Horsham Transport Study

Local Plan 2039 Transport Assessment

December 2022

On behalf of **Horsham District Council**

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A	07/12/22	Client & WSCC Comments	RD	PG	PG
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Executive Summary

Introduction

Stantec has been commissioned by Horsham District Council to produce a high-level transport assessment to support the emerging Local Plan 2039. The assessment has been undertaken using a SATURN highway model. SATURN is an industry standard modelling package, which has been used to assess the impact of a number of development scenarios on the local highway network managed by West Sussex County Council, along with assessing impacts on the Strategic Road Network, managed by Highways England.

The modelling work is also used to inform more detailed junction modelling, using industry standard modelling packages, where required and to inform the mitigation strategy required to support the Local Plan. Models have been developed to represent potential impacts at the end of the Local Plan period (2039), for the AM (0800-0900) and PM (1700-1800) peak hours.

The assessment is undertaken as per MHCLG Planning Practice Guidance, Transport Evidence Bases in Plan Making and Decision Taking (March 2015)[1]. The mitigation strategy will be required to mitigate the impact of the Local Plan development and as per the guidance the emphasis on mitigation should be delivery of a sustainable transport strategy, which will enable growth, whilst also considering environmental impacts and climate change targets.

The modelling undertaken is based on the most unbiased and realistic set of assumptions. Background forecasts only include schemes where the likelihood of them going ahead is near certain, or more than likely.

The following are not included directly within the modelling, but may have an influence on future traffic conditions:

- Peak spreading and change of travel time – The model is a peak hour only and does not reflect behaviour seen where people will change the time of their journey to avoid the worst congested parts of the peak.
- Increases in home working – the COVID-19 pandemic has seen an increase in home working and there are some indications, that for some, this may become a more common occurrence in the future and as the technology improves, this may become more of the norm in some areas of work.
- Autonomous Vehicles and other future innovations - the impact of 'disruptive' technologies such as autonomous (i.e. 'driverless') vehicles is unknown at this time.

Local Plan Development

A number of scenarios have been taken through the modelling process and outputs of these used to inform the development of a preferred development scenario. More detailed modelling has then been undertaken on the preferred scenario to inform the mitigation strategy required to demonstrate that the Local Plan can be delivered, in the context of transport.

The developments included within the preferred scenario are shown in the table below, split into the strategic sites and non-strategic sites. These figures are subject to some minor degree of amendment as the Local Plan preferred strategy is refined (for example to reflect updated employment allocations).

[1] https://www.gov.uk/guidance/transport-evidence-bases-in-plan-making-and-decision-taking

Since the modelling was conducted the development West of Southwater has now been updated to 720 dwellings within the plan period, this is a relatively modest reduction in comparison to the 840 modelled within the plan period and will cause a negligible impact within the modelling outputs. Additionally, the estimate of development coming forward at West of Ifield has been updated to 1,720 which is similarly not considered a significant change for strategic modelling purposes.

Preferred Scenario - Strategic Sites

Development Location	Plan Period (Dwellings)	Overall (Dwellings)	Employment - B1 (Plan Period) (M^2)	Employment - B2 & B8 (Plan Period) (M^2)
West of Ifield (SA101)	1,600	3,000	2,700	6,300
West of Southwater (SA119)	840	1,200	8,000	16,000
East of Billingshurst (SA118)	650	650	660	1,540
North Horsham densification (SA296)	500	500	11,000	8,500
TOTAL	**3,590**	**5,350**	**22,360**	**32,340**

*Employment at North Horsham (SA296) reflects recent planning permissions not originally included in the baseline 'Reference Case' modelling

Preferred Scenario - Settlement Sites (non-strategic)

Development Location	Plan Period (Dwellings)	Overall (Dwellings)	Employment - B1 (Plan Period) (M2)	Employment - B2 & B8 (Plan Period) (M2)
Ashington	300	300		
Barns Green	105	105		
Broadbridge Heath	150	150		
Cowfold	105	105		
Henfield	325	325		
Horsham - Forest ward	100	100		
Horsham - Novartis	300	300		
Lower Beeding	57	57		
North Horsham parish	300	300		
Partridge Green	255	255	1,000	8,000
Pulborough	245	245	1,000	6,000
Rudgwick and Bucks Green	66	66		
Rusper	38	38		
Small Dole	40	40		
Southwater (land to north)	0	0	0	3,000
Steyning	265	265		
Storrington & Sullington	125	125		
Thakeham	65	65		
Warnham	20	20	0	0
West Chiltington	38	38		
TOTAL	**2,899**	**2,899**	**2,000**	**17,000**

*Housing at Horsham – Novartis reflects a planning permission not originally included in the baseline 'Reference Case' modelling

Transport Modelling Overview

The transport model used to inform the impact of the Local Plan, is a SATURN highway model. SATURN is an industry recognised modelling package, used widely in the assessment of developments and schemes. During the process of model development, West Sussex County Council and National Highways have been engaged and have agreed the use of the modelling tool and the process for developing the forecast models to assess the Local Plan impacts.

A base year model was developed to represent traffic conditions in 2019. This model uses independent traffic count and journey time data to validate the model to a standard as set out within guidance produced by the Department for Transport.

Forecast Development Trip Rates

For all developments added to the models (Reference Case and Local Plan), vehicle trip rates have been derived using the industry standard TRICS software. A trip rate is produced by land use type and provides the number of trips entering or leaving a development based on a rate per specified measure e.g. for residential this is per household and for employment per 100 square metres. These trip rates were agreed with WSCC.

For the strategic development sites, where housing, jobs, schools and other ancillary uses are provided together, a reduction in vehicle trip rates was made to represent trip internalisation (i.e. trips that would take place between the uses provided). The factor used – a 12% reduction on all trips both arriving at and leaving the respective sites – was based upon a figure agreed by a planning inspector to support the North Horsham development at the planning application stage.

Reference Case Forecast Model

A Reference Case forecast model has been developed to represent future traffic conditions at the end of the plan period (2039), without the consideration of the Local Plan development. This model includes all committed development within Horsham District, including development within the adopted Local Plan and in neighbourhood plans that were 'made' before May 2021, as well as any committed development within neighbouring authorities. A suite of ten neighbourhood plans in Horsham District were 'made' on 23 June 2021, three of which (Henfield, Upper Beeding and Ashington) included site allocations. These allocations were, however, accounted for in the transport modelling as proposed Local Plan allocations.

For neighbouring authorities only, a further level of growth is added in order to represent expected growth from developments up to 2039 more accurately. This growth is derived from the Department for Transport National Trip End Model (NTEM) version 7.2. NTEM includes housing, jobs and geodemographic predictions for all planning authorities. This additional growth assumption is not applied within the Horsham District itself as adding both the level of housing within Horsham given in NTEM and growth associated with the Local Plan would result in double counting when applying the Local Plan developments to the forecast model.

For each of the neighbouring authorities, the housing and job numbers within NTEM are adjusted downwards, based on the authorities committed development information, which avoids any double counting. This results in the combination of the adjusted NTEM growth and the specific committed developments within the neighbouring authorities matching expected NTEM growth.

Local Plan Forecast Model

The Local Plan model builds upon the Reference case model by adding the Horsham Local Plan development information provided by HDC as detailed above.

The outputs from the Local Plan model are then compared to the Reference Case model outputs to show the impact of the Local Plan scenario. From this an evaluation is made to determine the requirements of further highway mitigation.

Sustainable Transport Mitigation

Consideration has been given to sustainable travel measures that could impact on how people travel in the future and achieve a mode shift from car use.

The local plan development sites are proposed to comprise of sustainable transport measures that promote and encourage more sustainable active travel modes. This includes enhanced public transport, cycling and walking facilities compared with what might normally be expected from development.

Further Local Plan strategic off-site sustainable mitigation measures have been discussed. These would be led by WSCC and supported by funding from the strategic developments and potentially general CIL monies. The ideas are used to inform a level of car trip reduction in addition to the internalisation and the soft measures outlined previously. The car trip reduction rates are input within the Local Plan Forecasts.

Junctions initially identified as requiring further mitigation were analysed to understand whether the capacity shortcomings could be addressed through further sustainable mitigation measures (i.e. those likely to reduce car trips) connected with the Horsham Transport Strategy and to minimise as far as possible the need for physical mitigation. The unmet demand was also determined for each junction.

The proposed measures at the junctions listed below included the prioritisation of active modes and public transport measures, where specifically feasible to reduce localised car trips further, and the general projection of virtual mobility (i.e. increased opportunity to work from home, due to technological advances reducing need to commute and reduce face to face meetings). The effect was to reduce car trips.

In addition, where junctions are signalised and only just over the threshold for requiring mitigation, the signal timings and Volume to Capacity ratio (V/C) on all arms were examined, to explore whether there would be an opportunity to alter the signal timings. This typically involved looking at where the worse performing movement could be given more green time, without unduly impacting upon opposing movements which had plenty of spare capacity.

The following junctions were seen to be only just over the threshold based on the preferred strategy and could be dealt with through the measures above. The junction locations are highlighted within the figure at the end of this Executive Summary.

1. A264/A24 Dumb-bell Roundabout at South Broadbridge Heath, Horsham (Sustainable measures) (this is part of the recently upgraded road layout, specifically the A264/A24 southern roundabout on the western side of the A24).
2. A281 East Street / Park Way Junction, Horsham (Optimisation of traffic signals)
3. A264 / B2195 Moorhead Roundabout (Optimisation of traffic signals)
4. B2195 Harwood Road/Crawley Road/ Forest Road Junction (Optimisation of traffic signals)
5. A29/ A264 Five Oaks Roundabout (Sustainable Measures)
6. A283 /A29 Roundabouts, Pulborough (Sustainable Measures)

Highway Mitigation

Where it has been demonstrated that sustainable travel measures would not be enough to fully mitigate the impacts of the Local Plan, further mitigation measures have been assessed.

The following junctions are shown to require physical mitigation (i.e. some degree of upgrade) within Horsham District (note junctions on the Strategic Road Network (SRN) are looked at separately). The junction locations are highlighted within the figure at the end of this Executive Summary.

1. A24 / A272 Buck Barn
2. A24 / B2237 Hop Oast Roundabout
3. A24 / A283 Washington Roundabout

Detailed junction modelling for each of these junctions has been undertaken and shown that a mitigation scheme can be provided, which mitigates the impact of the Local Plan.

The A24/A272 Buck Barn junction has been tested within a more detailed modelling package (LinSig) using traffic flows from the SATURN model. Additional right turning lanes to the A272 westbound from the A24 and two lanes through the staggered junction from the A272 carrying on westbound are proposed. The modelling outputs indicate that the mitigation is effective in relieving congestion impacts resulting from the Horsham Local Plan and background forecast traffic growth as the junction output results show operation within capacity.

At the A24 Hop Oast roundabout, signalising the roundabout is proposed. This has also been modelled in a similar fashion in a more detailed modelling package (LinSig). This is shown to work within capacity with the Local Plan traffic and therefore is deemed to be mitigated. The modelling has also been undertaken with an alternative design to include bus priority at the junction, however, this did not mitigate the impact for general highway traffic and the design without the bus priority demonstrated that buses also benefit. The design without the bus priority will not preclude this coming forward at a future date.

At the A24/A283 Washington Roundabout, additional left turn lanes provide additional capacity to alleviate congestion increases from the Local Plan allocations. Any scheme to improve this junction is likely to need sensitive design to ensure that landscape impacts on the South Downs National Park are mitigated, although the proposed design is within the existing highway boundary. It is also noted that should the Arundel bypass progress, this is likely to have an impact on how flows interact at Washington Roundabout, with flows from the west expected to decrease and flows from the south expected to increase, depending on timescales this may change requirements at Washington Roundabout.

The schemes provided and high-level scheme costs (including 20% Risk and Contingency and 44% Optimism Bias[2]), are provided within the table below.

High Level Scheme Costs

Scheme	High Level Cost (Including Optimum Bias)
A24 / A272 Buck Barn	£5,175,806
A24 / B2237 Hop Oast Roundabout	£3,107,922
A24 / A283 Washington Roundabout	£3,810,572

[2] Optimism Bias is the recognised inherent bias in underestimating costs, particularly at early stages of projects when risks are unknown. 44% is the figure used by DfT in early stages of projects. See Transport Appraisal Guidance Unit A1.2 Section 3.5 (TAG UNIT A1.2 Scheme Costs (publishing.service.gov.uk))

Strategic Road Network

The assessment of the impacts of the Local Plan on the SRN, has indicated that the A23 is already over capacity within the Reference Case model, due to the amount of additional traffic being added from the south coast towns, travelling north towards the M25 and London, as well as growth from Mid Sussex and Crawley. This additional traffic is resultant from background growth of traffic not related to the Horsham Local Plan developments and therefore the majority of impacts arise due to increases in background growth from elsewhere.

This has made the assessment of the Local Plan impacts difficult, notwithstanding that such impacts are minor compared with background traffic growth. It is therefore recommended that further discussion be held with National Highways to discuss what further means there are to quantify impacts that would specifically arise from Local Plan developments, which in practical terms will mean exploring options for mitigation in a future Road Improvement Strategy (RIS) or other multi-body delivery routes, likely to also include consideration of combined impacts from this Plan and the emerging Mid Sussex Local Plan.

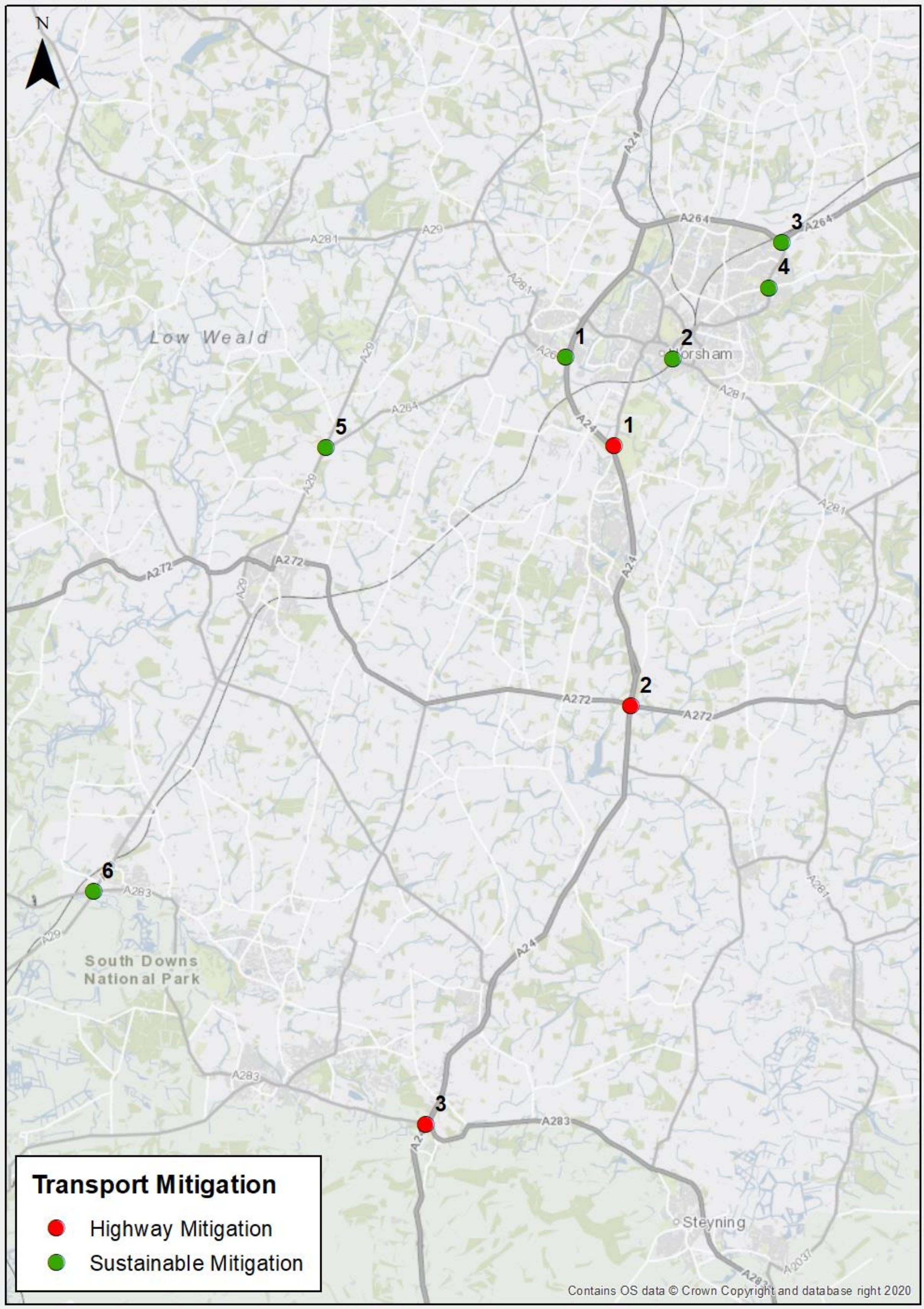
Summary and Conclusions

Modelling has been undertaken to inform this Transport Assessment for the local plan preferred strategy (i.e. the preferred scenario). The work has considered, at a high level, the sustainable travel mitigation and impact on traffic levels across Horsham District and any impacts within neighbouring authorities and on the Strategic Road Network, which in this case is the A23 and M23.

Based on the capacity metrics used within this assessment, the specific mitigation measures implemented ensure that congestion hotspots earmarked within the reference case do not worsen, nor flag any additional junctions as a congestion hotspot. Furthermore, the relative impacts of Local Plan growth on the Strategic Road Network against general traffic growth are minor, with no stand-alone Local Plan mitigation currently proposed (further discussion recommended with National Highways).

Limited physical highway mitigation is proposed, with four junctions on the A24 corridor being shown to require mitigation, which is deemed to be deliverable through the Local Plan process.

Proposed sustainable travel measures (physical and non-physical) and highway physical mitigations are shown to alleviate significant increases of congestion which result from the Local Plan preferred scenario. Furthermore, the sustainable travel mitigation measures which have been included within the modelling assessment are deemed to be conservative in terms of the mode shift away from cars, and therefore the physical mitigation requirements shown may be reduced if more ambitious sustainable transport measures and targets proposed by individual site promoters are realised.



Junction Mitigation Locations

1 Introduction

1.1 Background

1.1.1 Stantec has been commissioned by Horsham District Council (HDC) to undertake a transport study to inform the emerging Horsham Local Plan.

1.1.2 The purpose of the study was to develop a strategic highway model to underpin the assessment of the Local Plan impacts. This model was then used to undertake testing of the Local Plan developments and evaluate the impact of proposed development scenarios on the strategic and local highway network up to 2039 within Horsham District. The highway impacts in neighbouring authorities and on the Strategic Road network managed by National Highways as a result of Local Plan development within Horsham is also assessed as part of the study.

1.1.3 The modelling work will then be used to inform a mitigation strategy that will assist in facilitating development going forward and inform any infrastructure requirements for delivery of the plan.

1.1.4 The assessment is undertaken as per DLUHC Planning Practice Guidance, Transport Evidence Bases in Plan Making and Decision Taking (March 2015)[3]. The mitigation strategy will be required to mitigate the impact of the Local Plan development and as per the guidance the emphasis on mitigation should be delivery of a sustainable transport strategy, which will enable growth, whilst also considering environmental impacts and climate change targets.

1.2 Local Context

1.2.1 Horsham is a local government district in West Sussex, the district borders Crawley, Mid Sussex, Mole Valley and Waverley districts (both Surrey), Chichester, Arun and Adur. The Office for National Statistics mid-2018 population estimate for the district was just above 142,000.

1.2.2 Horsham is the main settlement within the district, other major areas of population within being Billingshurst, Storrington & Sullington, Pulborough, Henfield & Southwater, Broadbridge Heath and the Steyning/Bramber/Upper Beeding cluster of villages.

1.2.3 The main routes through the district are the A24 travelling north to south from the M25 to Worthing on the south coast, the A272 running through the centre of the Horsham District East to West and the A264 from the A23 to the south west of Crawley, to the A24 to the north east of Horsham.

1.2.4 To the south of Horsham is the A27, the main route for east-west traffic along the south coast and to the east of the district is the A23. This is one of the main north-south routes from the south coast (Brighton) to London and, along with the A27, forms part of the National Highways -controlled Strategic Road Network (SRN).

1.2.5 Within Horsham itself, the A24 and A264 forms an outer ring road to the West and North. The A264 specifically accommodates traffic movement to/from Horsham and Crawley and traffic onwards to/from Horsham onto the M23.

1.2.6 The Horsham District is situated within the Gatwick Diamond, which is a key area of economic growth within West Sussex. Major areas of employment are located within Horsham Town centre. Outside of Horsham, Gatwick airport is a major employment area.

[3] https://www.gov.uk/guidance/transport-evidence-bases-in-plan-making-and-decision-taking

1.3 Local Plan Review

1.3.1 The Horsham District Planning Framework (Local Plan) was adopted on 27 November 2015. The Framework sets out development proposals and policies to guide and bring forward new development in the district up to 2031.

1.3.2 As part of the background evidence base to underpin the District Planning Framework, the "Horsham District Transport and Development Study" was published on 1 April 2014. The study was updated following the publication of the Inspector's report into the Examination in Public in December 2014. The Inspector's findings included a requirement for Horsham District Council (HDC) to assess whether the housing level planned in the district could be increased to 15,000 houses over the 20-year Plan period, i.e. an annual housing growth target of 800 dwellings (up from 750 dwellings per year). This Technical Transport Note was published in April 2015.

1.3.3 Horsham District Council is now preparing a new Local Plan to replace the current adopted Horsham District Planning Framework (November 2015). The Local Plan Review will set out the vision, spatial strategy policies and new development allocations for the district to meet development needs up to 2039. It will establish the overall amount of new development needed over this period of time and indicate the broad locations for new development, including new strategic-scale development sites.

1.4 Report Purpose

1.4.1 The purpose of this report is to provide a high level, non-technical review of the work undertaken to develop a suitable modelling tool to assess the impact of Local Plan development and to inform the Transport Evidence Base as part of the Local Plan process and assessment of the Council's recommended development strategy (the 'preferred scenario'). This report is supported by Technical Appendices setting out in more detail, the development of the modelling tools and the modelling approach to assess the impacts of the wider development scenarios assessed. This report details the outcomes from the Preferred Local Plan Scenario. Previous work has looked at alternative scenarios, which are referenced within this report and detailed in associated appendices, which sit alongside this report.

1.4.2 It should be noted that the quanta and timing of development assumed for this stage of modelling is based at the Council's best estimate at the time the stage commenced; as strategy emerges, the sites and capacity for development may change as a result of the evolving evidence base. It should also be noted that this stage of modelling tests impacts up until 2039.

1.5 Report Structure

1.5.1 Following this introduction, the report is set out as follows:

- Section 2 details the Local Plan Scenarios that have been assessed and detailing the preferred scenario.
- Section 3 provides a high-level overview of the model used within the assessment.
- Section 4 sets out the sustainable transport measures considered within the assessment.
- Section 5 sets out the initial results of the modelling to identify areas of concern.
- Section 6 sets out the highway mitigation requirements on the West Sussex highway network.

- Section 7 provides commentary on impacts on the Highway’s England Strategic Road Network.
- Section 8 provides an overall summary and conclusions from the study.

2 Local Plan Scenario

2.1 Introduction

2.1.1 As part of the overall study, a preferred development scenario has been modelled. This preferred scenario has been developed by HDC based on a number of factors, including data from extensive previous transport modelling exercises.

2.1.2 For the updated 2039 Local Plan the development of the preferred scenario took into consideration the transport modelling test previously conducted, taking into consideration transport constraints as well as issues relating to water neutrality.

2.1.3 Outputs from previous modelling work were published by HDC as part of the Local Plan Review Evidence base[4]. The evidence base included a number of Transport Modelling Reports produced by Stantec in 2021.

2.2 Preferred Scenario

2.2.1 The Preferred Scenario strategic development sites modelled and reported within this report are summarised within Table 2-1 and the neighbourhood plan sites summarised within Table 2-2.

2.2.2 Since the modelling was conducted the development West of Southwater has now been revised to 720 dwellings within the plan period, this is a relatively modest reduction in comparison to the 840 modelled within the plan period and will cause a negligible impact within the modelling outputs. Additionally, the estimate of development coming forward at West of Ifield has been updated to 1,720 which is similarly not considered a significant change for strategic modelling purposes.

2.2.3 The preferred strategy also included refinements to the employment total and greater detail regarding employment type and employment Gross Floor Area.

Table 2-1: Preferred Scenario Strategic Sites

Development Location	Plan Period (Dwellings)	Overall (Dwellings)	Employment - B1 (Plan Period) (M2)	Employment - B2 & B8 (Plan Period) (M2)
West of Ifield (SA101)	1,600	3,000	2,700	6,300
West of Southwater (SA119)	840	1,200	8,000	16,000
East of Billingshurst (SA118)	650	650	660	1,540
North Horsham densification (SA296)	500	500	11,000	8,500
TOTAL	**3,590**	**5,350**	**22,360**	**32,340**

[4] Local Plan review evidence base | Horsham District Council

Table 2-2: Preferred Scenario Settlement Sites (non-strategic)

Development Location	**Plan Period (Dwellings)**	**Overall (Dwellings)**	**Employment - B1 (Plan Period) (M2)**	**Employment - B2 & B8 (Plan Period) (M2)**
Ashington	300	300		
Barns Green	105	105		
Broadbridge Heath	150	150		
Cowfold	105	105		
Henfield	325	325		
Horsham - Forest ward	100	100		
Horsham - Novartis	300	300		
Lower Beeding	57	57		
North Horsham parish	300	300		
Partridge Green	255	255	1,000	8,000
Pulborough	245	245	1,000	6,000
Rudgwick and Bucks Green	66	66		
Rusper	38	38		
Small Dole	40	40		
Southwater (land to north)	0	0	0	3,000
Steyning	265	265		
Storrington & Sullington	125	125		
Thakeham	65	65		
Warnham	20	20	0	0
West Chiltington	38	38		
TOTAL	**2,899**	**2,899**	**2,000**	**17,000**

2.2.4 Figure 2-1 shows the location of the strategic sites and the neighbourhood allocations within the preferred scenario.

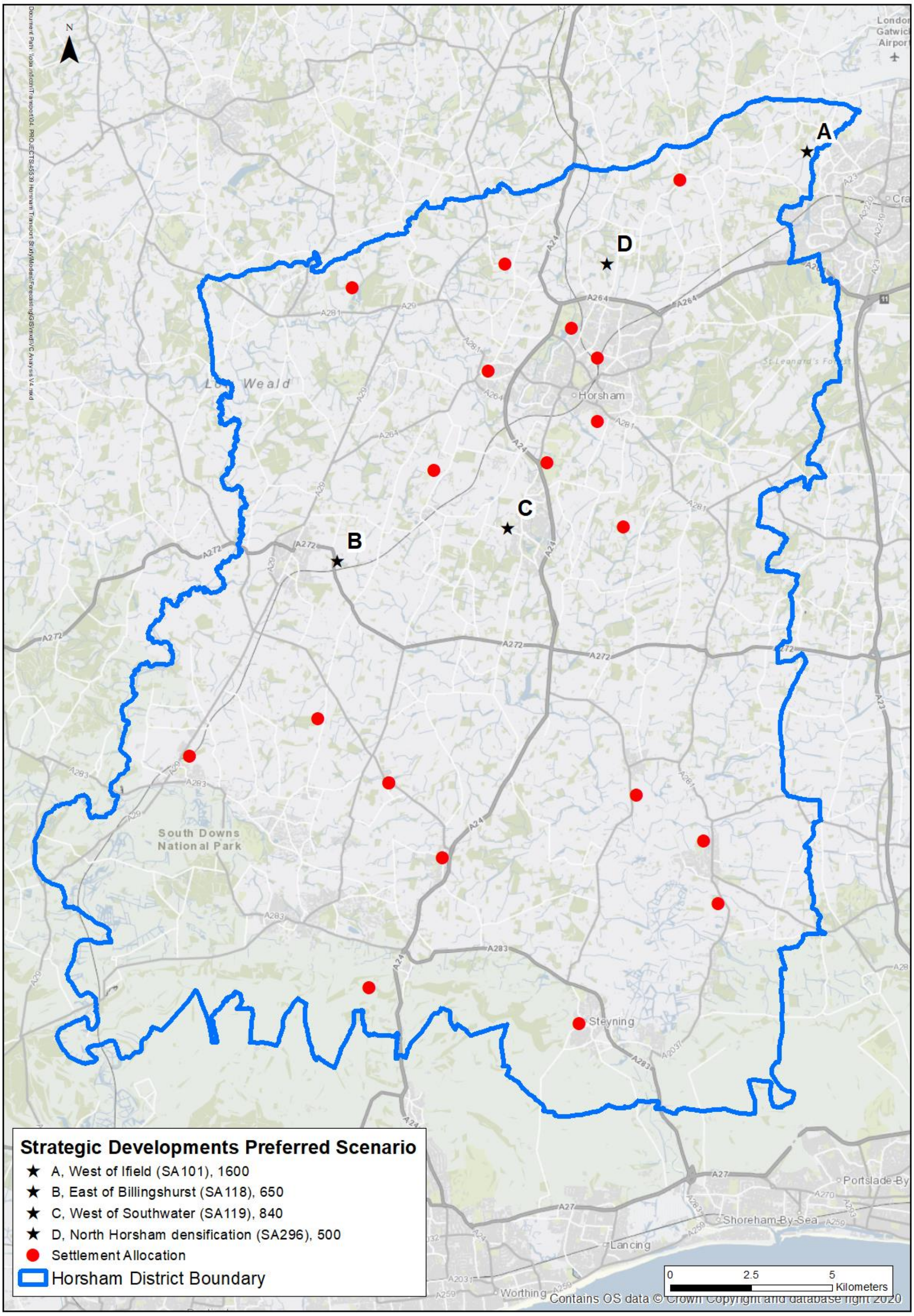


Figure 2-1: Preferred Scenario Development Locations

3 Transport Modelling

3.1 Overview

3.1.1 The modelling tool takes the form of a highway assignment model, known going forward as the Horsham Highway Model (HHM). The HHM has been designed to adequately replicate traffic conditions in order to provide a basis for forecasting future impacts of the local plan.

3.1.2 To inform the impact of the Local Plan developments a transport modelling package known as SATURN[5] has been used. SATURN is a widely used and industry respected software package for highway assignment modelling.

3.1.3 One of the main benefits of using SATURN for the assignment process is that it is applicable to both urban and rural networks and can model peak hour congestion in sufficient detail. As a combined simulation and assignment model, SATURN also has the advantage that it enables detailed junction modelling.

3.1.4 The model in question is a highway assignment model only and uses a fixed trip matrix approach, as such the simulation only focuses on vehicle route choice change only. By using a fixed trip matrix, this means the model does not consider changes in travel behaviour or change in mode (i.e. to public transport, cycling or walking) as a result of increased car costs caused by congestion.

3.1.5 The fixed trip matrix approach is seen to be proportionate for the purposes of the Local Plan study, which is strategic in nature and concerned with the overall impacts of development across Horsham district.

3.1.6 During the process of model development, West Sussex County Council and Highways England have been regularly engaged. They have provided feedback on the modelling process and outputs from the modelling process, which have been taken on board throughout the model development process.

3.2 Base Year Model Development

Model Area

3.2.1 The HHM covers the entire Horsham District, along with some additional network in the immediate surrounding area, including the M23/A23 Strategic Road Network, which is managed by National Highways and any areas outside of Horsham, but within the model area. The model will be able to provide additional Local Plan flows in neighbouring areas. The model area is shown in Figure 3.1.

[5] https://saturnsoftware2.co.uk/

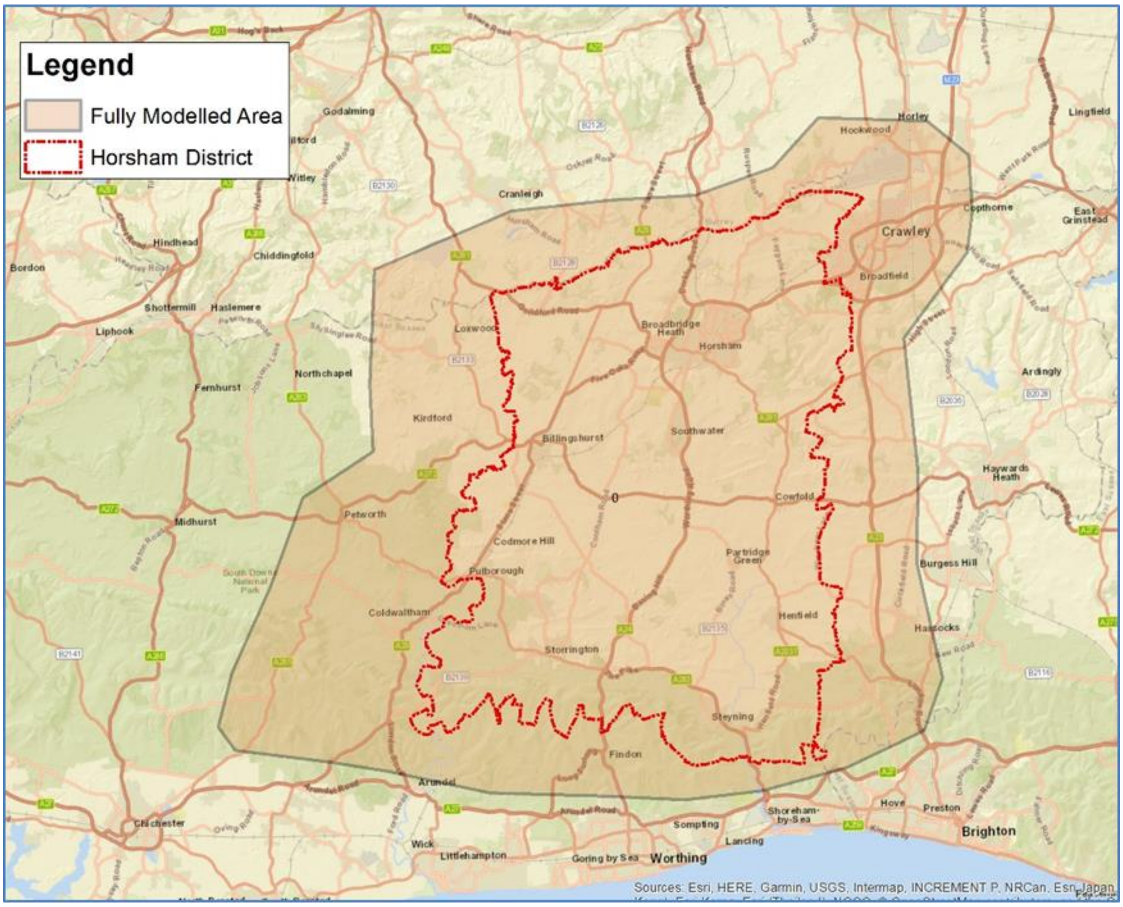


Figure 3-1: Horsham Highway Model Area

Data

3.2.2 In order to develop the model a lot of data is required. This is used to develop the trip matrices. This includes existing and newly collected data. The types of existing and new collected data comprise:

- Automatic Traffic Counts (ATC)
- Manual Classified Turning Counts (MCTC)
- Journey Time data
- Mobile network data for matrix building
- Traffic Signal Data

3.2.3 More detail and analysis of the data that has been used in developing the HHM is reported in the Horsham Transport Study, Horsham Transport Model Data Report, Stantec, (29/06/2020). This report is attached as Appendix A.

Model Development and Validation - Overview

3.2.4 An overview of the model build process is provided below. More technical detail on the model development and the model validation is provided within the Horsham Transport Study, Local Model Validation Report, Stantec, (29/06/2020), which is attached as Appendix B.

3.2.5 The model is made up of a highway network (supply) and a matrix of trips (demand). In broad terms the network is made up of a series of junctions (known as nodes) and sections of road between junctions (known as links) and represents the roads and junctions within the study area shown in figure 3.1.

3.2.6 The model has been developed with a base year of 2019 as the majority of the data used in the model development was collected in May 2019. This also represents the start of the emerging Local Plan period.

3.2.7 Models have been developed to reflect the worst traffic conditions on a typical weekday. This would represent a period during school term time and avoid large scale events or periods within the year, where traffic conditions may not be typical i.e. Christmas. No weekend modelling has been undertaken. Two weekday time periods have been represented within the model:

- AM Peak hour (0800-0900).
- PM Peak hour (1700-1800).

3.2.8 The peak hours modelled were confirmed using count data.

3.2.9 The following vehicle types have been included within the model:

- Car;
- Light Goods Vehicles; and
- Heavy Goods Vehicles.

3.2.10 Vehicle trips are further classified by travel or trip purpose resulting in five user classes in the model:

- Car Commuting (CarCom)
- Car Other (CarOth)
- Car Employer Business (CarEB)
- Light Goods Vehicles (LGV);
- Heavy Goods Vehicles.

3.2.11 The model area is split into a number of zones and a matrix is developed to represent all trips between each of these zones, using the mobile network data as a starting point. The zones are generally based on census geography as this simplifies the use of available data including existing and future population data available from the Office for National Statistics. Within the main study area, zones are smaller, with larger zones further away from the study area. Figure 3.2 shows the zoning in Horsham District and Figure 3.3 shows the wider zoning. Several zones have been further disaggregated in order to provide refined geographically constraint to zone loading choice, i.e., the initial Lower Super Output Areas (LSOA's)[6] were judged too large and zone loading was judged too geographically coarse. This is particularly the case in built up areas, such as Horsham.

[6] Office for National Statistics reports data and statistics in the UK at different levels, which includes Output Areas. Lower Super Output Areas are the lowest level (smallest areas) that the data is broken down into. The next level is Middle Super Output Areas (MSOA's)

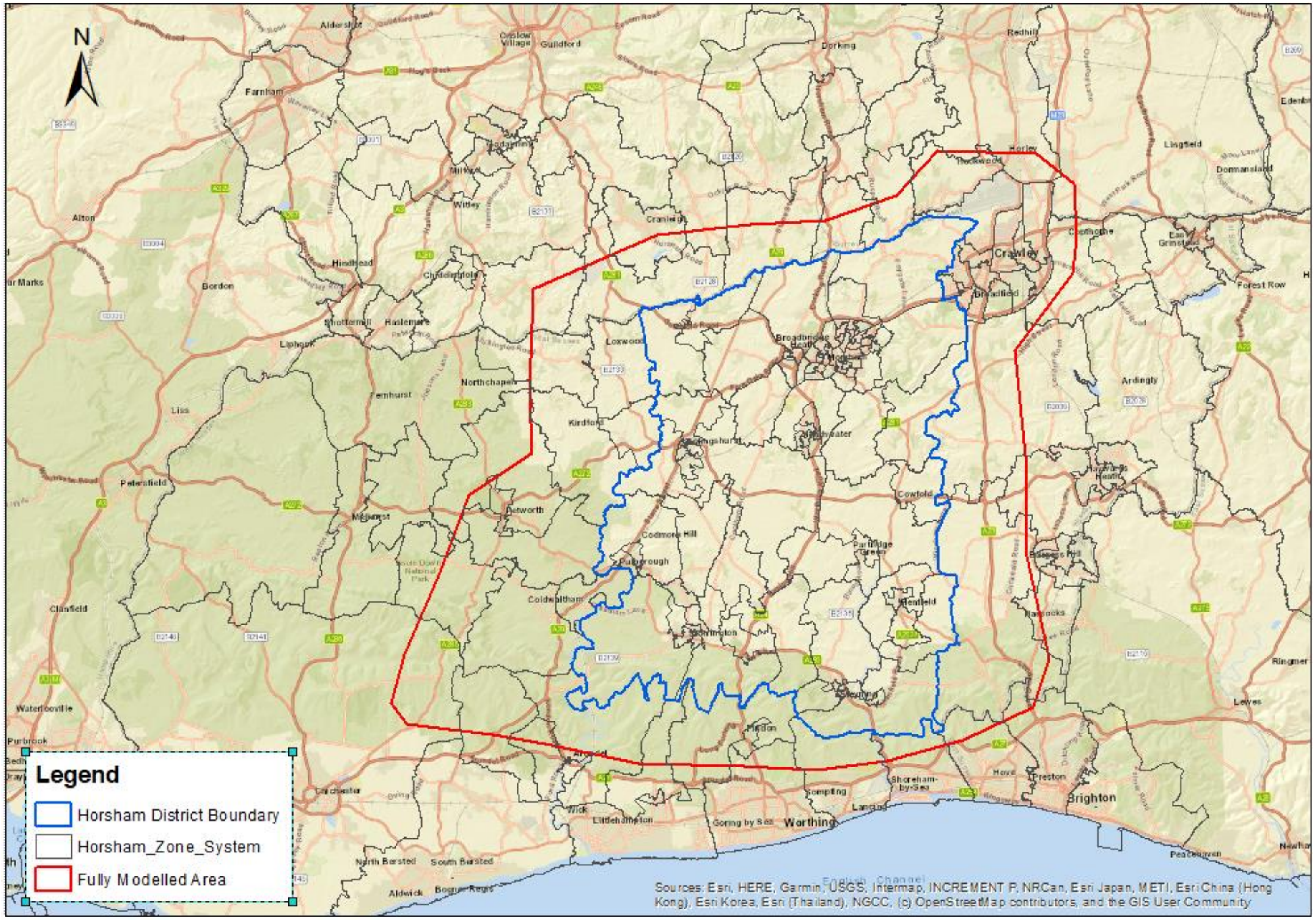


Figure 3-2: Horsham District Zones

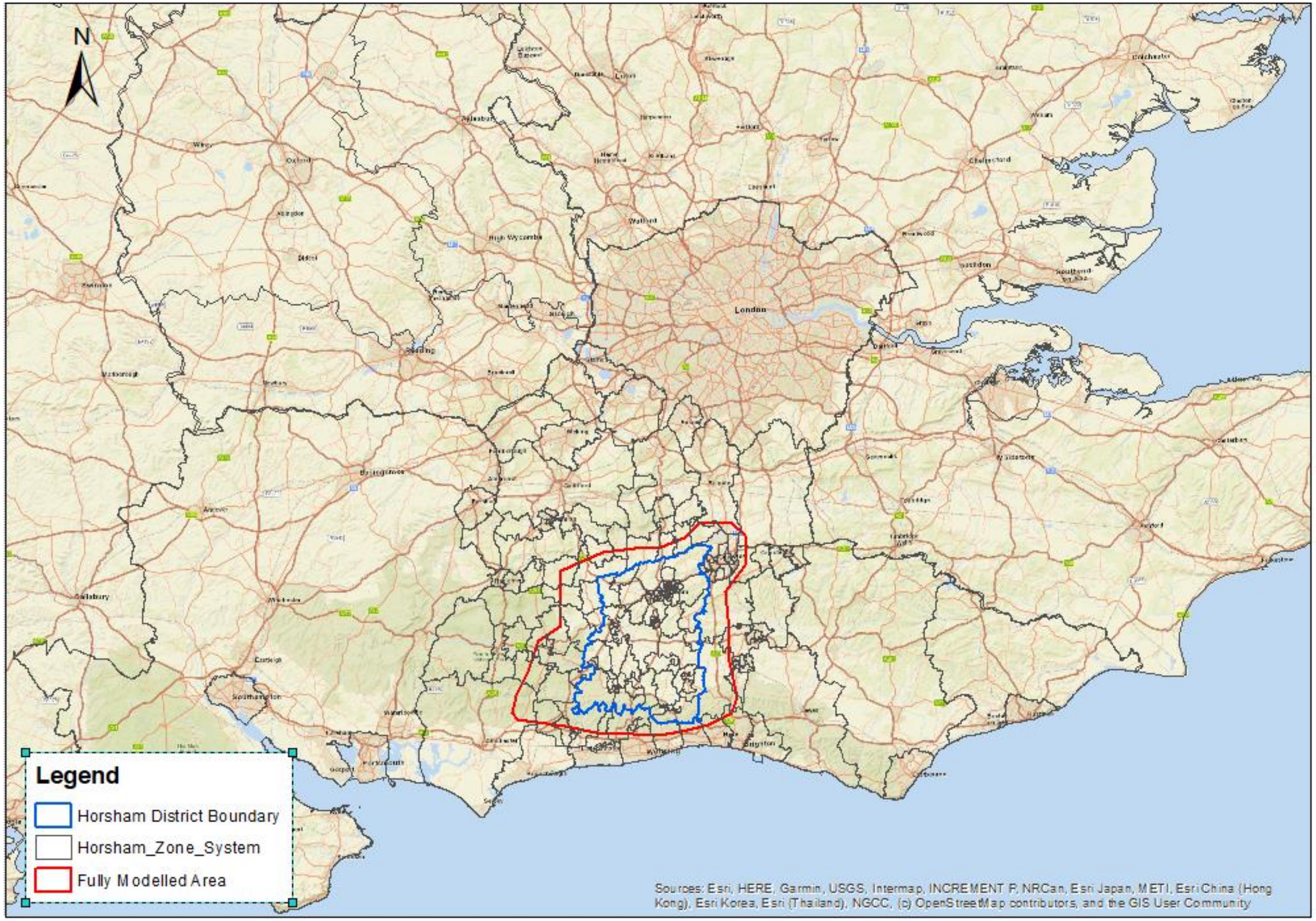


Figure 3-3: Wider Area Model Zones

3.2.12 Zones are connected to the network using a series of connectors, otherwise known as zone centroid connectors, which reflect points where trips from a zone are loaded on to the network. The trip matrix is then assigned to the network.

3.2.13 Once the trips are assigned to the network a process of calibration and validation is undertaken. The process for this follows best practice and guidance produced by Department for Transport, known as Transport Appraisal Guidance (TAG).

3.2.14 The criteria of achieving an adequate replication or validation of traffic conditions for the base year model are provided within TAG Unit M3.1[7]. In addition to validation, model convergence is important. This demonstrates the stability of a model, such that the model reaches a point of relative equilibrium between changes in cost of travel and changes in trip route choice (assignment).

3.2.15 As reported within the Local Model Validation Report, the model is shown to be adequately validated when comparing the modelled flows and journey times against observed data. The model is also shown to converge within the relevant criteria provided within the TAG guidance. The base year model development process and validation have been agreed with West Sussex County Council and National Highways and is therefore deemed suitable for undertaking the testing of the Local Plan Scenarios.

3.3 Reference Case Forecast Model Development

3.3.1 This section provides an overview to the development of the Reference Case Models. The technical detail for development of the Reference Case Models is provided with Horsham Transport Study, Model Forecast Report, Stantec, June 2020, which is attached as Appendix C. The methodology used for developing the forecast models was agreed with West Sussex County Council and National Highways.

3.3.2 The technical detail pertained to the development of the 2036 model is covered within the Horsham Highway Model Forecast Report (Appendix C), however the same methodology has been applied to the updated 2039 model. Further information relating to the updated Reference Case can be found within the addendum to Appendix C.

3.3.3 In order to inform the Local Plan Review transport evidence base, Reference Case models have been produced to represent a forecast year of 2039. These take into account committed growth in Horsham up to 2039, committed growth in neighbouring authorities and background growth.

3.3.4 Traffic growth has been applied to the validated Base Year Model to account for forecast changes in traffic demand that is projected to occur regardless of the additional development now being considered as part of the Local Plan scenario testing.

3.3.5 The Reference Case Forecasting is set out by establishing predicted changes between the base year model and a future year scenario or conditions. In order to establish robust traffic forecasts the Reference case model has been developed in accordance with DfT TAG forecasting guidance. The guidance helps limit and define uncertainty around assumptions and traffic growth forecasts that feed into the reference case. This includes guidance on the development of an uncertainty log which summarises all known assumptions that feed into the model and the level of certainty of each assumption. Also, DfT TAG provides guidance on the application of background growth assumptions stemming from the National Trip End Model (NTEM).

3.3.6 The Reference Case model is used as the basis of comparison with emerging Local Plan scenarios and will inform the transport mitigation that would be required to deliver the Local Plan growth in transport terms. The Reference Case therefore includes all growth up to 2039

7 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/427124/webtag-tag-unit-m3-1-highway-assignment-modelling.pdf

which results from development in neighbouring authorities and growth in Horsham District, excluding likely growth associated with emerging Local Plan. The Reference Case presents a picture of highway conditions, prior to the addition of the emerging Local Plan developments. The growth included within the Reference Case model is described below. Full details of the developments included within the Reference Case are provided in Appendix D.

3.3.7 Information feeding into the reference case assumptions includes data (housing numbers, employment size) on developments and highway infrastructure schemes that are either committed through the planning system or have a high probability that the outcome will happen as they are within adopted Local Plans or within Neighbourhood Plans, and trip rates associated with new developments.

3.3.8 The trip rates are used to derive the number of trips which each development included will produce. These are represented by trips to and from developments and are included within the model at a zonal level. Trips rates are derived for different land use types, and these are shown in Tables 3-1. These are derived from TRICS, which is an industry standard tool used for such purposes. The derivation of the trip rates is provided within Appendix E.

Table 3-1: Trips Rates

Land Use	AM Peak (0800-0900)			PM Peak (0800-0900)		
	In	Out	Total	In	Out	Total
Residential (Trips per Household)	0.172	0.405	0.577	0.355	0.155	0.51
Business (B1) (Trips per 100sqm)	1.534	0.159	1.693	0.168	1.296	1.464
Storage or Distribution (B8) (Trips per 100sqm)	0.074	0.059	0.133	0.044	0.092	0.136

3.3.9 The trip rates used have also been reviewed against trip rates used within the transport assessments undertaken for Land North of Rectory Lane (Ashington), West of Southwater (first phase) and Land South of Marringden, Billingshurst and the trip rates are shown to be consistent.

3.3.10 Due to the limited data available of internalisation rates for large mixed land use "garden village" type sites within the TRICS database, the recently approved North Horsham 'Mowbray' development has been used to inform a level of internalisation. The study concluded an internalisation car trip reduction rate of 12%. The manual calculation of internalisation is deemed acceptable and the rate of internalisation of 12% is deemed to be a conservative (i.e. worst-case) estimate.

3.3.11 As each of the strategic sites are expected to have an element of employment, as well as housing and ancillary land uses (education, local shops, etc), it is felt that applying the 12% internalisation rate to all Local Plan strategic sites is appropriate.

3.3.12 Trips from committed development sites have been distributed between zones based on existing zones within the model. This is standard practice and assumes that trip making patterns for new developments will be similar to existing trip making patterns.

3.3.13 As well as incorporating any committed development within the Horsham district into the reference case scenario, further committed developments within neighbouring authorities are also included. Developments within neighbouring authorities have been reviewed at a case-by-case basis and have only been included if assumed to have a perceptible impact to the Horsham highway network. Only developments of 20 or more dwellings are included explicitly, both within Horsham and in neighbouring authorities.

3.3.14 In addition, background growth assumptions have been applied to neighbouring authorities through growth rates. These growth rates are derived from national assumptions providing background growth in travel demand, produced by the DfT through the National Trip End Model (NTEM) dataset and extracted using the DfT TEMPro software. This dataset provides growth rates for any given year, based on housing growth, increases in job numbers and demographic changes at a District/Borough level and is a recognised source of data for the purposes of producing forecast transport models of this nature. In essence, any known committed developments, plus adopted Local Plan developments are included in neighbouring authorities. The growth is then compared to NTEM, within these areas and any additional growth then added on top, such that the growth matches that included within NTEM.

3.3.15 Adjusted NTEM Background growth rates are applied on top of committed developments in neighbouring authority areas. The adjusted NTEM background growth rates take into consideration projected NTEM growth rates for the forecast year of 2039 and subtract growth already applied through individual committed sites input within the model forecasts, so that the entire growth within neighbouring authorities matches with NTEM forecast figures.

3.3.16 Within Horsham, NTEM growth assumptions are not used. The exemption of any NTEM background growth within Horsham is due to NTEM assumptions being superseded by the greater detailed understanding of the districts committed developments and the function of the Local Plan to deliver forecast housing and employment in comparison to assumptions from growth assumptions derived from NTEM.

3.3.17 A summary of the approach to infilling committed development and adjusting NTEM background growth forecasting is highlighted within Tables 3-2 to 3-4.

3.3.18 The adjusted NTEM rates noted within the tables below applies to neighbouring authorities where committed developments have been applied, as such the adjustment takes into consideration the specific committed development forming part of the projected NTEM growth totals and is adjusted in order to balance and constrain total growth within a Local Authority to projected NTEM forecasts. Commitments have been included where data was available from neighbouring authorities, and they are deemed to have an impact on traffic within the study area. This does not apply within Horsham as stated above, forecast growth is covered through the Local Plan Development and windfall allocations.

3.3.19 It is acknowledged that a small number of commitments from neighbouring authorities have not been picked up, however this is not considered a significant factor given projected NTEM growth will make up for this.

Table 3-2: Reference Case Forecasting Assumptions

Zone Type	Committed Developments	NTEM Derived Background Growth
Horsham District Zones	✓	×
Neighbouring Authority Zones	✓	✓

Table 3-3: NTEM Dwellings Forecast Adjustment

Households						
Authority	NTEM 2019	NTEM 2039	Projected NTEM Growth	Committed Development Total (Dwellings)	Adjust/Not Adjust NTEM	Adjusted NTEM
Adur	29,269	32,044	2,775	-	No Adjustment	-
Arun	73,413	86,431	13,019	3,089	Adjust	83,342
Chichester	55,324	66,325	11,001		No Adjustment	-
Crawley	46,177	51,573	5,396	3,753	Adjust	47,820
Horsham	62,459	77,243	14,784	6,641	Not Applied	-
Mid Sussex	64,326	78,728	14,402	10,295	Adjust	68,433
Worthing	50,200	55,237	5,037	-	No Adjustment	-

Table 3-4: TEMPro Jobs Forecast Adjustment

Employment (Jobs)					
Authority	NTEM 2019	NTEM 2039	Projected NTEM Growth	Committed Employment (Jobs)	Adjust/Not Adjust/Do not Use NTEM
Adur	26,625	28,177	1,552	-	No Adjustment
Arun	59,368	62,901	3,533	-	No Adjustment
Chichester	73,832	78,205	4,373	-	No Adjustment
Crawley	95,326	100,882	5,556	-	No Adjustment
Horsham	67,348	71,267	3,919	6,641	Not Applied
Mid Sussex	72,794	77,081	4,287	-	No Adjustment
Worthing	59,459	62,992	3,533	-	No Adjustment

3.3.20 Another approach would be to use neighbouring authority Local Plans and Development Plan Documents to underpin the total forecast growth from all neighbouring authorities. However, as Local Plan periods differ from authority to authority, and as there is a level of uncertainty regarding employment projections obtained from local plans, there is an overall level of uncertainty in discerning whether neighbouring local plans diverge or not from NTEM, therefore it has been assumed that adjusted NTEM figures, in combination with selected developments, provide a robust approach for background growth forecasting over assumptions from local plans with varying plan periods.

3.4 Committed Highway Schemes

3.4.1 The following highway schemes have been included within the Reference Case Models:

- A24 Great Daux Roundabout (Horsham)/
- A24 Robin Hood Roundabout (Horsham)
- A281 Newbridge Roundabout, Broadbridge Heath (Horsham)
- Horsham Enterprise Park Access (Horsham)
- A23 / A2220 Cheals Roundabout (Crawley)
- A29 / Brinsbury Fields access, Adversane (Horsham)
- New Road, East Billingshurst (Horsham)
- North Horsham Development Committed Infrastructure (Horsham)
- A2011 Crawley Avenue / A2004 Northgate Avenue / Hazelwick Avenue Proposed Improvements (Crawley)
- Fleming Way / Gatwick Road Roundabout (Crawley)
- Ifield Avenue / Ifield Drive (Crawley)
- M23 Smart Motorway and J11 improvements (Crawley)
- A264 / Calvert Link, Kilnwood Vale Main Access (Crawley)
- A2300 Dualling (Mid Sussex)
- M23 J10 Copthorne Interchange (Mid Sussex)
- A264 Copthorne Way roundabout development access (Mid Sussex)
- B2114 Brighton Road Pease Pottage (Mid Sussex)
- Access improvements at A2037 Henfield Road
- A283/B2135/Horsham Road, Steyning
- A23 Bolney Slip Rd / A272 Cowfold Road Improvements (Mid Sussex)

3.4.2 The A27 Arundel bypass is not included, as the scheme is outside the detailed model area.

3.5 Local Plan Scenario Modelling

3.5.1 The model performance is again demonstrated by the level of model convergence. It can be confirmed that model performance is acceptable, with model converging to acceptable criteria as set within DfT guidance. As such impacts of congestion and re-routing through the iterative model convergence process is stable and therefore can be concluded to be rational. The convergence statistics can be found within Appendix C - Horsham Forecast Report 2039 Update Addendum.

3.6 Local Plan Scenario Modelling

3.6.1 Each Local Plan site has its own zone within the model and zone loading added, such that traffic is assigned on to the network appropriately. The zone loading has been agreed with WSCC.

3.6.2 As with the Reference Case developments, trip rates for Local Plan sites utilises TRICS. The same rates have been used as provided in Table 3-1. TRICS was reviewed to understand the differences in trip generation characteristics between each location type. From this review and edge of town data was deemed to be the most appropriate in the context of the Local Plan modelling. TRICS does not include data for standalone residential sites and therefore these edge of town sites were also deemed as the most appropriate rates for the strategic sites modelled. Further reduction in trips will be applied for trip internalisation and when sustainable transport mitigation is considered later in the study.

3.6.3 Where there are large strategic sites which include both residential and employment allocations, trip internalisation has been considered and a reduction in trips has been applied of 12%, which is consistent with the reduction agreed as part of the planning application for North Horsham development, which is included as a committed development. The use of the North Horsham site was previously discussed in paragraph 3.3.10. This reduction is applied at this early stage and is deemed to reflect the fact that some trips which may normally go off site would be made solely on site e.g. education trips where it would be expected that schools would be provided and some employment trips, where the strategic sites would include a level of employment.

3.6.4 Trip distribution has been applied utilising existing zones with a similar land use, close to the Local Plan development sites. The zones used for this process are tabulated in Appendix F.

3.6.5 At this stage, no changes were made to the highway network, apart from any essential infrastructure associated with developments e.g. a new access road into the site. The essential infrastructure has been agreed with HDC and WSCC.

4 Application of Sustainable Mitigation Measures

4.1 Overview

4.1.1 This chapter provides an overview of the methodology for modelling the impact of sustainable travel measures and strategies used within the “With Mitigation” scenario testing for the Preferred Local Plan scenario.

4.1.2 Mitigation considerations are formed by sustainable transport measures, as well as physical highway mitigation. The mitigation measures aim to ensure that the positive impacts of developments in Horsham are not undermined by adverse impacts arising from additional traffic.

4.1.3 The primary focus is on reducing the need to travel in the first place, prioritising sustainable transport and ensuring the effective and efficient operation of the Horsham transport network.

4.1.4 The initial strategic transport modelling forecasting of the strategic developments have been carried out based on DfT assumptions about vehicle trip growth in the future (NTEM) and strategic development trip rate assumptions based on available observed information stemming from the TRICS database, as detailed in Section 3. The outputs at that stage accounted for a 12% internalisation reduction factor which was applied to the strategic development mixed used sites, where there is expected to be a mix of housing, employment, schools and other local services, which would reduce the need to travel out of the immediate site. The internalisation rate is based on previous evidence gathered for the North Horsham development. The internalisation rate is also in line with that seen in TRICS for a mixed-use site located at Camborne to the west of Cambridge (noting that this is the only mixed-use site with data available within TRICS database).

4.1.5 Beyond this, further reductions have been applied to account for sustainable transport measures which may have an impact on trips outside of the development sites and the methodology set out below is based on a recognised approach, using empirical evidence form Department for Transport (DfT) studies and has been used by Stantec for similar Local Plan Transport Modelling projects for Chichester District Council and Brentwood Borough Council. This approach has also been agreed with National Highways in both instances. The sustainable travel measures align with any emerging schemes and approaches that appear within the Infrastructure Delivery Plan or are being promoted by specific site developers.

4.1.6 A final step has been undertaken at a site-by-site basis to include further trip reductions aligned with specific measures, associated with individual strategic sites.

4.1.7 Whilst there is an ambition to minimise travel outside the site through internalisation of trips and maximise sustainable modes, there is also a need to have a realistic level of trip reduction, which can be applied. The approach set out is felt to be a pragmatic and proportionate approach, given the level of uncertainty as to what sustainable mitigation could be introduced at each site and the level of reduction that could realistically be achieved.

4.1.8 Within the context of the modelling, the trip reduction process is undertaken manually, and the approach set out below provides conservative estimates, which will not account for the potential impacts of more ambitious measures that may be promoted by site developers.

4.2 Sustainable Transport Measures

4.2.1 The clear aim of a sustainable transport strategy is to promote and encourage more sustainable ways for people to move and to reduce the need for trips to be made by the private car. This will involve a mixture of hard (i.e. physical) measures and infrastructure such as improved public transport, cycling and walking facilities which link the Local Plan sites to key destinations. There will also be a need to reduce the need to travel by providing sustainable communities, which offer residents places to work, educate their children and to utilise other facilities including shops, leisure and health facilities where applicable. These measures would be supported by softer measures, comprising packages including personal travel planning, travel awareness campaigns, cycling and walking promotion, public transport information and marketing, school travel planning, workplace travel planning and the development of a strong brand identity.

4.2.2 Research published by the DfT demonstrates that there is a benefit from implementing Travel Plans and sustainable travel measures to achieve a mode shift from car use. This includes the following research:

- 'Making Personal Travel Plans Work' (DfT, 2007) – this reports a reduction in single occupancy vehicle trips of 12% across 12 DfT areas following to implementation of Personalised Travel Planning
- 'Smarter Choices – Changing the Way We Travel' (DfT, 2005) reports a reduction of between 5% and 9% in single occupancy vehicle trips in non-urban areas for commuting journeys following the implementation of a Workplace Travel Plan. The sites considered in this research included a wide range of employers in differing locations implementing a variety of measures.
- The report on "The Effects of Smarter Choice Programmes in the Sustainable Travel Towns": Full Report (Sloman et al., 2010)

4.2.3 Some of the headline results from "The Effects of Smarter Choice Programmes in the Sustainable Travel Towns" report include:

- Car driver trips per resident of the three towns taken together fell by 9% between 2004 and 2008.
- Car driver distance per resident fell by 5% to 7% (for trips of 50km or less). Car use per head also fell nationally in comparable (medium-sized) urban areas during this period, but by a much smaller amount: a change of -1.2% for car driver trips and -0.9% for car driver distance.
- Overall reductions in car traffic (based on counts) of the order of 2%, and more substantial reductions in inner areas, of the order of 7 to 8% overall.
- Bus use grew substantially in Peterborough and Worcester during the period of the Sustainable Travel Town work, whereas it declined in Darlington. Bus trips per resident of the three towns taken together increased by 10% to 20% (for trips of 50km or over) whereas there was a national decline of bus trips in medium-sized towns of 0.5% over the same period.
- There were positive results for cycling in all three towns, with particularly substantial growth in Darlington. Cycle trips per resident of the three towns taken together increased by 26 to 30%, whereas, according to the National Travel Survey, there was a national decline of cycle trips in medium-sized towns over an approximately similar period.
- Walking trips by residents grew in all three towns during the period of the Sustainable Travel Town work. Walk trips per resident of the three towns taken together increased by 10% to 13%, whereas, according to the National Travel Survey, there was a national decline in walk trips in medium-sized towns of at least 9% over an approximately similar period.
- The growth in bus use, cycling and walking cannot be explained by trip generation. In fact, at the aggregate level, the total number of trips per capita by all modes, as recorded in household surveys, fell by 1.1%

4.2.4 Although the largest behaviour changes were seen in short car driver trips, the largest reductions in distance travelled as a car driver came from medium and longer distance trips.

Of the reduction in distance travelled for trips of <50km, about 45% of the reduction in car driver kilometres came from trips of 10 to 50km; about 40% from trips of 3 to 10km; and about 15% from trips of less than 3km. Table 4-1: shows the car trip reductions by distance from the Sustainable Travel Towns study.

Table 4-1: Trip Reductions Applied to Local Plan Sites

	Up to 1km	**1.1 – 3km**	**3.1 – 5km**	**5.1 – 10km**	**10.1 – 50km**	**Over 50km**	**Total**
Car Trip Reduction	-22%	-14%	-10%	-6%	-3%	0%	-9%

4.2.5 The above evidence indicates that through a targeted approach to promoting and providing sustainable travel options, a reduction in distance travelled by car can be achieved.

4.2.6 To meet the requirements of NPPF and to be consistent with the guidance for Local Plans, the emphasis needs to be on sustainable transport and its foundation. The Local Plan offers up this opportunity within Horsham to provide a comprehensive sustainable transport strategy, aligned with growth, which will provide greater opportunities for all and move away from the emphasis being on physical highway mitigation, which is shown to only provide a short-term solution if nothing else is done.

4.2.7 The principles of sustainable travel have been applied through the use of the Sustainable Travel Towns study. It is noted that in the case of the sites within Horsham District, many of these are more rural in nature than the towns within the Sustainable Travel Towns and the level of trip reduction for off-site trips would be expected to be lower. The off-site trips from these sites within the model will be more focused on longer distance trips (as people will need to travel further for jobs, facilities etc. that are off-site), therefore applying the reductions at the distance-based level will mean that trip reductions will be relatively low.

4.2.8 The application of the distanced based reductions will reflect the nature of the site location. The proportion of short distance trips for edge of town and urban sites in comparison to sites which are more rural and further away from larger centres of employment or population will be shown to have a greater reduction within the model, as residents from edge of town and urban site areas will have, for example, more employment locations which are reasonably close by, whereas a more rural destination, commuters would have to travel further. As such it can be expected that the model will reflect the greater car trip reduction impact for urban and edge of town sites in comparison to more rural sites. By the very nature of being closer to existing facilities, sites located on the edge of existing settlement would be expected to have more short distance trips, as they will have more facilities and attractions closer by and this would be reflected within the model for these sites and the trip making patterns, when compared to the more rural sites.

4.2.9 Given the nature and location of the Strategic Sites within Horsham and the zone structure of the model, there are few short distance trips within the trip matrix and therefore reductions are small, however, this is off set for shorter distance trips by the previous reductions made to reflect trip internalisation. This confirms that there is not an element of double counting of reduction in these short distance trips.

4.2.10 Once the reductions have been made to the model, sense checks have been undertaken to analyse the variance in impacts and an exercise to cross reference the reduction with available information sent through from site promoters regarding expected mode share and mode shift will be undertaken. This will confirm that the reduction of car trips is realistic and acceptable prior to consideration of physical highway mitigation.

4.3 Site Specific Sustainable Transport Considerations

4.3.1 In addition to the sustainable transport measures outlined above, further physical site-specific mitigation measures have been discussed and agreed in principle with WSCC. Ideas have been set out below and these have been considered for each of the Horsham LP strategic sites. The ideas are used to inform a level of car trip reduction in addition to the internalisation and the sustainable measures outlined previously.

4.3.2 The sustainable measures outlined previously include the following:

- 12% internalisation reduction

- Distance based trip reduction outline in Section 4.2 and Table 4.1

4.3.3 Further information of sustainable measures and potential reductions is summarised below. The level of reduction applied on a site-specific basis within the modelling is discussed in Section 4.4. The schemes highlighted below would be expected to be delivered as part of site-specific measures, in order to meet trip reduction targets.

4.3.4 The site-specific measures demonstrate the level of ambition put forward by site promoters and aspirations of WSCC to promote more sustainable means of travel. Some have been listed for specific sites but may be appropriate for more than one strategic location, to help alleviate the traffic impacts and promote more sustainable means of travel.

4.3.5 Examples of typical site-specific proposed mitigation measures that could be expected for individual developments are outlined below. These are to provide an indication of the typical measures that site promoters could bring forward, rather than a definitive list of all measure that would come forward. The measures listed for each site are proposed at this stage and not final solutions to achieve the stated objectives. Further analysis, design, negotiations and feasibility analysis are required including at pre-application and application stage to ensure delivery thereof and achieving the overall performance outcomes.

4.3.6 However, it should be noted that these specific bus measures are not being relied upon for the delivery of the Local Plan mitigation but are instead complementary measures that will help achieve sustainable mode share in the longer term.

4.3.7 The proposals are indicative potential schemes that would require further exploration as to their feasibility and prioritisation to take forward in future. This would include getting views from the current bus operator (Metrobus) about which of these would provide the greatest speed, reliability and/or efficiency benefits for their network, with a view to sifting and prioritising the schemes within the list.

East of Billingshurst

- Frequent bus service to Horsham

- Local/personal mobility solutions / "MAAS" – electric buggies/vehicles – travel on demand to/from station and town centre

- Cycleway / footpath network including:
    - Cycle/pedestrian only connection to Broomfield Drive
    - Cycle/pedestrian connection to Brookers Road - employment area + cycle route to Weald School
    - Bus and cycle/pedestrian connection to Daux Rd - employment area and route to rail station
    - Cycle/ped connection to Daux Avenue

Southwater

- Bus frequency improvements to Horsham & Worthing
- Bus priority at A24 Hop Oast including at junction and on approaches
- Traffic calming features in village with bus/cycle bypasses
- Cycle route improvements to Horsham
- Additional bus priority on route into Horsham Town centre/Station from Hop Oast
- Bus priority at Albion Way / Worthing Road roundabout
- Bus Priority at Copnall Way / Piries Place car park
- Improved capacity at Horsham Bus Station
- Improved Interchange facilities at Horsham train station
- Local/personal mobility solutions / "MAAS" in village – electric buggies/pods
- Downs link improvements/ improvements at Christ's Hospital station such as to waiting and cycle parking facilities.
- Contribute to major high capacity and frequency bus priority corridor to Crawley
- Supporting sustainable transport measures including Transport on Demand[8], Shared Transport solutions (e.g. car share schemes), Mobility as a Service (MaaS)[9], Behaviour Change (e.g. working from home), Micromobility (e.g. E-bikes, electric scooters) and Active Travel Solutions

North Horsham Densification

- Expand upon walking / cycling network in North Horsham
- Increase frequency of buses to Horsham and Crawley – 10 mins overall
- Improve cycle/walking links across A264 and into Horsham further – cycle/bus priority at Rusper Rd / A264 junction.
- Improve cycle parking at Horsham station
- Cycle route to Crawley / West of Ifield development
- Modify junctions on A264 North Horsham Bypass.
- Contribute to major high capacity and frequency bus priority corridor scheme Horsham – Crawley & West of Ifield

West of Ifield

- Contribute to major high capacity – BRT bus routes

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[8] Transport on Demand is a mobility offer that is adapted to areas where the demand for shared mobility is sparse, unlike in urban areas e.g. business parks, suburban areas, rural communities or night services.

[9] Mobility as a Service (MaaS) is a term used to describe digital transport service platforms that enable users to access, pay for, and get real-time information on, a range of public and private transport options

- Phase 1 route: into Crawley and on to Manor Royal and Gatwick Airport – via Ifield Station and Three Bridges Station – high frequency and high quality 'Fastway' service
- Phase 2 route: uses the CWLR (Link Road) to Manor Royal and Gatwick Airport in addition to route for phase 1
- Eventual frequencies of both services would be very high (each being 8 minutes of better)

- Bus priority in Crawley
  - Bus only – Rusper Road
  - Bus only provision Ifield Drive to Crawley Avenue
  - Bus priority in the town centre
  - Improvements to bus station
  - Bus priority at Three Bridges station
  - Interchange improvements at Three Bridges

- High quality bus provision throughout CWLR
  - Bus lanes over the entire length
  - High bus priority at all junctions

- High quality bus provision throughout the site
  - High bus priority at all junctions
  - Provision of segregated bus lanes

- Full suite of supporting sustainable transport package including Transport on Demand, Shared Transport solutions, MaaS, Behaviour Change, Micromobility and Active Travel Solutions (including an extensive e-bike hire scheme)

A264 Horsham to Crawley Bus Priority Measures

4.3.8 A number of the site promoters have indicated the need for improving bus services between Horsham and Crawley, in order to provide more attractive alternatives to the private car.

4.3.9 This would include provision of bus priority at Moorhead and Faygate roundabouts, in order to improve journey times and bus reliability on this section of the corridor. The modelling indicates the following level of delay at Moorhead Roundabout in the 'With Development' Model:

AM Peak

- B2195 NB approach – 43 secs delay
- A264 EB approach – 11 secs delay
- A264 WB approach – 12 secs delay

PM Peak

- B2195 NB approach – 43 secs delay
- A264 EB approach – 12 secs delay
- A264 WB approach – 67 secs delay

4.3.10 At Faygate, the A264 approaches to the roundabout could be widened to provide a bus lane. A bus pre-signal would then be provided to allow buses to return to the general carriageway prior to entering the roundabout. This would alleviate any need for widening the carriageway on the roundabout.

4.3.11 At Moorhead, buses could utilise Old Crawley Road. This would require a new traffic signal at the eastern end to allow buses to turn right on to the A264 heading towards Crawley. The signal would be vehicle activated, only allowing buses to make this turn. There may be a need to widen the carriageway at the western end to provide an improved right turn ghost island for buses (and general vehicles) to turn right from Crawley Road.

4.4 Reduction in Car Trips

4.4.1 In terms of modelling, each of the measures above is not explicitly modelled, however these have been used to inform a site-specific level of reduction in trips based on categorising the sustainable mitigation of each development into low, medium or high impact as referenced in Table 4.2.

4.4.2 The measures outlined above and the estimated percentage car trip reduction rate as a result of these measures, applied only to targeted routes (or specific origin and destination movements in the context of the modelling), are summarised within the table below. For the purposes of the modelling, the lower range of the rates has been used, the reduction rates are therefore based on a conservative estimate as to not overestimate car trip reduction and mode shift. This is applied on top of the trip internalisation and application of reduction due to soft measures, as previously discussed.

Table 4-2: Site Specific Mitigation Car Trip Reduction

Development	Estimated % car trip reduction	End Destination Reduction
East of Billingshurst	Low % car trip reduction (4%)	Horsham Town Centre
Southwater	Medium / high % car trip reduction – 7% to 10%	Horsham Town Centre & Worthing
North Horsham Densification	Medium % car trip reduction - Overall 5% to 7%	Horsham Town Centre, Crawley Town Centre
West of Ifield	Very high % car trip reduction – 12% to 15%	Crawley Town Centre

4.4.3 Based on the current distribution of the models, car trip reduction factors are applied through a two-tiered approach.

4.4.4 Firstly, origin and destination movements within the model between the strategic site and main centres which are expected to benefit from the specific bus priority measures have been selectivity targeted and factored down, using the lower figure for car trip reduction percentage estimate highlighted within the table above (lower band used in order to test the a 'conservative case' scenario of the mitigation impacts). For example, trips from West of Ifield, with destinations in Crawley town centre will be reduced by 12%, whilst this reduction would not be applied to trips that have destinations further afield and would not be expected to benefit from the specific measures.

4.4.5 The second stage of car trip reduction will apply further reduction based on the travel distance banding brought about by the sustainable travel measure highlighted previously in Table 4-1.

4.4.6 Table 4-3 highlights the Inbound and Outbound total percentage reduction of vehicle trips to/from each site as a result of applying all the sustainable mitigation measures. This is a further reduction on trips once the internalisation factor of 12% has been applied.

Table 4-3: Development Trip Total Reduction from Sustainable Measures

	AM		PM	
Development	**Outbound**	**Inbound**	**Outbound**	**Inbound**
West of Ifield	8%	7%	6%	9%
Southwater	6%	7%	7%	8%
Billingshurst	4%	5%	5%	6%
North Horsham	8%	7%	6%	9%

4.4.7 As the percentage totals are relatively small and the distribution of trips from the sites relatively widely dispersed, the sustainable mitigation measures bring about small reductions to Volume over Capacity ratios of the worst performing junctions.

4.4.8 The largest reduction is seen from the West of Ifield site due to the trips within the zone having a shorter trip distance (predominately to and from Crawley). This compares with the smaller reduction of trips at other more rural locations.

4.4.9 The proportion of reduction at each individual site is deemed to provide an accurate representation of each sites constraints in delivering sustainable mitigations.

5 Local Plan Scenario Outputs

5.1 Introduction

5.1.1 This section sets out the results of the modelling exercise, providing outputs for the preferred scenario and comparing the outputs against the Reference Case, thus informing the impact of the Local Plan developments on the highway network.

5.1.2 The outputs provide a summary of the Local Plan scenario with sustainable mitigation already in place and thus providing the trip rate reduction mentioned in Chapter 4, with shorter distance trips and site-specific origin to destination car trips being reduced.

5.2 Modelled Outputs

5.2.1 A set of data and key performance indicators (KPIs) have been produced from the highway model, which enable easy and direct comparisons for each option. They will also outline which junctions require mitigation as a result of the additional traffic the Local Plan development sites produce.

5.2.2 The highway modelling outputs include:

- Plots showing flow changes within the network, comparing the preferred scenario with the Reference Case.
- Plots and tables showing junctions which are shown to be over capacity and where the newly generated traffic from the Local Plan sites is shown to have a detrimental impact.

5.2.3 The junction capacity analysis has formed the main basis for identification of the impact of the Local Plan and to inform potential mitigation requirements at this stage of the study.

Traffic Flow Changes

5.2.4 Traffic flow comparisons between the Reference Case and the preferred scenario are provided within Appendix G. These show where large increases in flows are seen on the network, resulting from the new developments.

5.2.5 The flow plots indicate that the largest changes in flows are, as expected, close to the larger strategic sites tested and these become more dispersed the further away from these you get.

5.2.6 As would be expected the largest flow increases are seen on the A264 and A24 around Horsham, including the A24 to the north heading into Surrey, as well as on the A272, A23 and roads on the western side of Crawley.

5.2.7 Some flow decreases are seen on the A264 between Crawley and Horsham as a result of the Local Plan development causing congestion at some of the junctions, in particular the A264/B2195 roundabout. As a result, traffic is diverting to use Forest Road, as a result of congestion close to Horsham at junctions on the A264. Similarly, high levels of background growth are influencing traffic and route choice on the A23.

Changes in Delay

5.2.8 Changes in delays on links between the Reference Case and the preferred scenario are provided within Appendix H. These show where large increases in flows are seen on the network, resulting from the new developments.

5.2.9 The plots show locations where there are increases in delays of more than 30 seconds per vehicle on average in the modelled peak hour.

5.2.10 In all scenarios, there are junctions to the south of Horsham where delay increases are seen. This includes the A24/B2237 Hop Oast roundabout and A281/Kerves Lane junction.

5.2.11 In Horsham itself, delay increases are seen on the Wimblehurst Road approach to North Parade and the North Street/Hurst Road junction in all scenarios.

5.2.12 To the north of Horsham, delay increases are seen on the A264/B2195 Moorhead roundabout and on the Tower Road approach to the A264 in all scenarios.

5.2.13 To the south of the district delays are seen on a number of approaches to the A24/A272 Buck Barn junction and the A24/A283 Washington Roundabout.

Over Capacity Junctions

5.2.14 The outputs of the modelling exercise have been reviewed to determine which junctions are shown to be over capacity and where a Local Plan scenario has a significant impact on the capacity at the junction.

5.2.15 The measure used to assess this is the volume to capacity ratio or V/C. This effectively indicates how arms on junctions are performing based on the flows predicted in the model and the modelled capacity of each arm at a junction. When a junction goes over capacity, there will be increases in delays experienced by travellers as flows increase. Therefore, if Local Plan development increases the flows, this will exacerbate any existing issues or lead to new issues of excessive delays at a junction.

5.2.16 Tables 5-1 to 5-2 provide the V/C outputs at junctions for the AM and Tables 5-4 to 5-5 provide the V/C outputs for the PM peak for junctions within Horsham District. Tables 5-3 and 5-6 provide the V/C outputs for junctions in Crawley Borough for the AM and PM respectively.

5.2.17 The Local Plan scenario includes the car trip rate reduction based upon the site-specific sustainable transport considerations and the sustainable transport measures outlined in section 4 and table 4.3.

5.2.18 Due to the iterative process of scenario testing, the numbering of the junctions was established at an early stage using a chronological order of the worst V/C hotspots being numbered first. As the iterative process of scenario testing evolved some of the junctions did not show up to be performing badly and therefore are omitted from the table.

5.2.19 The figures in the tables are shown as percentages. A V/C of 100% indicates that an arm at a junction is at capacity and over 100% that it is operating over capacity and therefore will experience delays which will increase as the V/C increases. The colour coding is as follows:

- White – V/C < 85% - The junction is operating well within capacity.
- Amber – V/C between 85% and 100% - The junction is performing close to, but within capacity.
- Red – V/C between 100% and 110% - At least one arm of the junction is over capacity.
- Purple – V/C >110% - At least one arm of the junction is well over capacity.

5.2.20 The worst performing junctions are those which are shown to have large increases in the V/C percentage when comparing the Local Plan scenario with the Reference Case outputs.

5.2.21 The label numbers shown in the tables for the junctions are shown in Figure 5-1 and 5-2, within Horsham and for Crawley within Figure 5-3.

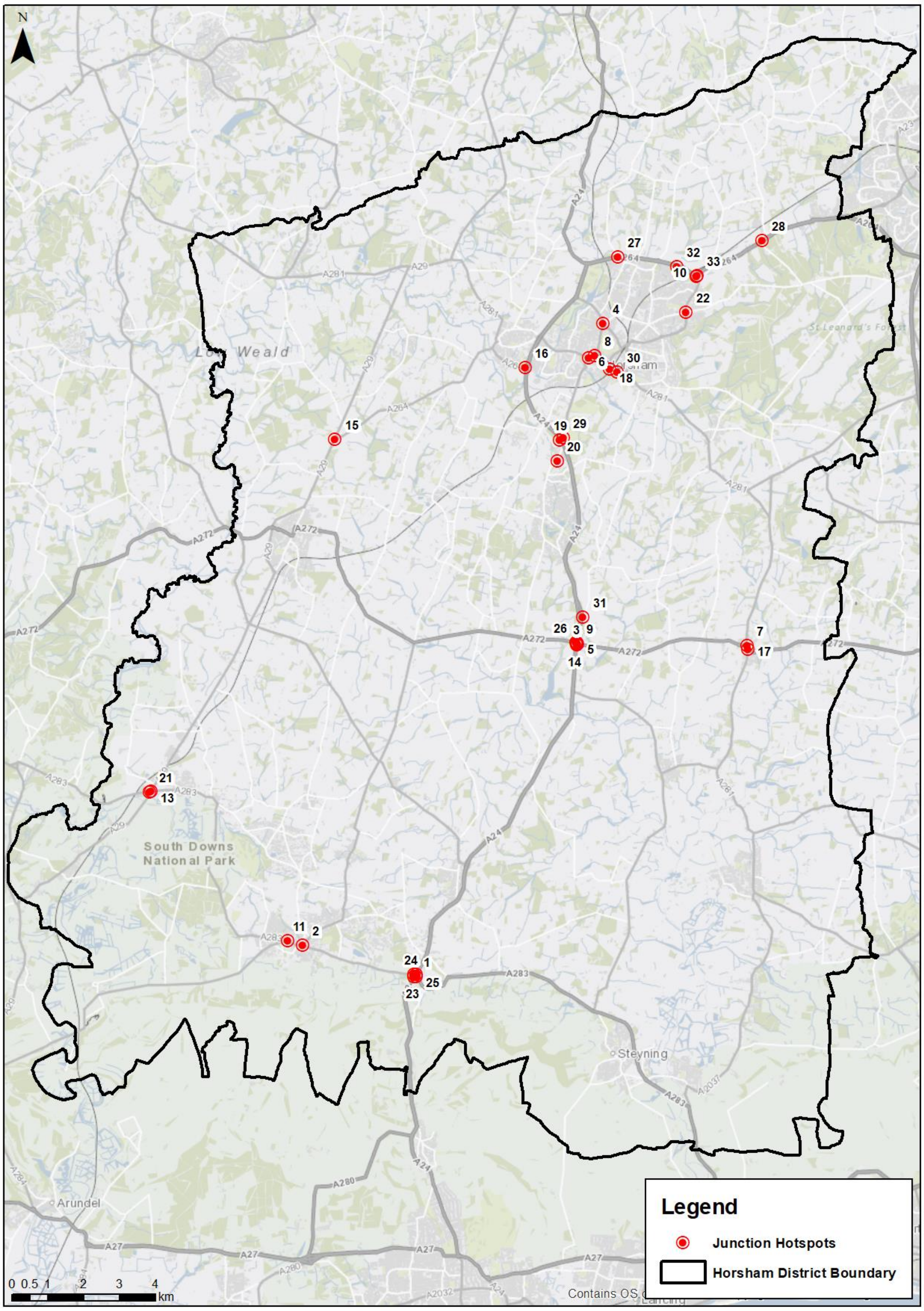

Figure 5-1: Horsham District Hotspots

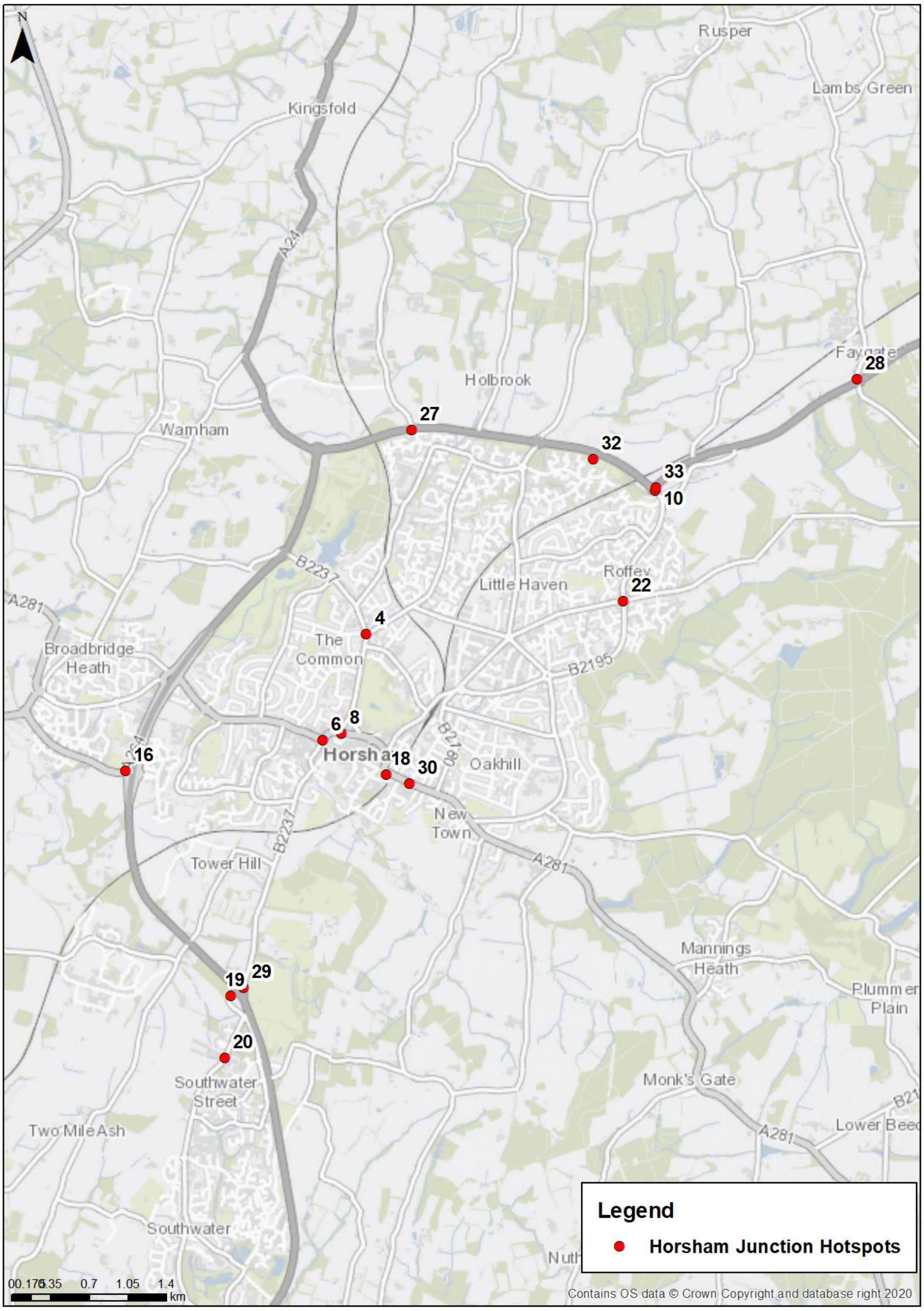

Figure 5-2: Horsham Town Hotspots

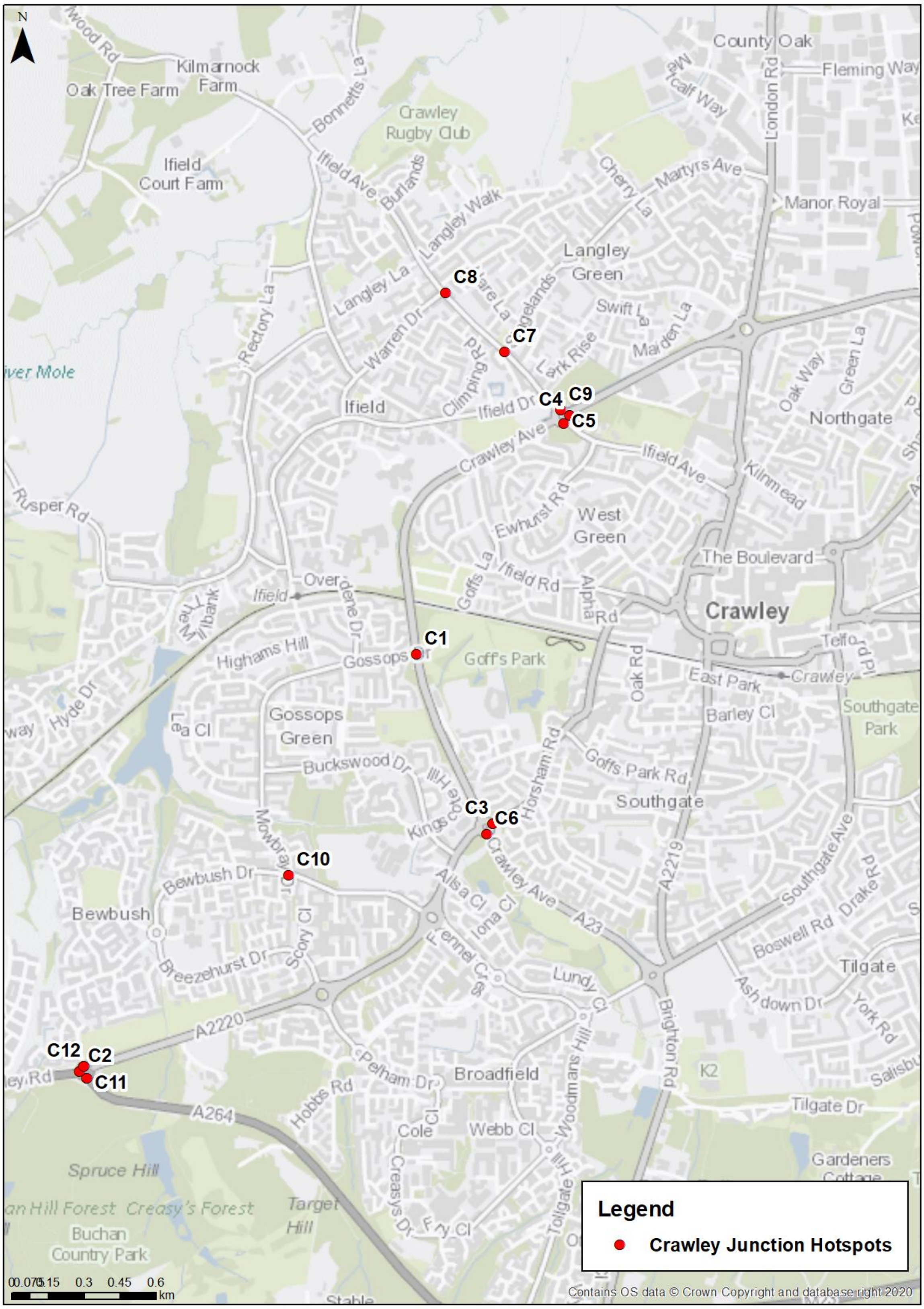

Figure 5-3: Crawley District Hotspots

Table 5-1: Junction Capacity Outputs – Horsham District - AM Peak

Label	Junction Name	2039 Reference Case	2039 Local Plan Scenario
1	A24 Northbound approach at Washington Roundabout	123.9	125.8
4	B2237/Wimblehurst Road, Horsham	106.8	107.0
6	A281/B2237 junction, Horsham Centre	103.2	103.1
7	A272/A281 roundabout north of Cowfold	102.2	103.6
8	A281/Springfield Road Junction	102.0	102.1
10	B2195 Exit at Moorhead Roundabout	101.2	100.9
11	A283 Amberley Road Roundabout Storrington	100.8	100.8
13	A283/A29 Junction – Northern Roundabout, Pulborough	96.6	101.0
15	Five Oaks Roundabout	94.1	102.6

Table 5-2: Junction Capacity Outputs – A24/A272 Junction - AM Peak

Label	Junction Name	2039 Reference Case	2039 Local Plan Scenario
3	A24 Northbound signalised junction with A272	108.4	108.8
5	A272 westbound signals at the A24/A272 junction	103.9	103.8
9	A272 signals over the A24/A272 junction	101.2	102.0
12	Slip road to A24 southbound from A27 (A24/A27 junction)	100.0	100.0
14	A24 southbound signals before A24/A272 junction	94.0	100.2

Table 5-3: Junction Capacity Outputs – Crawley Borough - AM Peak

Label	Junction Name	2039 Reference Case	2039 Local Plan Scenario
C1	Gossop Drive/Crawley Avenue	104.4	104.7
C7	Ifield Avenue/ Stagelands	95.4	102.5
C10	Bewbush Drive/Mowbray Drive	100.2	82.5
C11	Horsham Rd/A264 Roundabout (Skelmersdale Playing Field) NB Entry	101.2	95.4
C12	Bewbush Manor Roundabout Sullivan Drive exit	100.4	100.9

Table 5-4: Junction Capacity Outputs – Horsham District - PM Peak

Label	Junction Name	2039 Reference Case	2039 Local Plan Scenario
1	A24 Northbound approach at Washington Roundabout	92.3	100.2
4	B2237/Wimblehurst Road, Horsham	103.0	103.2
6	A281/B2237 junction, Horsham Centre	102.1	102.3
8	A281/Springfield Road Junction, Horsham	102.0	102.5
10	B2195 Exit at Moorhead Roundabout, Horsham	100.2	100.4
11	A283 Amberley Road Roundabout, Storrington	101.4	101.4
13	A283/A29 Junction – Northern Roundabout, Pulborough	99.0	100.4
16	A264/A24 Roundabout Entry to NB Mainline, Horsham	98.6	100.3
17	A272/A281 roundabout south of Cowfold	101.0	101.0
18	A281 East Street / Park Way Junction, Horsham	92.6	97.0
21	A283 /A29 South Roundabout Pulborough	101.4	101.7
22	Harwood Rd/Forest Rd/ Crawley Rd Junction	95.2	101.5
23	Washington Roundabout (Entry from Storrington Rd)	90.6	101.1
24	London Road approach at Washington Roundabout	108.2	108.0
25	A283 approach at Washington Roundabout	107.5	107.8
27	A281 East Street / Park Way Junction, Horsham	104.0	104.2
28	Faygate Roundabout/Faygate Lane	103.7	101.6
29	B2237 exit at Hop Oast Roundabout	103.6	105.3
30	A281/New Street Junction Horsham Town Centre	100.6	101.2
31	Bar Lane/A24 junction	100.6	101.9
32	Access to land West of Ifield	100.7	100.4
33	A264 WB Approach at Moorhead Roundabout	98.8	102.6

Table 5-5: Junction Capacity Outputs – A264/A272 Junction - PM Peak

Label	Junction Name	2039 Reference Case	2039 Local Plan Scenario
3	A24 Northbound signalised junction with A272	115.0	116.1
5	A272 westbound signals at the A24/A272 junction	120.9	121.0
12	Slip road to A24 southbound from A27 (A24/A27 junction)	100.0	100.0
14	A24 southbound signals before A24/A272 junction	104.4	103.9
26	A272 eastbound approach to A24/A272 junction	106.7	109.9

Table 5-6: Junction Capacity Outputs – Crawley Borough – PM Peak

Label	Junction Name	2039 Reference Case	2039 Local Plan Scenario
C1	Gossop Drive/Crawley Avenue	100.8	104.6
C2	A264 Eastbound exit at Bewbush Manor Roundabout	61.3	102.4
C3	Cheals Roundabout/A2220	140.7	142.4
C4	Ifield Roundabout (Southbound Entry from A23)	117.0	119.5
C5	Ifield Roundabout/Northbound Ifield Avenue Entry	115.4	117.5
C6	Cheals Roundabout/Northbound Entry Crawley Avenue	106.9	108.9
C7	Ifield Avenue/ Stagelands	107.6	110.8
C8	Ifield Way/ Warren Drive	90.7	102.2
C9	Ifield Roundabout Southbound Entry from Ifield Avenue	102.2	102.3
C11	Horsham Rd/A264 Roundabout (Skelmersdale Playing Field) NB Entry	104.8	101.8
C12	Bewbush Manor Roundabout Sullivan Drive exit	89.2	100.7

5.2.22 Where junctions are shown to be over-capacity in the Local Plan Case and have a v/c ratio at least 1.5% higher than the reference case, they have been analysed further and are detailed below.

Junctions Congestion Hotspots in Horsham District Summary

5.2.23 ***A24/A283 Washington Roundabout*** **-** Severely congested within the AM Reference Case at A24 NB approach (V/C over 100%), other approach arms to junction within the reference showing congestion also with V/C over 80%. Additional flow within the Local Plan Scenario exacerbates the congestion in both the AM and Peak. **Requiring mitigation**. Potential mitigation could be to signalise the roundabout. The junction lies within the South Downs National Park; therefore, any mitigation would require discussions and liaison with the National Park Authority and the process for determining a scheme may take longer than elsewhere.

5.2.24 ***A264 / A24 Dumb-bell Roundabout at South Broadbridge Heath*****, Horsham,** circulatory egress onto the A24 NB is over the turn capacity within the PM Peak Local Plan scenario. The slight increase over the V/C threshold can be mitigated by further sustainable measures – in particular, further improvement to PT connectivity from the East of Billingshurst site to Horsham, which demand for that movement would potentially go through. **No further mitigation required.**

5.2.25 **A281 East Street / Park Way Junction, Horsham,** Junction shown to be just over 100% capacity within the PM Peak Local Plan scenario. Signal optimisation would be sufficient to alleviate the slight impact caused at the junction from the Local Plan. **No further mitigation required.**

5.2.26 ***A264 WB Approach at Moorhead Roundabout, Horsham*** – V/C just under 100% within the reference case, and over the 1.5% threshold in the Local Plan scenario in the PM peak. With signal optimisation V/C is brought down to below the mitigation threshold within the PM Peak. **No further mitigation required.**

5.2.27 **A24 Hop Oast Roundabout** – The Worthing Road eastbound approach is an issue in PM peak within the Local Plan scenario. **Requiring mitigation**. Potential to signalise or partially signalise the roundabout.

5.2.28 **B2195 Harwood Road/Crawley Road/ Forest Road Junction** - Over capacity and above 1.5% threshold in the Local Plan scenario PM peak. Congested at all approach arms, however modelling indicates that there is scope to optimise the signals to mitigate the local plan impact in the preferred scenarios.

5.2.29 **A283 /A29 Roundabouts, Pulborough** - The junctions are shown to be only just over capacity in the PM peak with the Local Plan development or are not significantly worse than the Reference Case. They operate within capacity in the AM peak. There is limited opportunity to provide physical highway mitigation within Pulborough, due to lack of space and constraints created by building located close to the roadside. Traffic signals were tested, however these only increased queueing and delays.

5.2.30 Further mitigation proposal could include a metering scheme whereby traffic lights are put on the A283 east and west approaches to the double roundabout junction (but not the A29 approaches) to allow A29 traffic to be prioritised when necessary. The SATURN model is not suitable for modelling this type of mitigation accurately and would require modelling in a micro-simulation modelling tool such as VISSIM or Paramics.

5.2.31 Alternatively, sustainable transport mitigation would be required, linking Public Transport to/through Pulborough. Due to the semi-rural locality of the site and the low frequency of bus services, solutions brought forward should include demand responsive measures linked to the Pulborough station.

5.2.32 Furthermore, The Arundel Bypass, currently being progressed by National Highways could provide relief along the A27 at Arundel, which will make the A27/A24 route from Chichester and further west towards Horsham, Crawley and Gatwick Airport a more attractive route, which could result in some traffic being removed from Pulborough and provide relief at the junctions.

5.2.33 **A272/A24 Buck Barn** - The staggered crossroads junction is well over capacity in the reference case and the situation exacerbated in the Preferred Scenario. Signal optimisation may be sufficient to negate the impact of the Local Plan, however as stated the junction is still well over capacity. WSCC are studying this route to examine possible enhancements to the MRN**. Mitigation required**.

5.2.34 **A29 Five Oaks Roundabout** – Northbound approach showing increase in V/C to over 100% within the AM Peak Local Plan scenario resulting predominantly from the increase of traffic from the East of Billingshurst site. **Mitigation required**. Roundabout has limited scope for improvements due to physical constraints. Due to the constraints of delivering physical mitigation, viable options of mitigating the impacts of the Local Plan, in the main coming from trips produced by the East of Billingshurst development, would require significant increases in sustainable transport measures for Billingshurst. It would be expected that these would be provided through the transport strategy promoted by the East of Billingshurst developers, in particular providing improved public transport services from East of Billingshurst to Horsham which would potentially reduce private vehicle demand through the junction.

5.2.35 From the above highlighted junctions, the following issues are seen, with potential mitigation and issues stated:

5.2.36 **Washington Roundabout** –The main congestion hotspots stem from the large traffic volume approaching the junction from the South, travelling North bound on the A24 in the AM and the opposite direction travelling South in the PM. A solution for mitigation would be to signalise the roundabout therefore managing traffic flow and providing greater capacity for these movements. This is discussed further in Section 6.

5.2.37 **Hop Oast Roundabout** –The junction is above capacity and worse than the Reference Case within the preferred scenario. The main congestion hotspots stem from the large traffic volume approaching the junction along the A24, causing limited gap time for vehicles to exit onto the roundabout from Worthing Road. A solution for mitigation would be to signalise the roundabout, therefore managing traffic flow and providing greater capacity for these movements. This is discussed further in Section 6.

5.2.38 **A272/A24 Buck Barn –** The junction is over capacity within all approaches, with limited scope for further signal optimisation improvements. Potential further dedicated left and right turn lane filtering and bypassing the interchange would improve the capacity and performance of the junction.

5.2.39 **A29 Five Oaks Roundabout –** The northbound approach to the junction is shown to be above capacity within the AM Peak with the addition of Local Plan trips. The proximity of buildings and narrow footways will make any mitigation here difficult. Intensification of sustainable measures is the most viable mitigation option, as explained in paragraph 5.2.30 above.

6 Highway Mitigation (WSCC Network)

6.1 Introduction

6.1.1 Following the identification of junction congestion hotspots, additional modelling has been conducted in order to provide analysis of where additional mitigation could be provided to increase capacity and reduce over capacity queuing and delays. This is with the aim of achieving the V/C below 100 or similar to those in the reference case. The analysis also looks at the knock-on impacts elsewhere in the study area as a result of potential reassignment due to the provision additional capacity.

6.1.2 The further mitigation strategy has been assigned with the preferred scenario forecast demand.

6.1.3 The following junctions have been looked at within the modelling:

- Washington Roundabout
- Buck Barn Junction
- Hop Oast Roundabout

6.1.4 From the above, physical mitigation has been proposed at the following junctions:

- Washington Roundabout
- Buck Barn Junction
- Hop Oast Roundabout

6.2 Reassignment Impact of Mitigation – SATURN Modelling

6.2.1 An iterative process has been created where proposed mitigations has been tested and modelled within SATURN. This enables a further understanding of any reassignment impact as a result of the changes proposed at the junctions, due to the alleviation of congestion and increased capacity.

6.2.2 The revised mitigated modelled flows are subsequently extracted from the SATURN model to inform further detailed junction modelling analysis using the LinSig and Junctions 9 modelling platforms. The detailed junction modelling platforms provide a greater level of traffic simulation granularity, therefore providing more accurate junction congestion impact findings than strategic SATURN modelling.

AM Model Reassignment

6.2.3 Figure 6-1 below shows the modelled representation of the highway network within the Horsham District region. The diagram outputs compare traffic flow difference between the local scenario and the mitigated local scenario. The green links represent an increase in flow within the mitigated preferred scenario, whilst the blue represent a decrease. The thicker the colour shading on the road network the greater the flow difference is.

6.2.4 The mitigation shows that by improving the Buck Barn junction, trips that would otherwise have avoided the junction and re-routed elsewhere, are now using the junction as a result of increased capacity.

6.2.5 With the additional capacity at Hop Oast allowing more trips to route through the roundabout, likewise the addition of the dedicated left turn lanes at Washington Roundabout from the A24 to the A283 are now providing more capacity for journeys previously queued up within the Local Plan un-mitigated scenario.

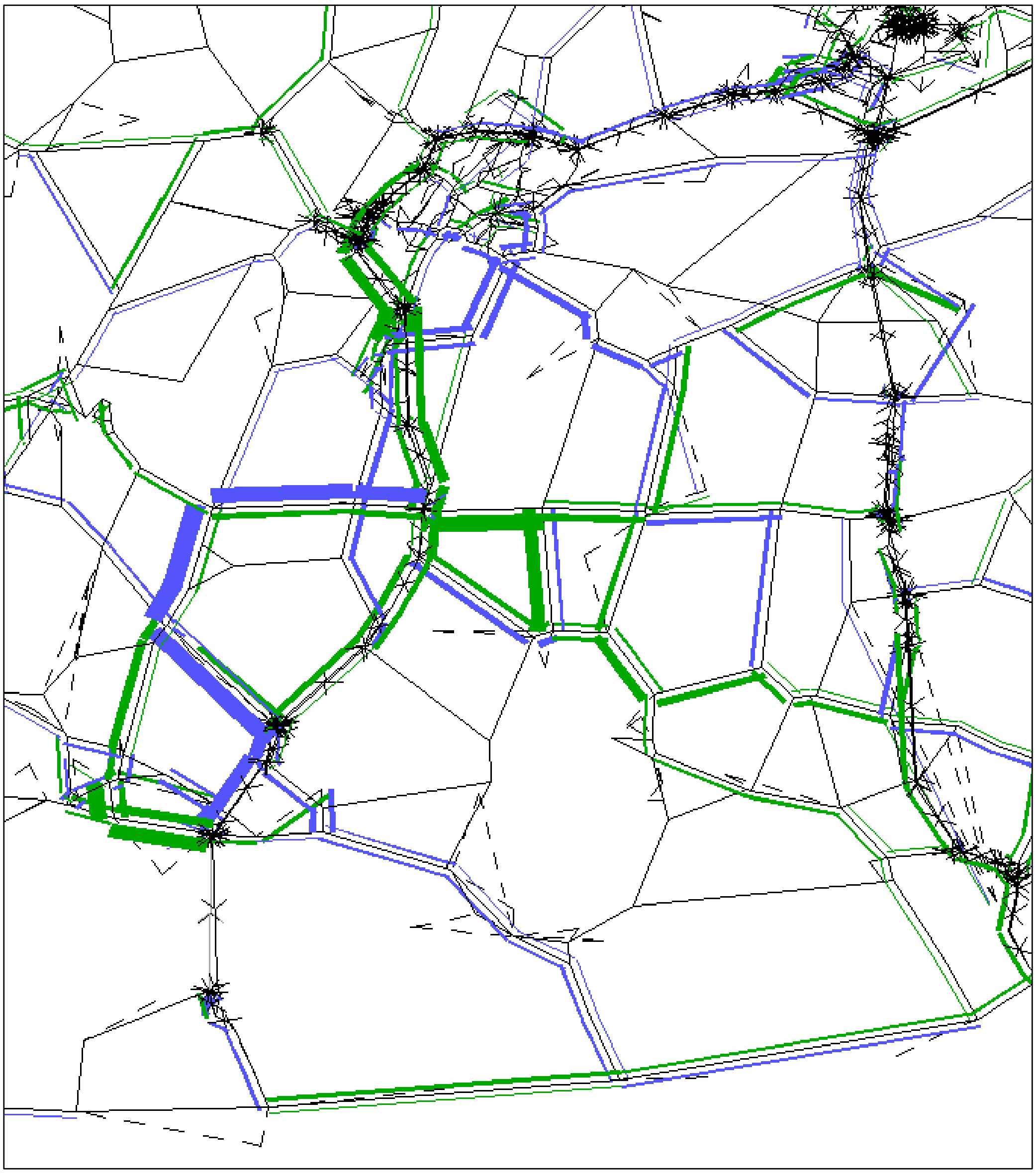

Figure 6-1: AM Flow Reassignment with Mitigation

PM Model Reassignment

6.2.6 As with the AM analysis there is wider reassignment to the A24. With the introduction of the mitigation at Hop Oast roundabout, trips leaving Horsham travelling south on the A24 are more inclined to use the B2327 Worthing Road. This is shown in Figure 6-2.

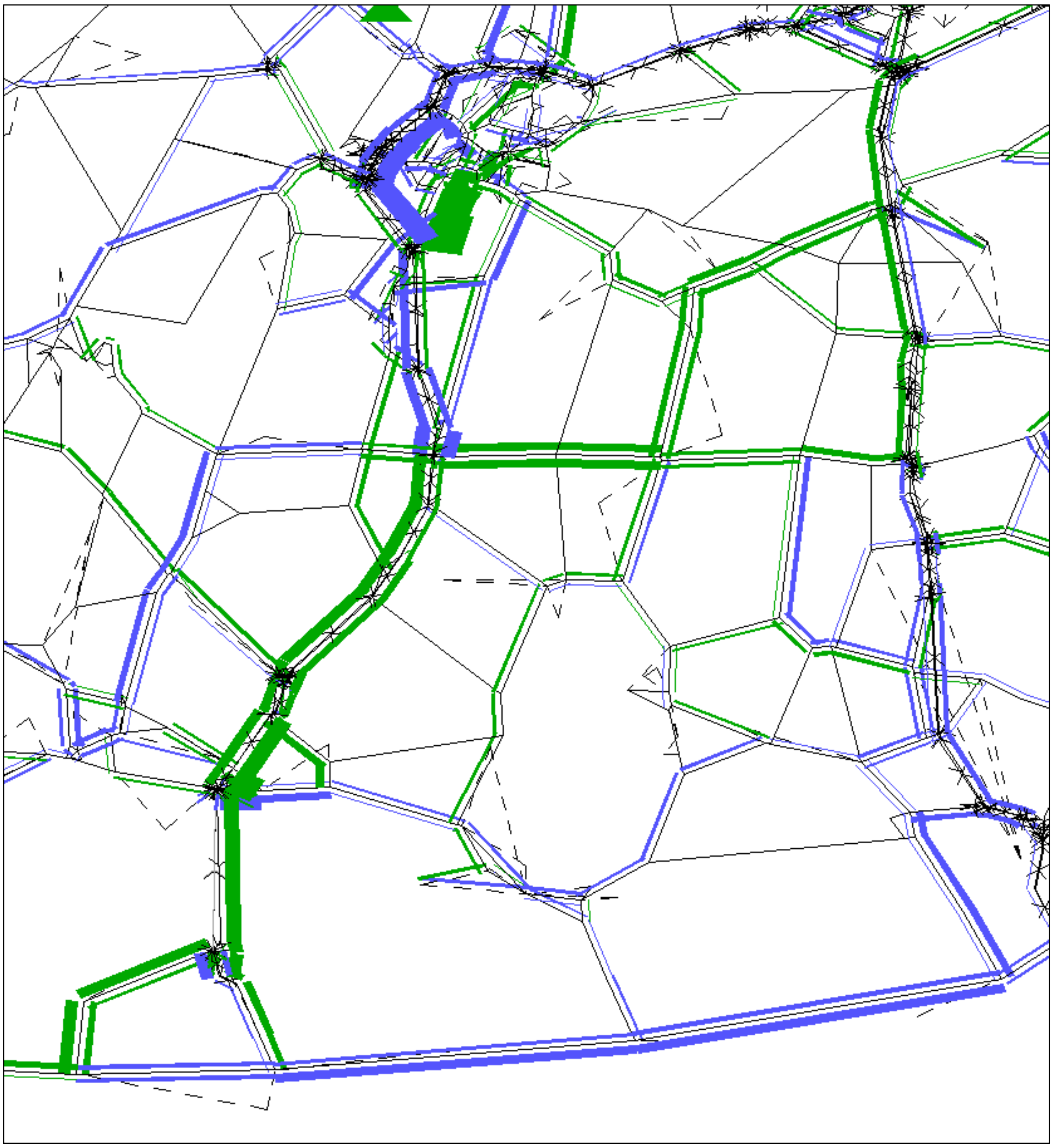

Figure 6-2: PM Flow Reassignment with Mitigation

6.2.7 Tables 5-1 to 5-6 highlight the V/C of the junctions with the further physical mitigation against the preferred scenario with no mitigation. The outputs show the worse performing arm. The modelling only included highway capacity mitigation at Washington roundabout, Hop Oast roundabout and the Buck Barn junction. Commentary has previously been provided for the other junctions in section 5.2.

Table 5-1: Junction Capacity Outputs – Horsham District - AM Peak

Label	Junction Name	2039 Ref Case	2039 LP No Mitigation	2039 LP With Mitigation
1	A24 Northbound approach at Washington Roundabout	123.9	125.8	111.2
4	B2237/Wimblehurst Road	106.8	107.0	107.0
6	A281/B2237 junction Horsham Centre	103.2	103.1	103.3
7	A272/A281 roundabout north of Cowfold	102.2	103.6	102.2
8	A281/Springfield Road Junction	102.0	102.1	102.1
10	B2195 Exit at Moorhead Roundabout	101.2	100.9	100.9
11	A283 Amberley Road Roundabout Storrington	100.8	100.8	100.8
13	A283/Church Hill A29 Roundabout	96.6	101.0	100.5
15	Five Oaks Roundabout	94.1	102.6	102.7

Table 5-2: Junction Capacity Outputs – A24/A272 Junction - AM Peak

Label	Junction Name	2039 Ref Case	2039 LP No Mitigation	2039 LP With Mitigation
3	A24 Northbound signalised junction with A272	108.4	110.1	107.9
5	A272 westbound signals at the A24/A272 junction	103.9	104.0	106.9
9	A272 signals over the A24/A272 junction	101.5	102.1	87.8
12	Slip road to A24 southbound from A27 (A24/A27 junction)	100.0	100.0	100.0[10]
14	A24 southbound signals before A24/A272 junction	92.1	101.5	89.6

Table 5-3: Junction Capacity Outputs – Crawley Borough - AM Peak

Label	Junction Name	2039 Ref Case	2039 LP No Mitigation	2039 LP With Mitigation
C1	Gossop Drive/Crawley Avenue	104.4	104.7	105.5
C7	Ifield Avenue/ Stagelands	95.4	102.5	103.2
C10	Bewbush Drive/Mowbray Drive	100.2	82.5	78.9
C11	Horsham Rd/A264 Roundabout (Skelmersdale Playing Field) NB Entry	101.2	95.4	100.6
C12	Bewbush Manor Roundabout Sullivan Drive exit	100.4	100.9	101.1

[10] These figures are at 100% for all scenarios, as SATURN will not record a figure over 100% for merge junctions, as is the case here.

Table 5-4: Junction Capacity Outputs – Horsham District - PM Peak

Label	Junction Name	2039 Ref Case	2039 LP No Mitigation	2039 LP With Mitigation
1	A24 Northbound approach at Washington Roundabout	92.3	100.2	84.5
4	B2237/Wimblehurst Road, Horsham	103.0	103.2	102.2
6	A281/B2237 junction, Horsham Centre	102.1	102.3	102.0
8	A281/Springfield Road Junction, Horsham	102.0	102.5	100.8
10	B2195 Exit at Moorhead Roundabout, Horsham	100.2	100.4	100.4
11	A283 Amberley Road Roundabout, Storrington	101.4	101.4	101.3
13	A283/A29 Junction – Northern Roundabout, Pulborough	99.0	100.4	100.5
16	A264/A24 Roundabout Entry to NB Mainline, Horsham	98.6	100.3	100.4
17	A272/A281 roundabout south of Cowfold	101.0	101.0	101.3
18	A281 East Street / Park Way Junction, Horsham	92.6	97.0	100.8
21	A283 /A29 South Roundabout Pulborough	95.2	101.5	101.1
22	Harwood Rd/Forest Rd/ Crawley Rd Junction	90.6	101.1	101.0
23	Washington Roundabout (Entry from Storrington Rd)	108.2	108.0	78.6
24	London Road approach at Washington Roundabout	107.5	107.8	105.4
25	A283 approach at Washington Roundabout	104.0	104.2	103.5
27	A281 East Street / Park Way Junction, Horsham	103.7	101.6	101.8
28	Faygate Roundabout/Faygate Lane	103.6	105.3	84.5
29	B2237 exit at Hop Oast Roundabout	100.6	101.2	102.8
30	A281/New Street Junction Horsham Town Centre	100.6	101.9	42.0
31	Bar Lane/A24 junction	100.7	100.4	100.3
32	Access to land West of Ifield	98.8	102.6	102.2
33	A264 WB Approach at Moorhead Roundabout	102.1	102.3	102.0

Table 5-5: Junction Capacity Outputs – A264/A272 Junction - PM Peak

Label	Junction Name	2039 Reference Case	2039 Local Plan Scenario with Sus
3	A24 Northbound signalised junction with A272	115.0	116.1
5	A272 westbound signals at the A24/A272 junction	120.9	121.0
12	Slip road to A24 southbound from A27 (A24/A27 junction)	100.0	100.0
14	A24 southbound signals before A24/A272 junction	104.4	103.9
26	A272 eastbound approach to A24/A272 junction	106.7	109.9

Table 5-6: Junction Capacity Outputs – Crawley Borough – PM Peak

Label	Junction Name	2039 Reference Case	2039 Local Plan Scenario with Sus
C1	Gossop Drive/Crawley Avenue	100.8	104.6
C2	A264 Eastbound exit at Bewbush Manor Roundabout	61.3	102.4
C3	Cheals Roundabout/A2220	140.7	142.4
C4	Ifield Roundabout (Southbound Entry from A23)	117.0	119.5
C5	Ifield Roundabout/Northbound Ifield Avenue Entry	115.4	117.5
C6	Cheals Roundabout/Northbound Entry Crawley Avenue	106.9	108.9
C7	Ifield Avenue/ Stagelands	107.6	110.8
C8	Ifield Way/ Warren Drive	90.7	102.2
C9	Ifield Roundabout Southbound Entry from Ifield Avenue	102.2	102.3
C11	Horsham Rd/A264 Roundabout (Skelmersdale Playing Field) NB Entry	104.8	101.8
C12	Bewbush Manor Roundabout Sullivan Drive exit	89.2	100.7

6.3 Impact of Mitigation – Detailed Junction Modelling

A24/A283 Washington Roundabout

6.3.1 To reduce delays and queueing, in particular on the A24 northbound approach, an arrangement has been tested with additional left turning lanes on the A24 northbound and southbound approach as well as the A283 eastbound approach. Also the mitigation includes the widening of the circulatory from 2 lanes to 3 in order to accommodate the left turn movements. The mitigation scheme has been tested within Junction 10. The proposed scheme is shown in Figure 6-1.

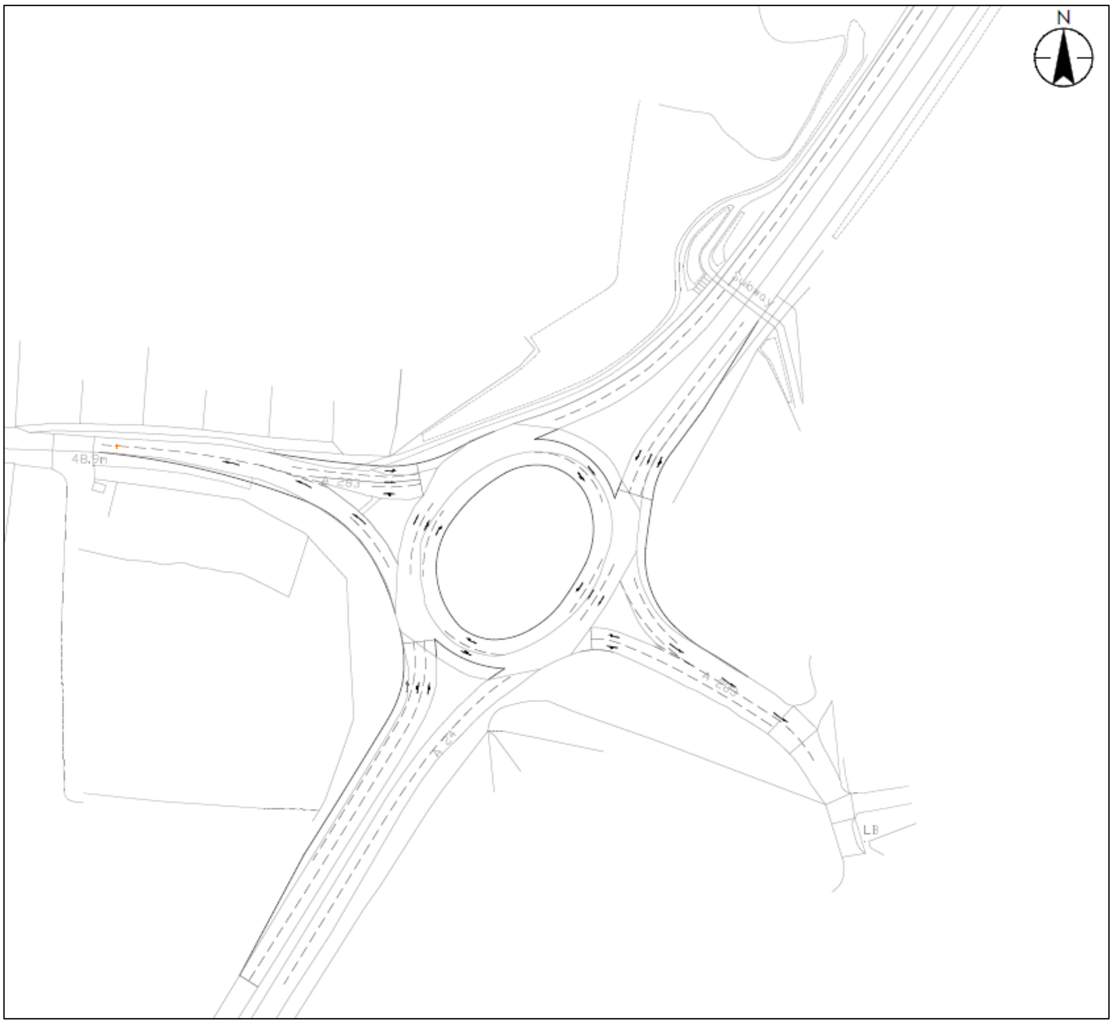

Figure 6-1: Washington Roundabout Mitigation Scheme

6.3.2 Table 6-5 shows a summary of the outputs from the detailed junction modelling and detailed junction modelling outputs are provided within Appendix I. This is compared with detailed junction assessment of the reference case shown in Table 6-6. These outputs are taken directly from a modelling tool called Junction 10, with the following outputs demonstrating the performance of junction are shown:

- DoS – Degree of Saturation – measure of capacity of the junction – A figure of 100% shows that the junction is operating at capacity – below 100% the junction is operating below capacity.
- Delay (Seconds/PCU) – this is the average delay per PCU through the modelled peak hour
- Queue (PCU) – maximum queue in peak period

Table 6-6: Washington Roundabout Junction Modelling Summary (Reference Case)

Arm Name	AM Peak Hour (08:00 – 09:00)			PM Peak Hour (17:00 – 18:00)		
	DoS	Delay (s/ PCU)	Queue (PCU)	DoS	Delay (s/ PCU)	Queue (PCU)
A24 (North)	83%	9.8	5	106%	109.4	81.9
A283 (East)	88%	35.2	7.1	100%	91.8	16.3
A24 (South)	97%	42.2	18.7	76%	7.6	3.1
A283 (West)	83%	21.8	5.2	85%	20.7	5.5

Table 6-5: Washington Roundabout Junction Modelling Summary (Local Plan + Mitigation)

Arm Name	AM Peak Hour (08:00 – 09:00)			PM Peak Hour (17:00 – 18:00)		
	DoS	Delay (s/ PCU)	Queue (PCU)	DoS	Delay (s/ PCU)	Queue (PCU)
A24 (North)	68%	4.1	2.3	98%	37.2	28.2
A283 (East)	75%	16.9	3.3	76%	34.5	2.9
A24 (South)	58%	3.1	1.4	53%	2.4	1.1
A283 (West)	48%	4	1	54%	4.3	1.2

6.3.3 Overall, the mitigation performs better than the reference case, with RFC, and therefore the proposed junction design is deemed to mitigate the Local Plan impacts.

6.3.4 A high-level cost for the design has been produced for the scheme. The estimated cost is £3.811 million including risk, contingency and optimism bias[11]. A breakdown of the high-level scheme costs is provided within Appendix M.

A24/A272 Buck Barn junction

6.3.5 A refined signalised junction has been tested, the design aims to reduce the staggered signal stages by providing closer approaches and increased capacity for vehicles travelling eastbound through the junction along the A272. This involves adjusting the eastern approach

[11] Optimism Bias is the recognised inherent bias in underestimating costs, particularly at early stages of projects when risks are unknown. 44% is the figure used by DfT in early stages of projects. See Transport Appraisal Guidance Unit A1.2 Section 3.5 (TAG UNIT A1.2 Scheme Costs (publishing.service.gov.uk))

from the A272 slightly further north, thus creating a crossroads, rather than the current staggered junction arrangement.

6.3.6 The proposed scheme is shown in Figure 6-2.

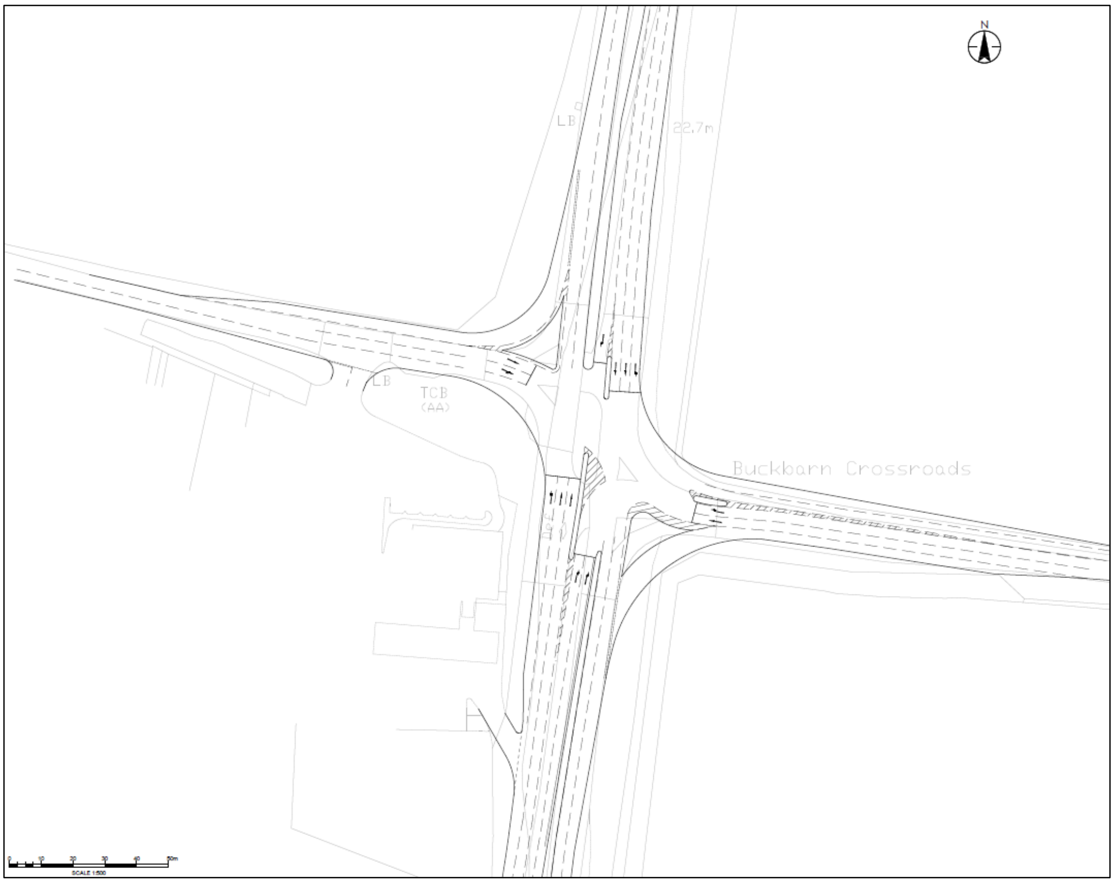

Figure 6-2: Buck Barn Junction Mitigation Scheme

6.3.7 Table 6-7 and 6 -8 shows a summary of the outputs from the detailed junction modelling of the reference case and the non-mitigated scenario respectively (current junction layout) with junction modelling outputs provided in Appendix J. The outputs highlight the significant delay at the junction within the reference case, with delay on many approach arms having DoS significantly higher than 100%, with the local plan scenario flows impacting and causing further deterioration of the Dos, Queues and total delay.

Table 6-7: Buck Barn Junction Modelling Summary (Reference Case)

Arm Name	AM Peak Hour (08:00 – 09:00)			PM Peak Hour (17:00 – 18:00)		
	DoS (%)	Delay (s/PCU)	Queue (PCU)	DoS (%)	Delay (s/PCU)	Queue (PCU)
A24 (N) Worthing Road Nearside	97%	67.2	26.6	126%	441.0	179.5
A24 (N) Worthing Road Middle	97%			126%		
A24 (N) Worthing Road Offside	86%	41.1	15.7	117%	343.9	135.2
A24 (N) Nearside (Right turn)	74%			124%		
A272 (E) Nearside (Give Way Left Turn)	98%	43.1	19.7	123%	386.4	90.0
A272 (E) Nearside (Right Turn)	89%			123%		
A272 (E) Offside (Right Turn)	85%	64.7	9.6	48%	44.0	4.5
A24 (S) Worthing Road Nearside	69%	24.2	13.3	62%	21.9	13.1
A24 (S) Worthing Road Middle	69%			62%		
A24 (S) Worthing Road Middle Offside	84%	38.3	16.1	122%	394.9	112.7
A24 (S) Worthing Road Nearside (Right turn)	98%			127%		
A272 (W) Nearside Lane (Left Turn)	82%	51.7	6.8	90%	75.9	9.5
A272 (W) Nearside Lane (Right Turn)	82%			90%		

6.3.8 Table 6-9 shows a summary of the outputs from the detailed junction modelling and detailed junction modelling outputs are provided within Appendix J.

Table 6-9: Buck Barn Junction Modelling Summary (Local Plan + Mitigation)

Arm Name	AM Peak Hour (08:00 – 09:00)			PM Peak Hour (17:00 – 18:00)		
	DoS (%)	Delay (s/ PCU)	Queue (PCU)	DoS (%)	Delay (s/ PCU)	Queue (PCU)
A24 (N) Worthing Road Nearside	87%	41.7	24.7	98%	83.0	38.0
A24 (N) Worthing Road Middle	87%			98%		
A24 (N) Worthing Road Offside	92%	54.8	29.3	99%	87.6	38.3
A24 (N) Worthing Road Nearside (Right turn)	92%			99%		
A272 (E) Nearside (Give way Left Turn)	92%	40.9	16.5	97%	59.5	25.2
A272 (E) Nearside (Right Turn)	92%			97%		
A272 (E) Offside (Right Turn)	91%	92.2	15.3	92%	87.7	17.1
A24 (S) Worthing Road Nearside	85%	43.8	24.5	85%	46.9	22.9
A24 (S) Worthing Road Middle	85%			85%		
A24 (S) Worthing Road Middle Offside	90%	53.0	27.0	86%	54.8	25.0
A24 (S) Worthing Road Nearside (Right turn)	93%			96%		
A272 (W) Nearside Lane (Give way Left Turn)	94%	78.7	12.1	96%	125.5	12.9
A272 (W) Nearside Lane (Right Turn)	94%			96%		
A272 (W) Offside Lane (Right Turn)	92%	125.1	10.2	94%	132.3	11.7

6.3.9 The modelling outputs indicate that the mitigation is effective in relieving congestion impacts resulting from the Horsham Local Plan and background forecast traffic growth as the junction output results show operation within capacity (in comparison to the max V/C outputs shown within Table 5.1 and 5.4).

6.3.10 A high-level cost for the design has been produced for the scheme. The estimated cost is £5.176 million including risk, contingency and optimism bias. A breakdown of the high-level scheme costs is provided within Appendix M.

A24 Hop Oast Roundabout

6.3.11 Two variations of the roundabout have been proposed, option 1 includes a Bus priority lane and through the circulatory of the junction, and one aims to increase throughput capacity without a dedicated bus lane prioritisation. Both options include signalisation of the roundabout. The mitigation scheme has been tested within LinSig.

6.3.12 The proposed schemes with and without the bus priority are shown in Figure 6-4.

Figure 6-4: Hop Oast Junction Mitigation Schemes (With/Without Bus Priority)

6.3.13 Table 6-11 and 6-12 shows a summary of the outputs from the detailed junction modelling and detailed junction modelling outputs are provided within Appendix K.

Table 6-11: Hop Oast Road Junction Modelling – With Bus Priority (With Local Plan + Mitigation)

Arm Name	AM Peak Hour (08:00 – 09:00)			PM Peak Hour (17:00 – 18:00)		
	DoS (%)	Delay (s/ PCU)	Queue (PCU)	DoS (%)	Delay (s/ PCU)	Queue (PCU)
A24 (NW) nearside lane	133%	506.4	169.8	140%	569.7	286.1
A24 (NW) middle lane	133%	507.1		140%	570.4	
A24 (NW) offside lane	132%	506.9	95.2	139%	568.8	212.4
Worthing Road (NE) nearside lane	0%	0.0	9.3	0%	0.0	16.3
Worthing Road (NE) middle lane	70%	25.9		89%	38.5	
Worthing Road (NE) offside lane	0%	0.0		0%	0.0	
A24 (SE) nearside lane	141%	589.0	10.6	138%	565.1	88.3
A24 (SE) middle lane	141%	587.6	14.4	151%	680.2	150.9
A24 (SE) offside lane	140%	574.9		112%	234.5	
Worthing Road (SW) nearside lane	29%	1.3	0.2	25%	1.2	0.2
Worthing Road (SW) middle lane	58%	36.1	1.4	83%	52.9	8.1
Worthing Road (SW) offside lane	0%	0.0	1.1	0%	0.0	0.0

Table 6-12: Hop Oast Road Junction Modelling – Without Bus Priority (With Local Plan + Mitigation)

Arm Name	AM Peak Hour (08:00 – 09:00)			PM Peak Hour (17:00 – 18:00)		
	DoS (%)	Delay (s/ PCU)	Queue (PCU)	DoS (%)	Delay (s/ PCU)	Queue (PCU)
A24 (NW) nearside lane	69%	11.4	6.8	90%	13.3	11.8
A24 (NW) middle lane	69%	11.6		90%	13.3	
A24 (NW) offside lane	42%	10.0	5.1	53%	6.5	7.0
Worthing Road (NE) nearside lane	65%	39.0	4.1	82%	45.6	8.4
Worthing Road (NE) middle lane	72%	38.9	4.9	87%	45.9	9.7
Worthing Road (NE) offside lane	72%	36.8		87%	43.8	
A24 (SE) nearside lane	60%	14.0	7.9	62%	19.2	8.0
A24 (SE) middle lane	72%	14.0	11.3	72%	19.2	11.1
A24 (SE) offside lane	72%	12.4		72%	16.5	
Worthing Road (SW) nearside lane	38%	1.5	0.3	26%	1.3	0.2
Worthing Road (SW) middle lane	27%	24.0	2.0	59%	39.9	3.8
Worthing Road (SW) offside lane	30%	24.2	2.2	58%	38.7	3.8

6.3.14 The Bus Lane Priority Mitigation DoS (same metric as V/C) is shown to be over 100% within the AM and PM Peak for the A24 approaches. This is resultant from the additional green time being taken for the bus priority lanes through the junction.

6.3.15 With the additional capacity for private vehicles through changing the proposed bus priority lane for all traffic and removing the additional bus priority phasing, this significantly improves the performance of the junction with DoS being below 95% and no worse than the reference case V/C outputs shown from the strategic model forecasts. Without the bus priority, delays on Worthing Road are negligible and therefore buses will not be unduly delayed, and the delays on the A24 are reduced for general traffic.

6.3.16 As such the 3-lane circulatory without bus priority would be most effective to alleviate congestion impacts of the Horsham LP. The provision of bus lanes as shown in Figure 6-4 would still be possible at any stage in the future with only minor changes to the geometry and would only require changes to lane markings, to provide bus lanes on the off-side lane of approaches and the roundabout circulatory. The changes would require some widening on the off side of the circulatory, taking some of the central island and would therefore not require any non-highway land.

6.3.17 It should be noted that no comparison has been made with the Reference Case in this instance, however, with the Local Plan flows included, the junction is shown to work within capacity without the bus priority in place and therefore can facilitate the additional traffic.

6.3.18 Further testing of increased modal shift through the increased public transport infrastructure provision has not been undertaken at this time but could provide improved results of the bus priority measure due to reduce numbers of car trips moving between Southwater and Horsham

6.3.19 A high-level cost for the design has been produced for the scheme. The estimated cost is £3.108 million including risk, contingency and optimism bias. A breakdown of the high-level scheme costs is provided within Appendix M.

6.4 Remaining Unmitigated Hot-Spots

6.4.1 All other remaining junctions that showed the mitigated scenario V/C to be worse that the reference case and where V/C is still greater than 100 have been analysed for unmet demand and capacity shortcomings.

6.4.2 It has been assumed that capacity shortcomings and unmet demand can be addressed through further sustainable mitigation measures (i.e. those likely to reduce car trips) connected with the Horsham Transport Strategy and to minimise as far as possible the need for physical mitigation.

6.4.3 The proposed sustainable mitigation measures at the junctions listed below included the prioritisation of active modes and public transport measures, where specifically feasible to reduce localised car trips further, and the general projection of virtual mobility (i.e. increased opportunity to work from home, due to technological advances reducing need to commute and reduce face to face meetings). The effect was to reduce car trips.

6.4.4 In addition, where junctions are signalised and only just over the threshold for requiring mitigation, the signal timings and Volume to Capacity ratio (V/C) on all arms were examined, to explore whether there would be an opportunity to alter the signal timings. This typically involved looking at where the worse performing movement could be given more green time, without unduly impacting upon opposing movements which had plenty of spare capacity.

6.4.5 The following junctions were seen to be only just over the threshold based on the preferred strategy, and could be dealt with through the measures above:

A29 Five Oaks Roundabout

6.4.6 Due to the land constraints surrounding the junction there is limited scope for widening the junction or altering the junction to a signalised arrangement.

6.4.7 Within the Local Plan scenario nearly all additional trips increases are related to trips to/from the East of Billingshurst site travelling to/from Horsham Town. It is recommended that sustainable transport measures, in particular improved bus services and increased bus frequency from Billingshurst and the East of Billingshurst site to/from Horsham would provide a sustainable alternative and reduce the traffic impacts from the East of Billingshurst site at the junction. It could also be possible to improve active travel links to Billingshurst station or demand responsive public transport services.

6.5 Neighbouring Authorities

6.5.1 It has been identified that a number of junctions within Crawley are shown to increase in congestion within the Preferred Scenario (both mitigated and un-mitigated), primarily due to the West of Ifield Site.

6.5.2 Sustainable transport mitigation on the Ifield Avenue route may reduce the need for highway mitigation at the level of development at the West of Ifield Site included within the model.

6.5.3 Furthermore, Junctions within Crawley identified as requiring mitigation, are all likely to be impacted on with the proposed Crawley Western Multi-modal Corridor, with a resultant reduction of traffic and congestion along the A2220 Horsham Road, the A23 Crawley Avenue and Ifield Avenue.

6.5.4 It has been discerned from the modelling outputs that aside from within Crawley, there are no further Neighbouring Authority junctions (excluding the Strategic Road Network) that are flagged as showing detrimental impact due to the Horsham Local Plan.

7 Impacts on Strategic Road Network

7.1 Overview of Traffic Flows on Strategic Road Network

7.1.1 This section provides an overview of the impacts of the local plan forecasts modelled on the National Highways Strategic Road Network (SRN).

7.1.2 Within the base year model high level of traffic and congestion are shown within the AM and PM Peak Horsham models along the A23 SRN corridor.

7.1.3 The 2039 Forecast Traffic growth, based upon the NTEM forecasts, predicts relatively high level of car trip growth between the base year of 2019 and the forecast year of 2039.

7.1.4 With the large proportion of long-distance trips along the A23 and M23 corridor between the Sussex / Brighton & Hove conurbation along the south coast and areas to the north including Crawley, Burgess Hill, Haywards Heath and London predicted significant growth in car travel demand by 2039, the predicted background growth from these regions is increasing demand along the corridor.

7.1.5 As such, some sections of the A23 corridor are at or above capacity within the Reference Case, specifically the 2-lane section of the A23 south of Hickstead, is showing up to be close to capacity within the Reference Case forecast models.

7.1.6 The level of growth and capacity issues on the A23 is therefore having an influence on how trips from Horsham are getting to and using the A23, including any traffic growth associated with the Local Plan.

7.1.7 At the time of the forecast model build process, aside from the scheme referenced in the paragraph below there were no known committed plans to provide additional capacity on the A23 and therefore no network changes are made within the Reference Case models.

7.1.8 However, it should be noted that National Highways has approved a scheme to improve the A23 Hickstead junction in order to mitigate the impacts of the proposed new business park north of Burgess Hill in Mid Sussex District. This forms part of the Local Plan strategy and will be funded by development in Mid Sussex District.

7.2 Merge and Diverge DMRB Layout Requirement Assessment

7.2.1 This section reports on the potential impacts of the proposed Local Plan development on National Highways Strategic Road Network (SRN) in the context of the merge/diverge layout requirements. This has been undertaken in light of National Highways requesting this level of analysis, and to ensure any impacts on the SRN have been fully understood.

7.2.2 The merge and diverge assessment layout requirement have been undertaken in accordance with ‘CD122 Geometric design of grade separated junctions, Revision 1, January 2020’. The approach has been to consider whether current merge and diverge layouts at SRN junctions with the Horsham model are able to accommodate future flows, for the Reference Case and Preferred Scenario, in their current configuration or whether alternative configurations are required.

7.2.3 The merge/diverge design classifications are categorised in alphabetical order based on the relationship between mainline volume of traffic against the merge/diverge volume of traffic. With Category A being the simplest design, accommodating minor merge/diverge flows, whilst layout H is designed to incorporated high levels of merge/diverge flows.

7.2.4 The results of the assessments are now summarised for each junction by direction and by particular merge and diverge assessed. All flows are provided in total vehicles. Detailed results and outputs are provided in Appendix L.

M23 Junction 9 Gatwick Airport

7.2.5 Table 7-1 shows the flows for the M23 J9 merge & diverges. In general, the local plan has minor changes in flow compared to the reference case in both peak periods on the mainline.

Table 7-1: M23 Junction 9 Merge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	5619	4920	5656	4754	37	-166
	Merge	241	294	201	296	-40	2
SB Merge	Mainline	4522	5826	5046	5701	524	-125
	Merge	50	412	59	537	9	125
NB Diverge	Mainline	5619	4920	5656	4754	37	-166
	Diverge	264	62	240	65	-24	3
SB Diverge	Mainline	4522	5826	5046	5701	524	-125
	Diverge	994	435	1016	551	21	115

7.2.6 The results of the assessment for the M23 J9 merge/diverge layout requirements are summarised in Table 7-2.

Table 7-2: M23 Junction 9 Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	E	E	3	4	2
	Reference Case	A	A	4	4	1
	Local Plan	A	A	4	4	1
SB Merge	Current Layout	E	E	4	4	2
	Reference Case	A	A	4	4	1
	Local Plan	A	A	4	4	1
NB Diverge	Current Layout	D	D	4	4	4
	Reference Case	A	A	4	4	4
	Local Plan	A	A	4	4	4
SB Diverge	Current Layout	D	D	4	3	2
	Reference Case	C	A	4	4	1
	Local Plan	C	A	4	4	1

7.2.7 From the above table the impacts of the Horsham Local plan on the junction indicate no additional requirement of merge layout in comparison to the reference case.

M23 Junction 10 Copthorne Junction

7.2.8 Table 7-3 shows the flows for the M23 J10 merge & diverges. In general, the local plan has minor changes in flow compared to the reference case in both peak periods on the mainline.

Table 7-3: M23 Junction 10 Merge/Diverge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3891	2775	3829	2687	-62	-88
	Merge	1992	2207	2066	2133	74	-73
SB Merge	Mainline	2897	4282	3444	4269	548	-13
	Merge	1145	1502	583	1415	-561	-87
NB Diverge	Mainline	3891	2775	3829	2687	-62	-88
	Diverge	1239	573	1276	644	37	71
SB Diverge	Mainline	2897	4282	3444	4269	548	-13
	Diverge	1675	1930	1661	1930	-15	0

7.2.9 The results of the assessment for the M23 J9 merge/diverge layout requirements are summarised in Table 7-4.

Table 7-4: M23 Junction 10 Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	E	E	3	4	2
	Reference Case	E	E	3	4	2
	Local Plan	E	E	3	4	2
SB Merge	Current Layout	A	A	3	3	2
	Reference Case	D	E	3	4	2
	Local Plan	D	E	3	4	2
NB Diverge	Current Layout	A	A	3	3	2
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
SB Diverge	Current Layout	D	D	4	3	2
	Reference Case	D	D	4	3	2
	Local Plan	D	D	4	3	2

7.2.10 From the above table the impacts of the Horsham Local plan on the junction indicate no additional requirement of merge layout changes in comparison to the reference case.

M23 Junction 10 a

7.2.11 Table 7-5 shows the flows for the M23 J10a merge & diverges. In general, the local plan has minor changes in flow compared to the reference case in both peak periods on the mainline.

Table 7-5: M23 Junction 10a Merge/Diverge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
M23 J9 NB Merge	Mainline	4394	3049	4598	3122	204	73
	Merge	736	299	508	209	-228	-90
M23 J9 SB Diverge	Mainline	3776	4984	3773	4779	-3	-206
	Merge	265	801	255	906	-10	105

7.2.12 The results of the assessment for the M23 J10a merge/diverge layout requirements are summarised in Table 7-6. The results indicate that no further requirements of merge layout changes in comparison to the reference case are required.

Table 7-6: M23 Junction 10a Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	C	C	3	3	2
	Reference Case	A	C	3	3	1
	Local Plan	A	C	3	3	1
SB Diverge	Current Layout	B	B	4	3	2
	Reference Case	A	C	4	3	1
	Local Plan	A	C	4	3	1

7.2.13 From the above table the impacts of the Horsham Local plan on the junction indicate no additional requirement of merge layout changes in comparison to the reference case.

M23 Junction 11 Pease Pottage

7.2.14 Table 7-7 shows the flows in the AM and PM peak period for the M23 J11 merge & diverges. In general, the local plan has minor changes in flow compared to the reference case in both peak periods on the mainline. The SB merge flow has increases within the LP scenario of up to 179 vehicles in the AM and up to 113 vehicles in the PM peak.

Table 7-7: M23 Junction 11 Merge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	2962	2098	3022	2105	60	7
	Merge	1432	951	1575	1016	143	66
SB Merge	Mainline	2156	2998	2242	2897	86	-101
	Merge	1381	1604	1561	1717	179	113
NB Diverge	Mainline	2962	2098	3022	2105	60	7
	Diverge	1930	1561	1930	1392	0	-168
SB Diverge	Mainline	2156	2998	2242	2897	86	-101
	Diverge	1620	1930	1530	1881	-89	-49

7.2.15 The results of the assessment for the M23 J11 merge/diverge layout requirements are summarised in Table 7-8.

Table 7-8: M23 Junction 11 Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	A	A	3	3	2
	Reference Case	E	A	2	3	1
	Local Plan	E	A	2	3	1
SB Merge	Current Layout	A	A	3	3	2
	Reference Case	B	E	2	3	2
	Local Plan	E	E	2	3	2
NB Diverge	Current Layout	A	B	3	3	2
	Reference Case	D	B	3	3	2
	Local Plan	D	B	3	3	2
SB Diverge	Current Layout	A	A	3	3	2
	Reference Case	D	D	3	2	2
	Local Plan	D	D	3	2	2

7.2.16 The southbound merge is shown as requiring a layout E in the local plan in comparison to layout B within the Reference Case, further consideration maybe required at this junction.

A23 southbound / B2114 Brighton Road Junction, Handcross

7.2.17 Flow outputs for the A23 / Brighton Road merge/diverge layout requirements are summarised in Table 7-9. Increase on the mainline are shown within both AM and the PM peak.

Table 7-9: A23 / Brighton Road Junction Merge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
SB Diverge	Mainline	3185	4072	3359	4119	174	47
	Merge	353	530	445	495	92	-35

7.2.18 The increase in flow does not change the junction merge requirement of the LP scenario in comparison to the reference case, as shown within Table 7-10 below.

Table 7-10: A23 / Brighton Road Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
SB Diverge	Current Layout	A	A	3	3	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1

7.2.19 From the above table the impacts of the Horsham Local plan on the junction indicate no additional requirement of lane changes in comparison to the reference case.

A23 / B2110 Junction, Handcross

7.2.20 Flow outputs for the assessment for the A23 / Brighton Road merge/diverge layout requirements are summarised in Table 7-11. Increase on the mainline are shown within the NB AM and both the AM and PM for the SB mainline (carried through from the A23 / Brighton Road junction).

Table 7-11: A23 / B2110 Junction Merge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	4393	3000	4490	2846	96	-153
	Merge	666	659	655	651	-11	-8
SB Merge	Mainline	3185	4072	3359	4119	174	47
	Merge	34	24	43	27	9	2
NB Diverge	Mainline	4393	3000	4490	2846	96	-153
	Diverge	220	165	218	247	-3	82

7.2.21 The increase in flow does not change the junction merge requirement of the LP scenario in comparison to the reference case, as shown within Table 17-2 below.

Table 7-12: A23 / B2110 Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	A	A	3	3	1
	Reference Case	D	D	3	3	1
	Local Plan	D	D	3	3	1
SB Merge	Current Layout	B	B	3	3	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
NB Diverge	Current Layout	A	A	3	3	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1

7.2.22 From the above table the impacts of the Horsham Local plan on the junction indicate no additional requirement of lane changes in comparison to the reference case. Further discussion with National Highways regarding the merge layouts may be required.

A23 / B2115 Junction, Warninglid

7.2.23 Flow outputs for the assessment for the A23 / Brighton Road merge/diverge layout requirements are summarised in Table 7-13. Increase on the mainline are shown within the NB AM and both the AM and PM for the SB mainline.

Table 7-13: A23 / B2115 Junction Merge/Diverge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	4410	2957	4536	2973	127	16
	Merge	204	208	171	120	-33	-88
SB Merge	Mainline	2970	3984	3152	4019	182	35
	Merge	591	919	546	920	-45	1
NB Diverge	Mainline	4410	2957	4536	2973	127	16
	Diverge	658	601	630	631	-29	30
SB Diverge	Mainline	2970	3984	3152	4019	182	35
	Diverge	250	112	250	127	0	15

7.2.24 The increase in flow does not change the junction merge requirement of the LP scenario in comparison to the reference case, as shown within Table 7-14 below.

Table 7-14: A23 / B2115 Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	A	A	3	3	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
SB Merge	Current Layout	A	A	3	3	1
	Reference Case	D	D	3	4	1
	Local Plan	D	D	3	4	1
NB Diverge	Current Layout	A	A	3	3	1
	Reference Case	C	C	4	3	1
	Local Plan	C	C	4	3	1
SB Diverge	Current Layout	A	A	3	3	1
	Reference Case	C	A	3	3	1
	Local Plan	A	A	3	3	1

7.2.25 From the above table the impacts of the Horsham Local plan on the junction indicate no change in lane requirements from the Reference Case to the Local Plan. The northbound diverge is showing an increase in upstream mainline lanes to 4 in the reference case and local plan. Further discussion with National Highways regarding northbound diverge lanes and merge layout may be required.

A23 northbound / London Road Junction

7.2.26 Flow outputs for the assessment for the A23 / London Road merge/diverge layout requirements are summarised in Table 7-15.

Table 7-15: A23 / London Road Junction Merge/Diverge Assessment Flows

A23 / London Road		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	5068	3558	5166	3604	98	46
	Merge	0	0	0	0	0	0
NB Diverge	Mainline	5068	3558	5166	3604	98	46
	Diverge	0	0	0	0	0	0

7.2.27 The increase in flow does not alter the junction merge requirement of the LP scenario in comparison to the reference case, as shown within Table 7-16 below.

Table 7-16: A23 / London Road Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	A	A	3	3	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
NB Diverge	Current Layout	B	B	3	3	1
	Reference Case	A	A	4	4	1
	Local Plan	A	A	4	4	1

7.2.28 From the above table the impacts of the Horsham Local plan on the junction indicate no change in layout requirements

A23 southbound exit slip / Broxmead Lane Junction

7.2.29 Flow outputs for the assessment for the A23 / Broxmead Lane merge/diverge layout requirements are summarised in Table 7-17.

Table 7-17: A23 / Broxmead Junction Diverge Assessment Flows

A23 / Broxmead Lane		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
SB Diverge	Mainline	3420	4852	3561	4880	141	28
	Diverge	141	51	136	60	-5	8

7.2.30 The increase in flow does not alter the junction merge requirement of the LP scenario in comparison to the reference case, as shown within Table 7-18 below.

Table 7-18: A23 / Broxmead Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
SB Diverge	Current Layout	A	A	3	3	1
	Reference Case	C	A	4	4	1
	Local Plan	A	A	4	4	1

7.2.31 The table above shows that 4 lanes are required on the upstream and downstream in both the reference case and local plan. Further discussions with National Highways will be required.

A23 / A272, Bolney

7.2.32 Flow outputs for the assessment for the A23 / A272 merge/diverge layout requirements are summarised in Table 7-19. Increase on the mainline are shown within the NB AM and SB PM models.

Table 7-19: A23 / A272 Junction Merge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3998	3376	3991	3408	-7	32
	Merge	1070	182	1175	196	105	14
SB Merge	Mainline	3420	4562	3561	4600	141	37
	Merge	395	314	355	285	-40	-29
NB Diverge	Mainline	3998	3376	3991	3408	-7	32
	Diverge	194	235	198	275	5	41
SB Diverge	Mainline	3420	4562	3561	4600	141	37
	Diverge	0	289	0	280	0	-10

7.2.33 The increase in flow does not alter the junction merge requirement of the LP scenario in comparison to the reference case, as shown within Table 7-20 below.

Table 7-20: A23 / A272 Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	A	A	3	3	1
	Reference Case	D	A	3	4	1
	Local Plan	D	A	3	4	1
SB Merge	Current Layout	A	A	3	3	1
	Reference Case	A	D	3	4	1
	Local Plan	A	D	3	4	1
NB Diverge	Current Layout	A	A	3	3	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
SB Diverge	Current Layout	B	B	3	3	1
	Reference Case	A	C	4	3	1
	Local Plan	A	C	4	3	1

7.2.34 The southbound diverge assessment shows there is a need for 4 upstream lanes in the reference case and local plan scenarios as well as a D merge layout in both scenarios.

A23 / A2300 Junction, Hickstead

7.2.35 Flow outputs for the assessment for the A23 / A2300 merge/diverge layout requirements are summarised in Table 7-21. Increase on the mainline are shown along the SB mainline within both the AM and PM peak models and the NB PM models.

Table 7-21: A23 / A2300 Junction Merge/Diverge Assessment Flows

A23 / A2300		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	4090	2722	4067	2785	-23	63
	Merge	142	888	177	897	35	10
SB Merge	Mainline	2687	3325	2814	3345	127	20
	Merge	1299	652	1199	635	-100	-17
NB Diverge	Mainline	4090	2722	4067	2785	-23	63
	Diverge	82	351	109	344	27	-7
SB Diverge	Mainline	2687	3325	2814	3345	127	20
	Diverge	1128	1552	1102	1540	-26	-12

7.2.36 The increase in flow does not alter the junction merge requirement of the LP scenario in comparison to the reference case, as shown within Table 7-22 below.

Table 7-22: A23 / A2300 Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	D	D	2	3	1
	Reference Case	A	D	3	3	1
	Local Plan	A	D	3	3	1
SB Merge	Current Layout	B	B	2	2	1
	Reference Case	E	A	3	3	2
	Local Plan	D	A	3	3	1
NB Diverge	Current Layout	A	A	2	2	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
SB Diverge	Current Layout	C	C	3	2	2
	Reference Case	C	D	4	3	2
	Local Plan	C	D	4	3	2

7.2.37 The merge/diverge analysis shows a requirement in additional capacity within both the reference case and local plan scenario. The change between the Reference Case and Local Plan scenario merge layout of the SB merge is resulting from a decrease in flow entering the motorway from the SB slip road.

A23 / B2118 Junction, Sayers Common

7.2.38 Flow outputs for the assessment for the A23 / B2118 merge/diverge layout requirements are summarised in Table 7-23.

Table 7-23: A23 / B2118 Junction Merge/Diverge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3861	2806	3905	2865	44	59
	Merge	391	267	350	264	-41	-3
SB Diverge	Mainline	3051	3443	3111	3425	60	-17
	Diverge	935	535	902	555	-33	20

7.2.39 The results of the assessment for the A23 / B2118 merge/diverge layout requirements are summarised in Table 7-24 below.

Table 7-24: A23 / B2118 Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	B	B	2	2	1
	Reference Case	D	A	3	3	1
	Local Plan	D	A	3	3	1
SB Diverge	Current Layout	B	B	2	2	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1

7.2.40 The table shows that an additional upstream and downstream lane are required in the reference case and local plan case. The local plan scenario is shown to not require further mitigation in comparison to the Reference Case.

A23 / B2117 Junction, Muddleswood

7.2.41 Flow outputs for the assessment for the A23 / B2117 merge/diverge layout requirements are summarised in Table 7-25.

Table 7-25: A23 / B2117 Junction Merge/Diverge Assessment Flows

A23 / B2117		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Diverge	Mainline	3861	2806	3905	2865	44	59
	Diverge	226	277	181	338	-44	61
SB Merge	Mainline	3051	3443	3111	3425	60	-17
	Merge	209	147	195	164	-14	17

7.2.42 The results of the assessment for the A23 / B2117 merge/diverge layout requirements are summarised in Table 7-26 below.

Table 7-26: A23 / B2117 Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Diverge	Current Layout	B	B	2	2	2
	Reference Case	A	A	3	3	1
	Local Plan	A	C	3	3	1
SB Merge	Current Layout	B	B	2	2	2
	Reference Case	D	A	3	3	1
	Local Plan	D	A	3	3	1

7.2.43 The table shows that an additional upstream and downstream lane are required in the reference case and local plan case.

A23 / A281 Junction, Pyecombe north

7.2.44 Flow outputs for the assessment for the A23 / A281 merge/diverge layout requirements are summarised in Table 7-27. Increases are noted within the PM Peak, in particular for the NB Mainline and NB Diverge

Table 7-27: A23 / A281 Junction Merge/Diverge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	4060	3083	4056	3203	-3	120
	Merge	26	0	31	0	5	0
SB Merge	Mainline	3260	3589	3306	3589	46	0
	Merge	39	0	66	0	27	0
NB Diverge	Mainline	4060	3083	4056	3203	-3	120
	Diverge	127	315	132	267	5	-48

7.2.45 The results of the assessment for the A23 / A281 merge/diverge layout requirements are summarised in Table 7-28 below. The highlighted flow increase shown within the PM peak do not alter the merge layout requirements.

Table 7-28: A23 / A281 Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	NA	NA	2	2	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
SB Merge	Current Layout	A	A	2	2	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
NB Diverge	Current Layout	A	A	2	2	1
	Reference Case	A	B	3	3	1
	Local Plan	A	A	3	3	1

7.2.46 The table shows that the junction may require extra in the Reference Case and Local Plan scenario. The local plan scenario is shown to not require further mitigation in comparison to the Reference Case.

A23 / South Downs Way Junction

7.2.47 Flow outputs for the assessment for the A23 / South Downs Way merge/diverge layout requirements are summarised in Table 7-29. Increases are noted within the NB mainline within both the AM and PM peak.

Table 7-29: A23 / South Downs Way Junction Merge/Diverge Assessment Flows

Approach		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	4035	3256	4169	3392	134	135
	Merge	153	143	28	79	-125	-64
SB Diverge	Mainline	3296	3446	3372	3510	76	64
	Diverge	3	143	0	79	-3	-64

7.2.48 The results of the assessment for the A23 / A281 merge/diverge layout requirements are summarised in Table 7-30 below. The highlighted flow increase shown within the NB mainline do not alter the merge layout requirements.

Table 7-30: A23 / South Downs Way Junction Merge/Diverge Layout Analysis

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Merge	Current Layout	NA	NA	2	2	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
SB Diverge	Current Layout	A	A	2	2	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1

7.2.49 The local plan scenario is shown to not require further mitigation in comparison to the Reference Case.

A23 / A273

7.2.50 Flow outputs for the assessment for the A23 / A273 merge/diverge layout requirements are summarised in Table 7-31. Increases are noted within the NB mainline within both the AM and PM peak.

Table 7-31: A23 / A273 Assessment Flows (Vehicles)

A23 / A273		Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Diverge	Mainline	4035	3256	4169	3392	134	135
	Diverge	1481	1930	1526	1930	45	0
SB Merge	Mainline	3296	3446	3372	3510	76	64
	Merge	1498	1437	1491	1442	-7	4

7.2.51 The results of the assessment for the A23 / A273 merge/diverge layout requirements are summarised in Table 7-32 below. The highlighted flow increase shown within the NB mainline do not alter the merge layout requirements.

Table 7-32: A23 / A273 Merge – Diverge Summary

Approach	Scenario	Merge Layouts		Upstream mainline lanes	Downstream Mainline Lanes	Connector Road Lanes
		AM	PM			
NB Diverge	Current Layout	C	C	3	2	2
	Reference Case	D	D	4	3	2
	Local Plan	D	D	4	3	2
SB Merge	Current Layout	D	D	2	3	2
	Reference Case	E	E	3	4	2
	Local Plan	E	E	3	4	2

7.2.52 The table shows that an additional upstream and downstream lane are required in the reference case and local plan case for the northbound and southbound merges. The local plan scenario is shown to not require further mitigation in comparison to the Reference Case.

7.3 Capacity & Travel Demand Analysis

7.3.1 Additional assessment has been undertaken reviewing the Volume to Capacity ratios of the SRN network and analysing impacts resulting from the LP traffic scenario on the following V/C outputs tables.

Table 7-33: Junction Capacity Outputs – SRN - AM Peak

Label	Junction Name	2039 Reference Case	2039 LP No Mitigation	2039 LP With Mitigation
A23 Bolney Junction	A23 Bolney Junction West Roundabout	100.0	100.0	100.0
A23 Hickstead Junction	A2300 northbound slip to A23	141.0	145.0	140.9
A23 Hickstead Junction	A23 northbound offslip at the roundabout at Hickstead	40.9	41.6	43.5
A23 Hickstead Junction	West Hickstead Lane Approach to HA23 Hickstead Roundabout Junction	42.0	44.9	44.2
A23 Hickstead Junction	A23 Hickstead Junction SB On Slip	96.4	97.2	97.7
A23 Pyecombe Junction	A23 at Pangdean Farm	114.1	115.8	115.2
A23 Pyecombe Junction	A23 NB Offlsip to A273	96.1	99.3	95.8
A23 Pyecombe Junction	A23 Access from West Road West of Pyecombe	96.7	102.9	96.7
A23 Pyecombe Junction	A23 NB On Slip Pyecombe Junction	100.9	100.0	99.8
A23 Pyecombe Junction	A23 NB Off Slip West of Pyecombe Junction	99.9	100.2	99.7
A23 Sayers Common Junction	B2118 merge onto A23 northbound	125.4	129.2	125.6
M23 J10	M23 J10 NB Off Slip Approach to Roundabout	84.0	100.9	101.2
M23 J10	M23 J10 Off Slip	86.8	86.0	87.1
M23 J10	M23 Northbound slip road merge at J10	99.8	99.9	99.8
M23 J11	A23 northbound slip road entry before M23 J11	108.6	110.0	109.1
M23 J11	Exit onto A264 WB at M23 Junction 11 roundabout	100.8	101.4	100.9
M23 J11	M23 J11 Roundabout NB Offslip Approach	100.3	102.5	101.4
M23 J11	A264 Exit at M23 Junction 11 roundabout	101.2	101.2	101.3
M23 J11	M23 southbound slip at M23 junction 11 roundabout	67.7	69.5	70.4
M23 J11	Horsham Rd/Brighton Road roundabout	70.0	72.0	72.8
M23 J9	M23 J9 Off Slip	86.7	97.2	97.3

Table 7-34: Junction Capacity Outputs – SRN - PM Peak

Label	Junction Name	2039 Reference Case	2039 LP No Mitigation	2039 LP With Mitigation
A23 Bolney Junction	A23 Bolney Junction West Roundabout	100.0	100.0	100.0
A23 Hickstead Junction	A2300 northbound slip to A23	84.2	86.4	85.6
A23 Hickstead Junction	A23 northbound offslip at the roundabout at Hickstead	116.7	117.0	116.5
A23 Hickstead Junction	West Hickstead Lane Approach to HA23 Hickstead Roundabout Junction	101.0	100.6	100.3
A23 Hickstead Junction	A23 Hickstead Junction SB On Slip	95.3	95.3	95.1
A23 Pyecombe Junction	A23 at Pangdean Farm	116.3	117.9	116.8
A23 Pyecombe Junction	A23 NB Offlsip to A273	100.9	101.2	101.1
A23 Pyecombe Junction	A23 Access from West Road West of Pyecombe	73.4	76.3	76.6
A23 Pyecombe Junction	A23 NB On Slip Pyecombe Junction	80.5	82.4	81.0
A23 Pyecombe Junction	A23 NB Off Slip West of Pyecombe Junction	80.0	81.9	80.4
A23 Sayers Common Junction	B2118 merge onto A23 northbound	71.8	73.2	72.9
M23 J10	M23 J10 NB Off Slip Approach to Roundabout	53.8	53.1	52.8
M23 J10	M23 J10 Off Slip	101.4	102.0	102.0
M23 J10	M23 Northbound slip road merge at J10	100.0	100.1	100.1
M23 J11	A23 northbound slip road entry before M23 J11	80.9	72.1	70.3
M23 J11	Exit onto A264 WB at M23 Junction 11 roundabout	55.0	54.9	53.6
M23 J11	M23 J11 Roundabout NB Offslip Approach	90.7	100.5	100.3
M23 J11	A264 Exit at M23 Junction 11 roundabout	73.9	74.6	75.3
M23 J11	M23 southbound slip at M23 junction 11 roundabout	102.4	103.8	104.0
M23 J11	Horsham Rd/Brighton Road roundabout	94.8	79.4	83.2
M23 J9	M23 J9 Off Slip	105.3	103.3	103.4

7.3.2 Analysis of each highlighted junction in the table above is described within the points below.

A23 Bolney Junction

7.3.3 Flow restricted to capacity at EB approach to roundabout within both reference case and preferred scenario within both the AM & PM Peak. **No mitigation required.**

A23 Hickstead Junction – A2300 NB on-slip merge to A23

7.3.4 Slip road significantly over capacity within AM reference case, restricted merge capacity within reference case due to large mainline flow. **No mitigation required.**

A23 Hickstead Junction - A23 NB off-slip approach to A2300 roundabout

7.3.5 Restricted Capacity at give way within the PM reference case due to large circulator flow. No V/C increase within the LP preferred scenario. **No mitigation required.**

A23 Hickstead Junction - West Hickstead Lane Approach to A23 Hickstead Roundabout Junction

7.3.6 Reduction of V/C within the PM LP scenario due to background traffic flow re-routing. **No mitigation required.**

A23 Hickstead Junction - A23 Hickstead Junction SB on Slip Merge

7.3.7 AM/PM – Similar level of V/C with the LP scenario when compared against the Reference case. **No mitigation required.**

A23 Pyecombe Junction – A23 SB Mainline "Q" merge point From Junction

7.3.8 Pseudo node representing the merge highlighted as being over capacity within reference case, LP preferred scenario increase this, however this is an existing background growth issue within the reference case AM & PM models. **No mitigation required.**

A23 Pyecombe Junction - A23 NB Off-slip Diverge

7.3.9 AM Mainline flow increase within the LP preferred scenario taking the 2-lane mainline diverge to be at capacity. It should be noted that this is a minor turning with minor flow that reduces within the mitigated scenario. No further mitigation required.

A23 Pyecombe Junction - A23 Access from West Road West of Pyecombe

7.3.10 Close to capacity within reference case AM, increase in flow in LP scenario along the A23 mainline results in increased V/C of merge. It should be noted that this is a minor turning with minor flow. No further mitigation required.

A23 Pyecombe Junction - A23 NB On-slip Merge

7.3.11 PM increase of mainline flow increasing V/C within the LP scenario. It should be noted that the NB on slip is a minor turning point with minor flows. No further mitigation required.

A23 Sayers Common Junction - B2118 NB on-slip merge

7.3.12 AM reference case significantly over capacity on merge due to high flow on mainline (at capacity) leaving no capacity for additional LP trips. **No mitigation required**

M23 J10 – NB Off-slip approach to Junction

7.3.13 V/C increase in LP scenario now being over capacity. **Changing of signal timings required and model indicates this should be possible.**

M23 J10 – SB Off-slip Diverge

7.3.14 No V/C increase in AM or PM LP Preferred scenario No further mitigation required.

M23 J11 – NB Off-slip Diverge

7.3.15 No V/C increase in AM or PM LP Preferred scenario No further mitigation required.

M23 J11 – EB A264 EB Exit

7.3.16 Blocking Back signalisation optimisation issues within the AM Reference Case no worse within LP scenario. **Changing of signal timings required and model indicates this should be possible.**

M23 J11 – NB Off slip Approach to Gyratory

7.3.17 Blocking Back signalisation optimisation issues within the AM & PM Reference Case no worse within LP scenario. **Changing of signal timings required and model indicates this should be possible.**

M23 J11 – A24 WB Approach to Gyratory

7.3.18 Blocking Back signalisation optimisation issues within the AM Reference Case no worse within LP scenario. **Changing of signal timings required and model indicates this should be possible.**

M23 J11 – SB off-slip approach to gyratory

7.3.19 Increase flow on circulatory with AM & PM LP scenario. **Changing of signal timings required and model indicates this should be possible.**

M23 J11 - Horsham Rd/Brighton Road roundabout

7.3.20 PM LP Preferred scenario V/C increase of Horsham Road WB approach due to increase in flow within the LP scenario. **Changing of signal timings required and model indicates this should be possible.**

7.4 Strategic Road Network Assessment Summary

7.4.1 The assessment of the impacts of the Local Plan on the SRN, has indicated that the A23 is already over capacity within the Reference Case model, due to the amount of additional traffic being added from the south coast towns, travelling north towards the M25 and London, as well as growth from Mid Sussex and Crawley.

7.4.2 One location where the Local Plan traffic does appear to have a clearer impact is on the southbound merge at M23 Junction 11 (Pease Pottage), as shown within the merge-diverge assessment in section 7.2. The M23 Junction 11 gyratory is shown to be at capacity within the V/C assessment table in section 7.3, but there is potential to mitigate through signal optimisation. Due to high levels of V/C already within the Reference Case, no additional physical mitigation is currently proposed at the junction, however further discussion with National Highways would be beneficial in order to confirm this approach.

8 Summary and Conclusions

8.1 Report Context

8.1.1 This report has been prepared by Stantec on behalf of Horsham District Council to provide technical evidence of the traffic impact impacts in context of the Local Plan Preferred Scenario for the period up to 2039.

8.1.2 The Transport Assessment derives its outputs and recommendations from the Horsham Transport Model forecasts, built in accordance with DfT Transport modelling guidance. This involves a fixed vehicle matrix approach in which origin to destination travel demand within the model respond to changes in network costs (combination of travel time and travel distance) in order to re-route to an optimal travel path.

8.2 Approach to Analysis

8.2.1 The modelling has been used to assess the Horsham Preferred Local Plan scenario. The approach focuses on mitigation through sustainable measures and informing any residual impacts where highway mitigation requires consideration.

8.2.2 The study has assessed the impacts of the Horsham Preferred Scenarios by comparing the performance of the highway network within Horsham and immediate neighbouring area and comparing these with the Reference Case outputs.

8.2.3 Where the network is shown to perform worse than the Reference Case and junctions are over-capacity, further analysis is undertaken to inform a mitigation strategy.

8.2.4 It is not the purpose of the Local Plan mitigation to resolve all forecast congestion issues within the Horsham network. If issues are shown to exist within the reference case scenario, prior to adding in Preferred Local Plan scenario growth, mitigation of local plan impacts is required to ensure that congestion and delays do not exceed reference case scenario level of congestion.

8.3 Sustainable Transport

8.3.1 Consideration has been given to sustainable travel measures that could impact on how people travel in the future and achieve a mode shift from car use.

8.3.2 The local plan development sites are proposed to comprise of sustainable transport measures that promote and encourage more sustainable active travel modes. This includes improved public transport, cycling and walking facilities.

8.3.3 Further Local Plan site-specific sustainable mitigation measures have been discussed and agreed with WSCC. The ideas are used to inform a level of car trip reduction in addition to the internalisation and the soft measures outlined previously. The car trip reduction rates are input within the Local Plan Forecasts.

8.3.4 Junctions initially identified as requiring further mitigation were analysed to understand whether the capacity shortcomings could be addressed through further sustainable mitigation measures (i.e. those likely to reduce car trips) connected with the Horsham Transport Strategy and to minimise as far as possible the need for physical mitigation.

8.3.5 Proposed measures included the prioritisation of active modes, where specifically feasible to reduce localised car trips further, and the general projection of virtual mobility (i.e. increased opportunity to work from home, due to technological advances reducing need to commute and reduce face to face meetings). The effect was to reduce car trips.

8.3.6 In addition, where junctions are signalised and only just over the threshold for requiring mitigation, the signal timings and V/C on all arms were examined, to explore whether there would be an opportunity to alter the signal timings. This typically involved looking at where the worse performing movement could be given more green time, without unduly impacting upon opposing movements which had plenty of spare capacity.

8.3.7 The following junctions were seen to be only just over the threshold based on the preferred strategy and could be dealt with through the measures above. The junction locations are highlighted within figure 8-1.

1. A264/A24 Dumb-bell Roundabout at South Broadbridge Heath, Horsham (Sustainable measures) (this is part of the recently upgraded road layout, specifically the A264/A24 southern roundabout on the western side of the A24).

2. A281 East Street / Park Way Junction, Horsham (Optimisation of traffic signals)

3. A264 / B2195 Moorhead Roundabout (Optimisation of traffic signals)

4. B2195 Harwood Road/Crawley Road/ Forest Road Junction (Optimisation of traffic signals)

5. A29/ A264 Five Oaks Roundabout (Sustainable Measures)

6. A283 /A29 Roundabouts, Pulborough (Sustainable Measures)

8.4 Highway Mitigation

8.4.1 Where it has been demonstrated that sustainable travel measures would not be enough to fully mitigate the impacts of the Local Plan, further mitigation measures have been assessed.

8.4.2 The following junctions are shown to require physical mitigation within Horsham District. The junction locations are highlighted within figure 8-1.

1. A24 / A272 Buck Barn

2. A24 / B2237 Hop Oast Roundabout

3. A24 / A283 Washington Roundabout

8.4.3 Detailed junction modelling for each of these junctions has been undertaken and shown that a mitigation scheme can be provided, which mitigates the impact of the Local Plan.

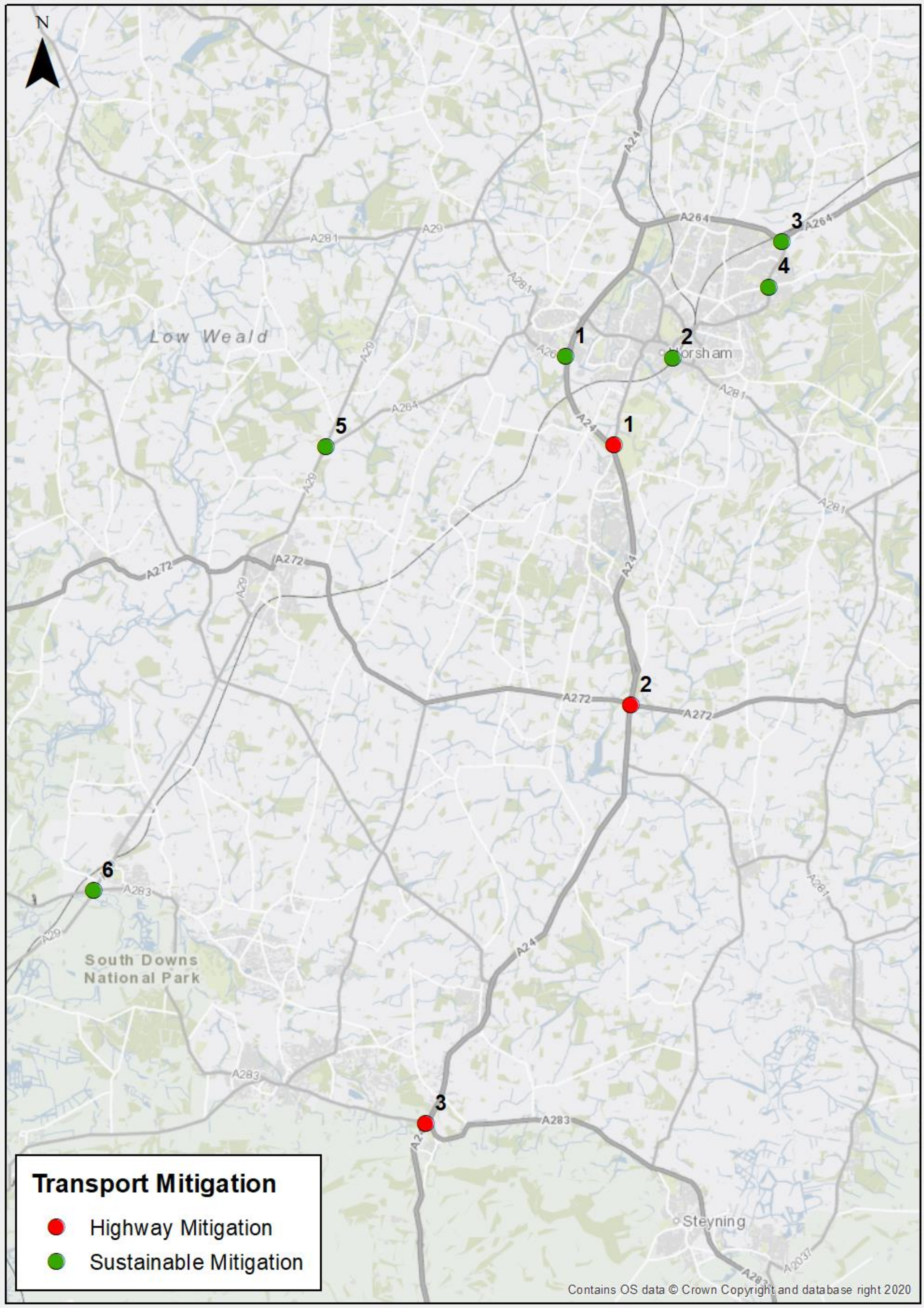

Figure 8-1: Junction Mitigation Locations

8.5 Strategic Road Network

8.5.1 The assessment of the impacts of the Local Plan on the SRN, has indicated that the A23 is already over capacity within the Reference Case model, due to the amount of additional traffic being added from the south coast towns, travelling north towards the M25 and London, as well as growth from Mid Sussex and Crawley. This additional traffic is resultant from background growth of traffic not related to the Horsham Local Plan developments and therefore the majority of impacts arise due to increases in background growth from elsewhere.

8.5.2 This has made the assessment of the Local Plan impacts difficult. It is therefore recommended that further discussion be held with National Highways to discuss what further means there are to quantify impacts that would specifically arise from Local Plan developments, in particular focusing on the impacts at M23 junction 11 at Pease Pottage.

8.6 Conclusion

8.6.1 Modelling has been undertaken to inform this Transport Assessment for the local plan scenario. The work has considered, at a high level, the sustainable travel mitigation and impact on traffic levels across Horsham District and any impacts within neighbouring authorities and on the Strategic Road Network, which in this case is the A23 and M23.

8.6.2 Limited physical highway mitigation is proposed, with three junctions on the A24 corridor being shown to require mitigation, which is deemed to be deliverable through the Local Plan process.

8.6.3 Proposed sustainable and physical mitigations are shown to alleviate significant increases of congestion which result from the Local Plan preferred scenario. Furthermore, the sustainable mitigation measures which have been included within the modelling assessment are deemed to be conservative in terms of the mode shift away from cars and therefore the physical mitigation requirements shown, may be reduced if more ambitious sustainable transport measures and targets made by individual site promoters are realised.

Appendix A Horsham Highway Model Data Collection Report

Appendix B Horsham Highway Model Local Model Validation Report

Appendix C Horsham Highway Model Forecast Report

Appendix D Reference Case Developments

Appendix E TRICS Trip Rate Derivation

Appendix F Zones used for Trip Distribution

Appendix G Reference Case v. Preferred Scenario Flow Differences

Appendix H Reference Case v. Preferred Scenario Delay Differences

Appendix I Washington Roundabout Detailed Junction Modelling Outputs

Appendix J Buck Barn Detailed Junction Modelling Outputs

Appendix K A24 Hop Oast Detailed Junction Modelling Outputs

Appendix L M23/A23 Merge Diverge Assessments

Appendix M High Level Mitigation Costs