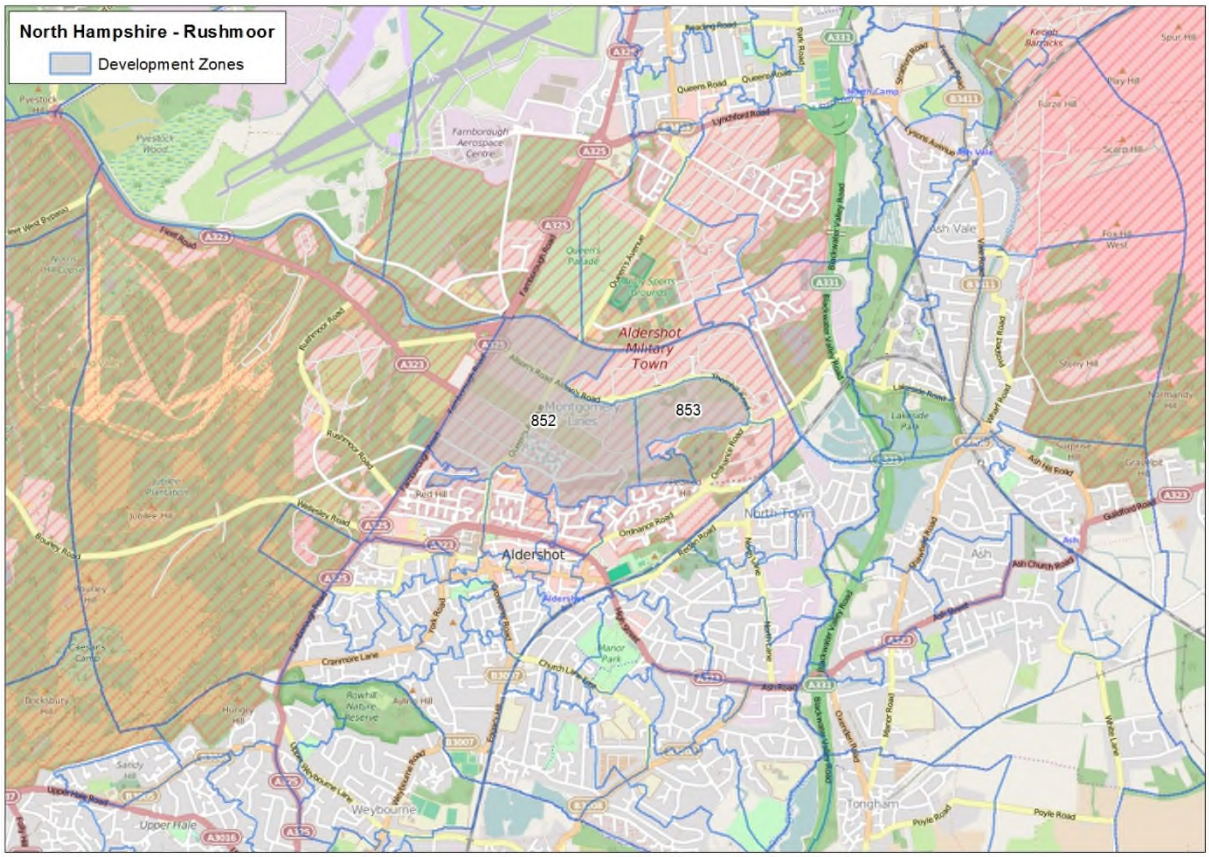
Table 3. Do Minimum Rushmoor Land Use Assumptions 2013-2032

	RESIDENTIAL (DWELLINGS)	EMPLOYMENT (SQM)	
		B1	B8
Do Minimum (2013-32 Rushmoor Completions and Committed)	5,600	109,824	19,049

3.3.2 The most significant committed development included within the DM Borough total is the Aldershot Urban Extension (AUE) that received outline planning consent in July 2013 with early phases of the development currently under construction. Due to the scale of this development (3,850 dwellings plus employment landuse), and in order to best represent the AUE in sufficient detail, two new zones have been added to the existing model zone structure as shown in Figure 5. The two new zones are as follows:

- Zone 852 –AUE (Residential land use only) with access from the west
- Zone 853 – AUE (Employment land uses only) with access from the east

Figure 5. Rushmoor AUE Additional Development Zones



3.4 Rushmoor Committed Highway Infrastructure

3.4.1 In addition to committed development landuse, the Do Minimum model scenario also includes a series of committed highway infrastructure proposals within, or on the border with, Rushmoor. The new highway infrastructure schemes that have been included in the DM are as follows with all the schemes included within model year 2019 onwards (the first model year after 2013):

- A327 Junction (Summit Avenue, Minley Link, Fleet Road) – this junction is reconfigured from a three arm roundabout into a signalised junction (completed)
- New northbound on-slip to the A331 from Government Road (under construction)
- New roundabout on Ively Road providing a second access to the Hartland Park development (completed)
- Improvements to the Shepherd and Flock Roundabout (A31/ A325)
- Improvements to Hickley's Corner (A31/ South St/ Station Hill)
- Improvements to Coxbridge roundabout (A31/ A325)
- Conversion of A325 Wrecclesham Hill with B3384 Echo Barn Lane priority junction to a mini-roundabout
- Partial signalisation of the A31 Hog's Back with A331 Blackwater Valley Road roundabout

3.4.2 At the time of scheme coding there were limited scheme details available for all but A327 junction and the Ively Road roundabout. The following paragraphs confirm the

assumptions included in the modelling. Appendix D contains the drawings and descriptions used to update the highway schemes listed.

3.4.3 The A327 Summit Avenue junction has been converted from a three arm roundabout with two approach lanes on each arm, to a three arm signalised junction. The junction include three lane approaches on each arm. This scheme formed part of the Hartland Park improvements.

3.4.4 The new on-slip to the A331 from Government Road is modelled as a two lane slip road . The entry to the on-slip from Government Road is represented as a priority junction with a dedicated lane for traffic turning right onto the slip road.

3.4.5 The new three arm roundabout on Ively Road provides a new access to Hartland Park. Both approaches of Ively Road are single lanes with additional short flares at the roundabout. The Hartland Park approach is a single lane with no flare.

3.4.6 The Shepherd and Flock roundabout improvements include signalising the A31 southbound approach (two lanes at both the approach and circulating stop lines) and an additional lane at the A31 northbound approach (this approach is already signalised).

3.4.7 Hickley's Corner improvements are the addition of a lane for the northbound A31 approach. An additional lane is included eastbound and westbound on the A31 at Coxbridge Roundabout.

3.4.8 The part signalisation of the A31 Hog's Back and A331 Blackwater Valley Road junction including signals at the southbound A331 approach to the roundabout and on the westbound off slip to the roundabout

3.4.9 There were no new Public Transport schemes in Rushmoor added to the DM scenario.

3.5 Do Minimum Model Results

3.5.1 The Do Minimum NHTM scenario was run through to model year 2031 (to represent the 2032 inputs for Rushmoor) and outputs are summarised in Sections 3.6 to 3.8 below. The DM results have been compared against NHTM Base Year conditions (2013). In Chapter 4 the Rushmoor Local Plan scenario is compared against the Do Minimum (both for a 2031 forecast year).

3.6 Population, Dwellings, Jobs (LEIM Module outputs)

3.6.1 Table 4 below shows the forecasts (produced by the LEIM module of NHTM) for the population, number of dwellings and number of jobs within the Borough. LEIM controls the level of overall development take up within the model in accordance with TEMPRO employment and population growth forecasts for the region which conforms with WebTAG.

3.6.2 The development within Rushmoor is fixed based on the committed land use inputs provided by Rushmoor Borough. Elsewhere in the model there is natural growth as well as committed developments allowed to occur.

3.6.3 The comparisons show the change between the 2013 base scenario and the 2031 Do Minimum scenario.

3.6.4 Based on the model outputs Rushmoor Borough is forecast to see an increase in population of just over 10,000 and an increase in dwellings of approximately 5,600 between 2013-31. The number of jobs increases by approximately 7,700.

Table 4. Rushmoor Borough Change in Population, Dwellings and Jobs, Do Min 2031 vs Base 2013

	BASE 2013	DM 2031	DIFFERENCE	% DIFFERENCE
Population	92761	102943	10182	11.0%
Dwellings	36965	42564	5599	15.1%
Jobs	44126	51821	7695	17.4%

NHTM Ref: MIF v MGW

3.7 Highway Network Performance (RTM Module outputs)

3.7.1 Table 5 and Table 6 below summarise key network statistics for both the full NHTM core modelled area and for Rushmoor Borough in isolation for both AM and PM peak periods respectively. Between 2013 to 2031, in both peaks, vehicle hours and kilometres increase with a decrease in average speed. This is not unexpected due to the general increase in traffic in future years. The changes are more pronounced in the PM peak.

Table 5. AM Period (07:00 – 10:00) Highway Model Network Statistics, Do Min 2031 vs Base 2013

PARAMETER	AREA	BASE 2013	DM 2031	DIFF	% DIFF
Vehicle Hrs	Core Model Area	97,437	132,393	34,956	36%
	Rushmoor	7,309	9,765	2,455	34%
Vehicle Kms	Core Model Area	5,683,696	7,159,337	1,475,641	26%
	Rushmoor	345,096	416,861	71,765	21%
Average Speed	Core Model Area	58	54	-4	-7%
	Rushmoor	47	43	-5	-10%

NHTM Ref: MIF v MGW

Table 6. PM Period (16:00 – 19:00) Highway Model Network Statistics, Do Min 2031 vs Base 2013

PARAMETER	AREA	BASE 2013	DM 2031	DIFF	% DIFF
Vehicle Hrs	Core Model Area	109,171	152,439	43,268	40%
	Rushmoor	7,457	10,180	2,723	37%
Vehicle Kms	Core Model Area	5,921,461	7,719,691	1,798,230	30%
	Rushmoor	350,142	438,603	88,461	25%
Average Speed	Core Model Area	54	51	-4	-7%
	Rushmoor	47	43	-4	-8%

NHTM Ref: MIF v MGW

3.8 Highway Link Flows, Delays and Capacity Hotspots (RTM Module outputs)

3.8.1 The following paragraphs introduce the type and format of the Road Traffic Model output presented in the remainder of this Chapter. To enhance clarity of the outputs only data that exceeds the thresholds identified below is included in the plots. All plots include the Rushmoor District boundary for reference.

3.8.2 In addition to the Rushmoor District wide plots there are zoomed in plots of both M3 junction 4 and M3 junction 4A.

Change in Traffic Flow

3.8.3 Figure 6 to Figure 11 identify the change in traffic flow in the AM and PM peak hours respectively between the Base (2013) and Do Minimum (2031). In addition to the new traffic directly associated with the DM landuse, these plots highlight any re-routing of traffic that may result from localised congestion or redistribution of existing trips to the new facilities. These plots identify where the net change to traffic flow is most pronounced. Flow reductions are often the result of upstream congestion restricting the volume of traffic that can continue past a particular bottleneck.

3.8.4 For the flow difference plots the absolute difference in PCUs is identified adjacent to the appropriate link. Blue lines identify a reduction compared to the 2013 Base and pink/red lines an increase. For both the blue and pink lines the colours gradually darken as the change increases i.e. goes from pink to red. In addition, the scale of the change is represented graphically with the coloured lines of varying bandwidth. Only flow differences of 50 PCUs or greater and are displayed in the plots.

3.8.5 The most notable change in traffic flow can be seen in Figure 6 along Alison's Road, as eastbound AM flows increase by 452 and a forecast 698 trips in the PM peak period. This eastbound flow increase towards the A331 is echoed in the AM and PM periods along Government Road with an increase of 682 and 879 vehicles respectively. The new link onto the A331 from Government Road accommodates 648 vehicles in the AM and 904 in

the PM (because this link does not exist in the Base, these flows represent absolute link volumes and not change in flows). This forecast increase in eastbound flow comes as a result of the new northbound on-slip to A331 and additional traffic on the network at this location from the AUE consented development.

3.8.6 Additional to the increases on Alison's and Government Road are those along Fleet Road to the west of the AUE development (568 westbound in the AM and 399 in the PM). Increases are also observed on the A325 with the highest concentration of increase between the Wellesley Road / A323 junction in the south and the Lynchford Road junction in the north (423 northbound and 414 southbound in the AM and 266 northbound and 313 southbound in the PM peak).

Highway Delays

3.8.7 Figure 12 and Figure 17 identify the change in link delay per PCU for the AM and PM peak hours respectively between the Base and DM scenarios. The absolute difference in delay in seconds is identified adjacent to the appropriate link. Note that the delay occurs at the junction at the end of the link that is highlighted rather than along the full length of the link. Blue lines identify a reduction compared to the 2013 Base scenario and pink/red lines an increase. In addition, the scale of the change is represented graphically with the coloured lines of varying bandwidth. All delay differences in excess of 5 seconds are displayed in the plots.

3.8.8 The greatest increase in delays is forecast during the PM peak. Increases in delay are forecast in the PM peak on the Minley Link Road at the A327 junction with M3 J4a w/b slips (267 seconds). Aldershot Road and Rushmoor Road are forecast to see increases in delay of 117 seconds and 130 seconds respectively in the PM peak at their junctions with A323 Fleet Road as a result of increased traffic on A323 particularly from the AUE resulting in less opportunity for traffic on the side roads to join the main road. PM delays are also forecast to increase by 65s along the A331 and by 160s leaving the M3 westbound at junction 4 following the development of Frimley Business Park.

3.8.9 During the AM peak the greatest increases in delay occur at the M3 junction 4a westbound on/off slip roundabout. Delays are 132 seconds northbound on A327, 128 seconds southbound on A327 and 68 seconds on the M3 westbound off slip.

3.8.10 There are also delays during the AM peak on Ordnance Road at the junction with Government Road due to the increase in traffic on Government Road primarily as a result of the AUE (94 seconds). There are also delays on the A3011 eastbound to the junction with the A331 (56 seconds), on the A331 northbound to the A3011 junction (72 seconds) and on B3166 westbound to the junction (31 seconds). The Farnborough Road / Hawley Lane junction also has delays on all arms except the southbound approach (64 second in Hawley Lane eastbound, 65 seconds on Farnborough Road northbound and 29 seconds on A331 westbound).

Capacity Hotspots

3.8.11 Figure 18 to Figure 23 identify the capacity hotspots for the AM and PM peak hours respectively for the DM scenario. The hotspots are defined in terms of the link Volume to Capacity ratio (V/C). For the V/C plots the performance of the link is identified through the colour of the link as follows:

- > 80% - Pink
- > 100% - Red

3.8.12 If the V/C is near, or in excess of 90%, then the junction will be subject to queuing and delays; a value of 90% is normally taken as the practical capacity value for design purposes. A value of >100% means that the junction is over capacity and signification queues and delay could occur.

3.8.13 Capacity issues are forecast along the A327 northbound towards A327 / M3 J4a junction reaching more than 114% during PM peak (and 111% in the AM peak). Capacity issues are also forecast between the Frimley Business Park employment hub and access to the M3. It is forecast that V/C will reach 116% along the A331 southbound to the A331 / M3 J4 roundabout and the business park.

3.8.14 The most dense concentration of over-capacity roads is forecast in Frimley. The V/C's on Frimley High Street and A325 towards Frimley Waitrose are forecast at 107% and 104% respectively in the AM peak and 105% and 101% in the PM peak. This trend of high V/C's (>80%) continues to B311 / Frimley Park Hospital junction and may prove problematic for emergency services when operating during the AM peak period.

3.8.15 The A31 is forecast to operate at over 100% V/C in 2031 during the AM and PM peak periods particularly westbound before the A325 exit. The A31 / A331 junction is also expected to have a V/C of more than 100% for traffic leaving the A31 eastbound as well as traffic leaving the A331 southbound. This is similar to the delays occurring at this junction in 2013 and is likely limited by the inclusion of partial signalisation of the junction.

Figure 6. Flow Difference (Base v Do Minimum) 2013 v 2031 (AM Peak)

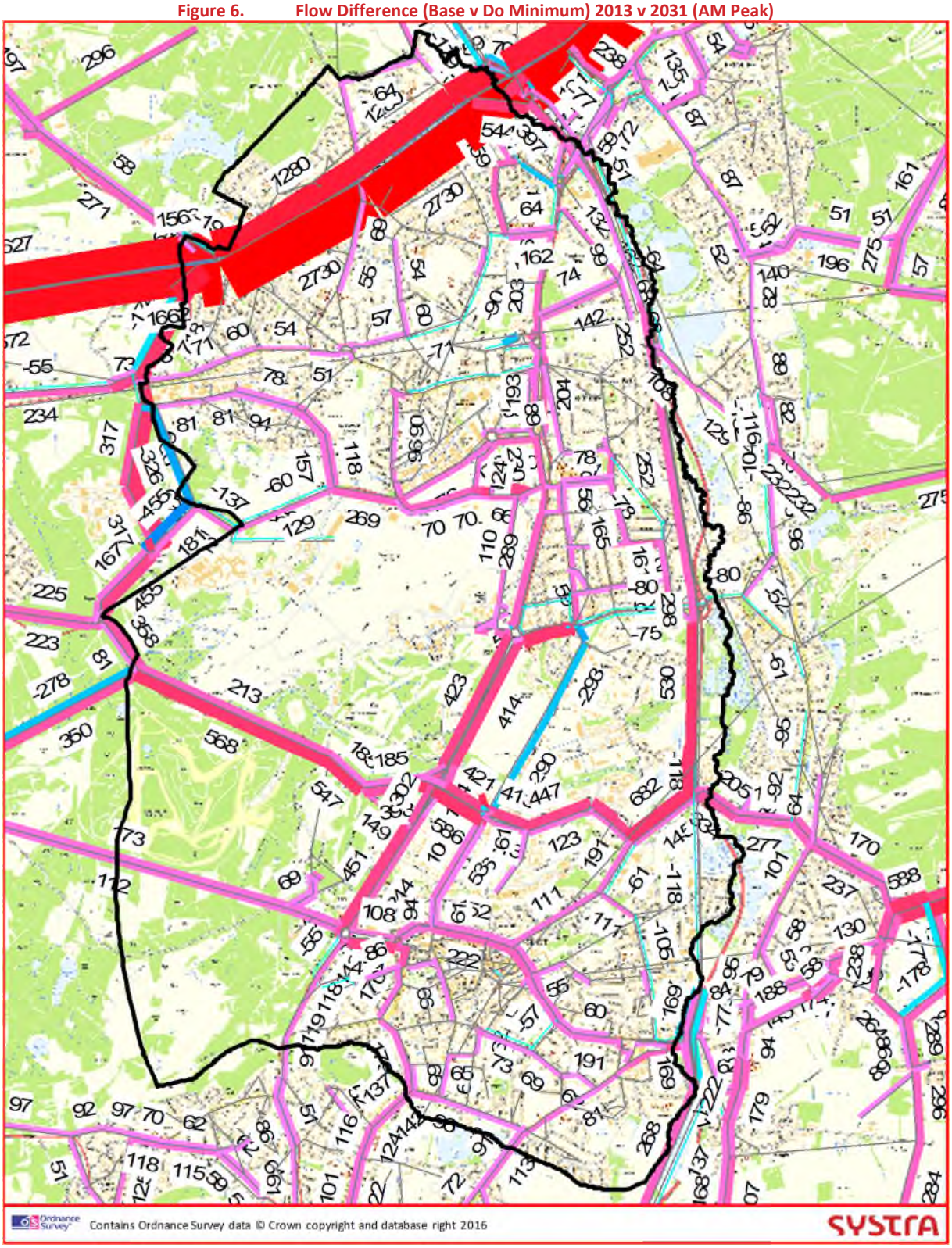


Figure 7. Flow Difference (Base v Do Minimum) 2013 v 2031 (AM Peak) M3 J4

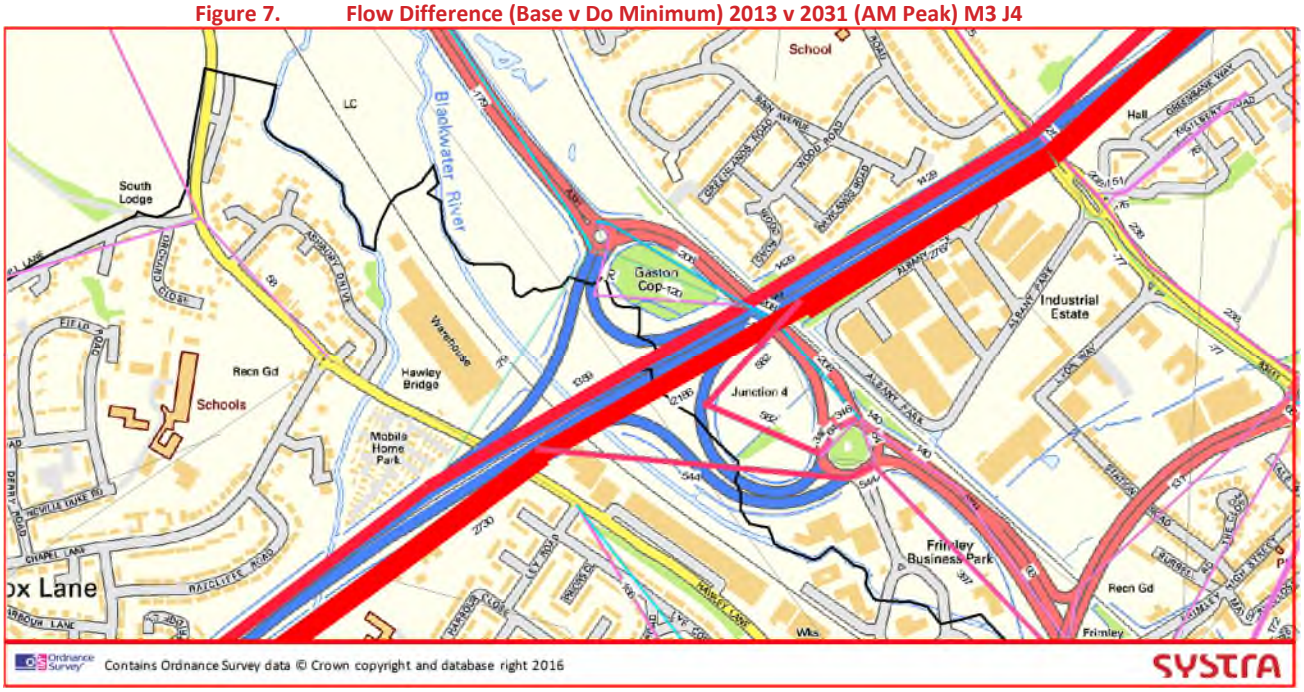


Figure 8. Flow Difference (Base v Do Minimum) 2013 v 2031 (AM Peak) M3 J4A

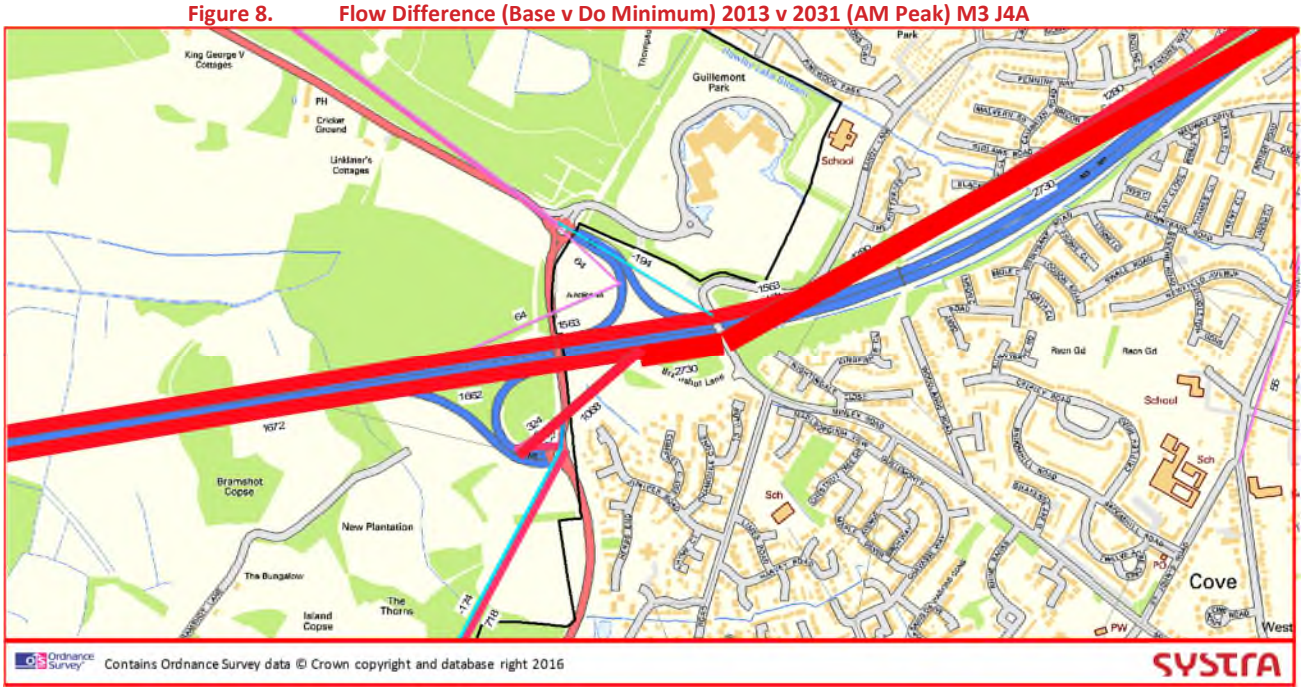


Figure 9. Flow Difference (Base v Do Minimum) 2013 v 2031 (PM Peak)

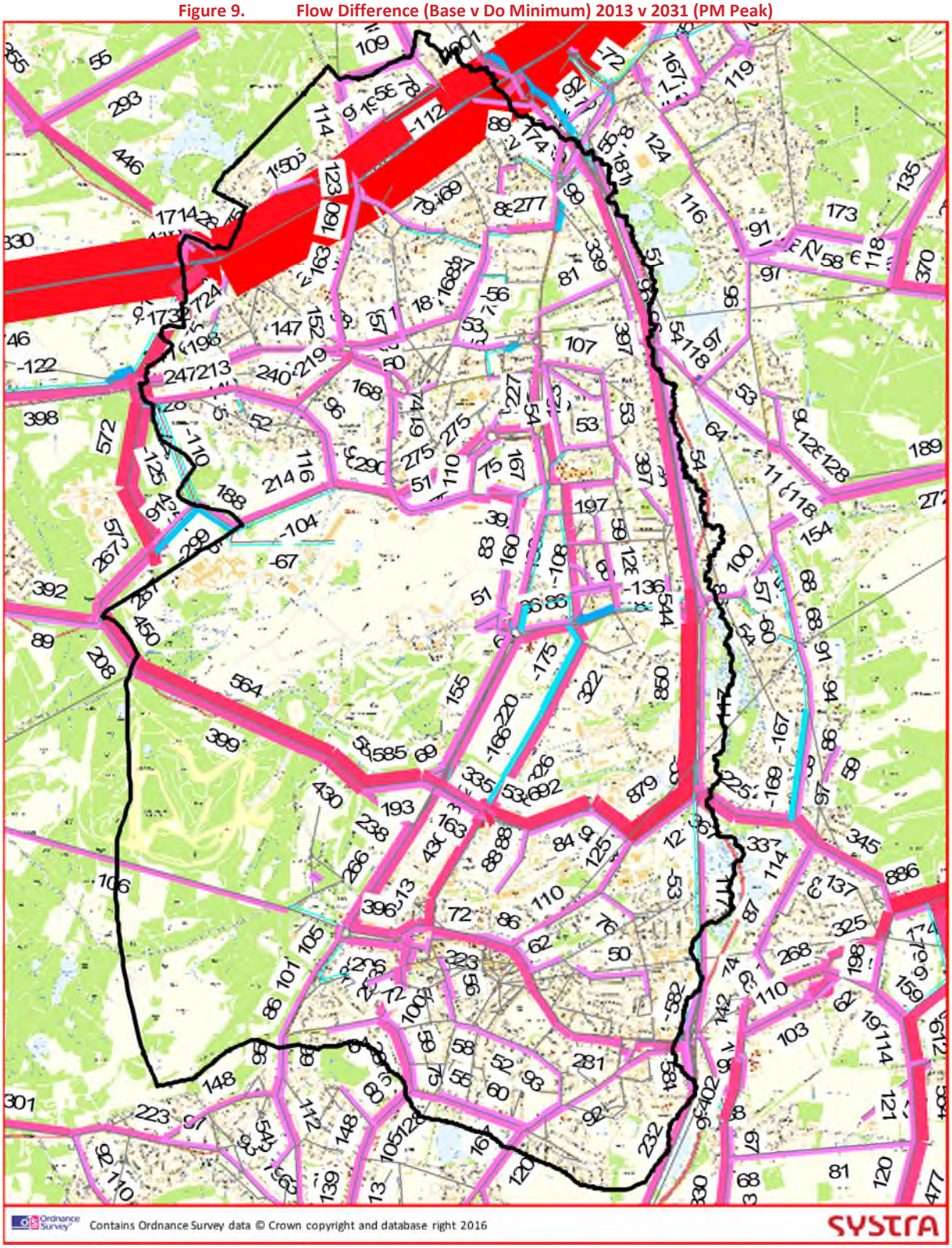


Figure 10. Flow Difference (Base v Do Minimum) 2013 v 2031 (PM Peak) M3 J4A

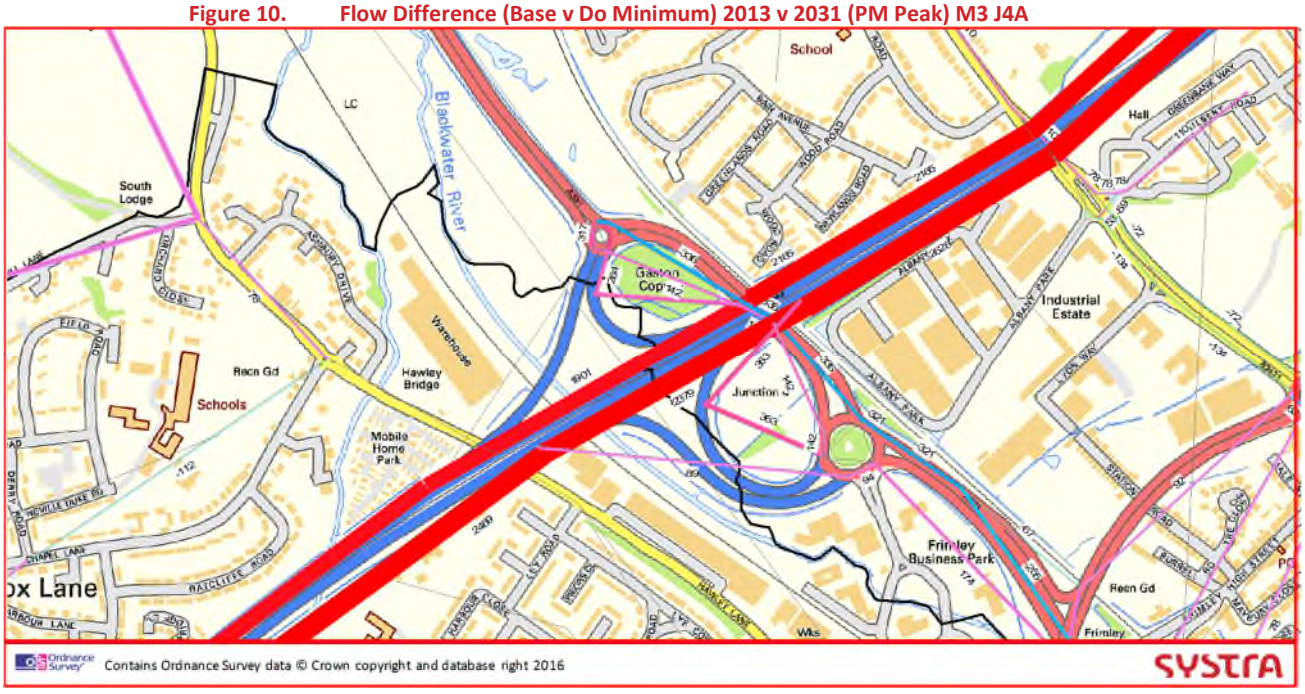


Figure 11. Flow Difference (Base v Do Minimum) 2013 v 2031 (PM Peak) M3 J4A

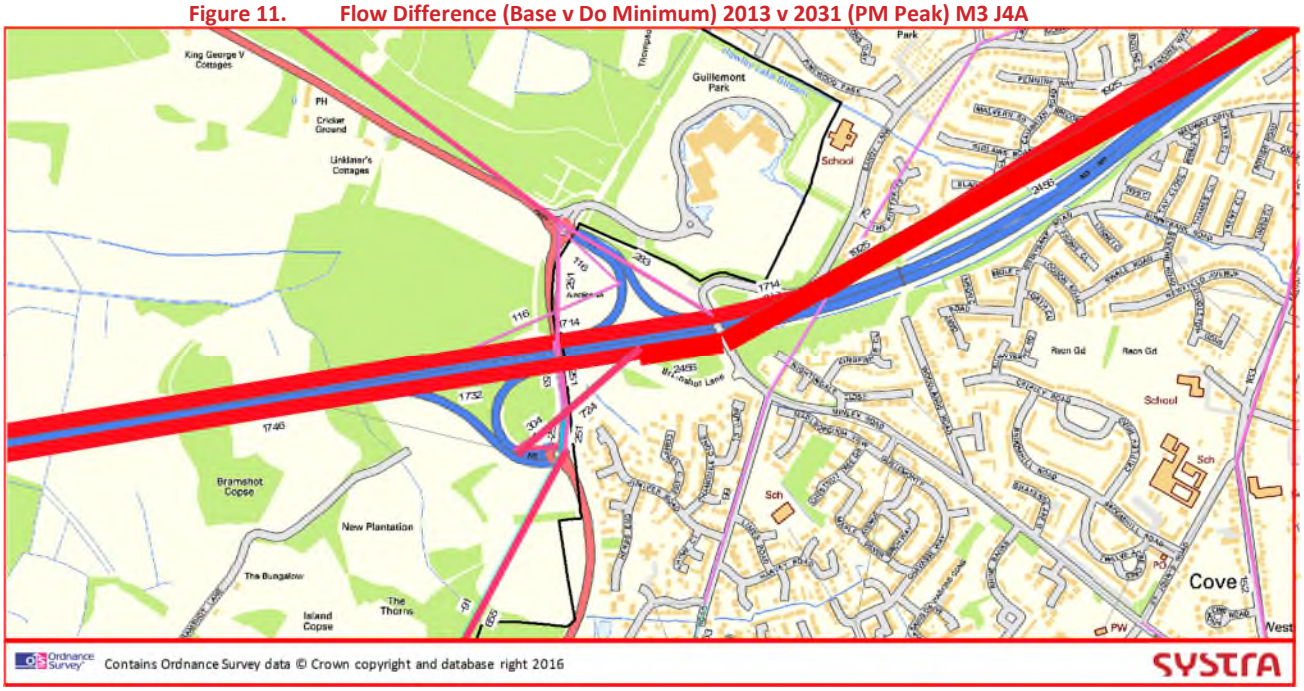


Figure 12. Delay Difference (Base v Do Minimum) 2013 v 2031 (AM Peak)

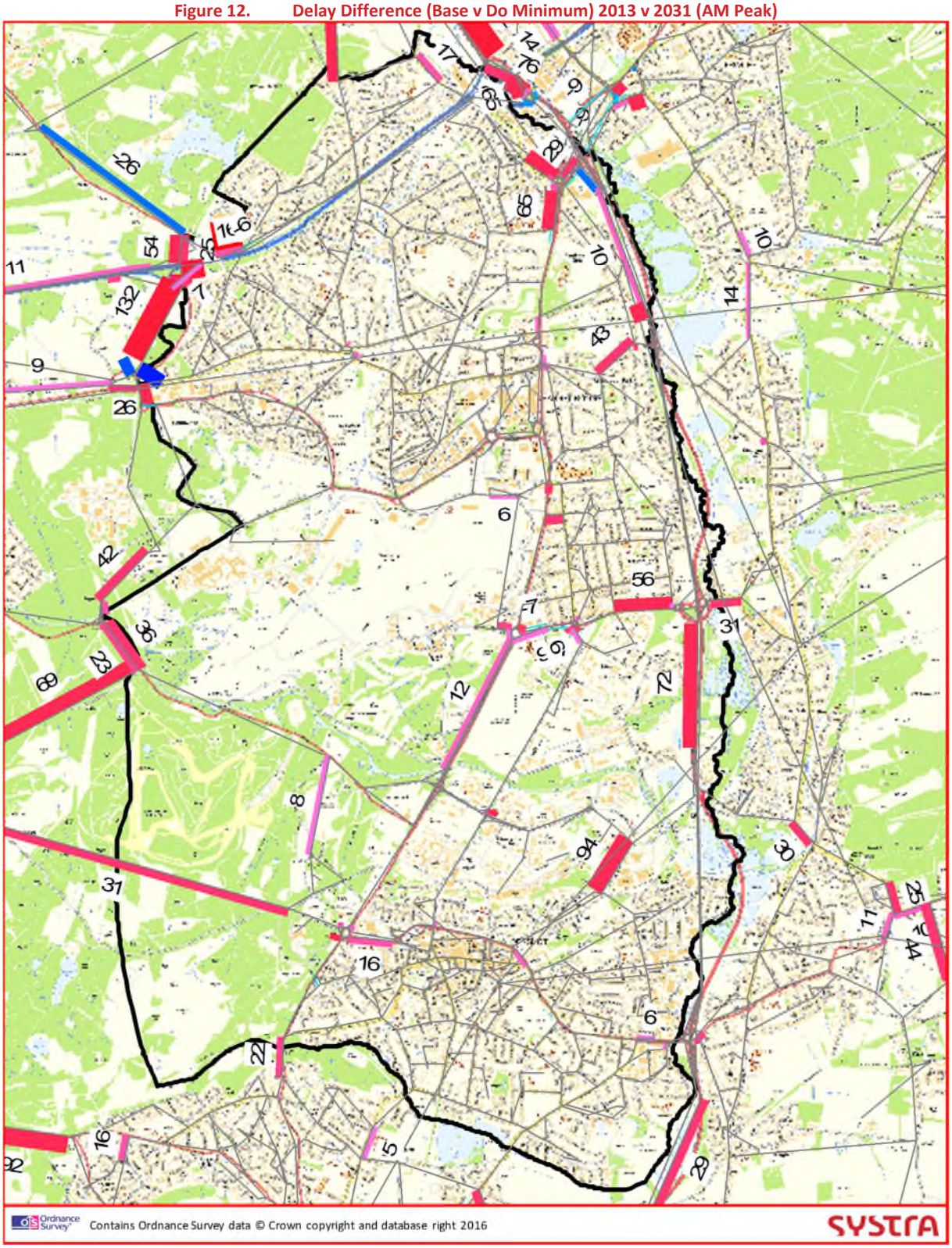


Figure 13. Delay Difference (Base v Do Minimum) 2013 v 2031 (AM Peak) – M3 J4

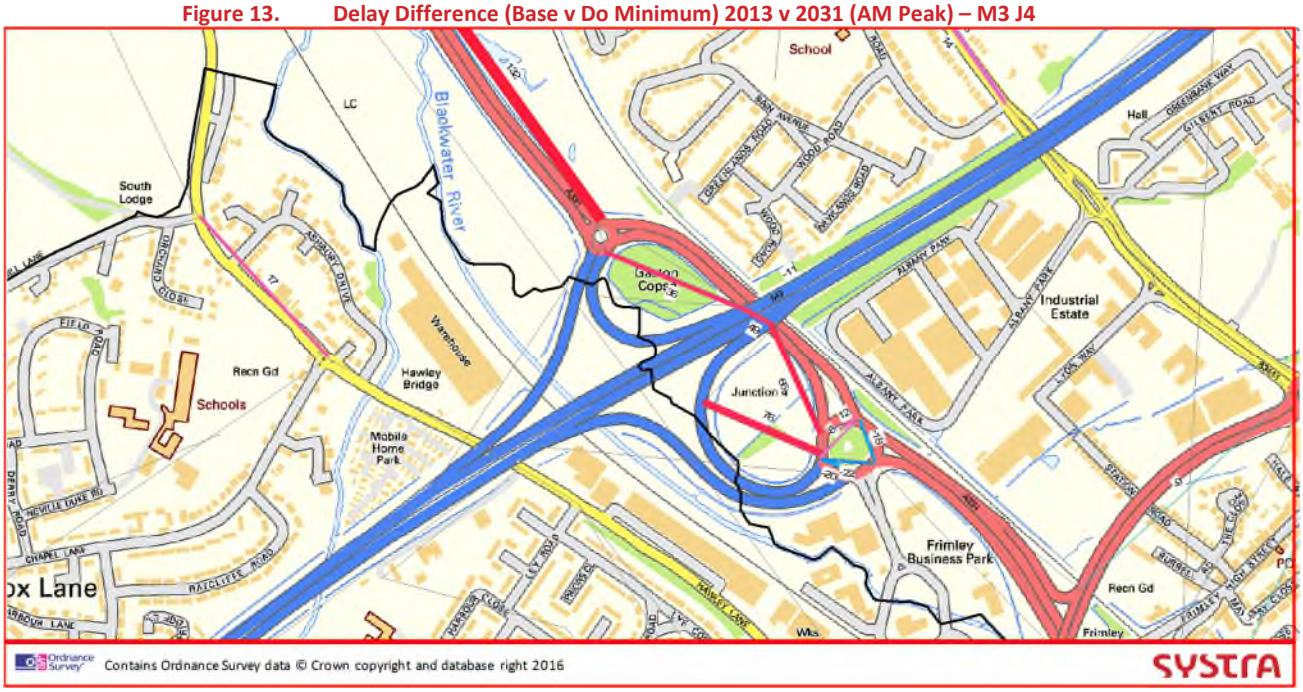


Figure 14. Delay Difference (Base v Do Minimum) 2013 v 2031 (AM Peak) – M3 J4A

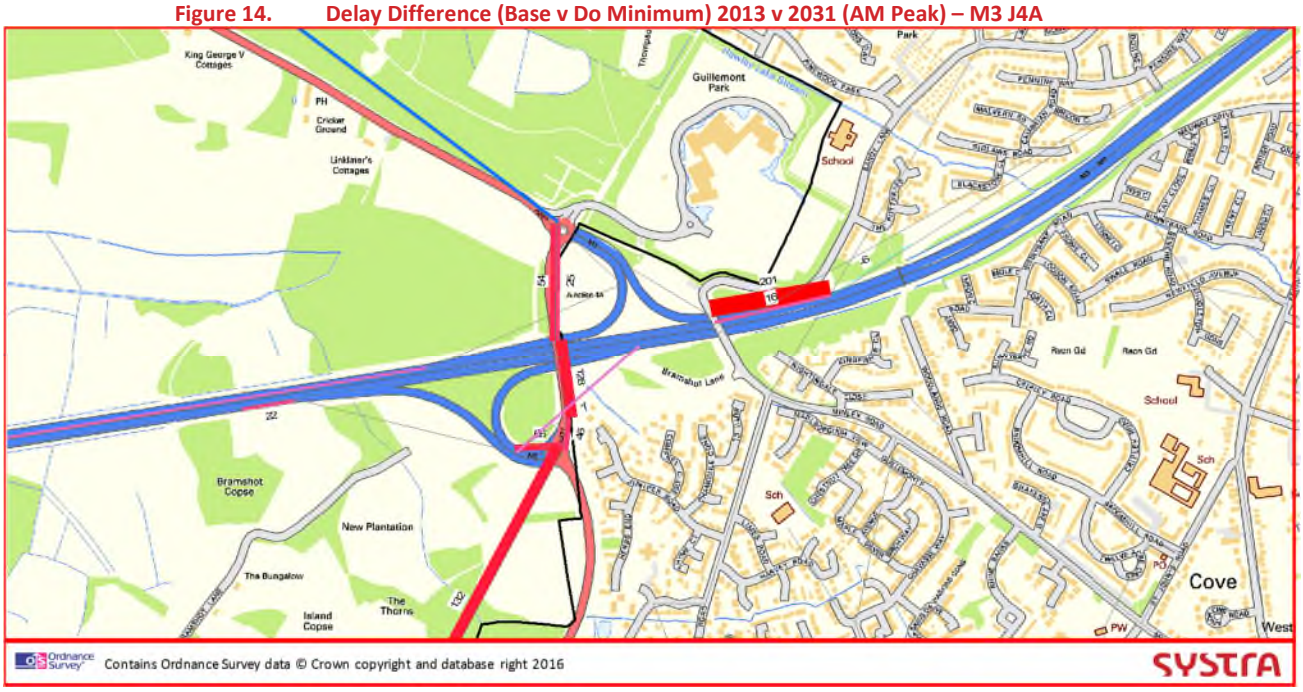


Figure 15. Delay Difference (Base v Do Minimum) 2013 v 2031 (PM Peak)

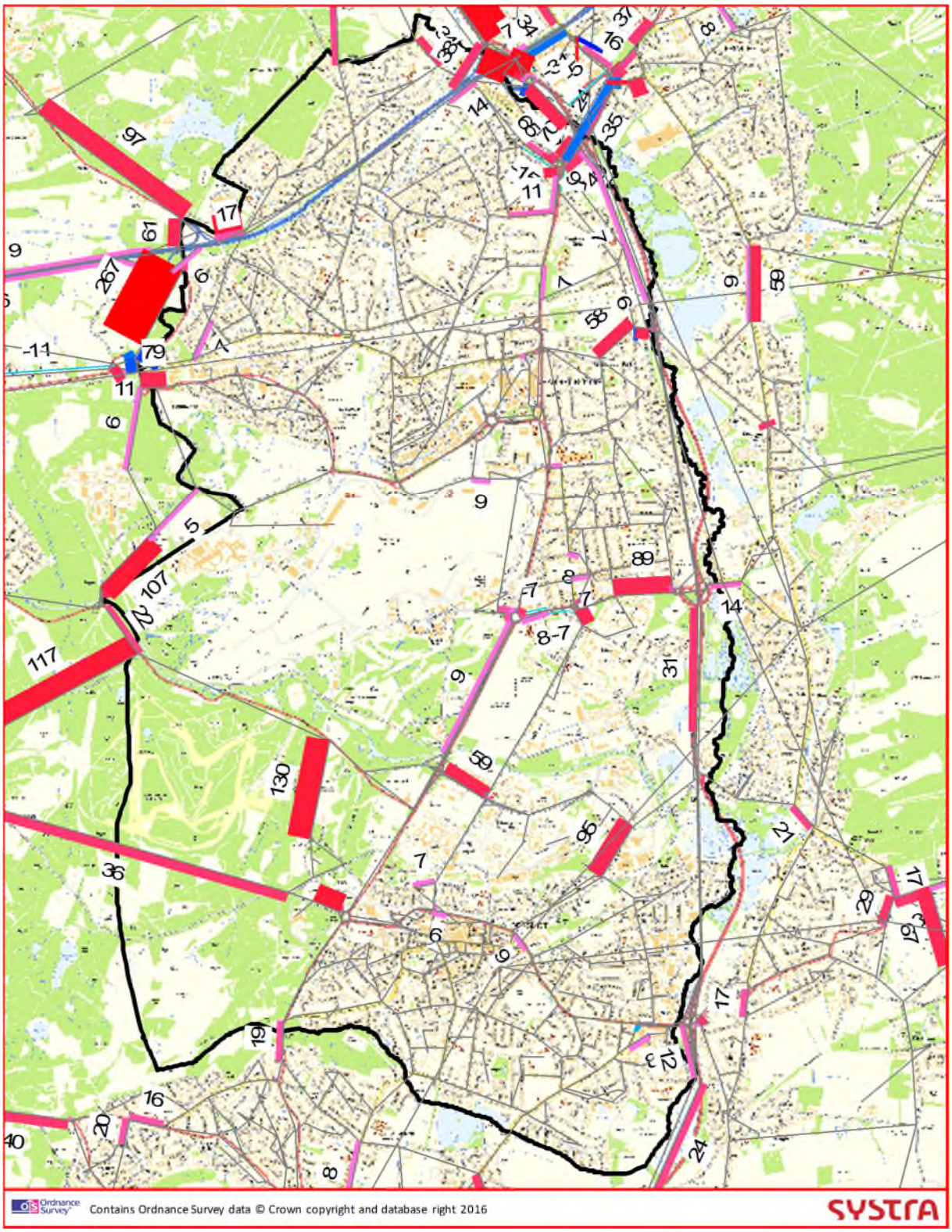


Figure 16. Delay Difference (Base v Do Minimum) 2013 v 2031 (PM Peak) – M3 J4

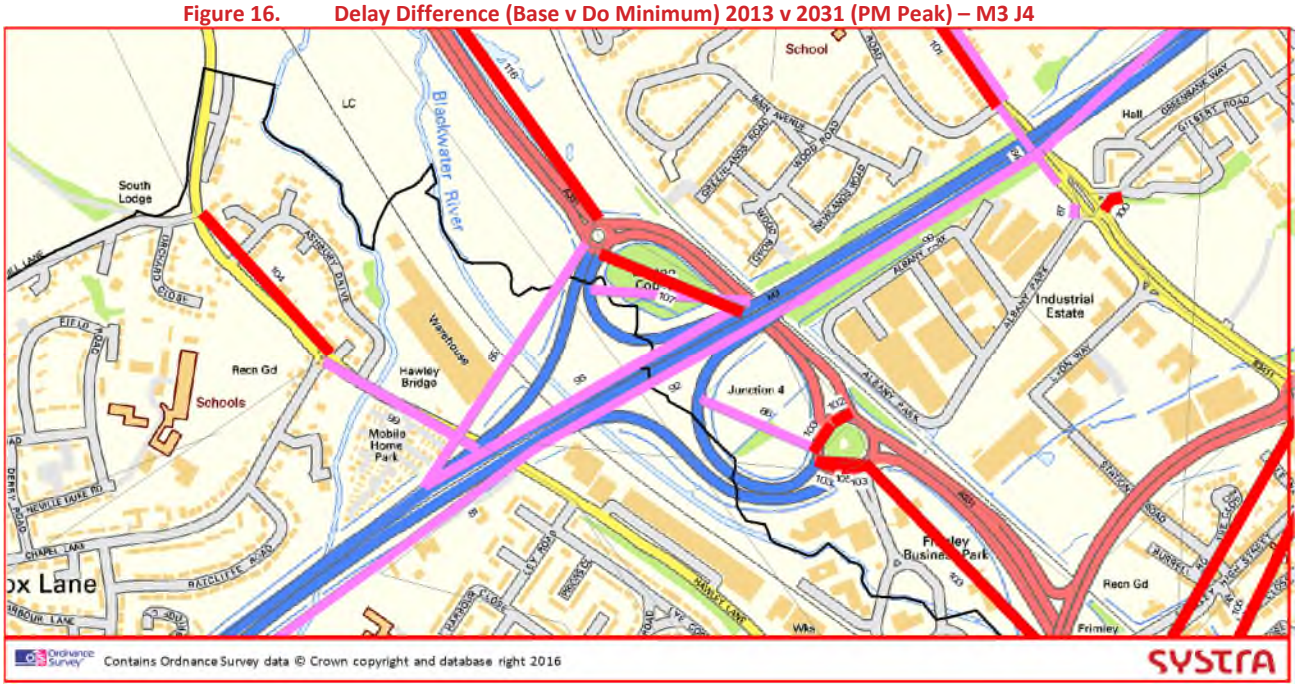


Figure 17. Delay Difference (Base v Do Minimum) 2013 v 2031 (PM Peak) – M3 J4A

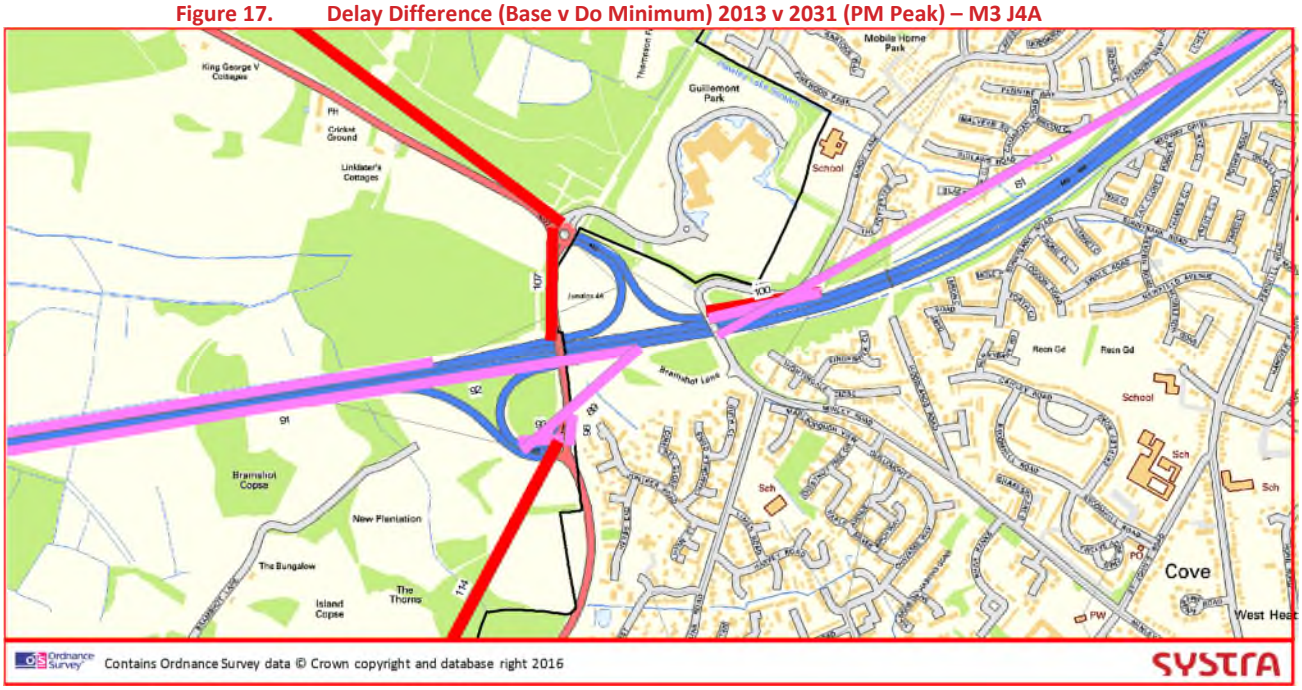


Figure 18. Volume over Capacity (Do Minimum) 2031 (AM Peak)

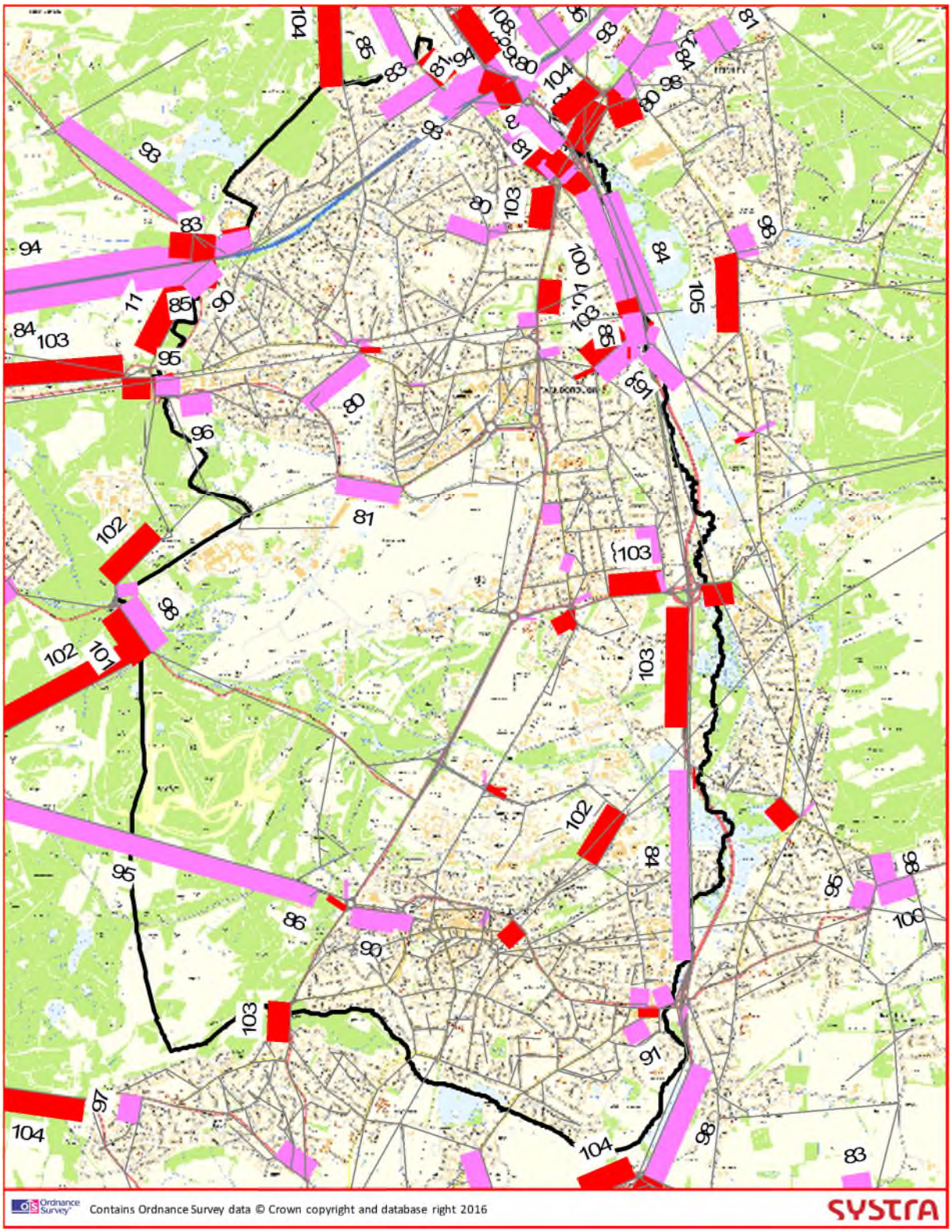


Figure 19. Volume over Capacity (Do Minimum) 2031 (AM Peak) – M3 J4

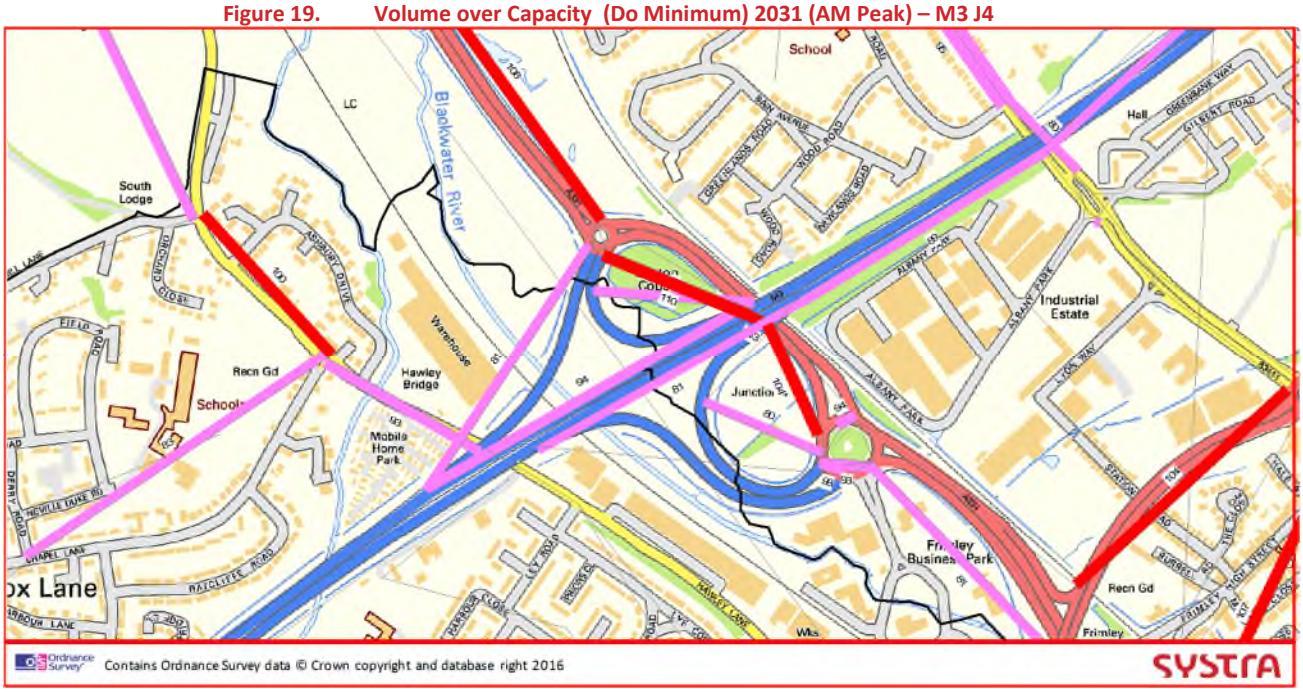


Figure 20. Volume over Capacity (Do Minimum) 2031 (AM Peak) – M3 J4A

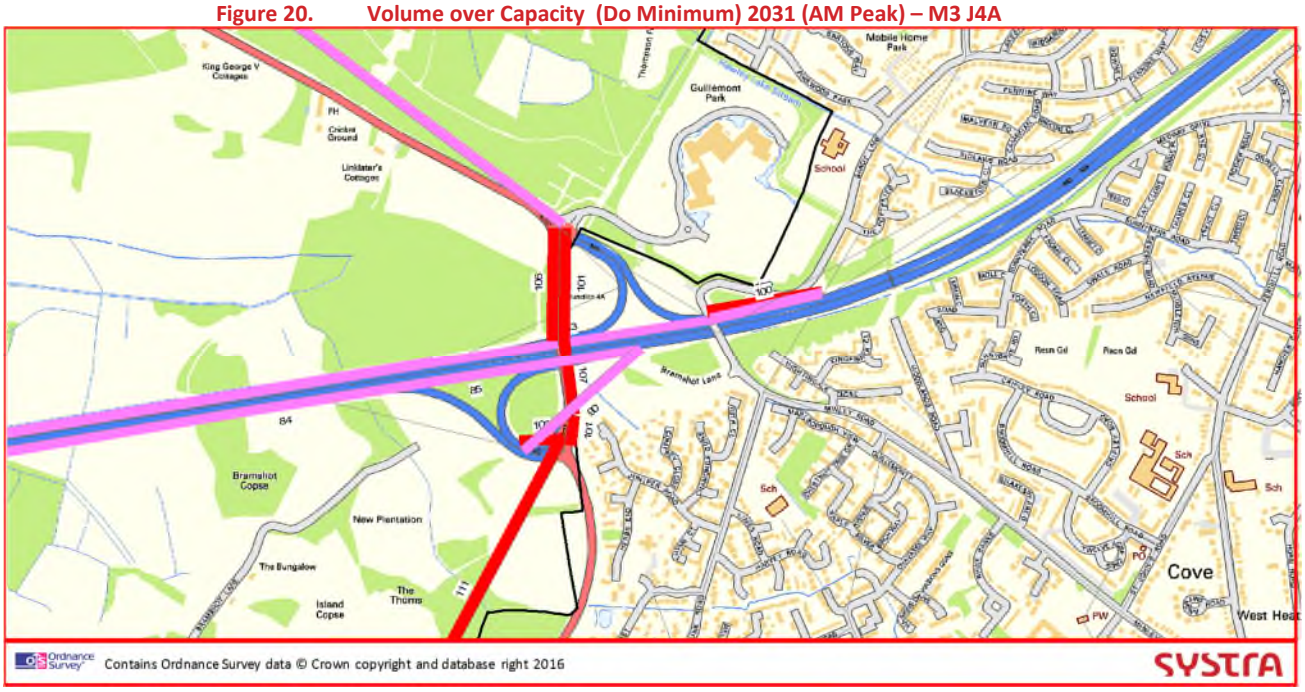


Figure 21. Volume over Capacity (Do Minimum) 2031 (PM Peak)

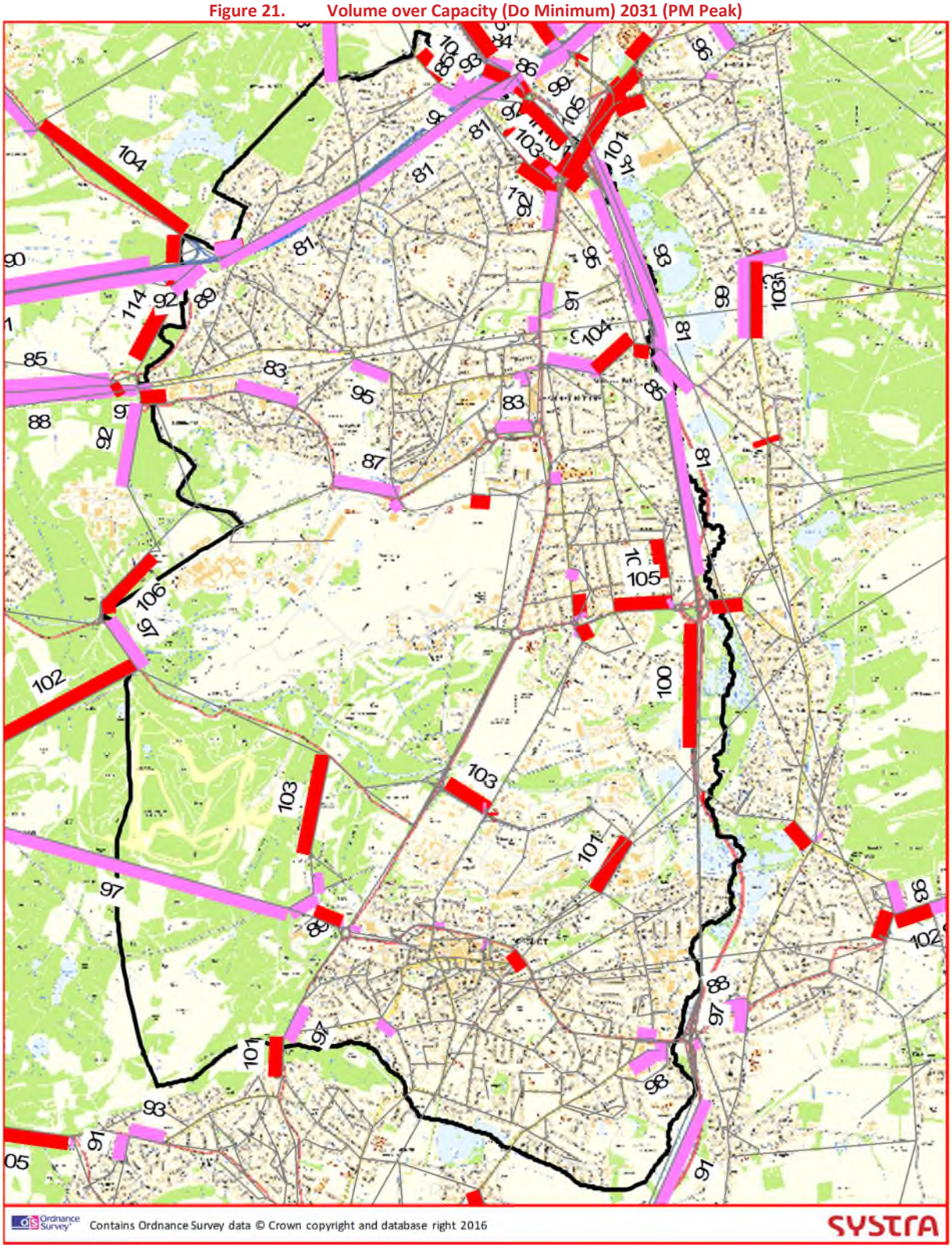


Figure 22. Volume over Capacity (Do Minimum) 2031 (PM Peak) – M3 J4

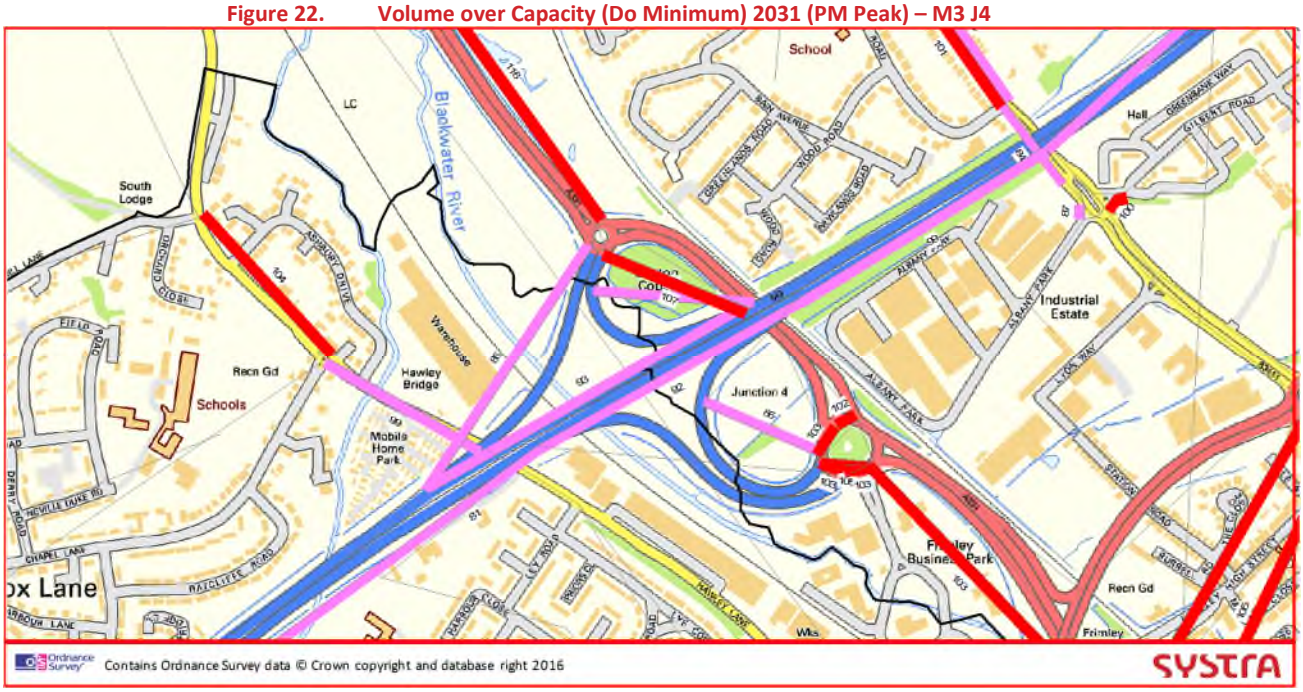
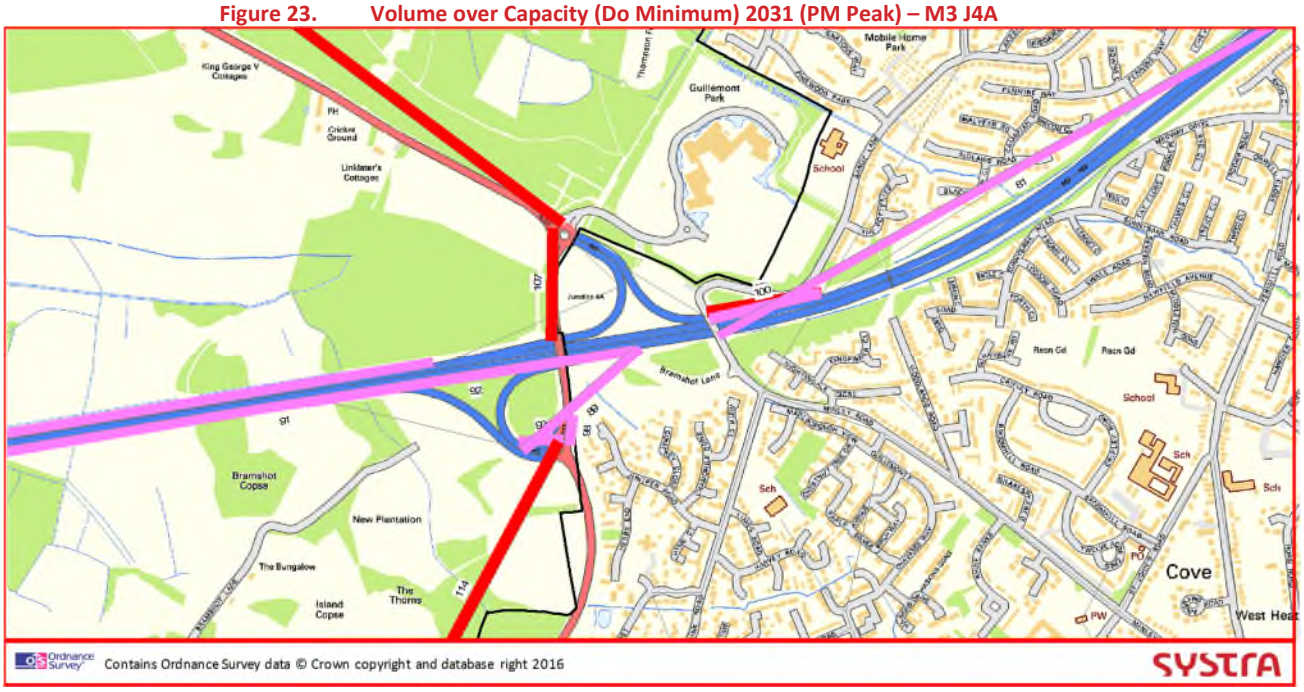


Figure 23. Volume over Capacity (Do Minimum) 2031 (PM Peak) – M3 J4A



4. STAGE 2 –WITH LOCAL PLAN DEVELOPMENT

4.1 Introduction

4.1.1 This chapter summarises the development of, and outputs from, the NHTM model scenario representing the Rushmoor Local Plan conditions. The outputs are compared to the Do Minimum (DM) scenario detailed in Chapter 3.

4.1.2 The sections below provide a breakdown of the key modelling processes, inputs and outputs. Committed development and infrastructure information was provided by Rushmoor Borough Council Officers in December 2016.

4.2 Rushmoor Local Plan Development Landuse Assumptions

4.2.1 The Rushmoor Local Plan scenario has a starting point of the Do Minimum inputs to which the additional Local Plan development land use was added. The total Rushmoor Local Plan development forecasts are shown in Table 7 and a breakdown by zone is included in Appendix E. The data was provided on 5th December 2016 and was up to date at that time. The Local Plan developments represent an increase in residential dwellings only with no additional employment land use over and above the DM values.

Table 7. Rushmoor Do Minimum and Local Plan Land Use Assumptions 2013-2032

	RESIDENTIAL (DWELLINGS) DO MINIMUM	RESIDENTIAL (DWELLINGS) LOCAL PLAN DEVELOPMENTS	TOTAL RESIDENTIAL (DWELLINGS)
Rushmoor Local Plan (2013-32 Additional Dwellings	5,600	2,806	8,406

4.3 Rushmoor Committed Highway Infrastructure

4.3.1 The highway and PT infrastructure in the Local Plan remains the same as that modelled in the Do Minimum (see Chapter 3).

4.4 Local Plan Model Results

4.4.1 The Local Plan NHTM scenario was run through to 2031 (to represent the Rushmoor Local Plan inputs up to 2032) and the outputs are summarised below. The results have been compared against the DM 2031 conditions to show where the Local Plan development impacts are most pronounced.

4.5 Population, Dwellings, Jobs (LEIM Module outputs)

4.5.1 Table 8 below shows the outputs (produced by the LEIM module of NHTM) for the population, number of dwellings and number of jobs within the Borough. LEIM controls the level of overall development take up within the model in accordance with TEMPRO employment and population growth forecasts for the region which conforms with WebTAG.

4.5.2 The comparisons show the change between the 2031 Do Minimum scenario and the 2031 Local Plan scenario.

4.5.3 Based on the model outputs Rushmoor Borough is forecast to see an increase in population as a result of the Local Plan compared to the Do Minimum of more than 6,000 and an increase in dwellings of approximately 2,800 by 2031. The employment floorspace is unchanged in Rushmoor from Do Minimum conditions and therefore there is minimal change to the number of jobs forecast by the model.

Table 8. Rushmoor Borough Change in Population, Dwellings and Jobs, Local Plan 2031 vs Do Min 2031

	DO MIN 2031	LOCAL PLAN 2031	DIFFERENCE	% DIFFERENCE
Population	102,943	109,110	6,167	6.0%
Dwellings	42,564	45,370	2,806	6.6%
Jobs	51,821	52,191	370	0.7%

NHTM Ref: MIE v MIF

4.6 Highway Network Performance (RTM Module outputs)

4.6.1 Table 9 and Table 10 below summarise key network statistics for both the full NHTM core modelled area and for Rushmoor Borough in isolation for both AM and PM peak periods respectively. In both peaks, vehicle hours and kilometres increase with a decrease in average speed. This is consistent with the increase in development related traffic from the Local Plan allocations.

Table 9. AM Period (07:00 – 10:00) Highway Model Network Statistics, Local Plan 2031 vs Do Min 2031

PARAMETER	AREA	DO MIN 2031	LOCAL PLAN	DIFF	% DIFF
Vehicle Hrs	Core Model Area	132,393	132,884	490	0%
	Rushmoor	9,765	10,020	255	3%
Vehicle Kms	Core Model Area	7,159,337	7,179,017	19,680	0%
	Rushmoor	416,861	420,456	3,595	1%
Average Speed	Core Model Area	54	54	0	0%
	Rushmoor	43	42	-1	-2%

NHTM Ref: MIE v MIF

Table 10. PM Period (16:00 – 19:00) Highway Model Network Statistics, Local Plan 2031 vs Do Min 2031

PARAMETER	AREA	DO MIN 2031	LOCAL PLAN	DIFF	% DIFF
Vehicle Hrs	Core Model Area	152,439	153,123	684	0%
	Rushmoor	10,180	10,499	319	3%
Vehicle Kms	Core Model Area	7,719,691	7,734,276	14,585	0%
	Rushmoor	438,603	444,386	5,783	1%
Average Speed	Core Model Area	51	51	0	0%
	Rushmoor	43	42	-1	-2%

NHTM Ref: MIE v MIF

4.7 Highway Link Flows, Delays and Capacity Hotspots (RTM Module outputs)

4.7.1 The following paragraphs introduce the type and format of the Road Traffic Model output presented in the remainder of this Chapter. To enhance clarity in the outputs only data that exceeds the thresholds identified below is included in the plots. All plots include the Rushmoor District boundary for reference.

4.7.2 As well as the Rushmoor District wide plots there are also zoomed in plots of both M3 junction 4 and M3 junction 4A.

Change in Traffic Flow

4.7.3 Figure 25 to Figure 30 identify the change in traffic flow in the AM and PM peak hours respectively between the Do Minimum (2031) and Local Plan (2031). In addition to the new traffic directly associated with the DS Rushmoor Local Plan landuse, these plots highlight any re-routing of traffic that may result from localised congestion or redistribution of existing trips to the new facilities. These plots identify where the net change to traffic flow is most pronounced. Flow reductions are often the result of upstream congestion restricting the volume of traffic that can continue past a particular bottleneck and necessitating use of alternative routes.

4.7.4 For the flow difference plots the absolute difference in PCUs is identified adjacent to the appropriate link. Blue lines identify a reduction compared to the 2031 DM and pink/red lines an increase. In addition, the scale of the change is represented graphically with the coloured lines of varying bandwidth. Only flow differences of 10 PCUs or greater and are displayed in the plots.

4.7.5 The changes in flow between the Local Plan scenario and DM are relatively small with only two locations seeing a change of more than 100 PCUs during both the AM and PM peaks. The first of these locations is in central Farnborough where the highest proportion of Local Plan additional dwellings are focussed (1250 units). The flow increase in both the

AM and PM accessing the road network near Sulzers roundabout, Pinehurst roundabout or on Victoria Road are more than 180 PCUs. Those going to Pinehurst in the AM are predicted to exceed an additional 170 PCUs. During the PM peak the traffic entering this zone is more concentrated from the north with predicted flows increasing by more than 110 PCUs. It should be noted that given the strategic nature of the model and the coarse zoning structure the locations where development traffic joins the highway network may not accurately reflect the final loading points.

4.7.6 The second location where flows are predicted to increase by more than 100 PCUs is at M3 junction 4 where the AM flows increase by over 120 PCUs for traffic heading west on the A331 under the M3 between the roundabouts at the eastbound and westbound on/off slips. The increase at M3 junction 4 during the PM peak is forecast on the south westbound on slip to the M3 (105 PCUs).

4.7.7 Other locations where the expected traffic flows increase by more than 50 PCUs during the AM peak include the A323 in Aldershot (60 PCUs) and northbound through Aldershot Camp likely related to development in central Aldershot along with the committed AUE development (included in both DM and DS). Southbound Flows on the A325 Farnborough Road between Queens roundabout and the Alison's Road junction increase by 50 PCUs. The A327 Elles Road in Farnborough westbound has an increase of 84 PCUs with a further increase along Ively Road westbound (55 PCUs) and northbound on the A327 Ively road (59 PCUs).

4.7.8 During the PM peak the A327 Elles Road westbound (78 PCUs) and Cody Road northbound (84 PCUs) see increases of more than 50 PCUs. The increases on the A327 are balanced by a reduction westbound along Victoria Road (80PCUs) suggesting some local re-routing. There are also increases of up to 70 PCUs eastbound on the B3014 Cove Road.

4.7.9 The A325 sees increases of up to 85 PCUs northbound and 57 PCUs southbound between the Alison's Road junction and Queens roundabout. The A331 northbound from Coleford Bridge to the M3 junction 4 is expected to see an increase of 56 PCUs during the PM peak.

Highway Delays

4.7.10 Figure 31 and Figure 36 identify the change in link delay per PCU for the AM and PM peak hours respectively between the DM and Local Plan scenarios. The absolute difference in delay in seconds is identified adjacent to the appropriate link. Blue lines identify a reduction compared to the 2031 DM scenario and pink/red lines an increase. In addition, the scale of the change is represented graphically with the coloured lines of varying bandwidth. All delay differences in excess of 5 seconds are displayed in the plots.

4.7.11 During the AM peak the delays increase at the Alison's Road junction with Queens avenue within Aldershot Camp (20 seconds and 14 seconds in the PM peak). This is related to the increase in flows also observed in this area associated with additional development in central Aldershot.

4.7.12 The A3011 Lynchford Road eastbound to the junction with the A331 northbound on/off slips sees an increase in delay of 24 seconds during the AM peak and 17 seconds during the PM peak. Rectory Road north eastbound towards the junction with Coleford Bridge road is expected to see an increase in delay of 23 seconds during the AM peak (13 seconds

in the PM). During the PM peak there are additional delays eastbound to the roundabout with the A331 northbound on-slip.

4.7.13 Finally during the AM peak the A331 northbound off slip to Frimley High Street see an increase in delay of 34 seconds (9 seconds in the PM peak).

4.7.14 During the PM peak there are additional delays on Ively Road southbound to the junction with Norris Hill Road (20 seconds) and westbound on A327 Summit Avenue to the junction with one of the entrances to the Hartland Park area (14 seconds). Both of these are likely related to the combination of the Hartland Park development (included as a residential development rather than a distribution centre) and the additional developments in Farnborough and Aldershot as part of the Rushmoor Local Plan.

Capacity Hotspots

4.7.15 Figure 37 and Figure 42 identify the capacity hotspots for the AM and PM peak hours respectively for the Local Plan scenario. The hotspots are defined in terms of the link Volume to Capacity ratio (V/C). For the V/C plots the performance of the link is identified through the colour of the link as follows:

- > 80% - Pink
- > 100% - Red

4.7.16 If the V/C is near, or in excess of 90%, then the junction will be subject to queuing and delays; a value of 90% is normally taken as the practical capacity value for design purposes. A value of >100% means that the junction is over capacity and signification queues and delay could occur.

4.7.17 Comparing the capacity hotspots observed in the DM with those observed in the Local Plan scenario shows that, in the majority of locations, there is relatively little change between the two scenarios. Those locations that are forecast to experience a more significant change are summarised below.

4.7.18 During the AM peak there is an increase in utilised capacity westbound on A327 Elles Road at the roundabout with Ively Road. During the DM scenario it was forecast at 81% and increases to 90% in the Local Plan scenario.

4.7.19 During the PM peak eastbound on Ively Road to the roundabout with A327 Elles Road utilised capacity increases from 87% in the DM to 94% in the Local Plan scenario.

4.7.20 On the A327 Summit Avenue westbound at the BMW roundabout (just east of Kennels Lane) the capacity utilisation increases from 96% in the DM to 100% in the Local Plan scenario during the AM peak.

4.7.21 During the PM peak, on the A325 Farnborough Road northbound approach to the Hawley Lane roundabout, the capacity utilisation increases from 92% in the DM to 100% in the Local Plan scenario. All arms at this junction struggle with V/C above or approaching 100% during the PM peak.

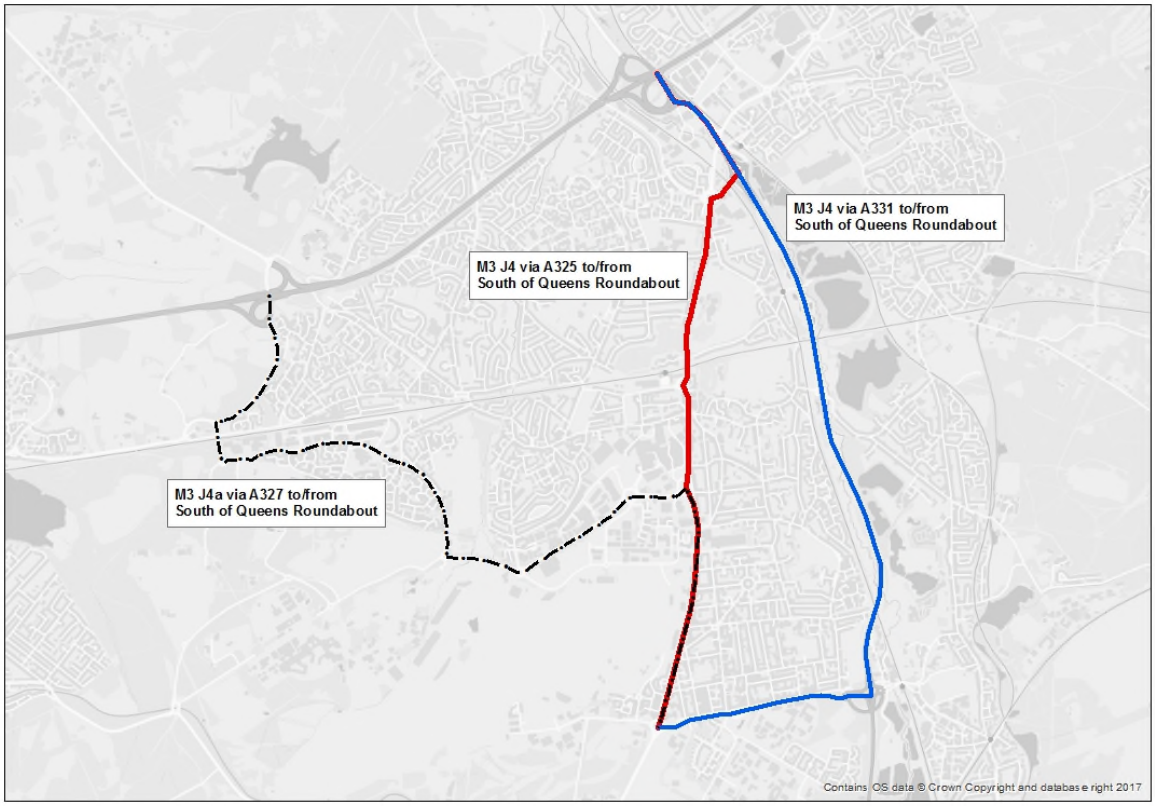
4.8 Highway Journey Times

4.8.1 Journey times along three key routes within Rushmoor have been extracted from the model in order to aid understanding how journey times are influenced by changes in traffic flow conditions. The journey time routes are shown in Figure 24 below.

4.8.2 The three Rushmoor routes are:

- M3 junction 4 via A331 to/from South of Queens Roundabout
- M3 junction 4 via A325 to/from South of Queens Roundabout
- M3 junction 4a via A327 to/from South of Queens Roundabout

Figure 24. Rushmoor Journey time routes



4.8.3 The journey time validation of the three routes shown above between the Base 2013 model and Traffic Master journey times is shown in Table 11 below to confirm that model validation is of a suitable standard at these locations. The table includes the percentage difference in journey time between the base model and Traffic Master data and identifies where the modelled journey times are within the required 15% of observed to meet WebTag criteria.

4.8.4 The journey times summarised in Table 11 confirm the model is fit for purpose in this area.

Table 11. Journey Time base validation

ROUTE	DIRECTION	AM		IP		PM	
A331	North	3%	✓	6%	✓	-15%	✓
A331	South	-14%	✓	-4%	✓	3%	✓
A325	North	5%	✓	1%	✓	-13%	✓
A325	South	-10%	✓	0%	✓	1%	✓
A327	North	13%	✓	2%	✓	-22%	✗
A327	South	10%	✓	-4%	✓	10%	✓

4.8.5 The same journey time routes to those in Table 11 have been extracted for both the DM and Local Plan scenarios and are shown in Table 12 below.

Table 12. Journey Times for DM and Local Plan Scenarios 2031 (minutes)

ROUTE	DIR	AM			IP			PM		
		2013	DM	LP	2013	DM	LP	2013	DM	LP
A331	N	08:07	10:42	11:04	06:30	06:41	06:42	07:45	09:55	09:32
A331	S	08:07	08:30	08:30	06:45	07:35	07:37	08:38	10:01	10:08
A325	N	11:13	13:32	13:51	08:51	09:30	09:38	10:50	14:33	14:11
A325	S	12:00	12:15	12:15	09:00	11:48	11:44	12:20	11:13	10:49
A327	N	10:55	13:16	13:37	09:21	09:43	09:47	10:00	13:41	13:30
A327	S	12:25	10:42	10:45	09:25	09:28	09:29	11:53	10:54	11:16

4.8.6 In general the journey times in 2031 are longer than in 2013 due to the increased traffic and associated delays on the network between this period. The changes in journey times between the DM and Local Plan scenario are relatively small with the largest being less than 30 seconds difference (24 second decrease on A325 southbound in the PM peak).

4.8.7 During the AM peak period for the Local Plan scenario the journey times are forecast to increase on all three routes with the greatest increase on the A331 northbound (23 seconds), followed by A327 northbound. The southbound journey times are expected to change very little between the two scenarios during the AM.

4.8.8 In the PM peak there are also some reductions in expected journey time, likely related to traffic re-routing as a result on the change in traffic flows due to new development in

particular locations. The routes where the largest reduction in journey are the A325 both northbound (22 seconds) and southbound (24 seconds) as well as the A331 northbound (22 seconds) and A327 northbound (11 seconds). The other two routes show an expected increase in journey time with the A331 southbound increasing by 7 seconds and the A327 southbound increasing by 22 seconds.

Figure 25. Flow Difference (Local Plan v Do Minimum) 2031 (AM Peak)

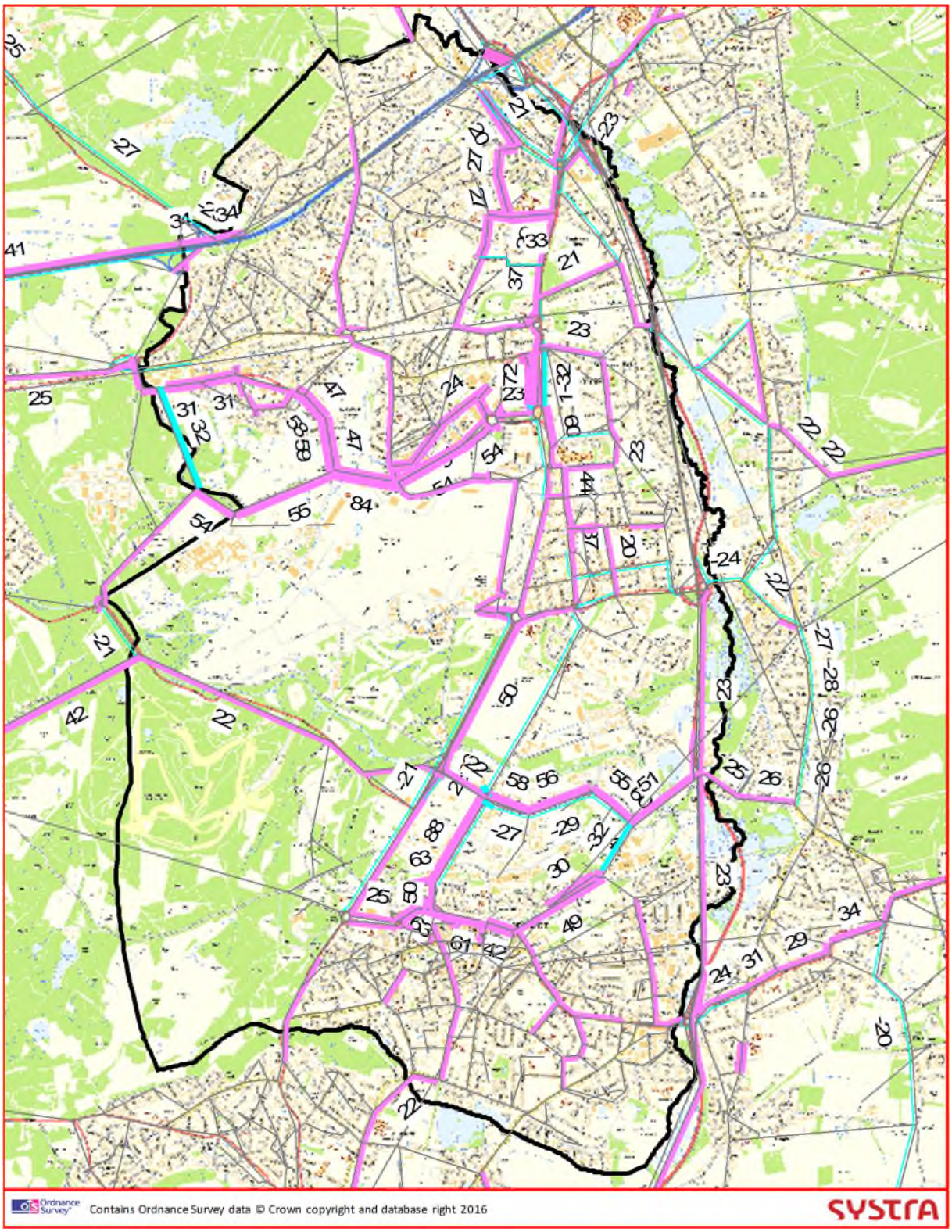


Figure 26. Flow Difference (Local Plan v Do Minimum) 2031 (AM Peak) – M3 J4

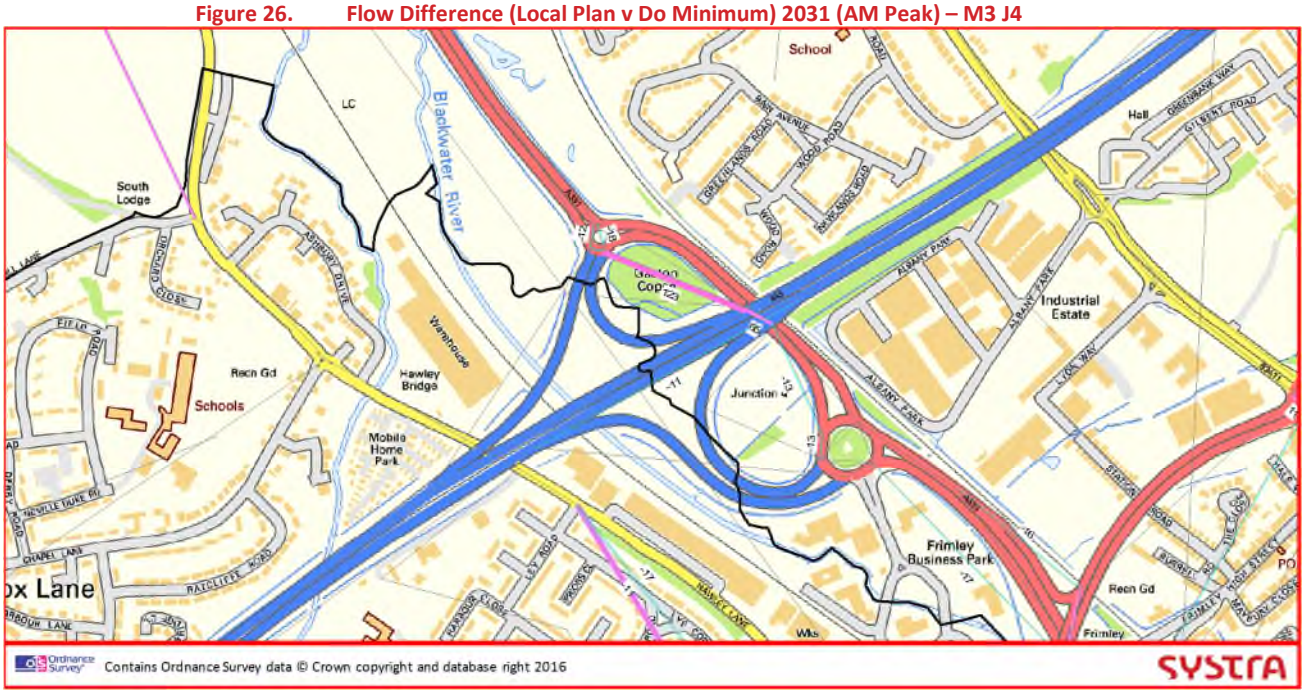


Figure 27. Flow Difference (Local Plan v Do Minimum) 2031 (AM Peak) – M3 J4A

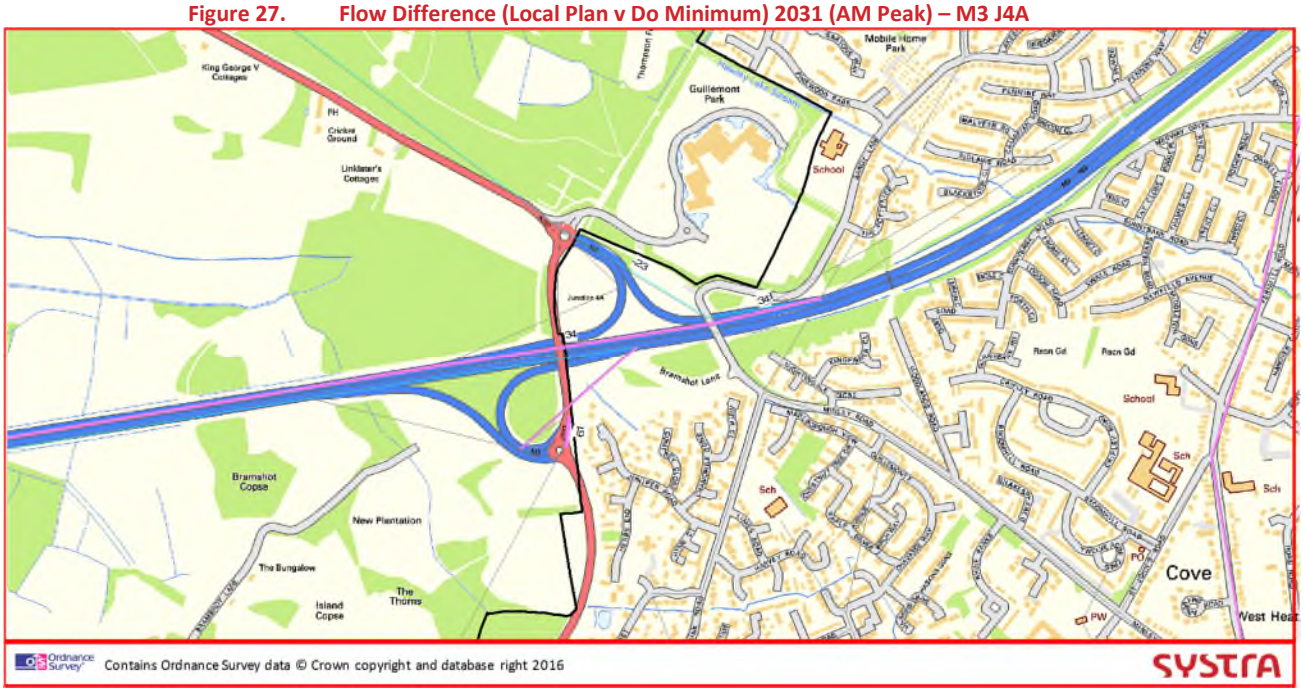


Figure 28. Flow Difference (Local Plan v Do Minimum) 2031 (PM Peak)

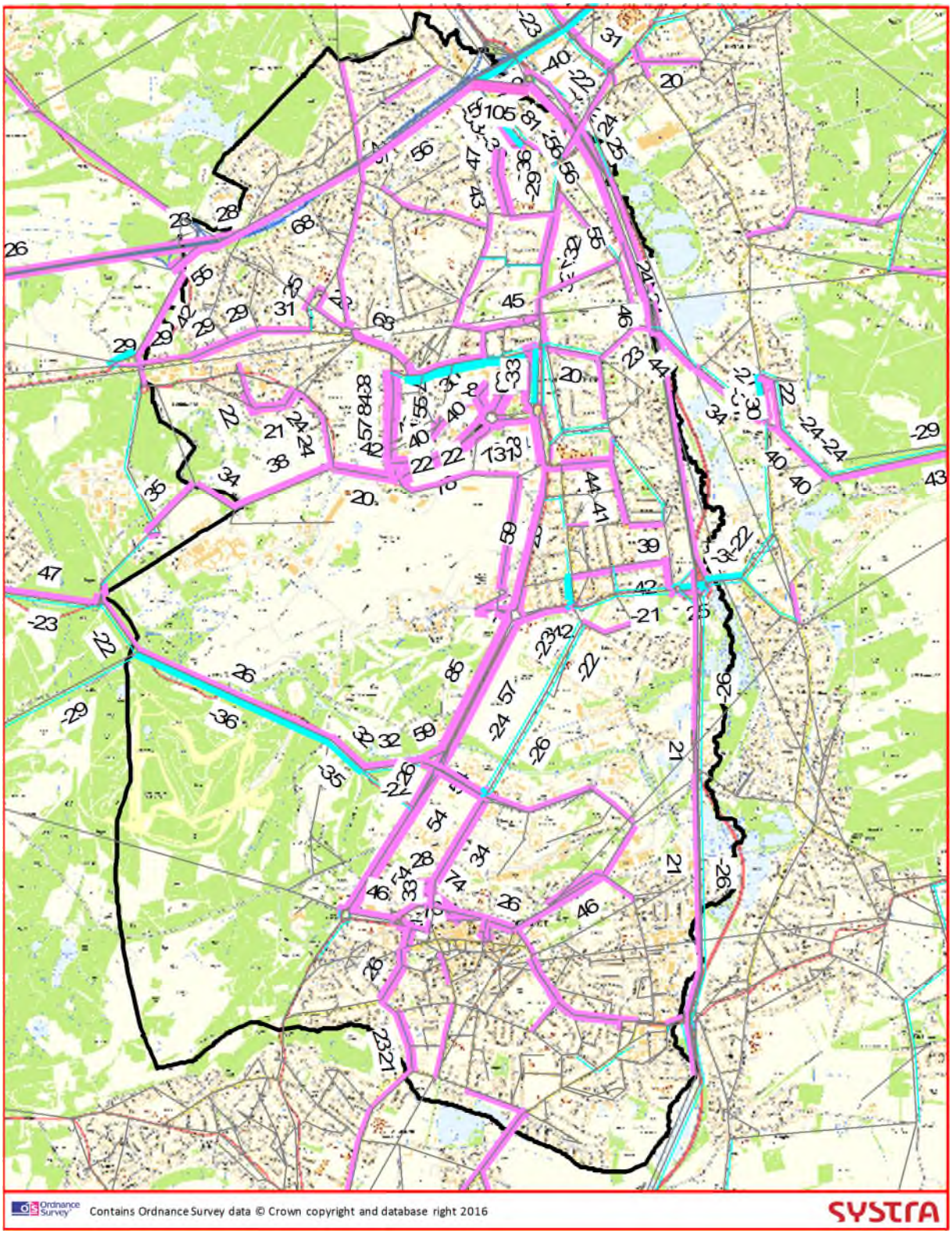


Figure 29. Flow Difference (Local Plan v Do Minimum) 2031 (PM Peak) – M3 J4

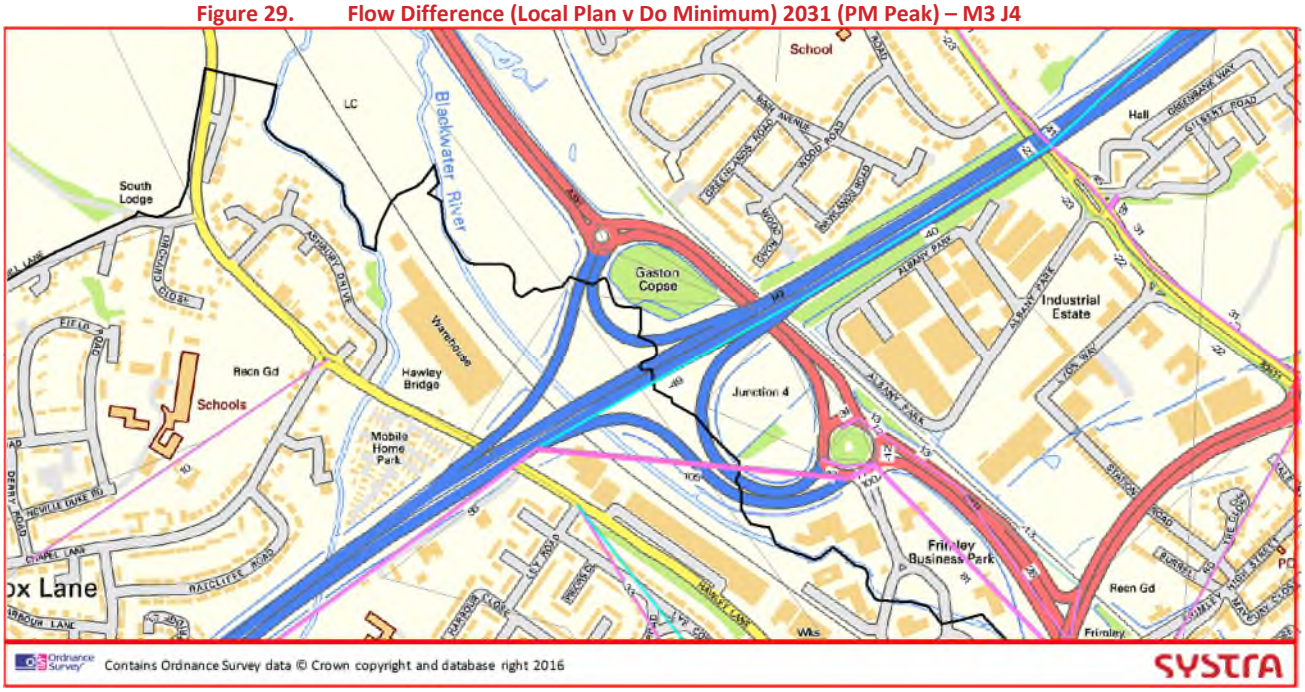


Figure 30. Flow Difference (Local Plan v Do Minimum) 2031 (PM Peak) – M3 J4A

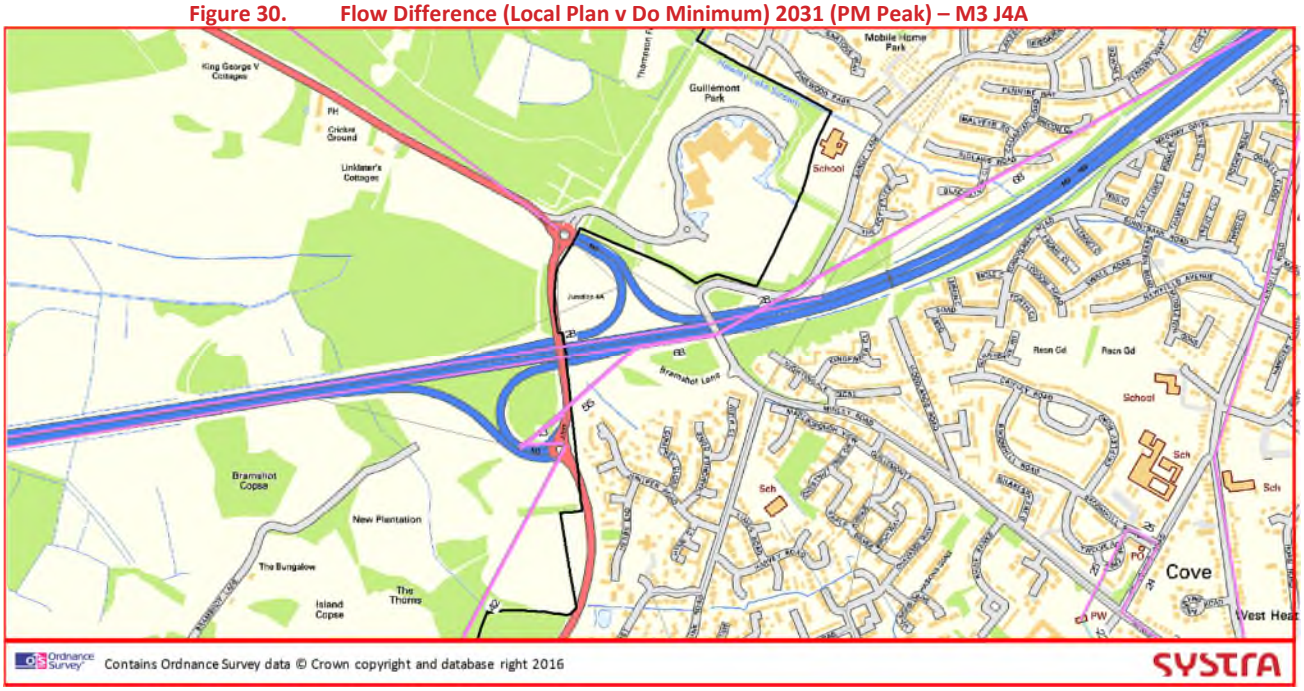


Figure 31. Delay Difference (Local Plan v Do Minimum) 2031 (AM Peak)

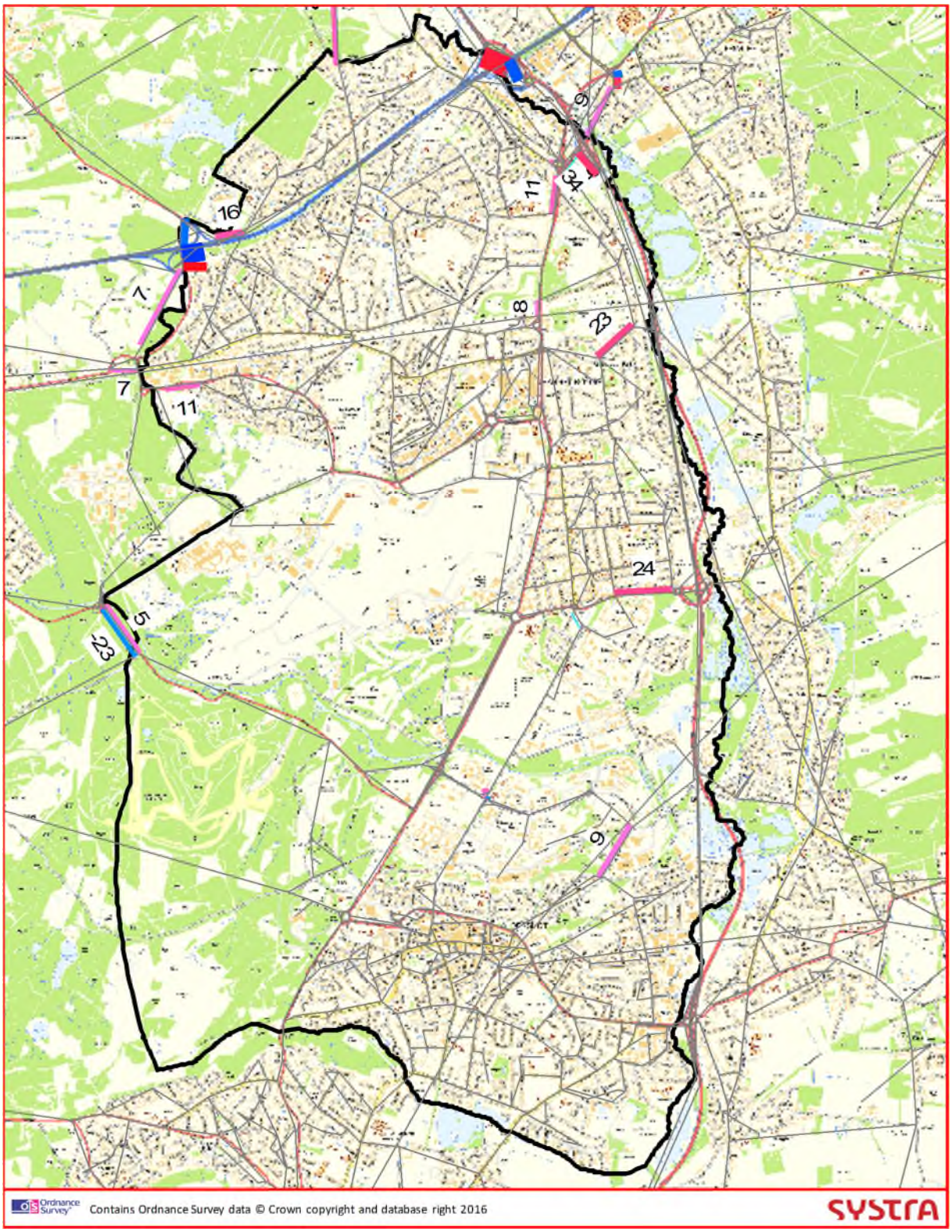


Figure 32. Delay Difference (Local Plan v Do Minimum) 2031 (AM Peak) – M3 J4

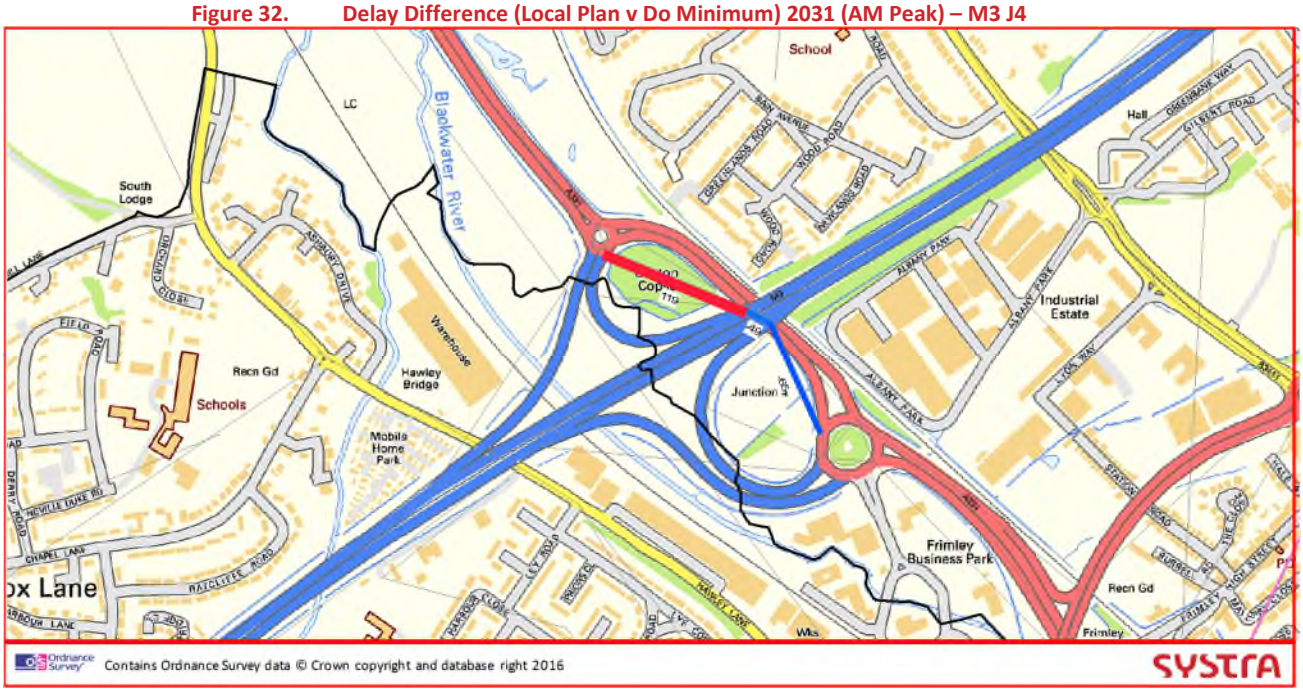


Figure 33. Delay Difference (Local Plan v Do Minimum) 2031 (AM Peak) – M3 J4A

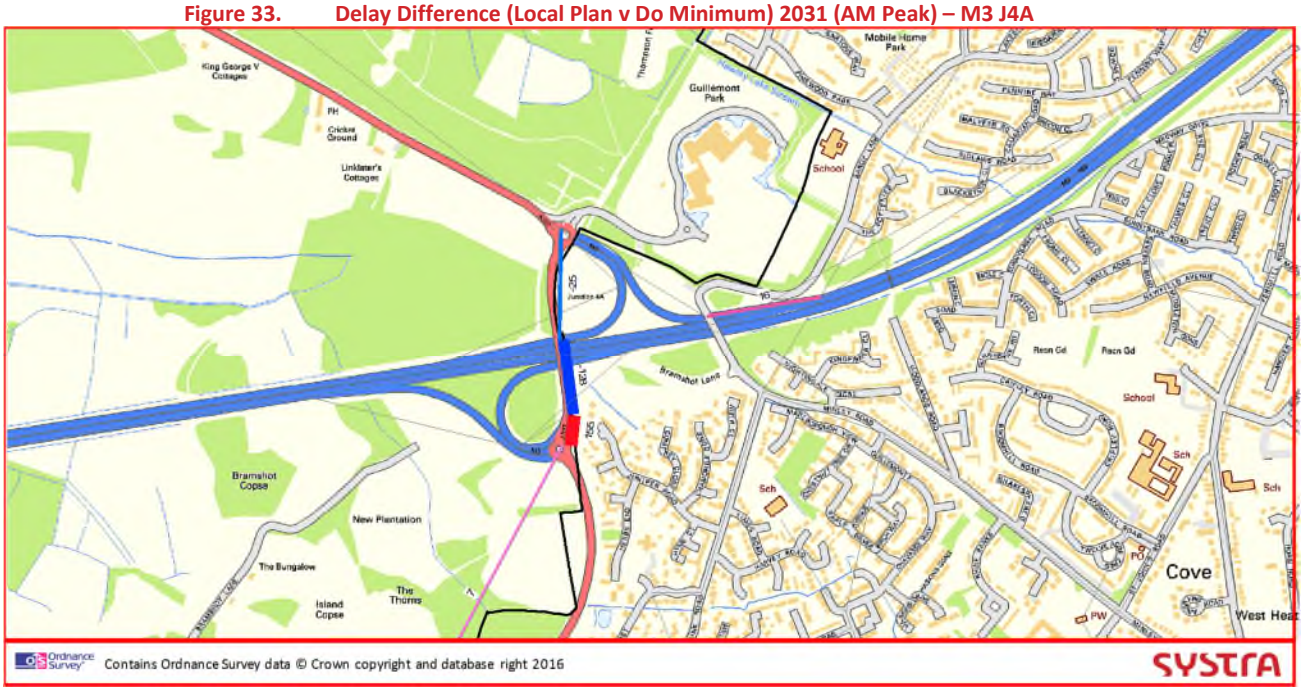


Figure 34. Delay Difference (Local Plan v Do Minimum) 2031 (PM Peak)

Figure 35. Delay Difference (Local Plan v Do Minimum) 2031 (PM Peak) – M3 J4

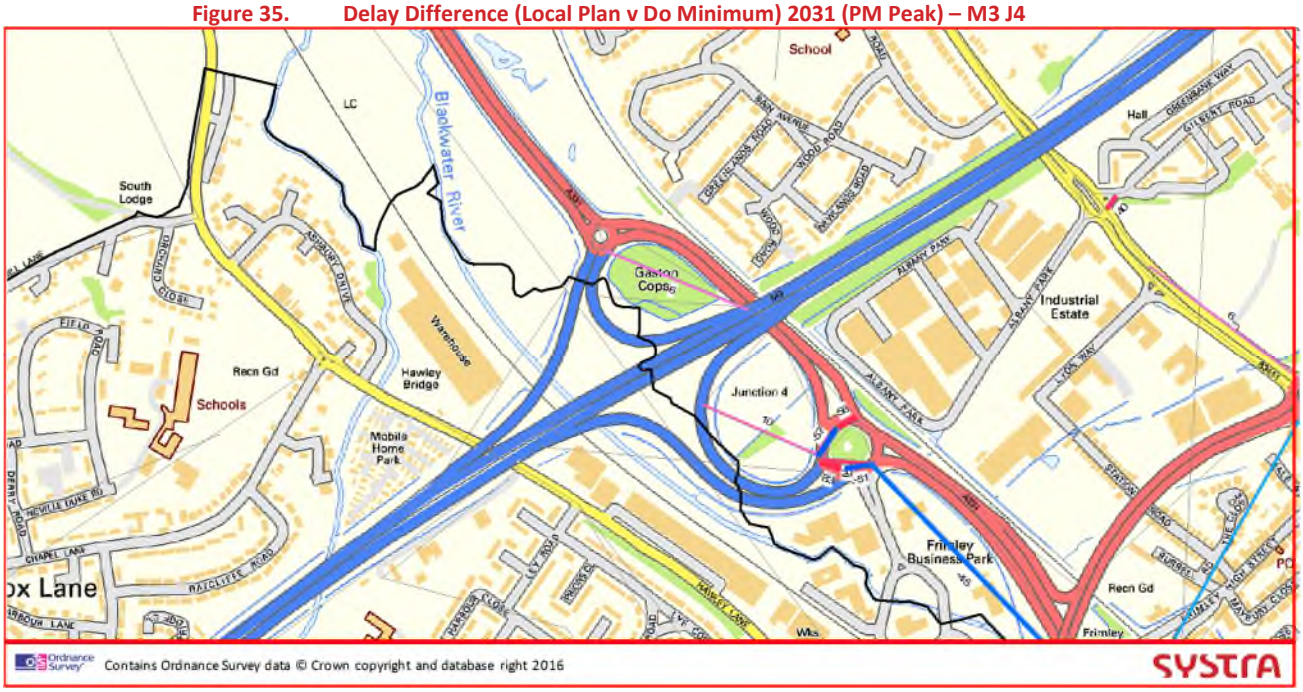


Figure 36. Delay Difference (Local Plan v Do Minimum) 2031 (PM Peak) – M3 J4A

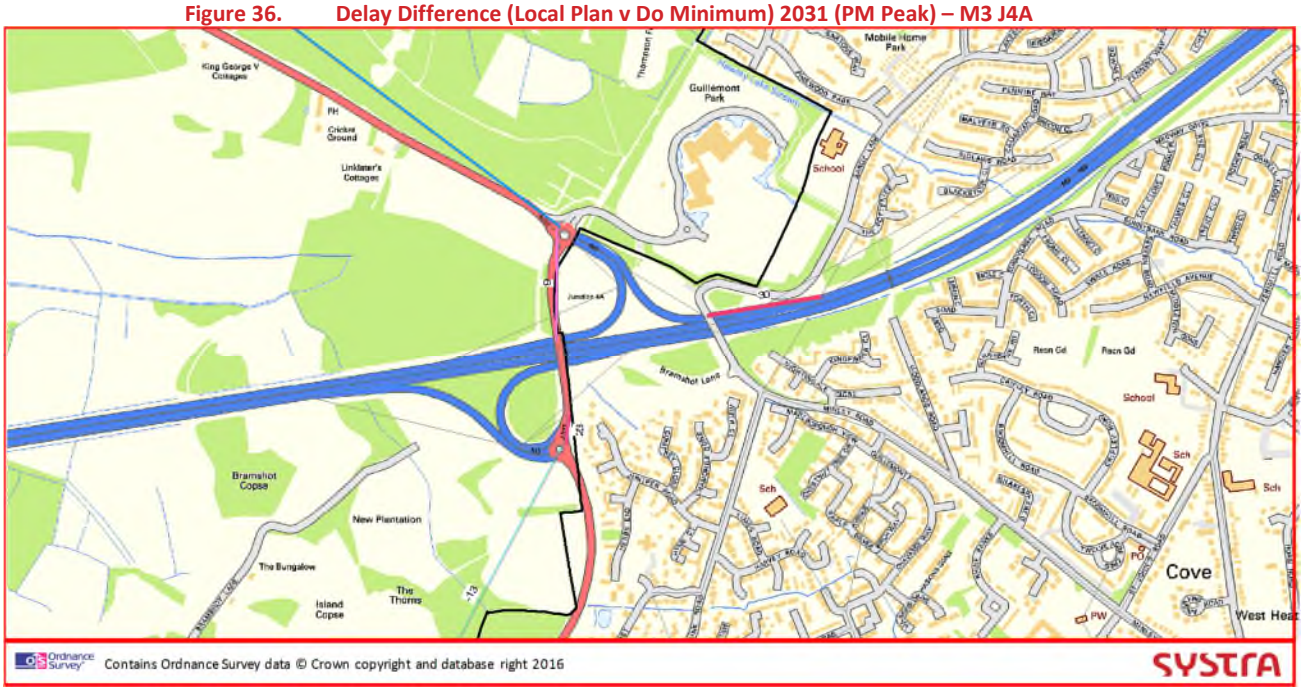


Figure 37. Volume over Capacity (Local Plan) 2031 (AM Peak)

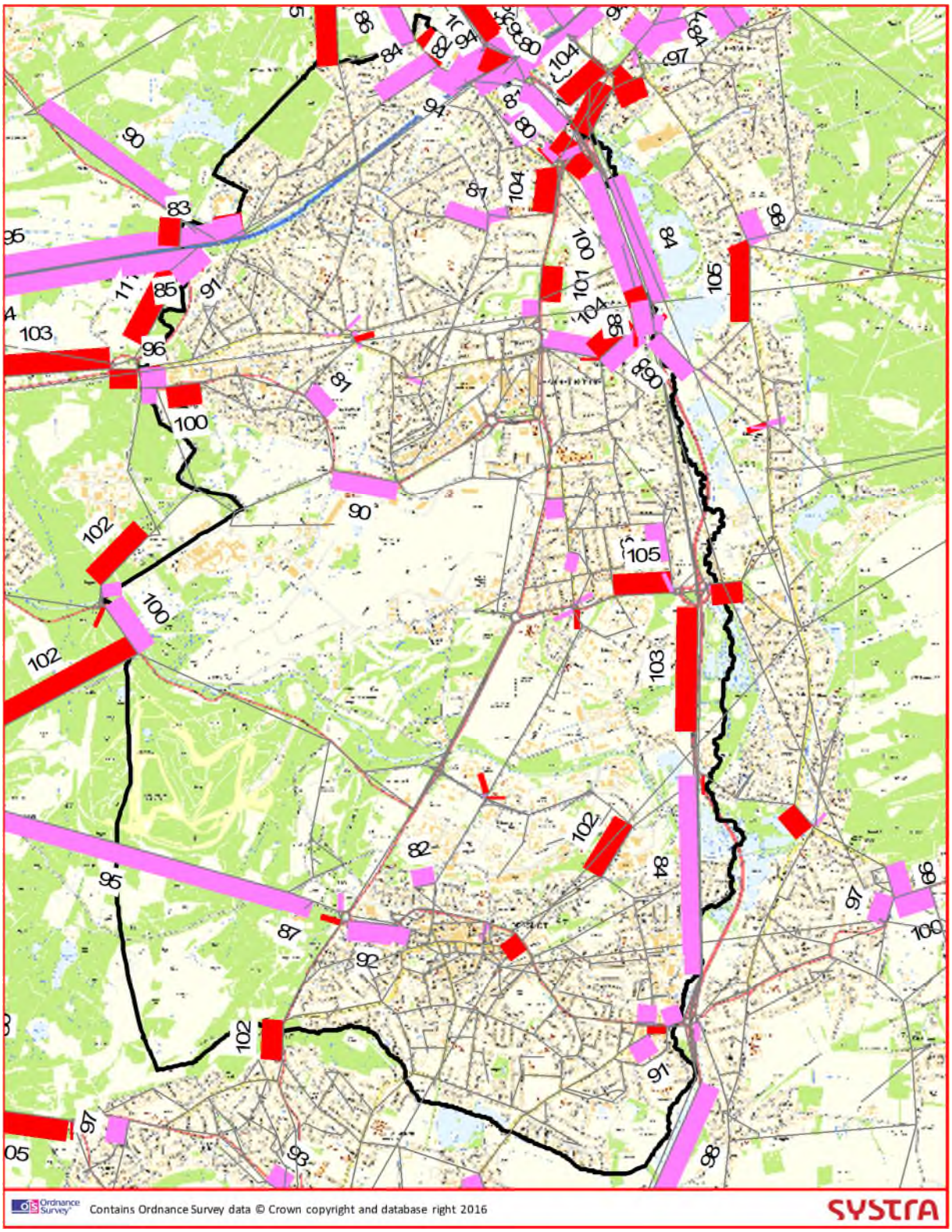


Figure 38. Volume over Capacity (Local Plan) 2031 (AM Peak) – M3 J4

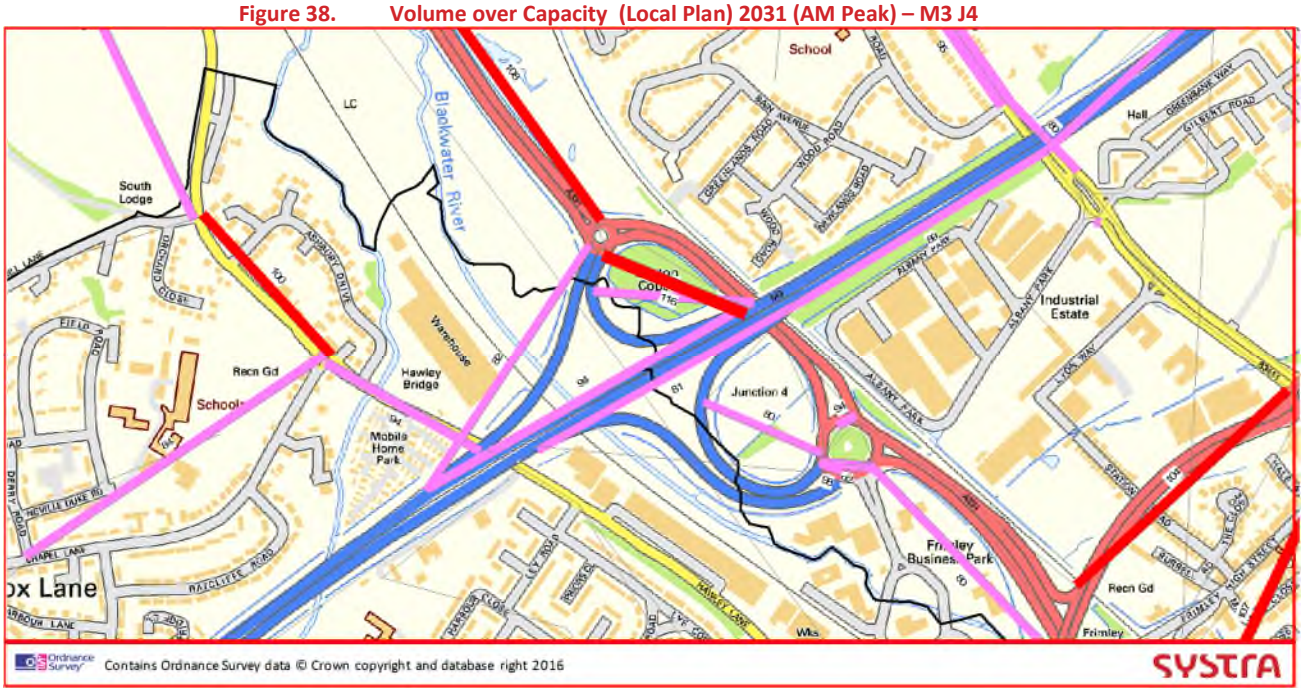


Figure 39. Volume over Capacity (Local Plan) 2031 (AM Peak) – M3 J4A

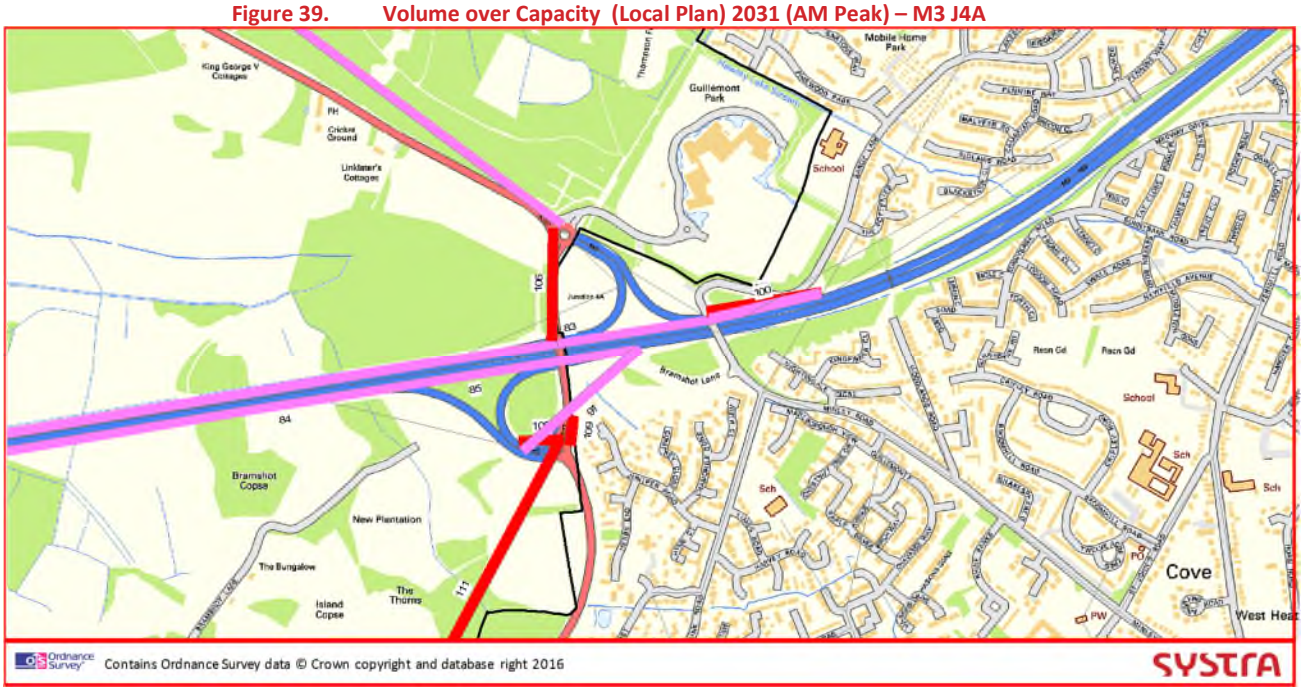


Figure 40. Volume over Capacity (Local Plan) 2031 (PM Peak)

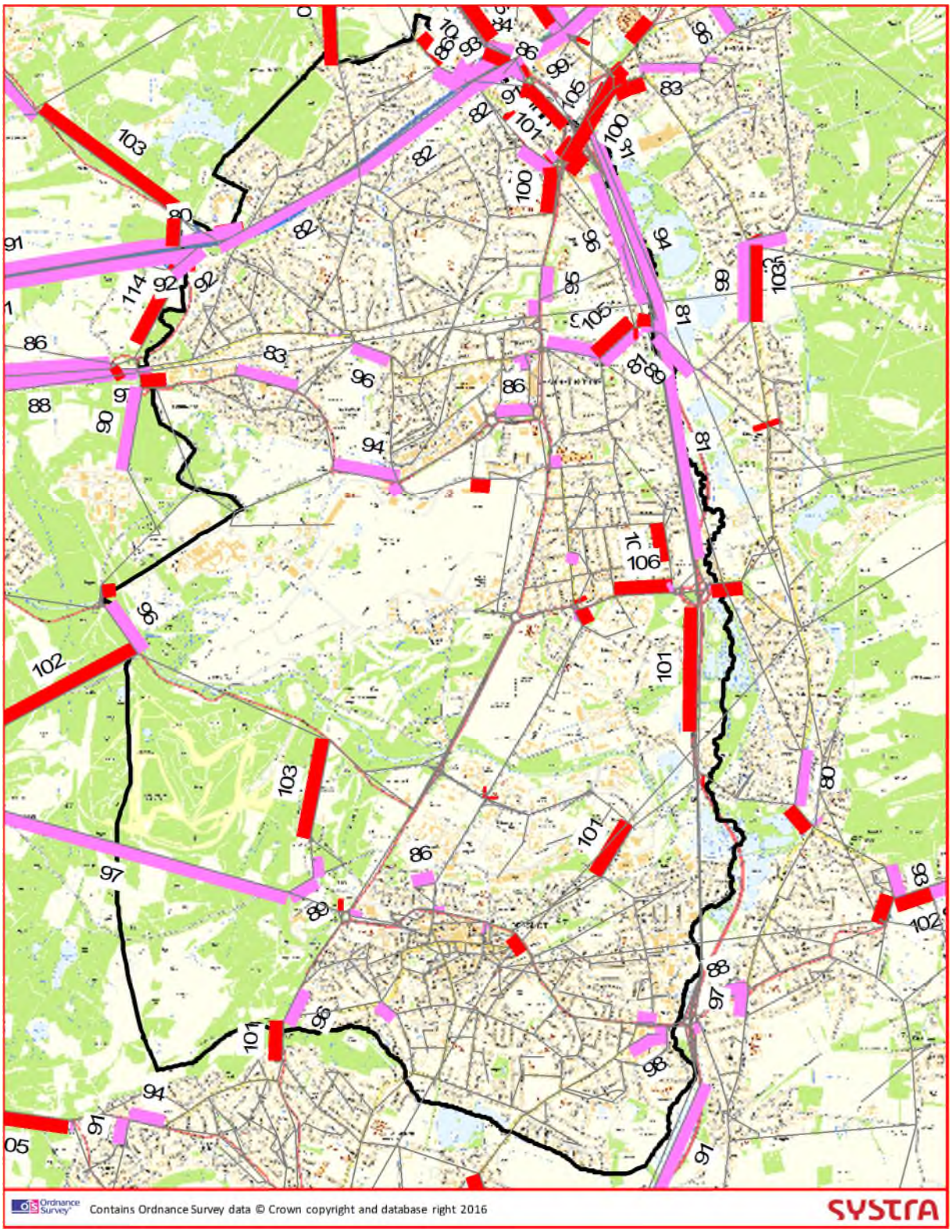


Figure 41. Volume over Capacity (Local Plan) 2031 (PM Peak) – M3 J4

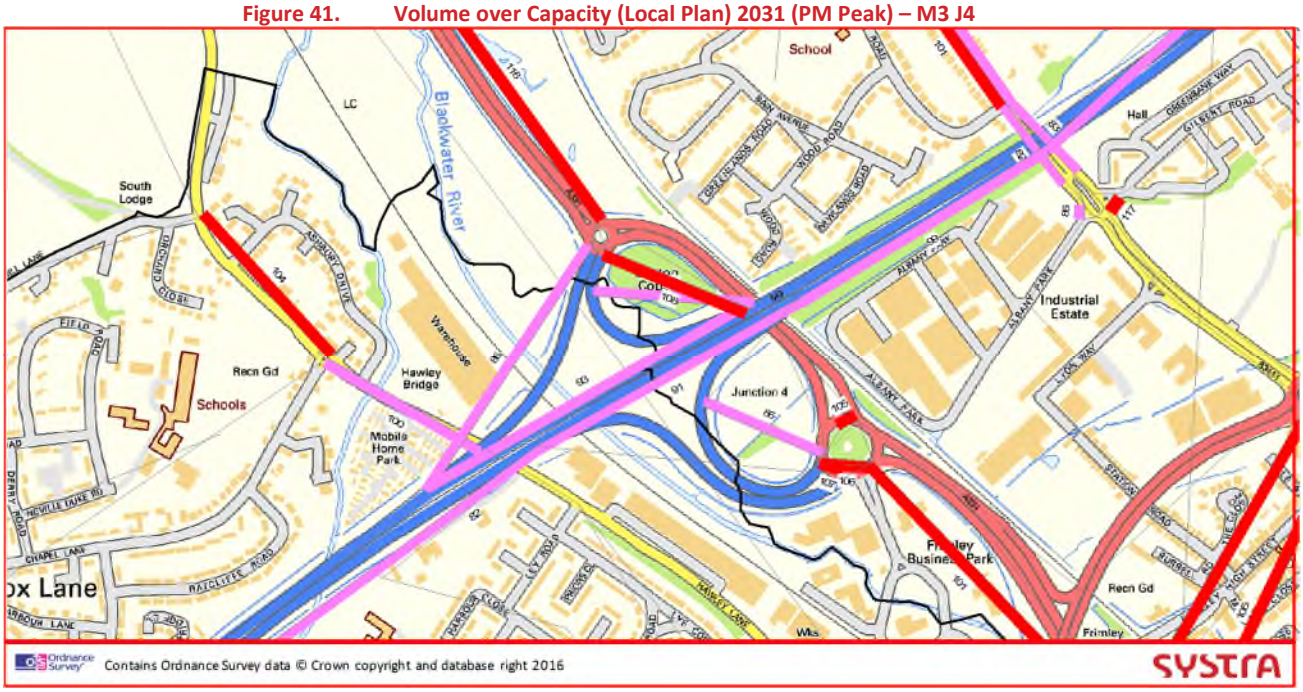
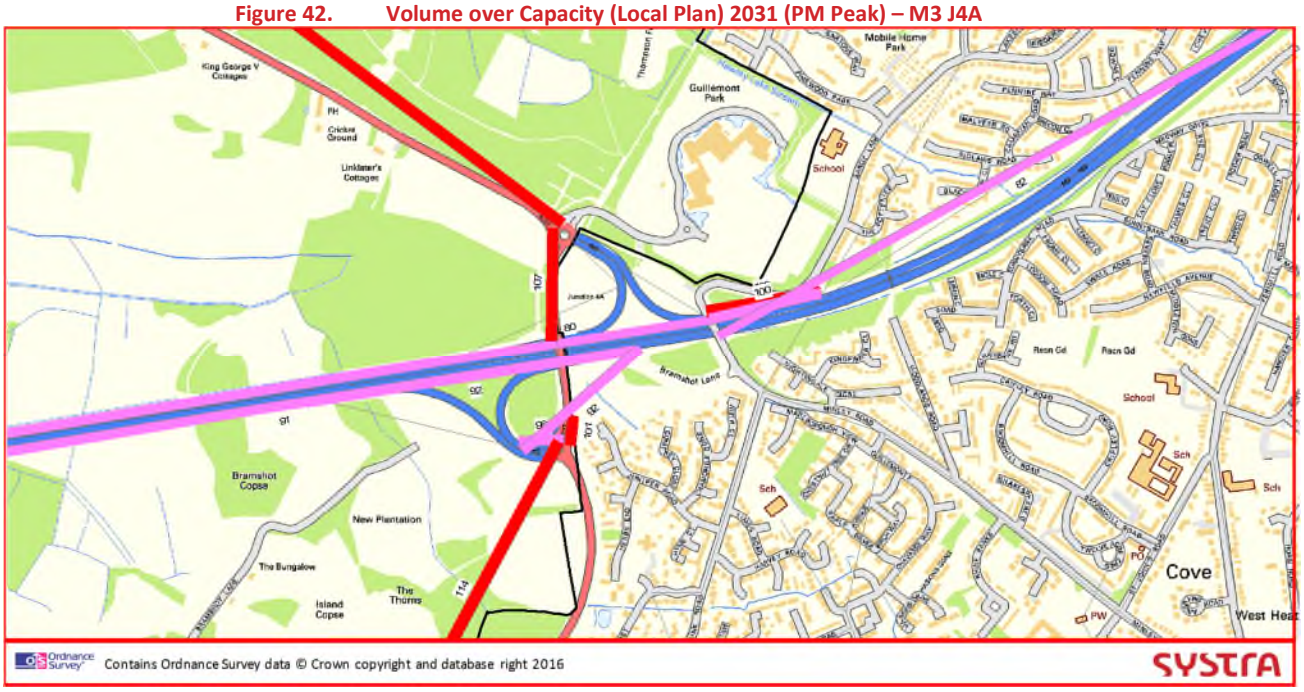


Figure 42. Volume over Capacity (Local Plan) 2031 (PM Peak) – M3 J4A



5. STAGE 3 – IMPACT OF TRANSPORT MITIGATION

5.1 Introduction

5.1.1 This chapter summarises the outputs from, the NHTM model scenario representing the Rushmoor Local Plan conditions and proposed highway mitigation measures. The outputs are compared to the Stage 2 -Local Plan (LP) scenario previously detailed in Chapter 4. The sections below provide a breakdown of the key modelling processes, inputs and outputs.

5.2 Rushmoor Local Plan + Mitigation Development Landuse Assumptions

5.2.1 Land use assumptions for the Rushmoor Local Plan + Mitigation scenario are identical to those included in the Rushmoor Local Plan scenario (Section 4.2).

5.3 Proposed Rushmoor Local Plan Mitigation Measures

5.3.1 Seven junctions have been proposed for mitigation through assessment of outputs from the Stage 1 and Stage 2 model scenarios, and further modular junction modelling undertaken on Junctions 9 (Arcady & Picady). Junctions where the Rushmoor Local Plan conditions have resulted in negative impacts on junction operation, in comparison to the Do Minimum scenario, have been brought forward for mitigation. The client also requested of additional junctions be included that did not initially trigger further assessment from the earlier Stage 1 and 2 modelling.

5.3.2 Highway mitigation measures predominantly consist of a combination of junction redesign and upgrade to increase capacity and reduce delay. A summary of these junctions are listed in Table 13.

Table 13. Proposed junctions put forward for mitigation

JUNCTION	EXISTING JUNCTION TYPE	PROPOSED JUNCRTION TYPE	JUNCTION ROAD TYPE
M3 J4A North	Roundabout	Roundabout	Motorway / A Road
M3 J4A South	Roundabout	Roundabout	Motorway / A Road
M3 J4 North	Roundabout	Roundabout	Motorway / A Road
A325 Farnborough Rd / B3008 Cranmore Ln	Roundabout	Roundabout	A Road / B Road
A327 Elles Rd / Ively Rd	Roundabout	Roundabout	A Road / B Road
A323 Wellington Ave / High St	Roundabout	Roundabout	A Road / B Road
Rectory Rd / Coleford Bridge Rd	Priority Junction	Roundabout	B Road

JUNCTION	EXISTING JUNCTION TYPE	PROPOSED JUNCRTION TYPE	JUNCTION ROAD TYPE
A325 Farnborough Road / A323 Wellington Ave	Roundabout	Roundabout	A Road / B Road

5.3.3 Further details on the selection process for junction mitigation, and the proposed mitigation measures can be found in the Rushmoor Local Plan Transport Impacts and Mitigation Report 2018.

5.4 Highway Network Performance (RTM Module outputs)

5.4.1 Looking at Borough wide statistics, level the impact of the minimal. This is not entirely suprising as the mitigation is focussed on a very small number of junctions across the Borough as a whole.

Table 14. AM Period (07:00 – 10:00) Highway Model Network Statistics, Local Plan 2031 vs LP + Mitigation 2031

PARAMETER	AREA	LOCAL PLAN	LOCAL PLAN + MITIGATION	DIFF	% DIFF
Vehicle Hrs	Core Model Area	132,884	132,682	-202	-0.002
	Rushmoor	10,020	10,092	72	0.007
Vehicle Kms	Core Model Area	7,179,017	7,192,167	13,150	0.002
	Rushmoor	420,456	421,457	1,001	0.002
Average Speed	Core Model Area	54	54	0	0
	Rushmoor	42	42	0	0

NHTM Ref: MNK v MIE

Table 15. PM Period (16:00 – 19:00) Highway Model Network Statistics, Local Plan 2031 vs LP + Mitigation 2031

PARAMETER	AREA	LOCAL PLAN	LOCAL PLAN + MITIGATION	DIFF	% DIFF
Vehicle Hrs	Core Model Area	153,123	152,388	-735	-0.005
	Rushmoor	10,499	10448	-51	-0.005
Vehicle Kms	Core Model Area	7,734,276	7,735,433	1,157	0.001
	Rushmoor	444,386	444,659	273	0.001
Average Speed	Core Model Area	51	51	0	0

PARAMETER	AREA	LOCAL PLAN	LOCAL PLAN + MITIGATION	DIFF	% DIFF
	Rushmoor	42	43	1	0.024

NHTM Ref: MNK v MIE

5.5 Highway Link Flows Differnce (RTM Module outputs)

5.5.1 The following paragraphs introduce the type and format of the Road Traffic Model output presented in this sub-chapter. To enhance clarity in the outputs only data that exceeds the thresholds identified below is included in the plots. All plots include the Rushmoor District boundary for reference.

5.5.2 As well as the Rushmoor District wide plots there are also zoomed in plots of both M3 junction 4 and M3 junction 4A.

Change in Traffic Flow

5.5.3 Figure 43 and Figure 44 identify the change in traffic flow at a Borough wide level in the AM and PM peak hours respectively between the Local Plan (2031) and Local Plan + Mitigation (2031). These plots highlight traffic any reassignment as a result of the proposed highway mitigation. Because the mitigation at the two motorway junctions (J4 and J4a) has necessitated links to be split within the coded network in addition to new nodes being added, the flow difference plots are difficult to interpret at these locations (i.e. like for like link structures are not being compared). For that reason we have not provided any zoomed in plots at these locations.

5.5.4 For the flow difference plots the absolute difference in PCUs is identified adjacent to the appropriate link. Blue lines identify a reduction compared to the 2031 LP and pink/red lines an increase. In addition, the scale of the change is represented graphically with the coloured lines of varying bandwidth. Only flow differences of 50 PCUs or greater and are displayed in the plots.

5.5.5 The flow changes are in main on the perimeter of the Borough with on minimal changes in the central areas (this corresponds with the location of most of the mitigation.

5.5.6 In both the AM and the PM peak hours, flows around the junctions proposed for mitigation have in the majority of instances increased. The most prominent of these located is at the M3 Junction 4 North Roundabout:

- northern approach a flow increase of 539 and 900 PCUs is forecast in the AM and PM peaks respectively.
- southern approach a flow increase of 901 and 596 PCUs is forecast in the AM and PM peaks respectively
- M3 eastbound off-slip a flow increase of 179 and 90 PCUs is forecast in the AM and PM peaks respectively.

5.5.7 Flows are predicted to increase on the M3 to the east of Junction 4 in both the eastern and western directions, with an AM westbound increase of 237 PCU's and an eastbound increase of 581 PCU's, and a PM westbound increase of 220 and an eastbound increase

of 221 PCU's. To the west of the M3 Junction 4 flows decrease on the M3, the most prominent of which is in PM, with a decrease of 276 PCU's westbound.

5.5.8 M3 Junction 4A also experiences increased traffic through the two junctions. The M3 motorway bridge between the two junctions has a flow increase of 462 PCUs northbound and 389 PCUs southbound in the AM, and a 390 PCU increase northbound and 101 PCUs southbound in the PM.

5.5.9 An increase in flows on the the A331 near the Coleford Bridge Road junction is predicted, with an additional 132 PCU's heading southbound in the AM, and 218 PCU's in the PM.

5.5.10 A substantial increase in flows on Ively Road / Elles Road is predicted in the PM, with an increase of up to 182 PCU's. This is in proximity to the A327 Elles Rd / Ively Rd Roundabout where mitigation has been provided.

5.5.11 Rectory Road, south of the Rectory Road / Coleford Bridge Road junction is predicted to see a flow increase southbound in both the AM and PM, with the most prominent being an increase of 122 PCUs in the PM. Rectory Road northbound sees a reduction in flow, with the most prominent being 93 PCUs in the PM.

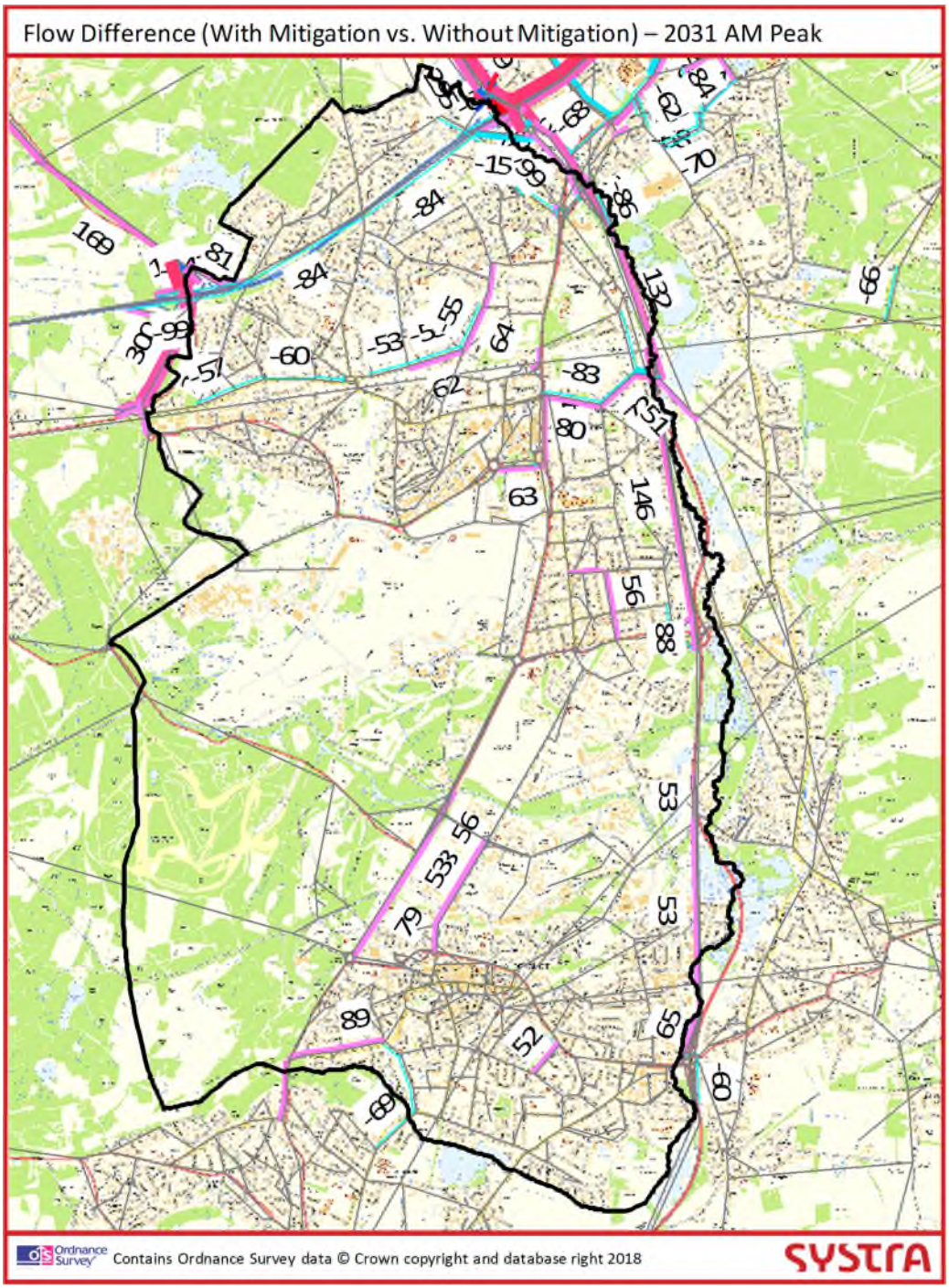


Figure 43. Flow Difference (With Mitigation vs. Without Mitigation) – 2031 AM Peak

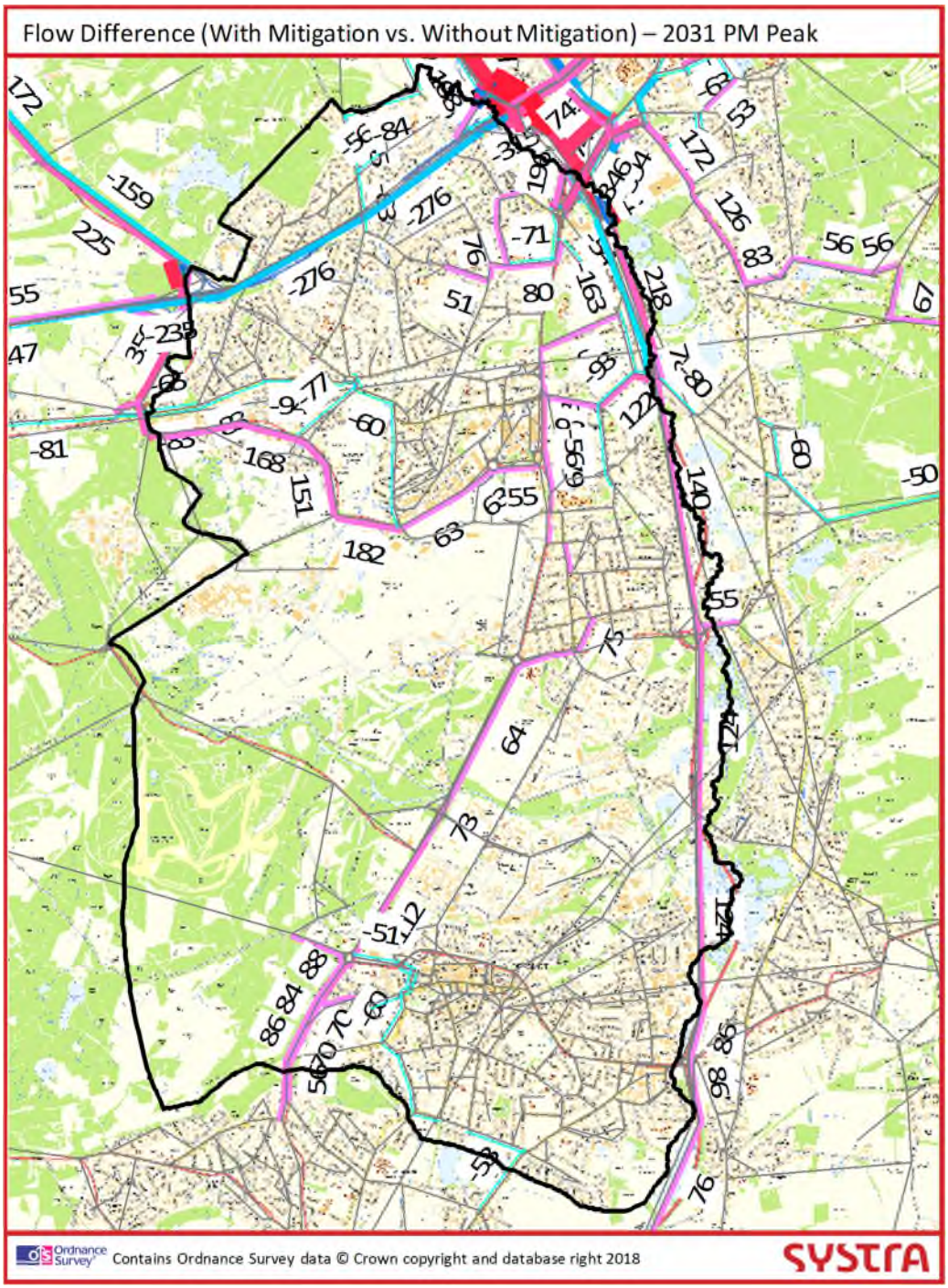


Figure 44. Flow Difference (With Mitigation vs. Without Mitigation) – 2031 PM Peak

5.6 Highway Impacts at Proposed Mitigation Junctions

5.6.1 The remainder of this chapter focuses on the performance of the junctions brought forward from the Transport Impact and Mitigation Report 2018, and the outputs taken from the NHTM Rushmoor LP + Mitigation scenario.

5.6.2 Table 16 below lists the junctions proposed for mitigation and provides an overview of the flows, delay and V/C (volume/capacity) for both the SATURN modelling and Junction 9 modelling. This table can also be found in Appendix G.

Table 16. Mitigated Junctions Performance Summary

			SATURN														SATURN			JUNCTION 9			SATURN			JUNCTION 9		
			2013	2031	2031	2031	2013	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031	2031
			BASE	DM	LP	MIT	BASE	DM	LP	MIT	DM	LP	MIT	DM	LP	MIT	DM	LP	MIT	DM	LP	MIT	DM	LP	MIT	DM	LP	MIT
			AM	AM	AM	AM	PM	PM	PM	PM	AM	AM	AM	PM	PM	PM	AM	AM	AM	AM	AM	AM	PM	PM	PM	PM	PM	PM
ID	Junction Name	Approach Arm	PCU	PCU	PCU	PCU	PCU	PCU	PCU	PCU	Delay (s)	Delay (s)	Delay (s)	Delay (s)	Delay (s)	Delay (s)	V/C (%)	V/C (%)	V/C (%)	V/C (%)	V/C (%)	V/C (%)	V/C (%)	V/C (%)	V/C (%)	V/C (%)	V/C (%)	V/C (%)
1	M3-J4a North RBT	A327 Minley Rd [NW]	774	832	805	844	483	963	968	790	17	14	6	106	83	6	0.93	0.90	0.71	0.88	0.85	0.53	1.04	1.03	0.66	0.82	0.81	0.54
1		Sun Park Link Road [N]	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0.07	0.07	0.06	*	*	*	0.28	0.29	0.27
1		M3 EB Off-Slip [SE]	549	613	619	859	445	596	599	607	8	8	4	7	7	4	0.62	0.62	0.57	0.58	0.58	0.39	0.55	0.55	0.39	0.53	0.53	0.36
1		A327 Motorway Bridge [S]	1145	1156	1152	1614	1151	1309	1314	1704	126	122	3	134	143	3	1.06	1.06	0.47	0.99	0.99	0.69	1.07	1.07	0.44	1.03	1.03	0.71
2	M3-J4a South RBT	A327 Motorway Bridge [N]	798	759	820	1209	525	828	834	935	55	210	14	30	53	8	1.01	1.09	0.90	0.87	0.87	0.38	0.98	1.01	0.67	0.85	0.87	0.38
2		A327 [S]	1421	1247	1256	1614	1372	1299	1304	1660	203	210	64	275	261	64	1.11	1.11	1.03	1.06	1.07	0.47	1.14	1.14	1.03	1.06	1.06	0.45
2		M3 WB Off-Slip [W]	736	1804	1815	1876	1052	1866	1818	1868	77	74	70	12	14	15	1.03	1.03	1.02	0.77	0.77	0.77	0.93	0.96	0.93	0.72	0.75	0.75
3	M3-J4 North RBT	A331 [N]	1426	1426	1423	1962	1434	1776	1779	2679	173	170	6	328	325	145	1.08	1.08	0.72	0.93	0.93	0.47	1.16	1.16	1.05	1.06	1.04	0.53
3		A331 [SE]	2228	2108	2231	3132	2088	2518	2516	3112	221	340	13	171	178	277	1.10	1.16	0.77	0.83	0.84	0.54	1.07	1.08	1.03	0.91	0.89	0.63
3		M3-J4 EB Off-Slip [SW]	1299	1220	1230	1409	1133	1268	1261	1351	27	26	10	99	103	40	0.81	0.82	0.77	1.14	1.20	0.62	0.85	0.86	0.98	1.20	1.21	0.78
8	A325 Farnborough Road / B3008 Cranmore Ln	A325 [S]	863	875	873	1014	774	895	891	1004	61	56	7	26	33	7	1.03	1.02	0.69	0.91	0.91	0.53	1.01	1.01	0.68	0.91	0.91	0.53
8		A325 [N]	519	637	649	711	792	832	838	897	10	10	10	15	14	10	0.76	0.77	0.51	0.74	0.75	0.48	0.97	0.96	0.63	0.96	0.94	0.59
8		B3008 Cranmore Lane [E]	189	161	160	145	111	136	135	127	10	10	10	10	10	10	0.25	0.25	0.23	0.24	0.24	0.24	0.23	0.23	0.22	0.22	0.22	0.23
11	A327 Elles Rd / Ively Rd RBT	A327 [N]	594	712	759	849	398	529	516	554	9	10	10	8	8	8	0.71	0.76	0.80	0.53	0.57	0.57	0.51	0.52	0.55	0.37	0.39	0.39
11		A327 Elles Road [E]	575	844	928	976	692	723	701	907	10	12	9	9	9	9	0.81	0.90	0.74	0.81	0.91	0.58	0.60	0.62	0.62	0.60	0.61	0.40
11		Wessex Road [S]	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0.14	0.16	0.16	*	*	*	0.17	0.19	0.19
11		Ively Rd [W]	442	383	385	379	377	639	600	612	11	11	11	11	11	12	0.41	0.42	0.40	0.30	0.32	0.32	0.63	0.68	0.71	0.48	0.52	0.52
14R	Rectory Rd	Rectory Road [N]	220	288	302	257	310	458	432	335	1	1	49	1	1	58	0.16	0.17	0.92	0.00	0.00	0.69	0.23	0.24	0.98	0.00	0.00	0.92
14R		Coleford Bridge Road [E]	712	734	740	906	582	658	636	906	75	75	48	39	95	38	1.03	1.03	1.02	1E+10	1E+10	0.73	1.00	1.03	1.01	1E+10	1E+10	0.64
14R		Rectory Road [S]	1069	1050	1052	928	1021	1004	1012	906	73	96	161	98	112	169	1.03	1.04	1.08	1.95	1.95	1.01	1.04	1.05	1.08	1.92	1.92	0.96
15	A325 Farnborough Road / A323 Wellington Ave RBT	Wellesley Road [W]	338	505	504	508	740	647	650	619	27	27	23	45	156	154	0.93	0.92	0.90	0.52	0.52	0.52	1.00	1.06	1.06	0.62	0.62	0.62
15		A325 Farnborough Rd [N]	905	1149	1166	1292	1096	1538	1478	1645	16	17	5	35	39	31	0.56	0.57	0.48	0.67	0.68	0.55	0.81	0.84	0.73	0.93	0.97	0.78
15		A323 Wellington Av [E]	638	1112	1124	1121	416	745	737	726	23	26	34	9	9	12	0.90	0.92	0.95	0.83	0.84	0.84	0.57	0.57	0.62	0.53	0.53	0.53
15		A235 Farnborough Rd [S]	889	834	834	866	698	830	827	912	59	63	92	6	6	8	1.01	1.01	1.03	0.89	0.89	0.89	0.68	0.69	0.78	0.67	0.67	0.67

Junction 1 – M3 Junction 4A North Roundabout

5.6.3 The Rushmoor LP scenario indicates that both the Minley Road and The A327 Motorway Bridge arms are over capacity, each with a PM V/C of 1.03 and 1.07 respectively.

5.6.4 Whilst there is no increase in capacity utilisation between the Do Minimum and te Rushmoor LP scenarios, the client identified junction M3 Junction 4A North Roundabout as a site for further study and proposed mitigation.

5.6.5 Mitigation measures include increasing the number of approach lanes on Minley Road from 2 to 3, and providing a jet lane from the A327 Motorway Bridge to Minley Road.

5.6.6 Minley Road capacity utilisation has decreased from 1.03 in the PM LP scenario, to 0.66 in the LP + Mitigation scenario. The A327 Motorway Bridge arm has also experienced significant improvements, reducing capacity utilisation from 1.07 in the PM LP scenario, to 0.44 in the LP + Mitigation scenario. As a result, delays experienced on the A327 Motorway Bridge arm have been significantly reduced to acceptable levels.

Junction 2 – M3 Junction 4 South Roundabout

5.6.7 The Rushmoor LP scenario indicates increased capacity utilisation on the A327 Motorway Bridge in the AM, with a V/C of 1.09, an increase from 1.01 in the Rushmoor DM scenario. Furthermore Rushmoor DM and LP scenarios indicate an existing over capacity utilisation on all arms in the AM and PM.

5.6.8 Mitigation measures include providing a jet lane from the A331 South to the M3 WB On-Slip, and widening the approach lane of the A331 North to accommodate 3 lanes on the approach. An additional exit lane has been provided on the A331 South exit.

5.6.9 The Rushmoor LP + Mitigation scenario indicates a reduction in capacity utilisation on all 3 arms, with the most prominent reduction on the A331 North to V/C of 0.9 in the AM. Proposed improvements mitigate the impacts of implementing the Local Plan and also address existing over capacity utilisation at the junction. The local modelling indicates a similar pattern in capacity improvement.

5.6.10 A significant increase in traffic flows between the Rushmoor LP and Rushmoor LP + Mitigation scenarios has occurred, with the largest increase of flows on the A325 South approach. This is the result of improved capacity around the junction, increasing the attractiveness, and generating additional traffic through the junction.

Junction 3 – M3 Junction 4 North Roundabout

5.6.11 The Rushmoor DM scenario indicates there is over capacity utilisation on both the A331 North and A331 South arms in both the AM and PM peaks. The most congested of these arms is the A331 North, which has a V/C of 1.16 in the PM. This situation is further exacerbated with the implementation of the Rushmoor Local Plan. The Rushmoor LP scenario shows a significant increase in capacity utilisation on the A331 South, increasing from a V/C of 1.10 to 1.16 in the AM.

5.6.12 Proposed mitigation measures include providing jet lanes on all approach arms for left turn traffic, enabling this manoeuvre to be made bypassing the give way at the roundabout. In addition, the approach lanes have been widened to accommodate 2 lanes on all approaches for right turning traffic.

5.6.13 The Rushmoor LP + Mitigation scenario indicated that the proposed junction mitigation has significantly improves the junction operation, bringing capacity utilisation in AM to below the level considered ideal, 0.85. The PM capacity utilisation in the Rushmoor LP + Mitigation has significantly improved, whilst the A331 North and South are still above 1, these are still lower than the Rushmoor DM scenario V/C and, and thus the proposed upgrades have mitigated the impacts of implementing the Local Plan. The local modelling indicates a similar pattern in capacity improvement.

5.6.14 Actual flows through Junction 3 have increased considerably as a result of the mitigation, with the largest increase on A331 South, but with an increase in flows on all arms in the AM and PM. This is as a result of the improved capacity around the junction increasing its attractiveness and generating additional traffic through the junction.

Junction 8 – A325 Farnborough Road / B3008 Cranmore Lane Roundabout

5.6.15 The Rushmoor LP scenario indicates that there is over capacity utilisation on the A325 South, with a V/C of 1.02 in the AM. In addition the A325 South arm experiences traffic close to capacity in the PM, with a V/C of 0.96.

5.6.16 Whilst there is no increase in capacity utilisation between the Rushmoor DM and Rushmoor LP scenarios, the client identified junction A325 Farnborough Road / B3008 Cranmore Lane Roundabout as a site for further study and proposed mitigation.

5.6.17 Proposed mitigation measures include increasing the size of the junction, to widen the approach arms of the A325 North and South, providing 2 lane approach of both arms.

5.6.18 The Rushmoor LP + Mitigation scenario indicates a decrease in capacity utilisation to a V/C of 0.68 and 0.63 for the A325 North and South respectively. The local modelling indicates a similar pattern in capacity improvement.

Junction 11 – A327 Elles Road / Ively Road Roundabout

5.6.19 The Rushmoor DM and LP scenarios indicate that implementing the Local Plan results in increased capacity utilisation from a V/C of 0.8 to above 0.9 in the AM. This is reflected in the local modelling that was undertaken in Junctions 9.

5.6.20 Proposed mitigation measures include widening the approach of Elles Road to provide a longer flare, enabling a greater number of vehicles through the junction and increasing the stacking capacity of the approach.

5.6.21 The Rushmoor LP + Mitigation scenario shows Elles Road capacity utilisation has decreased to a V/C 0.74 in the AM, compared from 0.9 in the Rushmoor LP scenario. This has mitigated the impacts of implementing the Local Plan, which was previously a V/C of 0.81 in the Rushmoor DM scenario. The local modelling indicates a similar pattern in capacity improvement.

Junction 14 – Rectory Road / Coleford Bridge Road Priority Junction

5.6.22 The Rushmoor LP scenario indicated a capacity utilisation of above capacity on the Coleford Bridge Road and Rectory Road South arms, with a V/C of 1.03 and 1.05 respectively in the PM. Similar over capacity utilisation in the AM was forecast.

5.6.23 Further local junction modelling undertaken on Junction 9 indicates that Rectory Road South experiences over capacity utilisation, predominantly from vehicle turning right into Coleford Bridge. In addition, vehicles exiting Coleford Bridge Road, who are required to give way to both Rectory Road North and South, experience severe delays, predominantly resulting for vehicles turning right from Coleford Bridge Road. The dominant movements at this junction are Rectory Road South to Coleford Bridge Road, and Coleford Bridge Road to Rectory Road South. Saturn based NHTM model has limitations when representing smaller, individual junctions. The development of, and outputs from, local junction models are typically considered more accurate at this individual site level.

5.6.24 Proposed mitigation measures include altering the junction from a priority to a roundabout, however confinements to space only allow for a mini roundabout with 1 lane approach.

5.6.25 Local junction modelling indicated that upgrading to a roundabout significantly improves the operation of the junction, reducing capacity utilisation on Rectory Road South from a V/C of1.95 to 1.01 in the AM, and Coleford Bridge Road from an exponentially severe scenario to 0.73. As a result of the junction type upgrades, Rectory Road North which previously experienced unrestricted movement, has a capacity utilisation of 0.92.

5.6.26 Rushmoor LP + Mitigation scenario indicates that the junction upgrades result in worsened capacity utilisation. Whilst local modelling also indicates that the proposed mitigation does not bring capacity utilisation to a desired level (but still an improvement

than without mitigation), this is predominantly due to space limitations. It is considered that a roundabout will enable a much smoother operation of the junction, by giving better egress from the strategic road network

Junction 15 – A325 Farnborough Road / A323 Wellington Avenue Roundabout

5.6.27 The Rushmoor LP scenario shows that in the AM the A235 South experiences over capacity utilisation, with a V/C of 1.03, and in the PM Wellesley Road experiences over capacity utilisation with a V/C of 1.06.

5.6.28 Further local junction modelling undertaken on Junctions 9 indicates that the arm most heavily impacted as a result of implementing the Local Plan was the A325 Farnborough Road North, which experienced a capacity utilisation increase from 0.93 to 0.97. The more strategic Saturn based NHTM model does have limitations when representing smaller, individual junctions. The development of, and outputs from, local junction models are typically considered more accurate at this individual site level.

5.6.29 Proposed mitigation measures include widening the approach on the A325 Farnborough Road North to allow more vehicles through the junction, and increasing the flare length to improve stacking capacity.

5.6.30 The A325 Farnborough Road North utilised capacity has reduced from a V/C of 0.97 to 0.78 in the PM Junction 9 modelling, and from 0.84 to 0.73 SATURN modelling, when comparing LP against LP + Mitigation scenario. Whilst the LP + Mitigation scenario indicates that there are still arms over capacity, local junction modelling typically provides a more accurate assessment of junction capacity, and demonstrates no significant issues at these locations.

6. SUMMARY AND CONCLUSIONS

6.1 Do Minimum

6.1.1 The Do Minimum scenario includes residential and employment growth based on hard committed sites within Rushmoor district and any committed highway infrastructure schemes up to a forecast year of 2032 (modelled as 2031 as the closest available NHTM model year). The scenario highlights the impact of the known committed developments (effectively, the existing consented position) prior to the addition of the Local Plan allocation sites.

6.1.2 The Do Minimum growth represents approximately 5,600 residential units and approximately 130,000 sqm of employment landuse.

6.1.3 The forecast growth in demand associated to increased development has impacts on the highway network with the locations influenced most including the following roads:

- Alison's Road, Aldershot eastbound
- Government Road, Aldershot eastbound
- A323 Fleet Road
- A325 Farnborough Road

6.1.4 Additionally, flows along the M3 in both directions increase by more than 1,500 PCUs per hour in both the AM and PM peaks by 2031. Of course these increases on the M3 are also driven by wider growth between 2013-31 outside of Rushmoor

6.1.5 Forecast capacity issues on the highway network occur mostly in and surrounding the main urban areas within the District or on the perimeter to the District. Locations include M3 junction 4A westbound/ A327 (both peaks), in the Frimley Business Park / A331 / M3 junction 4 area, Frimley High Street and A325, Frimley. Forecast capacity issues on the highway network in Rushmoor within the Do Minimum scenario are also affected by development allocations within neighbouring boroughs.

6.2 Local Plan Developments

6.2.1 The Local Plan Development allocations were tested and compared to the Do Minimum. These development allocations account for an additional 2,800 dwellings over the Do Minimum values and that in total equate to an increase of approximately 8,400 units by 2032 (modelled as 2031). The highest proportion of the additional 2,800 units are positioned in central Farnborough.

6.2.2 In accordance with the focus of the additional development, the main location, in both the AM and PM peaks, where flows increase is central Farnborough in the Sulzers roundabout / Pinehurst roundabout area.

6.2.3 In addition to this there are also notable increases in flows at M3 junction 4 in both peaks, on the A323 in Aldershot and through the area of Aldershot Camp which will be part of the AUE, A327 Elles Road westbound and Ively Road.

6.2.4 Forecast capacity issues on the highway network are generally similar to those forecast for the DM scenario. The locations where there is a notable increase in capacity utilisation for the Local Plan scenario in the AM peak are westbound on Elles Road to the Ively Road roundabout and westbound on A327 Summit Avenue at the BMW roundabout. During the PM peak all arms of the A325 Farnborough Road / Hawley Road roundabout show increase, particularly Farnborough Road northbound. Ively Road eastbound to Elles road also has a notable increase in capacity utilisation.

6.2.5 Journey times between the Do Minimum and Local Plan scenarios through Rushmoor remain similar in each with small increases in the AM peak and a mixture of increases and decreases in the PM peak as vehicles potentially use alternative routes as additional developments are built as various locations.

6.2.6 The outputs from the NHTM modelling of the Local Plan growth fed in to a TA/ Mitigation study that identified (using set criteria) those junctions most impacted by increased traffic volumes. The TA/ Mitigation is documented in a separate Report, but the outcome was the development of seven junction mitigation schemes to address forecast capacity issues. Both the detailed junction modelling in the TA and a final run of the NHTM model including the mitigation have confirmed that the schemes do address the capacity issues at these locations most impacted by the development traffic growth.

SYSTRA provides advice on transport, to central, regional and local government, agencies, developers, operators and financiers.

A diverse group of results-oriented people, we are part of a strong team of professionals worldwide. Through client business planning, customer research and strategy development we create solutions that work for real people in the real world.

For more information visit www.systra.co.uk

Birmingham – Newhall Street
5th Floor, Lancaster House, Newhall St,
Birmingham, B3 1NQ
T: +44 (0)121 233 7680 F: +44 (0)121 233 7681

Birmingham – Innovation Court
Innovation Court, 121 Edmund Street, Birmingham B3 2HJ
T: +44 (0)121 230 6010

Bristol
10 Victoria Street, Bristol, BS1 6BN
T: +44 (0)117 922 9040

Dublin
2nd Floor, Riverview House, 21-23 City Quay
Dublin 2,Ireland
T: +353 (0)1 542 6000 F: +353 (0)1 542 6001

Edinburgh – Thistle Street
Prospect House, 5 Thistle Street, Edinburgh EH2 1DF
United Kingdom
T: +44 (0)131 220 6966

Edinburgh – Manor Place
37 Manor Place, Edinburgh, EH3 7EB
Telephone +44 (0)131 225 7900 Fax: +44 (0)131 225 9229

Glasgow – St Vincent St
Seventh Floor, 124 St Vincent Street
Glasgow G2 5HF United Kingdom
T: +44 (0)141 225 4400

Glasgow – West George St
250 West George Street, Glasgow, G2 4QY
T: +44 (0)141 221 4030 F: +44 (0)800 066 4367

Leeds
100 Wellington Street, Leeds, LS1 1BA
T: +44 (0)113 397 9740 F: +44 (0)113 397 9741

Liverpool
Cotton Exchange, Bixteth Street, Liverpool, L3 9LQ
T: +44 (0)151 230 1930

Reading
Soane Point, 6-8 Market Place, Reading,
Berkshire, RG1 2EG
T: +44 (0)118 334 5510

London
Seventh Floor, 15 Old Bailey
London EC4M 7EF United Kingdom
T: +44 (0)20 7529 6500 F: +44 (0)20 3427 6274

London
5 Old Bailey, London EC4M 7BA United Kingdom
T: +44 (0)203 714 4400

Manchester – 16th Floor, City Tower
16th Floor, City Tower, Piccadilly Plaza
Manchester M1 4BT United Kingdom
T: +44 (0)161 831 5600

Manchester, 25th Floor, City Tower
25th Floor, City Tower, Piccadilly Plaza
Manchester M1 4BT United Kingdom
T: +44 (0)161 236 0282 F: +44 (0)161 236 0095

Newcastle
PO Box 438, Newcastle upon Tyne, NE3 9BT
United Kingdom
T: +44 (0)191 2136157

Perth
13 Rose Terrace, Perth PH1 5HA
T: +44 (0)1738 621 377 F: +44 (0)1738 632 887

Reading
Soane Point, 6-8 Market Place, Reading,
Berkshire, RG1 2EG
T: +44 (0)118 334 5510

Woking
Dukes Court, Duke Street
Woking, Surrey GU21 5BH United Kingdom
T: +44 (0)1483 728051 F: +44 (0)1483 755207

Other locations:

France:
Bordeaux, Lille, Lyon, Marseille, Paris

Northern Europe:
Astana, Copenhagen, Kiev, London, Moscow, Riga, Wroclaw

Southern Europe & Mediterranean: Algiers, Baku, Bucharest,
Madrid, Rabat, Rome, Sofia, Tunis

Middle East:
Cairo, Dubai, Riyadh

Asia Pacific:
Bangkok, Beijing, Brisbane, Delhi, Hanoi, Hong Kong, Manila, Seoul, Shanghai, Singapore, Shenzhen, Taipei

Africa:
Abidjan, Douala, Johannesburg, Kinshasa, Libreville, Nairobi

Latin America:
Lima, Mexico, Rio de Janeiro, Santiago, São Paulo

North America:
Little Falls, Los Angeles, Montreal, New-York, Philadelphia, Washington

SYSTRA