Horsham Transport Study

Local Plan Preferred Scenario Transport Assessment

On behalf of **Horsham District Council**

Project Ref: 330610047 | Rev: 1 | Date: May 2021

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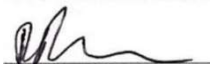
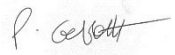
Prepared by:	Robert Dziurla	Principal Transport Planner		10/05/2021
Reviewed by:	Paul Gebbett	Senior Associate		11/05/2021
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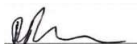
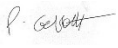
For and on behalf of Stantec UK Limited				

Revision	Date	Description	Prepared	Reviewed	Approved
1	19/07/21	Updated with revised Preferred Scenario Outputs	RD	PG	AN
					

Contents

Figures

Tables

Appendices

Executive Summary

Introduction

Stantec has been commissioned by Horsham District Council to produce a high-level transport assessment to support the emerging Local Plan. 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 the mitigation strategy required to support the Local Plan and inform more detailed junction modelling, using industry standard modelling packages, where required. Models have been developed to represent potential impacts at the end of the Local Plan period (2038), 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). The impacts and modelling outputs of such amendments would show negligible differences within the models.

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

Preferred Scenario - Strategic Sites

Development Location	Plan Period (Dwellings)	Overall (Dwellings)	Employment - B1 (Plan Period) (M^2)	Employment - B2 & B8 (Plan Period) (M^2)
Buck Barn (SA716)	2,100	3,500	8,800	21,200
West of Ifield (SA101)	3,250	10,000	2,700	6,300
West of Southwater (SA119)	1,200	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	**7,700**	**15,850**	**31,160**	**53,540**

*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) (M^2)	Employment - B2 & B8 (Plan Period) (M^2)
Ashington	300	300		
Barns Green	105	105		
Broadbridge Heath	290	290		
Christs Hospital	20	20		
Cowfold	105	105		
Henfield	325	325		
Horsham - Forest ward	100	100		
Horsham - Novartis	300*	300		
West of Kilnwood Vale Extension (SA341)	350	350		
Lower Beeding	57	57		
North Horsham parish	300	300		
Partridge Green	0	0	1,000	8,000
Pulborough	255	255	1,000	6,000
Rudgwick	66	66		
Rusper	38	38		
Slinfold	0	0		
Small Dole	60	60		
Southwater (land to north)	0	0	0	3,000
Steyning	240	240		
Storrington & Sullington	155	155		

Development Location	Plan Period (Dwellings)	Overall (Dwellings)	Employment - B1 (Plan Period) (M^2)	Employment - B2 & B8 (Plan Period) (M^2)
Thakeham	65	65		
Upper Beeding	70	70		
Warnham	20	20		
West Chiltington	36	36		
TOTAL	**3,257**	**3,257**	**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 Highways England 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 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 (2036), 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 more accurately represent expected development growth up to 2036. 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 improved public transport, cycling and walking facilities.

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.

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:

- A283/A29 Mini Roundabouts, Pulborough (sustainable mitigation)
- A283/Amberley Road Roundabout, Storrington (sustainable mitigation)
- A29/ High Street Roundabout, Pulborough (sustainable mitigation)

- B2237/Wimblehurst Road (signal optimisation)
- Moorhead Roundabout (signal optimisation)
- Albion Way/B2237 (signal optimisation)
- East Street / Park Way Junction (signal optimisation)
- A281/New Street Junction (signal optimisation)
- A264/Langhurst Wood Road (signal optimisation)
- Crawley Road/Forest Road (signal optimisation)

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 within Horsham District (note junctions on the Strategic Road Network (SRN) are looked at separately):

- A24 / A272 Buck Barn
- A24 Hop Oast Roundabout
- A24 Washington Roundabout
- A24 / Steyning Road

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. A through-about arrangement is proposed, whereby the A24 carriageways pass through the centre of the roundabout island thereby increasing the capacity of the junction.

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 to include bus priority at the junction, which emphasises the importance of sustainable transport within the overall strategy.

At the A24/A283 Washington Roundabout, it is proposed to signalise the roundabout. There is also a requirement to provide some localised widening to demonstrate that the Local Plan traffic can be mitigated. Any scheme to improve this junction is likely to need sensitive design to ensure landscape impacts on the South Downs National Park are mitigated.

At the A24/B2135 Steyning Road junction, it is proposed to replace the current priority arrangement with traffic signals. This is as much a safety scheme, as it is to provide additional capacity, although there is a capacity issue on Steyning Road due to increased flows on the A24 in the future. With higher flows on the A24, any traffic from Steyning Road will have fewer opportunities to turn onto the A24 and this is seen as a safety issue for right turning traffic, wishing to travel north in particular. The increase in flows on the A24 will make it even more difficult for traffic from Steyning Road to turn to/from the A24, particularly from/to the northbound carriageway.

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 OB)
A24 / A272 Buck Barn	£5,479,592
A24 Hop Oast	£2,825,384
A24 Washington Roundabout	£3,258,393
A24 / Steyning Road	£748,860

Cowfold

In addition, in the Preferred Strategy scenario, the northern mini roundabout at Cowfold in the AM peak, is shown to be an issue for the eastbound approach. It should be noted that without mitigation, the junction becomes congested under all scenarios tested but is marginally worse than for other scenarios due to the inclusion of the Buck Barn development. Physical mitigation has been examined for this junction; however, given the constraints within the village, a suitable junction mitigation scheme has not been found. Other options examined have included:

- signal gating traffic on the approach to the village, but this does not resolve the issue on the eastbound approach and changing the junctions to priority junctions, and
- A272 traffic having priority over the A281, however, the effect of removing the pinch point for the A272 is to generate overall more traffic on the A272, and also to cause excessive delays on the A281, which is a key public transport route.

Further interrogation of the modelling has been undertaken to understand traffic using Cowfold. Whilst the majority of traffic on this section of the A272 is using it to get to Mid Sussex towns, there is a reasonable proportion which is using the A272, A281 and B2110 and accessing the A23 at Handcross to travel northwards. Through concentrating physical mitigation along the main A24/A264 route, along with a signing strategy and reduced speed limits on the A272, A281 and B2110, this should be adequate to provide mitigation for Cowfold. Such a strategy would also help to address air quality issues relevant to the Cowfold Air Quality Management Area.

Strategic Road Network Impacts

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. It is therefore recommended that further discussion be held with Highways England to discuss what further means there are to quantify impacts that would specifically arise from Local Plan developments.

[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))

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.

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.

Traffic through Cowfold is a key issue for delivery of the Local Plan, however it is felt that a combination of signing and physical measures, such as reduced speed limits on the B2110 between Lower Beeding and Handcross, should reduce the traffic using the A272/A281/B2110 route to reach the A23 and thus alleviate the impacts of the Local Plan and go some way to addressing air quality issues. Physical highway mitigation measures in Cowfold have been explored, but do not mitigate the impacts.

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 proposed by individual site promoters are realised.

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 is to build a strategic highway model to underpin the assessment of the Local Plan impacts. This model will then be 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 2036 within Horsham District. The highway impacts in neighbouring authorities and on the Strategic Road network managed by Highways England (HE) 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 MHCLG 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 Horsham District being Billinghurst, Storrington & Sullington, Pulborough, Henfield & Southwater, Broadbridge Heath and Steyning/Bramber/Upper Beeding.

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 Highways England-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 750 dwellings (up from 664 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 2038. 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 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, that 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 an emerging 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 2036. Since the start of the exercise, the Local Plan period has been extended to 31 March 2038. It is considered that the outcome of modelling up until 2036 is still valid given (a) the primary purpose of is the scenario modelling was to assess the high-level relative impacts of the scenarios being tested, and (b) given the uncertainties inherent with forecasting of traffic growth 15/16 years into the future, and the long-term nature of development phasing on strategic sites, the evidence for the preferred strategy remains proportionate.

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 Scenarios

2.1 Introduction

2.1.1 As part of the overall study, a number of development scenarios have been modelled, which have then been used within an overall process to assist in the selection of the preferred scenario, on which this report concentrates. A decision on the preferred scenario has not been solely based upon the outputs from the Transport Assessment and modelling.

2.1.2 As stated within Section 1, reporting of the main outputs from the alternative development scenarios has been included within appendices to this report.

2.2 Previous Modelled Scenarios

2.2.1 The Horsham Local Plan transport assessment had initially been based on five spatial scenarios to inform a preferred Local Plan strategy. The work 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 the M23. The A27 lies to the south of Horsham District, but sits outside the detailed modelled area.

2.2.2 Full details of the developments included within each of these scenarios is provided within Appendix A. These can be summarised as follows (note the 'dwellings per annum' includes existing commitments):

- Scenario 1 – 1,000 homes per annum
- Scenario 2 - Medium Growth 1,164 homes per annum. New settlement plus settlement hierarchy (Mayfield):
- Scenario 3: Medium Growth 1,164 homes per annum. New settlement plus settlement hierarchy (Buck Barn)
- Scenario 4: Medium Growth 1164 Homes per annum. New settlement plus settlement hierarchy (Adversane)
- Scenario 5: High Growth - Urban Extension and New Settlements

2.2.3 All scenarios were modelled assuming both with and without physical mitigation. After the application of the sustainable transport measures within each of the 5 scenarios, further analysis was conducted identifying the locations where physical junction mitigation may still be required.

2.2.4 Locations where residual highway mitigation requirements have been identified from the modelling and discussed at a high level for the 5 scenarios are shown below. The key issues resulting from these outputs are as follows:

- Washington Roundabout lies adjacent to South Downs National Park; and any mitigation scheme is likely to involve works encroaching on the National Park, therefore, any major improvements will be difficult to achieve. Signalising the roundabout may be an option, which would not require land take or minimal land take. This will be more achievable in Scenario 3 and Scenarios 4 and 5 may require more substantial mitigation.
- Junctions in Cowfold are shown to be at capacity and traffic appears to be avoiding the route in future scenarios. Modelling does indicate that providing additional highway capacity will result in additional traffic in the village i.e. if additional capacity is provided on

the A272 to address congestion, traffic which was avoiding the route and using alternative (less suitable routes) will reassign to the A272. This will be a particular issue for scenarios including Mayfield's and/or Buck Barn. Cowfold is also an AQMA, which adds to potential issues for mitigation.

- A283/A29 junctions in Pulborough are very constrained and any physical mitigation is likely to be limited. Scenarios 4 and 5 are worse than other scenarios, therefore traffic growth from these scenarios will be more difficult to mitigate.
- A24/A272 Buck Barn junction is well over capacity and is shown to require mitigating. Further sustainable travel mitigation will be explored, but it appears that a relatively large scheme will be required.
- A24/Steyning Road requires mitigation in Scenarios 3, 4 and 5. New junction improvements proposals could include signalisation of the roundabout to improve junction throughput.
- A283/Amberley Road Roundabout, Storrington. Signalising the A283 Amberley Road roundabout could provide additional capacity for Amberley Road to exit onto the A283. This would be required in Scenarios 3, 4 and 5.
- Junctions within Crawley identified as requiring mitigation, are all likely to be impacted on with the proposed Crawley Western Link Road. However, further sustainable transport mitigation on the Ifield Avenue route may reduce the need for highway mitigation at the level of development included within the model.

2.2.5 Local Plan Scenario 3 results indicated that highway impacts remain of lower magnitude in comparison to other scenarios whilst still delivering a significant quantum of development for the local plan. This was a factor in the site initially brought forward as the preferred scenario. Further amendments were subsequently made to this scenario.

2.2.6 Subsequent modelling was undertaken for a revised scenario 3 with the following amendments.

- Removal of sites in Partridge Green (205 dwellings), reflecting the large quantum of development proposed at Buck Barn within the same parish (West Grinstead).
- Addition of Horsham – Novartis (300 dwellings). This site has recently gained planning permission; it was omitted as a commitment in the earlier assessments and is therefore now included for completeness.
- Removal of Rookwood (725 Dwellings and 3,000 square metres of employment).

2.2.7 Completion of this stage of work led to a preferred scenario, which id detailed below.

2.3 Preferred Scenario

2.3.1 The Preferred Scenario strategic development sites are summarised within Table 2-1 and the neighbourhood plan sites summarised within Table 2-2.

2.3.2 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) (M^2)	Employment - B2 & B8 (Plan Period) (M^2)
Buck Barn (SA716)	2,100	3,500	8,800	21,200
West of Ifield (SA101)	3,250	10,000	2,700	6,300
West of Southwater (SA119)	1,200	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	**7,700**	**15,850**	**31,160**	**53,540**

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

Development Location	Plan Period (Dwellings)	Overall (Dwellings)	Employment - B1 (Plan Period) (M^2)	Employment - B2 & B8 (Plan Period) (M^2)
Ashington	300	300		
Barns Green	105	105		
Broadbridge Heath	290	290		
Christs Hospital	20	20		
Cowfold	105	105		
Henfield	325	325		
Horsham - Forest ward	100	100		
Horsham - Novartis	300*	300		
West of Kilnwood Vale Extension (SA341)	350	350		
Lower Beeding	57	57		
North Horsham parish	300	300		
Partridge Green	0	0	1,000	8,000
Pulborough	255	255	1,000	6,000
Rudgwick	66	66		
Rusper	38	38		
Slinfold	0	0		
Small Dole	60	60		
Southwater (land to north)	0	0	0	3,000
Steyning	240	240		

Development Location	Plan Period (Dwellings)	Overall (Dwellings)	Employment - B1 (Plan Period) (M^2)	Employment - B2 & B8 (Plan Period) (M^2)
Storrington & Sullington	155	155		
Thakeham	65	65		
Upper Beeding	70	70		
Warnham	20	20		
West Chiltington	36	36		
TOTAL	**3,257**	**3,257**	**2,000**	**17,000**

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

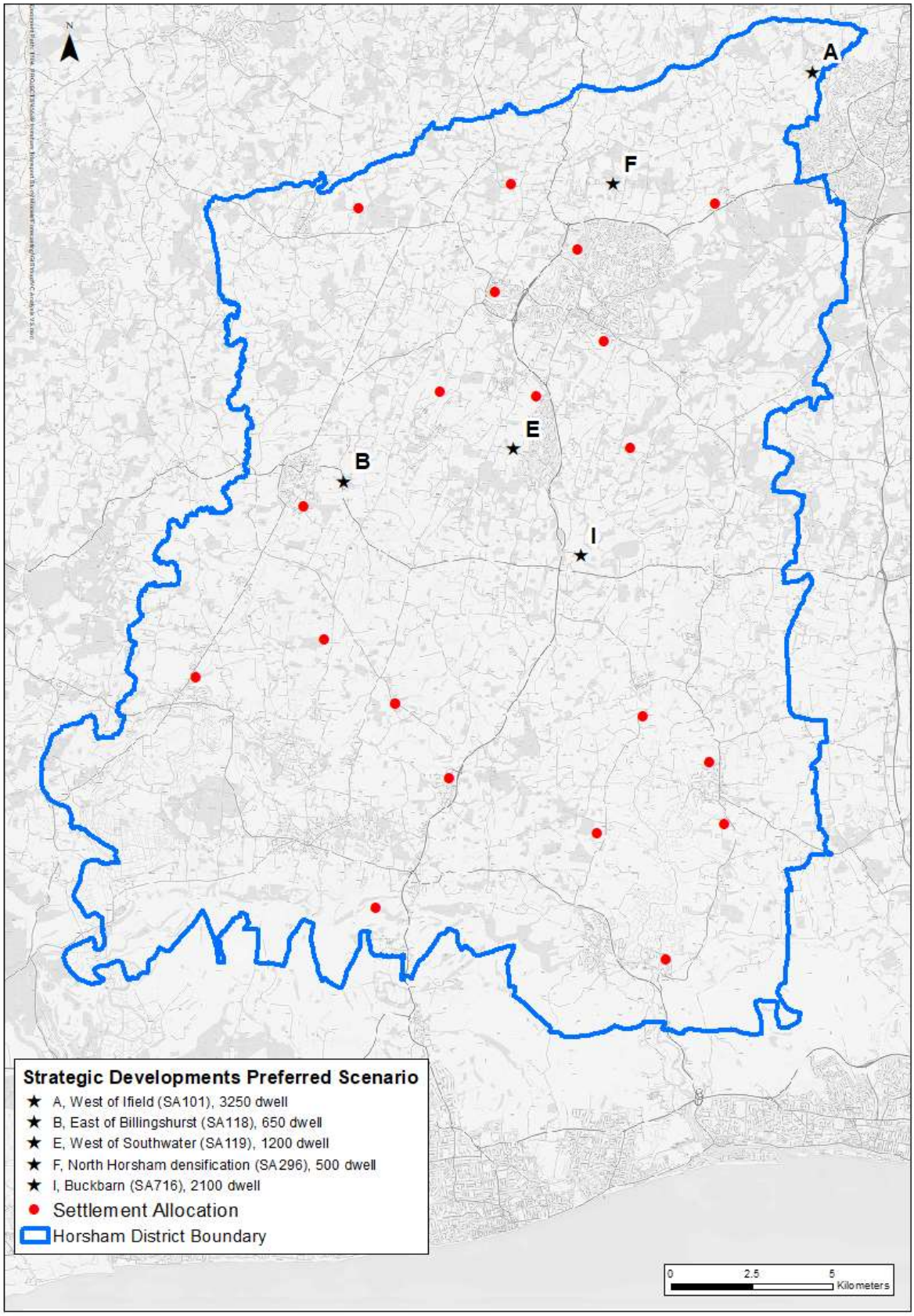


Figure 2-1: Preferred Scenario Development Locations

3 Transport Modelling

3.1 Overview

3.1.1 To inform the Transport Study and to provide information to support the development of Horsham's Local Plan a traffic modelling exercise has been undertaken. The study has been undertaken in two stages, with Stage 1 being to produce a highway modelling tool covering the District. This is developed to represent traffic conditions in the current situation, known as the base year models. This is then used to underpin Stage 2 of the study, to evaluate the highway impact of development within Horsham District up to 2036 and to support the delivery of the Horsham Local Plan, through development of forecast models to represent traffic conditions.

3.1.2 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.

3.1.3 To inform the impact of the Local Plan developments a transport modelling package known as SATURN[4] has been used. SATURN is a widely used and industry respected software package for highway assignment modelling.

3.1.4 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.

3.1.5 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 take into account 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.

3.1.6 The fixed trip matrix approach is seen to be proportionate for the purposes of then Local Plan study, which is strategic in nature and concerned with the overall impacts of development across Horsham district. Sustainable travel measures, which may form part of a Local Plan mitigation package will be considered as part of Stage 2 of the study and reflected within the modelling at that stage.

3.1.7 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 Highways England 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.

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

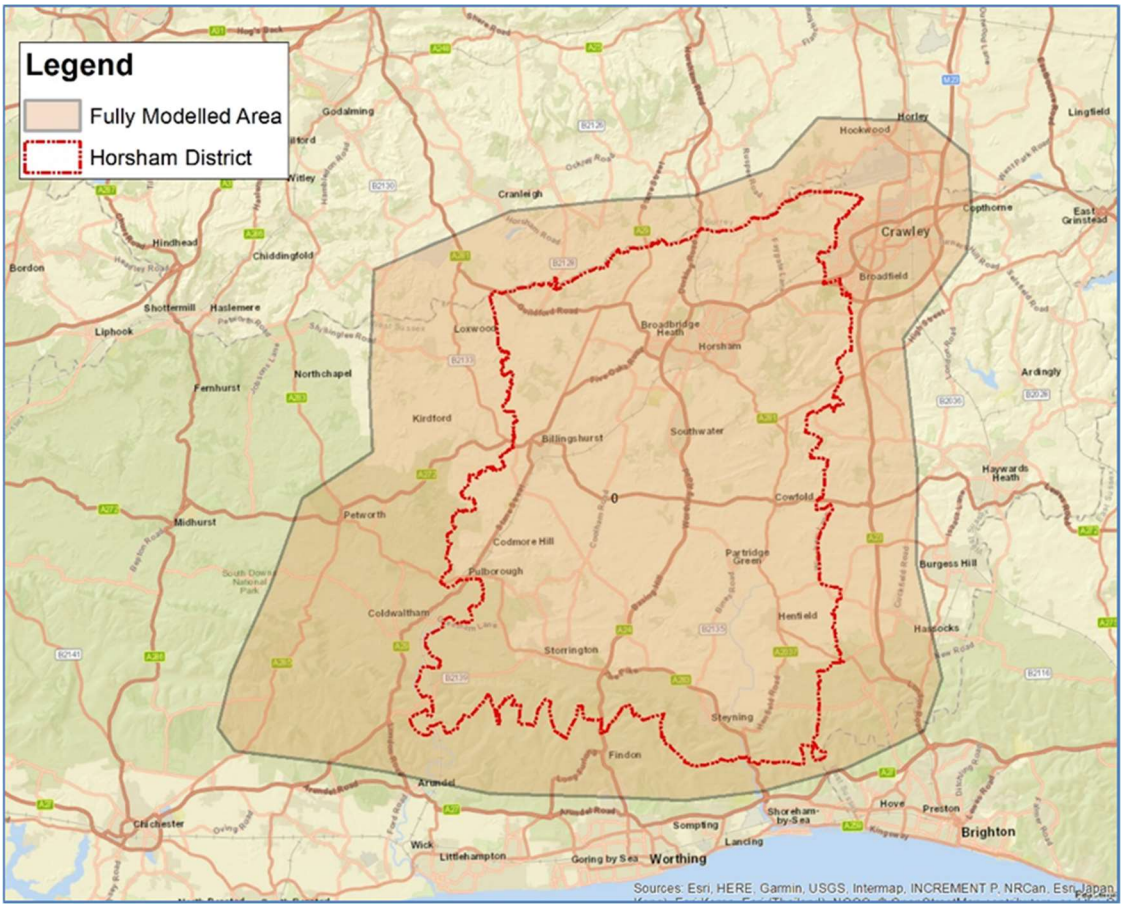


Figure 3-1: Horsham Highway Model Area

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 B.

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 C.

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 represented the start of the emerging Local Plan period as was originally envisaged when the work started.

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)[5] where judged too large and zone loading was judged too geographically coarse. This is particularly the case in built up areas, such as Horsham.

[5] 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)

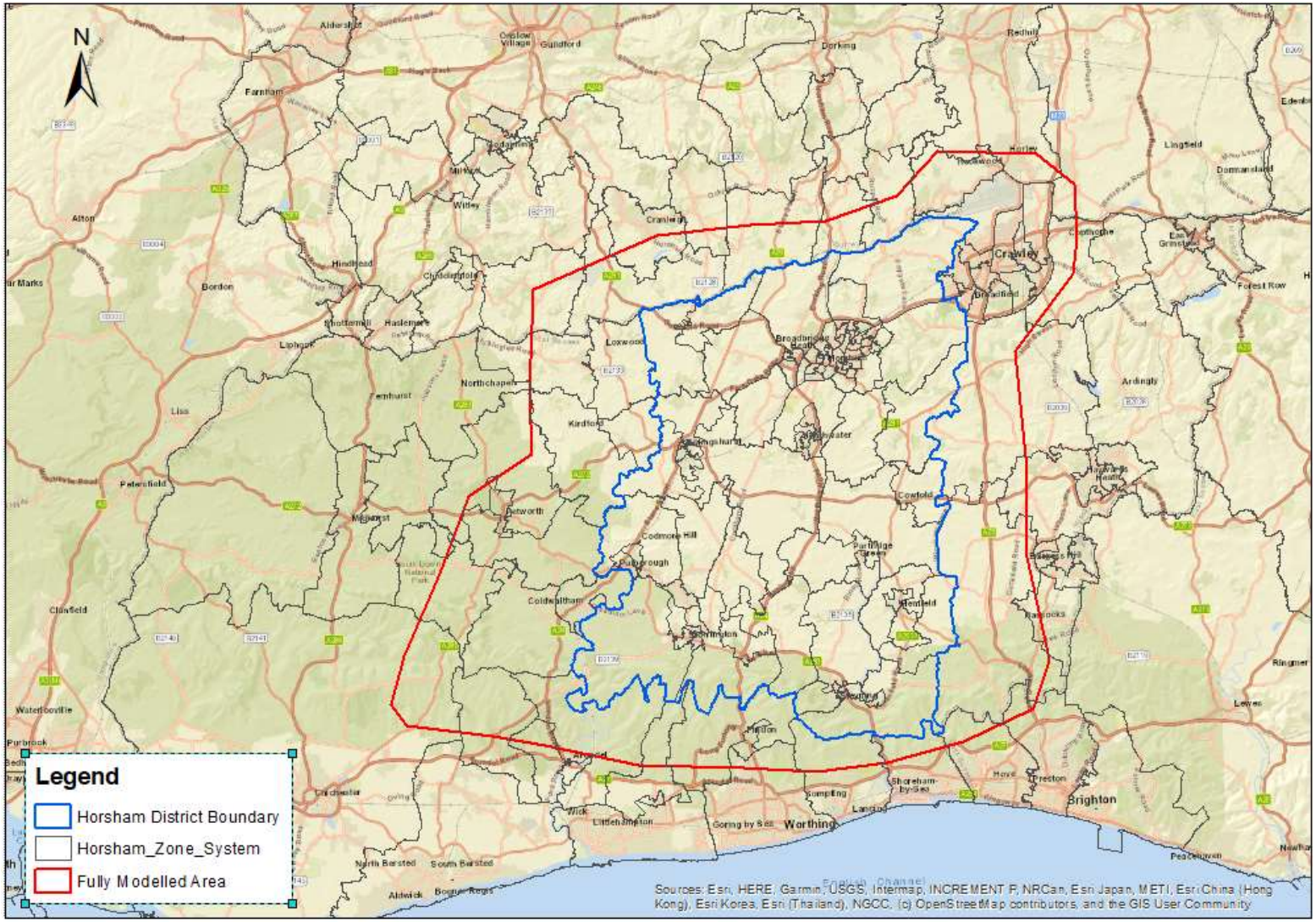


Figure 3-2: Horsham District Zones

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[6]. 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 Highways England 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 D. The methodology used for developing the forecast models was agreed with West Sussex County Council and Highways England.

3.3.2 In order to inform the Local Plan Review transport evidence base, Reference Case models have been produced to represent a forecast year of 2036. These take into account committed growth in Horsham up to 2036, committed growth in neighbouring authorities and background growth.

3.3.3 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.

3.3.4 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).

3.3.5 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 2036 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

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

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 E.

3.3.6 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.

3.3.7 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 F.

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

3.3.8 The trip rates used have also been reviewed against trip rates used within the transport assessments undertaken for Land North of Rectory Lane, West of Southwater and Land South of Marringden, Billinghurst and the trip rates are shown to be consistent.

3.3.9 In order to inform the level of internalisation to be applied to the strategic mixed used sites, the recently approved North Horsham development has been used to provide a level of internalisation within this study. 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), therefore it is felt that this approach is appropriate, given the proximity of the developments to this site.

3.3.10 North Horsham development includes both housing and employment and the Transport Assessment for that site has been used to inform the level of internalisation likely, as a result of people living and working within the North Horsham development. Trips for this site have therefore been reduced by 12% based on the calculations and assumptions made on the site. Due to the limited data available of internalisation rates of large mixed land use “garden village” type sites within the TRIC database, 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. The 12% trip reduction is applied to the total number of trips derived for

the development. Initial trip numbers are derived using trip rates applied on a land use basis (i.e. individual land use trips rates as per table 3.1 above).

3.3.11 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.

3.3.12 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.

3.3.13 In addition, background growth assumptions have been applied to neighbouring authorities through growth rates; these growth rates are derived from national assumptions about background growth in travel demand, provided 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.

3.3.14 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 2036 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.

3.3.15 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.

3.3.16 Windfall developments (c.1600 dwellings) within Horsham are also accounted for within the Local Plan scenarios, these have not been assigned to particular zones, rather the additional developments have been spread across the District and trips added within the model using a blanket growth factor. Developments within Neighbourhood Plan Sites have been included in the same manner as the Strategic Local Plan sites, with zones being allocated for trip distribution and trip generation based on the trip rates with table 3.1.

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.

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 2036	Projected NTEM Growth	Committed Development Total (Dwellings)	Adjust/Not Adjust NTEM	Adjusted NTEM
Adur	29,269	31,736	2,467	-	No Adjustment	-
Arun	73,413	84,698	11,285	3,089	Adjust	81,609
Chichester	55,324	64,847	9,523	-	No Adjustment	-
Crawley	46,177	50,854	4,677	3,753	Adjust	47,101
Horsham	62,459	75,256	12,797	6,026	Not Applied	-
Mid Sussex	64,326	76,724	12,398	10,232	Adjust	66,492
Worthing	50,200	54,566	4,366	-	No Adjustment	-

Table 3-4: TEMPro Jobs Forecast Adjustment

Employment (Jobs)					
Authority	NTEM 2019	NTEM 2036	Projected NTEM Growth	Committed Employment (Jobs)	Adjust/Not Adjust/Don't Use NTEM
Adur	26,625	27,927	1,302	-	No Adjustment
Arun	59,368	62,339	2,971	-	No Adjustment
Chichester	73,832	77,507	3,675	-	No Adjustment
Crawley	95,326	99,983	4,657	-	No Adjustment
Horsham	67,348	70,633	3,285	10,392	Not Applied

Employment (Jobs)					
Authority	NTEM 2019	NTEM 2036	Projected NTEM Growth	Committed Employment (Jobs)	Adjust/Not Adjust/Don't Use NTEM
Mid Sussex	72,794	76,393	3,599	-	No Adjustment
Worthing	59,459	62,431	2,972	-	No Adjustment

3.3.19 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.

3.3.20 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 D - Horsham Forecast Report.

Committed Highway Schemes

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

- A24 Great Daux Roundabout (Horsham)
- A24 Robin Hood Roundabout (Horsham)
- Newbridge Roundabout (Horsham)
- Horsham Enterprise Park Access (Horsham)
- Cheals Roundabout (Horsham)
- Bridsbury Field, Adversane (Horsham)
- New Road, East Billinghurst (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 Drive (Crawley)
- M23 Smart Motorway and J11 improvements (Crawley)

- Kilnwood Vale Main Access (Crawley)
- A2300 (Mid Sussex)
- A23 Copthorne Interchange (Mid Sussex)
- A23 Pease Pottage (Mid Sussex)

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

Reference Case Model Performance

3.3.23 The model performance is again demonstrated by the level of model convergence. This was shown to be within the relevant guidelines and is provided within Appendix D.

3.4 Local Plan Scenario Modelling

3.4.1 Modelling of the five spatial options as set out in Section 2, has been undertaken using the Reference Case model as the starting point in each scenario.

3.4.2 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.

3.4.3 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 between each location type 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 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.

3.4.4 Where there are large strategic sites which include residential and employment, 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.

3.4.5 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 is tabulated in Appendix G.

3.4.6 At this stage no changes will be 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 from 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 Highways England 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 In summary a three-step approach has been undertaken as detailed above.

4.1.8 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.

4.1.9 Within the context of the modelling, the trip reduction process is undertaken manually, and the approach set out below provides conservative estimates, that 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, that 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 soft sustainable transport measures outlined above, further physical site-specific mitigation measures have been discussed and agreed 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 soft measures outlined previously.

4.3.2 The soft 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.

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.

East of Billingshurst

- Frequent bus service to Horsham
- Cycleway / footpath network including:
  - Cycle/ped only connection to Broomfield Drive
  - Cycle/ped connection to Brookers Road - employment area + cycle route to Weald School
  - Bus+cycle/ped connection to Daux Rd - employment area and route to rail station
  - Cycle/ped connection to Daux Avenue
- Mitigation for A29 Northern roundabout (Bypass/Stane St./Amblehurst Green/High St) - Options:
  - Signals with bus priority
  - Conventional improvement to roundabout
- Local/personal mobility solutions / “MAAS” – electric buggies/vehicles – travel on demand to/from station and town centre

Buck Barn

- Frequent bus service to Horsham including direct connection to Horsham train station.
- Likely to be achieved through the extension of the 98 (Horsham P&R service) followed by an increase in the service frequency in later phases.
- Bus to Worthing with diversion of existing services and frequency improvements
- Provision of an east / west bus service serving Billingshurst and Haywards Heath – likely to be a lower frequency service introduced in the later phases of the development.
- Bus priority on A24 including, but not necessarily limited to Hop Oast junction
- 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
    - Additional DIDO (drive-in drive-out) stand at the south end of the station
    - Improved Interchange facilities at Horsham train station
- Cycleway network including:
    - Cycle only connection to Christ's Hospital train station using the Downs Link
- Contribute to major high capacity and frequency bus priority corridor to Horsham and Crawley
- Full suite of supporting sustainable transport measures including Transport on Demand, Shared Transport solutions, MaaS, Behaviour Change, Micromobility and Active Travel Solutions (including an extensive e-bike hire scheme)

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, Shared Transport solutions, MaaS, Behaviour Change, Micromobility and Active Travel Solutions

West of Kilnwood Vale

- Treat as part of West of Ifield, to have same level of internal and local measures
- Contribute to major high capacity and frequency bus priority corridor Horsham – Crawley – very high frequency services on corridor to include services between development areas in addition to town centre to town centre services.

North Horsham Densification

- Expand upon walking / cycling network in North Horsham
- Increase frequency of buses to Horsham and Crawley – 10 mins overall
- Additional bus route from Town centre to North Horsham
- 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
    - 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 or 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)

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 so 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
Buck Barn	Medium / high % car trip reduction – 7%	Horsham Town Centre
Southwater	Medium / high % car trip reduction – 7% to 10%	Horsham Town Centre & Worthing
West of Kilnwood Vale	High % car trip reduction – 10% to 12% up to 12% to 15%	Horsham Town Centre, Crawley Town Centre
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 Table 4-2 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**
East of Billingshurst	-4%	-3%	-4%	-3%
Buck Barn	-3%	-3%	-5%	-3%
Southwater	-6%	-6%	-6%	-7%
Rookwood	-5%	-4%	-6%	-8%
West of Kilnwood Vale	-4%	-8%	-5%	-7%
North Horsham Densification	-1%	-1%	-1%	-2%
West of Ifield	-8%	-5%	-7%	-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 brings 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 Preferred 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 for all previous scenarios modelled is provided within Appendix H.

5.1.3 The outputs provide a summary of the Preferred 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 I. 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 J. 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 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 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 Buck Barn junction and the 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 and 5-2 provide the V/C outputs at junctions for the AM and Tables 5-3 and 5-4 provide the data for the PM peak for junctions within Horsham District. Tables 5-5 and 5-6 provide the V/C outputs for junctions in Crawley Borough for the AM and PM respectively.

5.2.17 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.

5.2.18 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 excessive delays. 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.

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

5.2.20 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.

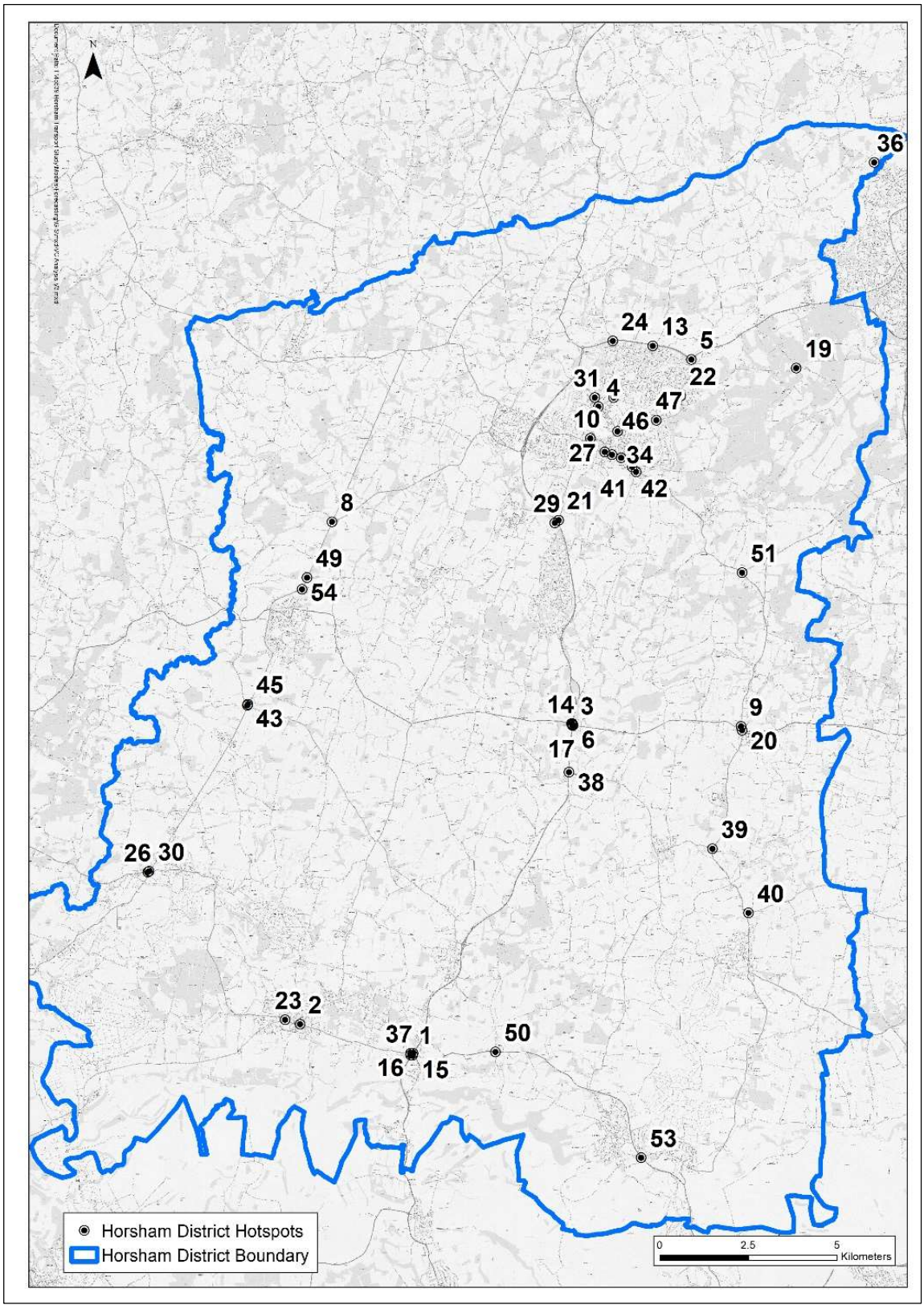


Figure 5-1: Horsham District Hotspots

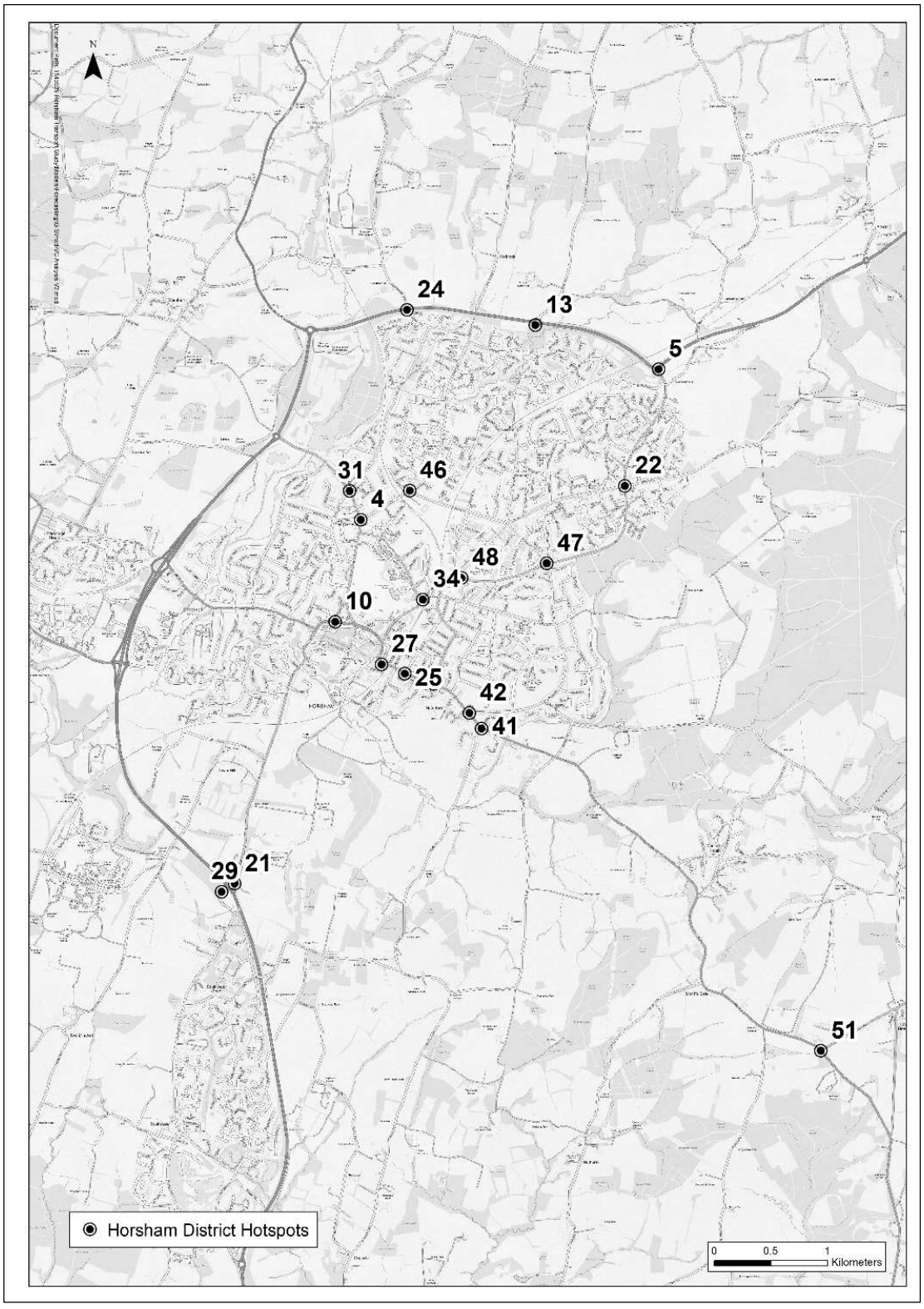


Figure 5-2: Horsham Town Hotspots

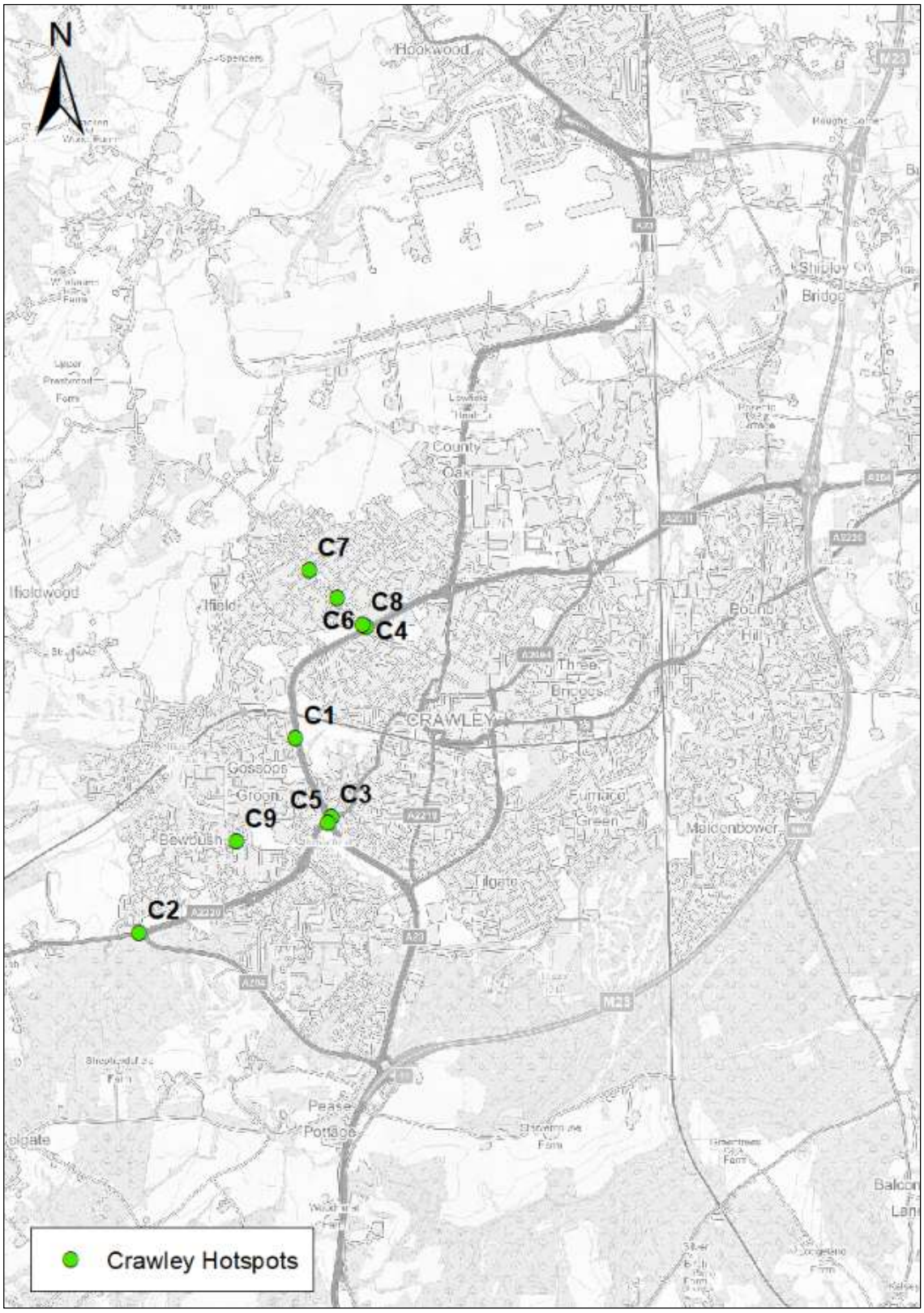


Figure 5-3: Crawley District Hotspots

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

Label	Junction Name	Reference Case	Preferred Scenario
1	A24 Northbound approach at Washington Roundabout	124.4	128.6
2	A283 High Street/Old Mill Road, Storrington	110.1	113.5
4	B2237/Wimblehurst Road, Horsham	106.7	107.2
5	A264 WB at Moorhead Roundabout, Horsham	64.6	99.4
9	A272/A281 northern roundabout, Cowfold	102.0	103.7
10	A281/North Parade Junction, Horsham	102.2	102.4
13	A24/ Rusper Road Roundabout (Rusper Road NB Approach), Horsham	84.4	92.3
23	A283 Amberley Road Roundabout, Storrington	96.9	100.1
27	A281 East Street / Park Way Junction, Horsham	88.0	99.2
29	A24 Hop Oast Roundabout - Worthing Road WB approach	94.5	107.2
30	A283/A29 Junction Eastern Mini Roundabout, Pulborough	97.1	101.7
31	Pondtail Road / North Parade, Horsham	74.5	92.2
34	North Street/ Hurst Street Roundabout, Horsham	65.4	83.4
38	A24/Steyning Road	66.9	99.8
40	Wheatsheaf Road/ A281	45.2	85.7
41	Kerves Lane/A281 Brighton Road, Horsham	54.0	97.2
46	Wimblehurst Rd/Parsonage Rd, Horsham	80.2	85.5
47	Harwood Road Roundabout, Horsham	73.0	90.6
49	A29/ New Road, Billinghurst	84.7	86.3
51	B2115/A281 Brighton Road (Ciswood House Junction)	76.7	92.5
53	Steyning Bypass Roundabout with Clays Hill	100.1	97.9

Table 5-2: Junction Capacity Outputs – A264/A272 Junction - AM Peak

Label	Junction Name	Reference Case	Preferred Scenario
3	A24 Northbound signalised junction with A272	108.3	116.5
6	A272 westbound signals at the A24/A272 junction	105.2	108.5
11	A272 eastbound signals at the A24/A272 junction	101.5	102.1
14	A24 northbound approach to A24/A272 junction	36.9	107.7
17	A24 southbound signals before A24/A272 junction	94.3	106.4

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

Label	Junction Name	Reference Case	Preferred Scenario
C6	Ifield Avenue/ Stagelands	88.8	102.6
C8	Ifield Roundabout, Ifield Ave SB approach	68.9	103.2
C9	Bewbush Drive/Mowbray Drive	98.5	86.8

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

Label	Junction Name	Reference Case	Preferred Scenario
2	A283 High Street/Old Mill Road, Storrington	107.8	111.5
4	B2237/Wimblehurst Road, Horsham	102.2	103.6
5	A264 WB at Moorhead Roundabout, Horsham	102.5	103.5
8	A264/A29 Five Oaks Roundabout	77.8	92.3
9	A272/A281 northern roundabout, Cowfold	86.6	93.9
15	London Road approach (A283 WB) at Washington Roundabout	108.8	110.4
16	A283 EB approach at Washington Roundabout	107.0	110.7
19	Colgate - Tower Road / Forest Road	87.1	97.8
20	A272/A8281 roundabout south of Cowfold	101.1	103.5
21	B2237 exit at Hop Oast Roundabout	103.2	104.9
22	Crawley Road/ Forest Road, Horsham	99.9	102.5

Label	Junction Name	Reference Case	Preferred Scenario
24	A264/Langhurst Wood Road, Horsham	103.7	104.4
25	A281/New Street Junction, Horsham Town Centre	101.1	101.5
26	A283/A29 Junction Western Mini Roundabout, Pulborough	100.7	100.8
27	A281 East Street / Park Way Junction, Horsham	95.6	100.7
29	A24 Hop Oast Roundabout - Worthing Road WB approach	69.3	102.3
30	A283/A29 Junction Eastern Mini Roundabout, Pulborough	99.4	99.3
31	Pondtail Road / North Parade, Horsham	94.8	95.3
37	A283 eastbound approach at Washington Roundabout	90.4	104.0
38	A24/Steyning Road	86.1	102.3
39	A281/Partridge Green Road, Henfield	70.8	93.6
41	Kerves Lane/A281 Brighton Road, Horsham	67.0	91.5
42	St Leonards Rd/A281, Horsham	71.5	93.9
45	A29/ Lordings Road, Billingshurst	84.5	92.6
50	A283/ Water Lane	64.9	88.4
51	B2115/A281 Brighton Road (Ciswood House Junction)	62.5	90.7
53	Steyning Bypass Roundabout with Clays Hill	83.2	92.6
54	A29/ High Street Roundabout, Billingshurst	84.0	99.4

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

Label	Junction Name	Reference Case	Preferred Scenario
3	A24 Northbound signalised junction with A272	116.7	113.3
6	A272 westbound signals at the A24/A272 junction	120.2	125.2
11	A272 signals over the A24/A272 junction	50.2	101.4
14	A24 eastbound approach to A24/A272 junction	109.0	109.9
17	A24 southbound signals before A24/A272 junction	103.9	105.0

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

Label	Junction Name	Reference Case	Preferred Scenario
C1	Bewbush Manor roundabout, Horsham Rd westbound approach	106.5	102.4
C2	Cheals Roundabout, Horsham Rd eastbound approach	137.3	142.5
C3	Ifield Roundabout, A23 eastbound approach	112.8	119.2
C4	Ifield Roundabout, Ifield Ave northbound approach	111.7	117.2
C5	Cheals Roundabout, Crawley Ave NB approach	104.4	109.0
C6	Ifield Avenue/ Rushetts Road	103.0	110.1
C7	Ifield Avenue / Warren Drive	102.7	102.4
C8	Ifield Roundabout, Ifield Ave SB approach	102.2	102.3
36	Ifield Avenue/Stagelands junction	53.5	110.3

5.2.21 There are a number of changes that result in some previously identified 'problem' junctions, now falling inside the 1.5% threshold used to indicate where junctions were deemed to have a 'significant' impact as a result of the Local Plan developments. A commentary of each of the key junctions identified within this Technical Note is provided below.

Junctions Congestion Hotspots in Horsham District Summary

5.2.22 ***A24/A283 Washington Roundabout*** - Severely congested within the AM Reference Case at A283, Storrington Road & A24 NB approach. Additional flow within the Preferred Scenario exacerbates the congestion exponentially in the AM 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.

5.2.23 ***B2237/Wimblehurst Road, Horsham*** - Over capacity within reference case and over the 1.5% threshold in the Preferred scenario in the PM peak. With signal optimisation V/C is brought down to below the mitigation threshold within the PM Peak. The junction had previously been identified as an issue in the AM peak, but this is no longer the case in the Preferred Scenario. **No further mitigation required.**

5.2.24 ***A264 WB Approach at Moorhead Roundabout, Horsham*** - Over capacity within reference case, and over the 1.5% threshold in the Preferred scenario in the PM peak. With signal optimisation V/C is brought down to below the mitigation threshold within the PM Peak. The junction had previously been identified as an issue in the AM peak, but this is no longer the case in the Preferred Scenario. **No further mitigation required.**

5.2.25 ***A272/A281 mini roundabouts, Cowfold***. - Above 1.5% threshold in the Preferred Scenario in AM and PM peak. A281 NB through movement capacity restricted by conflicting Right turning traffic from A281 SB. **Requiring mitigation**. Signalising junctions may be possible, which may also allow for improved pedestrian crossing facilities within the centre of Cowfold. Another alternative could be to change junction priorities, to make the A272 the major route, with the A281 having to give way, with priority junctions, however this has the potential to

attract more traffic on to the A272 and cause delays on the A281, which is a key north-south bus route.

5.2.26 **Colgate - Tower Road / Forest Road -** Above 1.5% threshold in the Preferred Scenarios in the PM peak. Limited scope for mitigation given constraints. The Tower Road approach is seen to be over capacity; however, it would not be appropriate to mitigate this through physical mitigation as it would potentially make the route more attractive to rat running traffic. The solution should be to improve the junctions on the A264 to make that a more attractive route and therefore reduce potential rat-running and flows at this junction. No physical mitigation would be proposed at this junction.

5.2.27 **A24 Hop Oast Roundabout** – The Worthing Road westbound approach is an issue in the AM peak and the B2237 arm in the PM peak within the preferred scenario. Significant through movement of the A24 SB restricts "gap time" and capacity for the B2237. **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 preferred scenario, AM and 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/Amberley Road Roundabout, Storrington -** Above 1.5% threshold in the preferred scenario AM peak. Below 1.5% threshold in PM peak preferred scenario. Mini Roundabout configuration. **Requiring mitigation**. Potential to signalise junction, which would improve pedestrian provision at this location.

5.2.30 A264**/Langhurst Wood Road junction** - Operates within capacity in AM peak. Just above 1.5% threshold in PM peak in Preferred Scenario. Signal optimisation result in significant reduction of V/C to less than 100, no further mitigation required.

5.2.31 **A281 Brighton Road/New Street Junction Horsham Town Centre** - Operates within capacity in the preferred scenario AM peak, above 1.5% threshold in Preferred Scenario PM peak. New Street approach - significant volume of right turning traffic restricted at priority marker. No mitigation would be proposed at this junction, as the issue is traffic coming out of New Street and improving this access could potentially make this route more attractive to rat-running.

5.2.32 **A283 /A29 Roundabouts, Pulborough** - The eastern roundabout operates within capacity in the preferred scenario AM peak, however above 1.5% threshold in the Preferred Scenario PM peak. A29 SB through movement capacity restricted by conflicting right turning traffic from A283 EB. Mini roundabouts are not ideal for high flows on more than one route within a junction as they have relatively low turn capacities, where there are large conflicting movements, and the model represents this situation. Driver behaviour at mini roundabouts also influences the capacity where there are large flows form more than one link. **Mitigation required**. There is limited scope for improvements due to physical constraints at the junction. There is potential to explore signalisation, however this would not resolve issues that are experienced by HGV's, which would require stop lines to be located quite far back and therefore require long inter-green times.

5.2.33 **A281 East Street / Park Way Junction** - Above 1.5% threshold in Preferred Scenario in AM and PM peak. Modelling indicates that signal optimisation should suffice at this location.

5.2.34 **A24/Steyning Road** – Junction is just over capacity in the preferred scenario PM peak. **Requiring further mitigation**. Given the current junction layout, the increase in traffic exiting from Steyning Road and in particular, turning north onto the A24, could potentially have safety implications.

5.2.35 **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**.

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

5.2.37 **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.

5.2.38 **A272/A281 Mini Roundabouts, Cowfold** – The junctions are well over capacity in the Reference Case and any increase in trips will exacerbate the issue. Traffic will also re-route to avoid Cowfold and this will need to be taken into consideration when looking at mitigation. One potential solution may be to signalise the two junctions and integrate pedestrian crossings into this and remove the current pedestrian crossing between the junctions. This could provide additional capacity, which is likely to suffice for some scenarios, however for the Preferred Scenario which includes Buck Barn, any additional capacity is likely to be used up quickly and the mitigation requirements are likely to be greater. This is discussed further in Section 6.

5.2.39 **Moorhead Roundabout** - Signal optimisation does improve the level of delay, however in the preferred scenario, including the reference case, it remains over 100%, therefore further capacity increases would be required to improve the congestion at the junction. As the junction is only just over the threshold, it may be possible to mitigate the impact with some minor widening on the WB approach arm to provide additional capacity here.

5.2.40 **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.

5.2.41 **A283/A29 Roundabouts, Pulborough** – The locality of the junctions and the constraints make mitigation considerations difficult. The proximity of buildings and narrow footways will make any mitigation here very difficult.

5.2.42 **A272/A24 Buck Barn -** Over capacity within all approaches, 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. However, it is most likely that the junction would require further larger scale physical mitigation and widening in order to accommodate the additional traffic demand. A through-about style arrangement that would significantly improve capacity of the junction, such an example of through-about style arrangements can be found at the Ringmead Road/ A322 Bagshot road junction in Bracknell. This is discussed further in Section 6.

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
- Cowfold Junctions
- Pulborough Junction
- Buck Barn Junction
- Amberley Road Roundabout, Storrington
- A283/A29 junctions in Pulborough
- 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 preferred scenario and the mitigated preferred 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 junctions on the A24 there is wider reassignment of trips between Horsham/Crawley and the South Coast along the A24 corridor, with trips switching from the A23 and more minor rural roads as well as a release of local traffic within Horsham district now utilising the A24.

6.2.5 The mitigations flow reassignment is a result of reduced congestion along the A24 corridor in both the AM and PM Peak, as a result of these mitigations on this corridor. Within the AM further improvements are seen by reducing rat running along Forest Road through Pease Pottage back onto the A264. Within the PM further improvements are seen by alleviating rat running along the A281 and the B2139 back onto the A24.

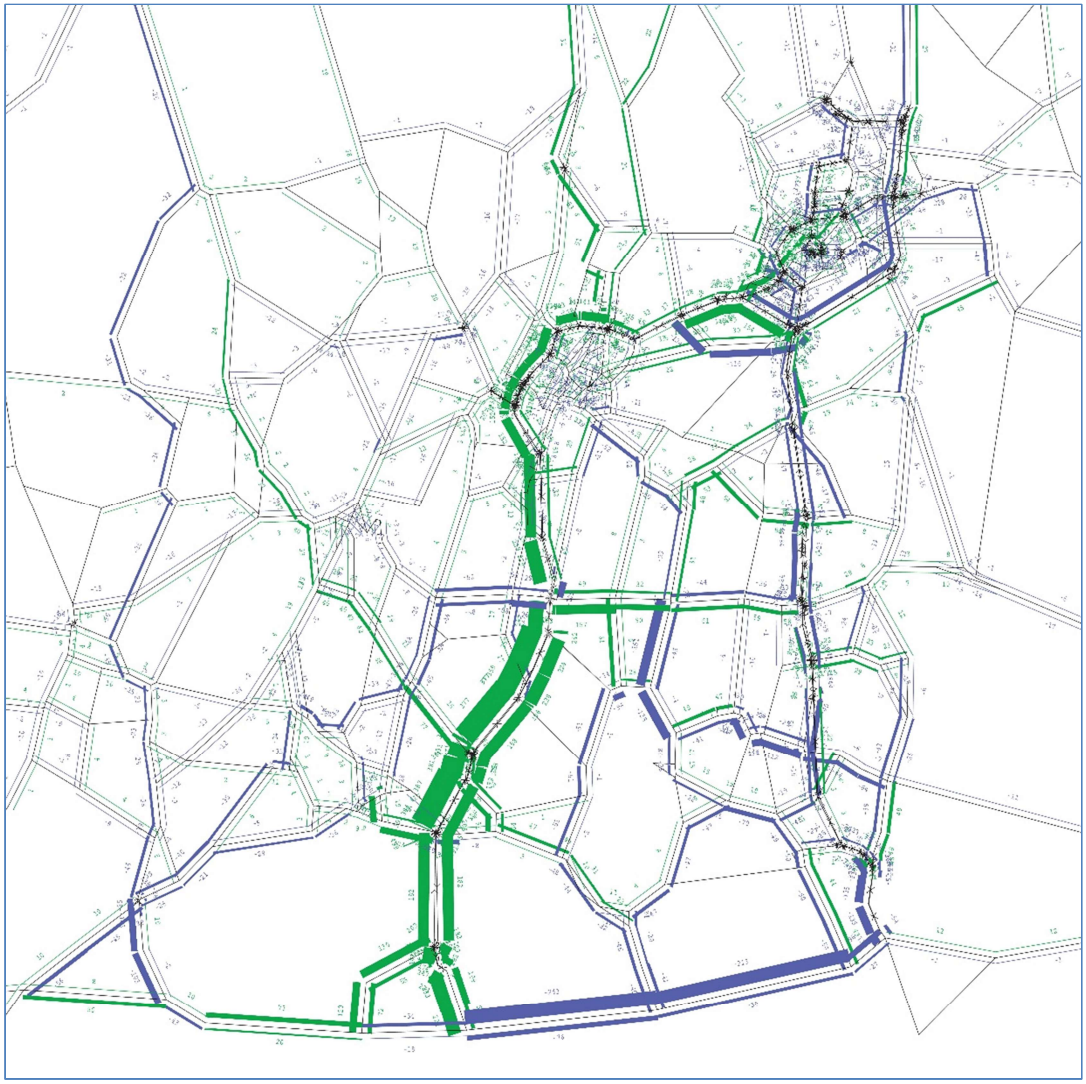


Figure 6-1: AM reassignment

PM Model Reassignment

6.2.6 As with the AM there is wider reassignment to the A24 but instead of continuing on it up to Horsham/Crawley it diverts via the A272 and A23. This is shown in Figure 6-2.

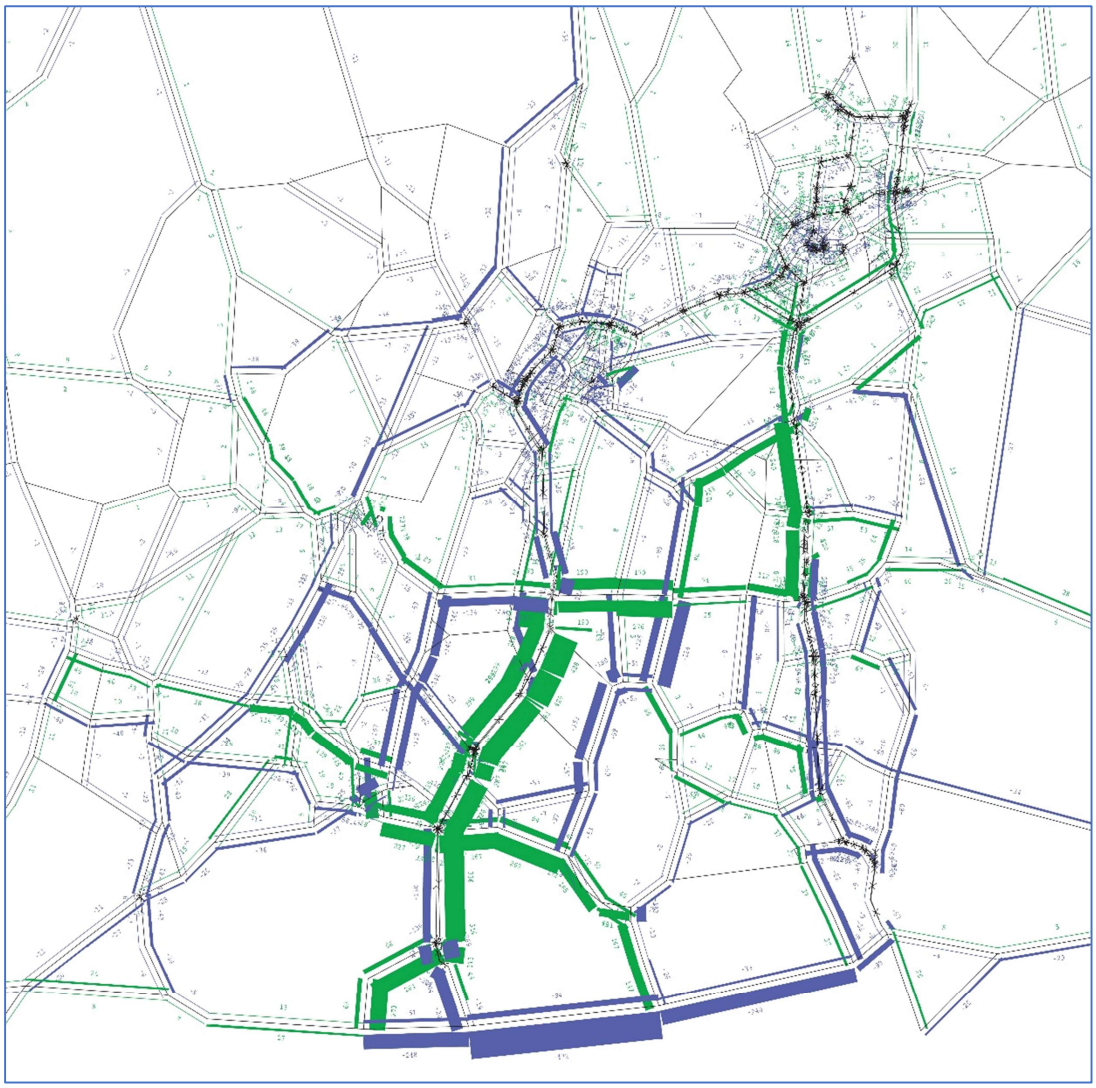


Figure 6-2: PM reassignment

6.2.7 Tables 6-1 to 6-4 highlight the V/C of the junctions with the further physical mitigation against the Reference Case.

Table 6-1: Junction Capacity Outputs – Horsham District - AM Peak

Label	Junction Name	Reference Case	Preferred Scenario (With Mitigation)
1	A24 Northbound approach at Washington Roundabout	124.4	93.7
2	A283 High Street/Old Mill Road, Storrington	110.1	109.7
4	B2237/Wimblehurst Road, Horsham	106.7	107.2
5	A264 WB at Moorhead Roundabout, Horsham	64.6	99.6
9	A272/A281 northern roundabout, Cowfold	102.0	104.6

Label	Junction Name	Reference Case	Preferred Scenario (With Mitigation)
10	A281/North Parade Junction, Horsham	102.2	102.3
13	A24/ Rusper Road Roundabout (Rusper Road NB Approach), Horsham	84.4	91.6
23	A283 Amberley Road Roundabout, Storrington	96.9	100.5
27	A281 East Street / Park Way Junction, Horsham	88.0	98.3
29	Hop Oast Roundabout - Worthing Road WB approach	94.5	105.9
30	A283/A29 Junction Eastern Mini Roundabout, Pulborough	97.1	101.0
31	Pondtail Road / North Parade, Horsham	74.5	91.8
34	North Street/ Hurst Street Roundabout, Horsham	65.4	82.2
38	A24/Steyning Road	66.9	90.9
41	Wheatsheaf Road/ A281	54.0	73.1
46	Kerves Lane/A281 Brighton Road, Horsham	80.2	93.7
47	Wimblehurst Rd/Parsonage Rd, Horsham	73.0	85.1
48	Harwood Road Roundabout, Horsham	70.9	89.8
49	A29/ New Road, Billinghurst	84.7	86.3
51	B2115/A281 Brighton Road (Ciswood House Junction)	76.7	84.9
53	Steyning Bypass Roundabout with Clays Hill	100.1	93.8

Table 6-2: Junction Capacity Outputs – Crawley Borough - AM Peak

Label	Junction Name	Reference Case	Preferred Scenario (With Mitigation)
C6	Ifield Avenue/ Stagelands	88.8	103.3
C8	Ifield Roundabout, Ifield Ave SB approach	68.9	103.0
C9	Bewbush Drive/Mowbray Drive	98.5	80.3

Table 6-3: Junction Capacity Outputs – Horsham District - PM Peak

Label	Junction Name	Reference Case	Preferred Scenario (With Mitigation)
2	A283 High Street/Old Mill Road, Storrington	107.8	103.6
4	B2237/Wimblehurst Road, Horsham	102.2	102.6
5	A264 WB at Moorhead Roundabout, Horsham	102.5	103.3
8	A264/A29 Five Oaks Roundabout	77.8	88.6
9	A272/A281 northern roundabout, Cowfold	86.6	101.1
15	London Road approach (A283 WB) at Washington Roundabout	108.8	100.7
16	A283 EB approach at Washington Roundabout	107.0	103.0
19	Colgate - Tower Road / Forest Road	87.1	95.8
20	A272/A8281 roundabout south of Cowfold	101.1	104.3
21	B2237 exit at Hop Oast Roundabout	103.2	103.3
24	Crawley Road/ Forest Road, Horsham	103.7	102.0
25	A264/Langhurst Wood Road, Horsham	101.1	104.1
26	A281/New Street Junction, Horsham Town Centre	100.7	101.4
27	A283/A29 Junction Western Mini Roundabout, Pulborough	95.6	102.0
29	A281 East Street / Park Way Junction, Horsham	69.3	100.8
30	Hop Oast Roundabout - Worthing Road WB approach	99.4	102.4
31	A283/A29 Junction Eastern Mini Roundabout, Pulborough	94.8	99.7
37	A283 eastbound approach at Washington Roundabout	90.4	97.7
38	A24/Steyning Road	86.1	107.7
39	A281/Partridge Green Road, Henfield	70.8	84.6
41	Kerves Lane/A281 Brighton Road, Horsham	67.0	92.5
42	St Leonards Rd/A281, Horsham	71.5	92.5
45	A29/ Lordings Road, Billingshurst	84.5	87.2
50	A283/ Water Lane	64.9	98.6
51	B2115/A281 Brighton Road (Ciswood House Junction)	62.5	82.5
53	Steyning Bypass Roundabout with Clays Hill	83.2	98.4
54	A29/ High Street Roundabout, Billingshurst	84.0	99.8

Table 6-4: Junction Capacity Outputs – Crawley Borough – PM Peak

Label	Junction Name	Reference Case	Preferred Scenario (With Mitigation)
C1	Bewbush Manor roundabout, Horsham Rd westbound approach	106.5	102.4
C2	Cheals Roundabout, Horsham Rd eastbound approach	137.3	141.9
C3	Ifield Roundabout, A23 eastbound approach	112.8	119.2
C4	Ifield Roundabout, Ifield Ave northbound approach	111.7	117.4
C5	Cheals Roundabout, Crawley Ave NB approach	104.4	109.0
C6	Ifield Avenue/ Rushetts Road	103.0	110.2
C7	Ifield Avenue / Warren Drive	102.7	102.2
C8	Ifield Roundabout, Ifield Ave SB approach	102.2	102.3
36	Ifield Avenue/Stagelands junction	53.5	110.2

6.3 Impact of Mitigation – Detailed Junction Modelling

A24/A283 Washington Roundabout

6.3.1 To reduce delays and queueing a signalised arrangement has been tested with an additional lane on the eastern side of the roundabout itself, and on the A24 southbound and the A283 westbound approaches. The mitigation scheme has been tested within LinSig. The proposed scheme is shown in Figure 6-1.

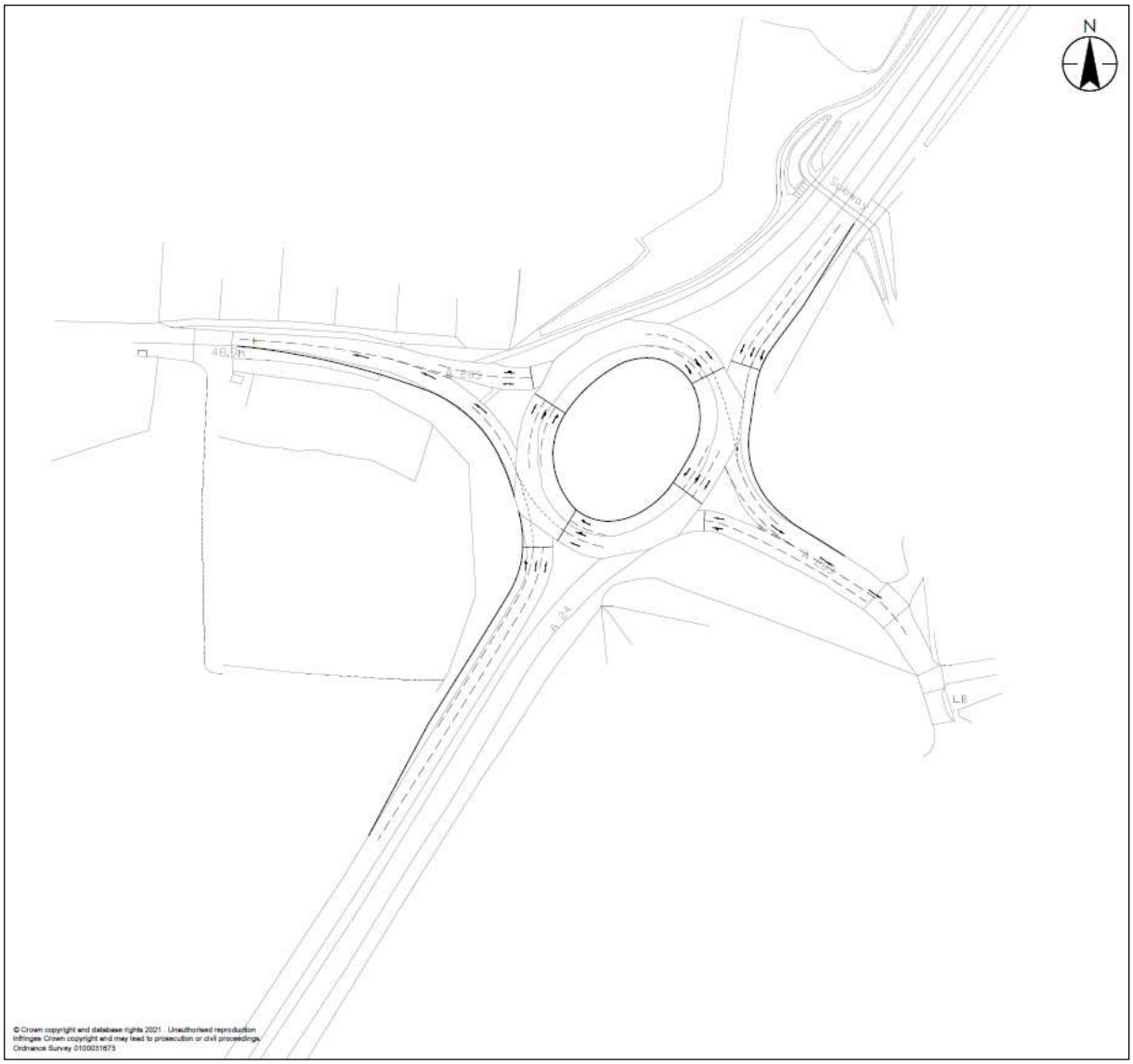


Figure 6-1: Washington Roundabout Mitigation Scheme

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 J. This is compared with detailed junction assessment of the reference case shown in Table 6-6. These outputs are taken directly from the LinSig junction models, 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 6-5: 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 (N) nearside lane	101.1%	60.9	54.4	115.4%	270.1	200.2
A24 (N) middle lane	101.1%	61.0		115.4%	270.1	
A24 (N) offside lane	33.1%	6.8	3.3	8.8%	4.4	0.7
A283 (E) nearside lane	80.0%	34.5	6.7	94.1%	50.5	13.0
A283 (E) offside lane	79.8%	34.5		94.1%	50.5	
A24 (S) nearside lane	89.6%	19.0	18.6	82.4%	14.3	13.9
A24 (S) middle lane	89.6%	23.9		82.4%	18.5	
A24 (S) offside lane	88.2%	23.5	17.7	80.6%	18.7	13.6
A283 (W) nearside lane	97.7%	54.7	21.9	109.4%	195.5	78.1
A283 (W) offside lane	97.7%	54.7		109.4%	195.5	

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 (N) nearside lane	113.0%	239.5	139.7	135.0%	823.9	437.3
A283 (E) nearside lane	78.0%	19.8	3.8	65.0%	12.6	1.9
A24 (S) nearside lane	104.0%	92.3	50.7	95.0%	29.6	15.4
A283 (W) nearside lane	115.0%	245.1	86.7	118.0%	262.7	110.2

6.3.3 It should be noted that although the performance of the mitigation is showing Degree of Saturation (DOS) greater than 100, overall, the mitigation performs better than the reference case, 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 £3,258,393 including risk, contingency and optimism bias[7]. A breakdown of the high-level scheme costs is provided within Appendix O.

A283/A29 Junctions in Pulborough

6.3.5 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. However, it should be noted that the junction is only just over capacity in the AM peak only, without any physical mitigation (it is just within capacity in the PM peak) and sustainable travel mitigation may suffice.

A24/A272 Buck Barn junction

6.3.6 A signalised 'through-about' style junction has been tested which results in reduced total queuing and delays. This would replace the existing signal-controlled junction. The mitigation scheme has been tested within LinSig.

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

[7] 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))

Figure 6-2: Buck Barn Junction Mitigation Scheme

6.3.8 Table 6-7 shows a summary of the outputs from the detailed junction modelling and detailed junction modelling outputs are provided within Appendix K.

Table 6-7: 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) nearside lane	23.7%	11	2.3	32.6%	11.2	3.2
A24 (N) middle lane	61.8%	15.6	8.1	91.1%	31.2	18.6
A24 (N) offside lane	63.8%	15.7	9.1	91.8%	31.3	20.4
A272 (E) nearside lane	74.3%	7.1	8.8	71.6%	7.2	8.1
A272 (E) offside lane	74.3%	8.3		71.6%	8.2	
A24 (S) nearside lane	6.2%	13.6	6.2	54.2%	13.5	6.9
A24 (S) middle lane	13.3%	22	13.3	62.7%	15.1	8.3
A24 (S) offside lane	15.1%	23.2	15.1	69.1%	16.2	10.6
A272 (W) nearside lane	66.2%	14.1	7.6	62.8%	12	5.4
A272 (W) offside lane	66.2%	12.3		62.8%	11.1	

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.

6.3.1 A high-level cost for the design has been produced for the scheme. The estimated cost is £2,825,384 including risk, contingency and optimism bias. A breakdown of the high-level scheme costs is provided within Appendix O.

A24/Steyning Road

6.3.2 A signalised junction has been tested specifically to test alleviate the safety concerns and the access of traffic from Steyning Road onto the A24. The mitigation scheme has been tested within LinSig.

6.3.3 The proposed scheme is shown in Figure 6-3.

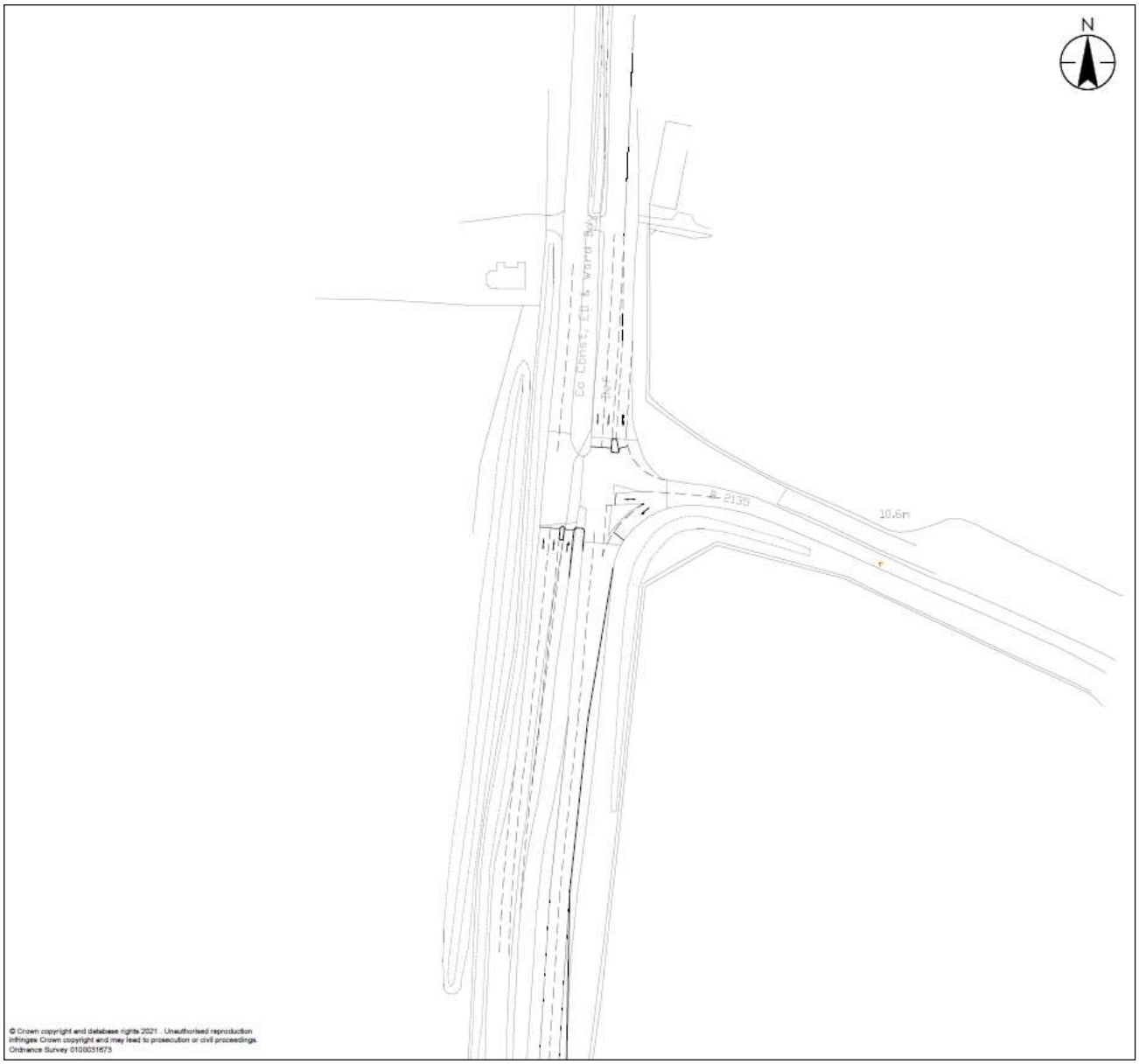


Figure 6-3: A24/Steyning Road Junction Mitigation Scheme

6.3.4 Table 6-8 shows a summary of the outputs from the detailed junction modelling and detailed junction modelling outputs are provided within Appendix L.

Table 6-8: A24/Steyning Road 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) Nearside	84.5%	21.7	21.7	89.4%	22.2	48.6
A24 (N) Offside	78.5%	25.7	25.7	87.2%	23.7	52.9
Steyning Road	115.9%	397.9	50.3	187.5%	1097.2	90.7
A24 (S) nearside lane	61.5%	12.0	21.0	55.0%	5.9	13.2
A24 (S) middle lane	64.6%	17.8	22.7	57.9%	12.2	13.3
A24 (S) offside lane	78.5%	17.8		78.5%	12.2	

6.3.5 As the mitigation has been designed primarily to alleviate safety concerns of the junction caused by vehicles from Steyning Road attempting to access the high speed A24, the V/C ratio for Steyning Road remains high. Minor delay is caused on the A24 mainline as a result of the green time given to Steyning Road onto the A24, this delay is deemed not to cause significant congestion.

6.3.6 A high-level cost for the design has been produced for the scheme. The estimated cost is £748,860 including risk, contingency and optimism bias. A breakdown of the high-level scheme costs is provided within Appendix O.

A283/Amberley Road Roundabout, Storrington

6.3.7 Limited highway land meant the only possible solution was to signalise the junction. To reduce the numbers of stages the junction with Monastery Road would need to be moved slightly south on Amberley Road.

6.3.8 Signalisation have been tested within the strategic model which indicated that signals would not improve capacity constraint issues and the junction should be left unmitigated. The junction is only just over-capacity and therefore, the junction is likely to only become an issue late in the Local Plan period and sustainable travel measures may lead to the situation not arising.

A24 Hop Oast Roundabout

6.3.9 Two variation 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.

6.3.10 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)

6.3.11 Table 6-9 and 6-10 shows a summary of the outputs from the detailed junction modelling and detailed junction modelling outputs are provided within Appendix M.

Table 6-9: Hop Oast Road Junction Modelling Summary –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	75.1%	11.4	7.7	100.1%	52	43.5
A24 (NW) middle lane	75.1%	11.4		100.1%	52	
A24 (NW) offside lane	50.8%	9.8	6.6	99.5%	53.1	40.7
Worthing Road (NE) nearside lane	0%	0	4.5	0%	0	12.3
Worthing Road (NE) offside lane	57.1%	23.1		95.8%	87.6	
A24 (SE) nearside lane	93.7%	39.8	19.8	66.0%	20.6	8.1
A24 (SE) middle lane	87.0%	20.8	16.1	80.3%	21.6	12.1
A24 (SE) offside lane	86.8%	19.9		80.3%	19.3	
Worthing Road (SW) nearside lane	34.2%	1.4	0.3	27.4%	13	0.2
Worthing Road (SW) offside lane	24.5%	17.2	2.2	31.8%	14.8	3.3

Table 6-10: Hop Oast Road Junction Modelling Summary – No 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	92.7%	21.9	19.3	86.6%	37.9	47.7
A24 (NW) middle lane	92.7%	23.9		98.4%	39.2	
A24 (NW) offside lane	43.8%	9.1	5.3	98.4%	15.4	27.1
Worthing Road (NE) nearside lane	0.0%	0	0	85.8%	72.1	9.3
Worthing Road (NE) offside lane	42.1%	21.9	3.7	25.5%	39.7	2.0
A24 (SE) nearside lane	85.6%	19.5	16.5	49.9%	10.7	8.6
A24 (SE) middle lane	89.7%	19.3	19.3	64.2%	11.5	11.4
A24 (SE) offside lane	89.7%	15.4		64.2%	9.2	
Worthing Road (SW) nearside lane	38.0%	26.6	2.7	34.4%	36.5	3.4
Worthing Road (SW) offside lane	1.5%	22.8	0.1	27.7%	35.4	2.8

6.3.12 The Bus Lane Priority Mitigation DoS (same metric as V/C) is shown to be greater than 100% within the PM Peak for the A24 SB approach. With the additional capacity for private vehicles through changing the proposed bus priority lane for all traffic, this shows better results within the PM peak, with DoS being below 100% 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.

6.3.13 As such the 3-lane circulatory without bus priority would be most effective to alleviate congestion impacts of the Horsham LP.

6.3.14 The modelling outputs indicate that the mitigation is effective in relieving congestion impacts resulting from the Horsham Local Plan and background forecast traffic growth.

6.3.15 A high-level cost for the design has been produced for the scheme. The estimated cost is £5,479,592 including risk, contingency and optimism bias. A breakdown of the high-level scheme costs is provided within Appendix O.

6.4 Cowfold Junctions Analysis

6.4.1 The mitigation proposed at the junctions on the A24 has had an impact on assignment of traffic, as discussed in Section 6.2 and in turn this has resulted in changes in the performance of the junctions within Cowfold,

6.4.2 Table 6-11 shows the v/c outputs from the mitigated model at the two junctions within Cowfold.

Table 6-11: Cowfold Junction Performance with A24 Mitigation

Tome Period	Junction Name	Reference Case	Preferred Scenario
AM	A272/A281 northern roundabout, Cowfold	102.0	104.8
	A272/A8281 southern roundabout, Cowfold	84.4	87.1
PM	A272/A281 northern roundabout, Cowfold	86.6	94.3
	A272/A8281 southern roundabout, Cowfold	101.1	104.3

6.4.3 With the A24 mitigation schemes in place at Buck Barn and Hop Oast, the resultant reassignment of traffic indicates that the northern roundabout in the AM peak is seen to operate over capacity and somewhat worse than in the Reference Case, however this is not an issue in the PM peak. The southern junction operates within capacity in both peaks. As the junction is only just over capacity, it is likely that this will only occur towards the end of the plan period.

Cowfold Travel Demand Assessment

6.4.4 It is noted that the A272/A281 northern roundabout is over capacity during the AM peak in not only in the mitigated preferred scenario but also in the reference case. In order to mitigate this impact, further analysis of travel demand relating to eastbound traffic into/through Cowfold has been examined to see if a signing strategy or changes in speed limits on sections of the routes used by traffic through Cowfold could suffice. Further analysis has been undertaken to understand the travel demand origin and destination along the A272. As such this provides evidence for developing travel demand diversion strategies including a signing strategy for longer distance trips that have the potential to use alternative routes. It is also likely that sustainable transport measures might reduce this impact further.

6.4.5 Figure 6-5 shows the flow of trips travelling east along the A272 within the AM Mitigated Preferred scenario. Note that this is different to the flow comparison analysis shown in Figures 6-1 and 6-2 as it shows absolute flows for the preferred scenario, rather than the reassignment of trips comparing reference case versus mitigated preferred strategy.

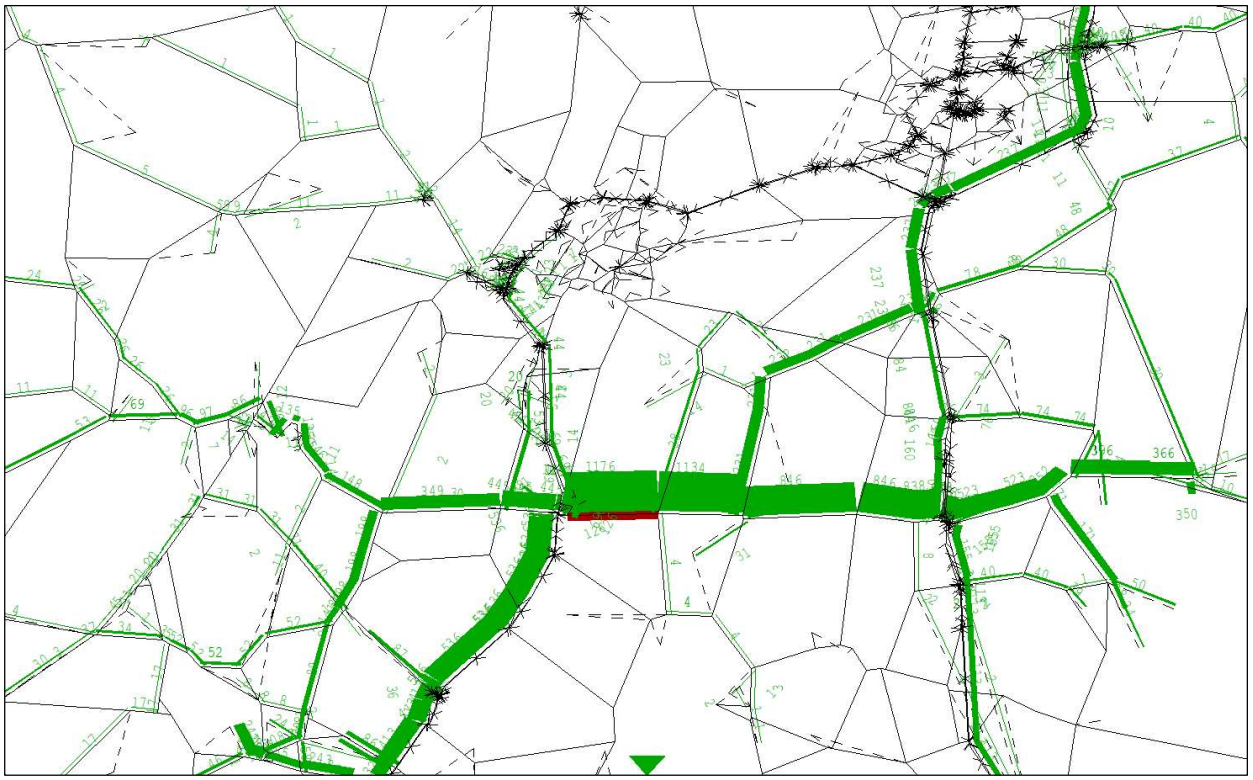


Figure 6-5: Traffic Flows Through Cowfold – AM Peak

6.4.6 The diagram highlights the high proportion of demand along the A272 eastbound travelling from the south of Horsham District to a destination north of Crawley. Trips travelling north predominantly travel through Cowfold and onto the A281 with 231 trips travelling through the A281 towards Handcross and 84 travelling through to the A23 Bolney junction.

6.4.7 Figure 6-6 shows the flow of trips travelling east along the A272 within the PM Mitigated Preferred scenario.

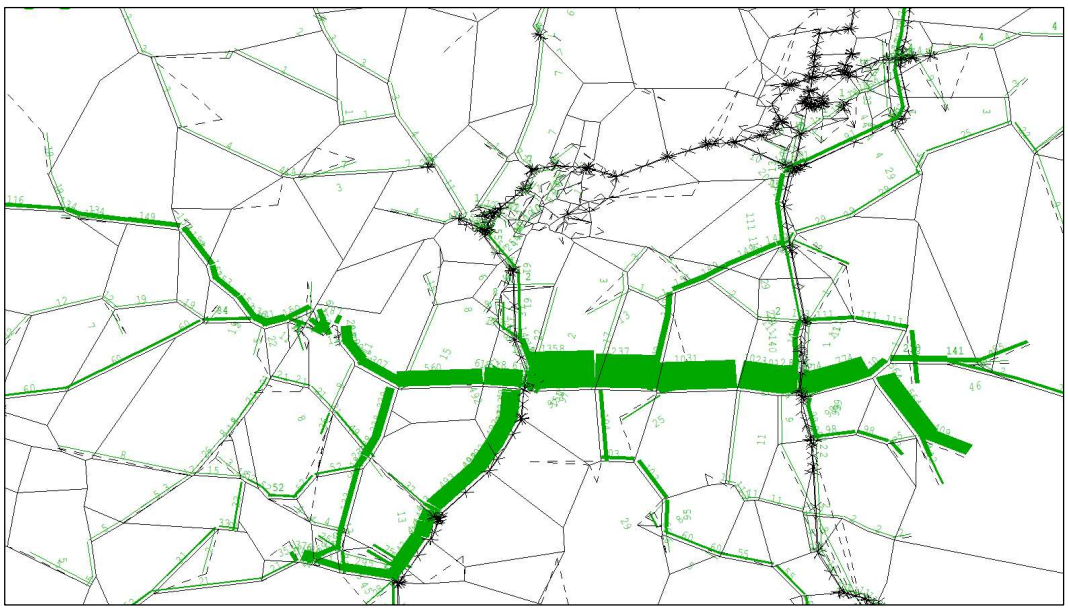


Figure 6-6: Traffic Flows Through Cowfold – AM Peak

6.4.8 A similar pattern of trips is seen within the PM Peak with the high proportion of demand along the A272 East bound travelling from the South of Horsham District, with destination North of Crawley. Trips travelling North predominantly travel through Cowfold and onto the A281, with 149 vehicles travelling through the A281 and 29 travelling through the A23 Bolney. Nevertheless, as shown in Table 6-11 above, the operation of the Cowfold junctions remain within capacity in the PM peak under the mitigated preferred scenario.

6.4.9 It should be noted that the A24 northbound to the A272 right turn lane at Buck Barn of the proposed mitigation at Buck Barn has been set as a single lane order to restrict capacity. However as can be seen with the flow diagrams above there is still a high demand of right turning traffic from the A24 to the A272 with 536 turning right in the AM Peak and the 493 turning right in the PM Peak.

6.4.10 Further investigation as to the journey time between Buck Barn and the Pease Pottage M23 J11 has been analysed on 3 separate routes in order to understand the potential for delivering a signage strategy in order to reduce demand along the A272. This has the potential to reduce the AM EB demand passing through Cowfold by 230 vehicles within the AM and 149 vehicles in the PM. Table 6-12 provides a comparison of distances and journey times on three potential routes from Buck Barn to Pease Pottage from the preferred option model.

Table 6-12: Buck Barn to Pease Pottage Distance and Journey Time Comparisons

Time Period	Route	Distance	Time Taken	Average Speed (km/hr)
AM	A24/A264	23.9km	24:26	59
	A272 & A23 Bolney Junction (via Cowfold)	22.1km	22:27	59
	A272 & A281 (via Cowfold)	19.3km	20:30	56
PM	A24/A264	23.9km	24:47	58
	A272 & A23 Bolney Junction (via Cowfold)	22.1km	21:29	62
	A272 & A281 (via Cowfold)	19.3km	20:52	55

6.4.11 As can be seen from the above table, the route through A272 & the A281 is almost 4 minutes faster than the A264 route and the route is shorter.

6.4.12 All 3 routes have similar average speed; therefore, the time difference stems from the shorter distance of the A272 & A281 route.

6.4.13 This does indicate that a signing strategy may have limited impact, particularly for drivers with local knowledge.

6.4.14 A recommended strategy is to seek speed limit restrictions on parts of the route using the A281 and B3110 at Lower Beeding. This could also be assisted by the provision of some form of informal gating on the entrances to Lower Beeding and Cowfold (on A272 and A281), which would act as a deterrent and remove some traffic from this route. The informal gating could consist of a give-way shuttle working arrangement, allowing free flow in one-direction only.

6.4.15 As previously noted, the impacts of the Local Plan on Cowfold with the A24 mitigation in place are seen to be relatively minimal and only in the AM peak, therefore such measures may suffice later in the plan period.

6.4.16 Further improvements including Variable Message Signs (VMS) on the A24 south of the Buck Barn junction could be explored and could promote the use of the A264 corridor for trips

travelling onto the M23 North, by the VMS providing information of congestion along the A272 at the Cowfold junctions.

6.4.17 Furthermore, improvements along the A264 corridor can be coupled with the provision of a high-quality public transport service of the Weald Cross – Horsham – Crawley corridor, that would alleviate background growth of existing car trip along the A24/A264 corridor and further improve journey times along the corridor.

6.5 Remaining Unmitigated Hot-Spots

6.5.1 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.

6.5.2 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.

6.5.3 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.

6.5.4 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.

6.5.5 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:

- A283/A29 Mini Roundabouts, Pulborough (sustainable mitigation)
- A283/Amberley Road Roundabout, Storrington (sustainable mitigation)
- A29/ High Street Roundabout, Pulborough (sustainable mitigation)
- B2237/Wimblehurst Road (signal optimisation)
- Moorhead Roundabout (signal optimisation)
- Albion Way/B2237 (signal optimisation)
- East Street / Park Way Junction (signal optimisation)
- A281/New Street Junction (signal optimisation)
- A264/Langhurst Wood Road (signal optimisation)
- Crawley Road/Forest Road (signal optimisation)

6.6 Neighbouring Authorities

6.6.1 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.

6.6.2 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.

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

6.6.4 It has been discerned from the modelling outputs that 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 Highways England 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 2036 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 2036.

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 2036, 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 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 Highways England (HE) 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. However, this was developed and agreed after the Horsham forecast models were built and has not therefore been included in the Horsham study at this stage.

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 Highways England's (HE) Strategic Road Network (SRN) in the context of the merge/diverge layout requirements. This has been undertaken in light of HE 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 classification 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 very 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. Detailed results and outputs are provided in Appendix N.

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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	4,831	4,534	4,911	4,389	81	-145
	Merge	168	288	198	290	30	2
SB Merge	Mainline	4,321	5,544	4,371	5,480	50	-63
	Merge	48	388	57	486	9	98
NB Diverge	Mainline	4,831	4,534	4,911	4,389	81	-145
	Diverge	204	63	236	64	32	1
SB Diverge	Mainline	4,321	5,544	4,371	5,480	50	-63
	Diverge	970	565	992	622	21	56

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	3	3	1
	Local Plan	A	A	3	3	1
SB Merge	Current Layout	E	E	4	4	2
	Reference Case	A	A	3	4	1
	Local Plan	A	A	4	4	1
NB Diverge	Current Layout	D	D	4	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	A	A	4	4	1
	Local Plan	A	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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3,039	2,417	3,111	2,311	72	-106
	Merge	2,000	2,180	2,043	2,137	44	-42
SB Merge	Mainline	2,754	3,979	2,778	4,014	24	36
	Merge	628	1,353	632	1,390	4	37
NB Diverge	Mainline	3,039	2,417	3,111	2,311	72	-106
	Diverge	1,233	676	1,254	678	21	2
SB Diverge	Mainline	2,754	3,979	2,778	4,014	24	36
	Diverge	1,616	1,914	1,650	1,914	35	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	3	2
	Local Plan	E	E	3	3	2
SB Merge	Current Layout	A	A	3	3	2
	Reference Case	A	E	3	3	2
	Local Plan	A	E	3	3	2
NB Diverge	Current Layout	A	A	3	3	2
	Reference Case	C	A	3	2	1
	Local Plan	C	A	3	2	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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3,750	2,902	3,843	2,791	93	-112
	Merge	523	190	523	198	0	8
SB Diverge	Mainline	3,184	4,426	3,193	4,502	9	77
	Diverge	198	905	217	902	19	-4

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	A	3	3	1
	Local Plan	A	A	3	3	1
SB Diverge	Current Layout	B	B	4	3	2
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	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 increases within the LP scenario of up to 167 vehicles in the AM and up to 118 vehicles in the PM peak.

Table 7-7: M23 Junction 11 Merge Assessment Flows

Approach	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	2617	2118	2679	2059	62	-58
	Merge	1134	783	1165	730	31	-53
SB Merge	Mainline	1818	2743	1818	2835	0	91
	Merge	1384	1651	1551	1770	167	118
NB Diverge	Mainline	2617	2118	2679	2059	62	-58
	Diverge	1909	1190	1904	1350	-5	160
SB Diverge	Mainline	1818	2743	1818	2835	0	91
	Diverge	1366	1682	1375	1668	8	-15

7.2.15 The results of the assessment for the M23 J11 merge/diverge layout requirements are summarised in Table 7-8. The results indicate, due to the increase of flow within the Local Plan scenario, that the NB Diverge within the PM peak in the LP changes the layout from type "A" to Type "B". The current layout type of the diverge is set as B and therefore the current layout can accommodate the increase of traffic due to the Horsham Local Plan. A such no changes of merge layout are required.

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	D	A	2	3	1
	Local Plan	D	A	2	3	1
SB Merge	Current Layout	A	A	3	3	2
	Reference Case	B	E	2	3	2
	Local Plan	B	E	2	3	2
NB Diverge	Current Layout	B	B	3	3	2
	Reference Case	D	A	3	3	2
	Local Plan	D	B	3	3	2
SB Diverge	Current Layout	A	A	3	3	2
	Reference Case	B	D	3	2	2
	Local Plan	B	D	3	2	2

7.2.16 Further discussion with Highways England regarding the merge layouts may be required. The southbound merge is shown as requiring a layout E in the reference and local plan, the northbound diverge, merge and southbound diverge are showing as requiring layout D in the reference case and local plan.

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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
SB Diverge	Mainline	2,793	3,889	2,933	4,013	140	123
	Diverge	412	506	441	592	29	86

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	C	A	3	3	1
	Local Plan	C	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. Further discussion with Highways England regarding the merge layouts may be required. The merge layout is showing as requiring a layout C.

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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	4,012	2,736	4,108	2,762	96	26
	Merge	661	572	649	646	-12	75
SB Merge	Mainline	2,793	3,889	2,933	4,013	140	123
	Merge	33	18	32	19	-1	1
NB Diverge	Mainline	4,012	2,736	4,108	2,762	96	26
	Diverge	205	161	202	182	-3	21

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	B	D	3	3	1
	Local Plan	B	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 Highways England regarding the merge layouts may be required. The northbound merge layout is showing as requiring layout.

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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3,961	2,816	4,084	2,809	123	-7
	Merge	256	81	227	135	-29	54
SB Merge	Mainline	2,582	3,804	2,721	3,919	139	115
	Merge	585	931	584	895	-1	-36
NB Diverge	Mainline	3,961	2,816	4,084	2,809	123	-7
	Diverge	691	556	654	619	-36	64
SB Diverge	Mainline	2,582	3,804	2,721	3,919	139	115
	Diverge	244	103	244	112	0	9

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	A	B	3	3	1
	Local Plan	D	D	3	3	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	A	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 Highways England regarding northbound diverge lanes and merge layout may be required. The northbound merge layout is showing as requiring layout C in both the local plan and reference case scenarios the southbound merge is showing as requiring layout B in the reference case and layout D in the local plan.

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

Approach	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	4,652	3,372	4,739	3,428	87	57
	Merge	-	-	-	-	0	0
NB Diverge	Mainline	4,652	3,372	4,739	3,428	87	57
	Merge	-	-	-	-	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	3	3	1
	Local Plan	A	A	3	3	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

Approach	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
SB Diverge	Mainline	3,029	4,710	3,184	4,811	155	101
	Diverge	139	25	122	3	-17	-21

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 Highways England 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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3,664	3,153	3,628	3,201	-36	48
	Merge	986	220	1,108	229	122	9
SB Merge	Mainline	3,029	4,425	3,184	4,563	155	137
	Merge	377	319	450	292	73	-27
NB Diverge	Mainline	3,664	3,153	3,628	3,201	-36	48
	Diverge	174	211	193	256	19	45
SB Diverge	Mainline	3,029	4,425	3,184	4,563	155	137
	Diverge	0	285	0	248	0	-36

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	B	D	3	3	1
	Local Plan	B	D	3	3	1
SB Merge	Current Layout	A	A	3	3	1
	Reference Case	D	A	3	3	1
	Local Plan	D	A	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 table above shows there may be the requirement for 4 downstream lanes on the southbound merge in the local plan scenario and a D merge layout. 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 C merge layout in both scenarios. Further discussions will be needed with Highways England.

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

Approach	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3,762	2,509	3,739	2,618	-23	110
	Merge	110	855	124	838	14	-17
SB Merge	Mainline	2,325	3,243	2,567	3,362	242	119
	Merge	1,289	630	1,121	620	-168	-10
NB Diverge	Mainline	3,762	2,509	3,739	2,618	-23	110
	Diverge	72	332	80	339	8	7
SB Diverge	Mainline	2,325	3,243	2,567	3,362	242	119
	Diverge	1,081	1,502	1,067	1,493	-13	-9

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	2	2
	Local Plan	C	D	4	2	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, however it should be noted that the increase of Volume to Capacity of the merge increases the V/C ratio of the mainline due to the increase of flow on the mainline, this is mentioned in further detail within paragraph 7.3.8.

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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3,866	2,757	3,787	2,761	-79	4
	Merge	387	205	483	250	96	45
SB Diverge	Mainline	3,032	3,389	3,082	3,375	50	-14
	Diverge	932	569	899	521	-33	-48

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	A	A	3	3	1
	Local Plan	A	A	3	3	1
SB Diverge	Current Layout	A	A	2	2	1
	Reference Case	C	A	3	3	1
	Local Plan	C	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

Approach	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Diverge	Mainline	3,516	2,635	3,525	2,721	9	85
	Diverge	391	205	372	236	-19	31
SB Merge	Mainline	2,675	3,340	2,775	3,398	100	58
	Merge	938	534	910	584	-29	51

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 Merge	Current Layout	B	B	2	2	1
	Reference Case	A	A	3	3	1
	Local Plan	A	A	3	3	1
SB Diverge	Current Layout	B	B	2	2	2
	Reference Case	C	A	3	3	1
	Local Plan	C	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. The local plan scenario is shown to not require further mitigation in comparison to the Reference 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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3,709	2,942	3,655	3,041	-54	99
	Merge	28	0	31	0	3	0
SB Merge	Mainline	2,888	3,482	2,972	3,555	84	73
	Merge	54	0	31	0	-23	0
NB Diverge	Mainline	3,709	2,942	3,655	3,041	-54	99
	Diverge	120	165	153	291	33	127

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	C	2	2	1
	Local Plan	A	C	2	2	1

7.2.46 The table shows that an additional lane is required both upstream and downstream in the reference case and the local plan case for the northbound and southbound merges. The northbound diverge may also require layout C in the reference 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	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Merge	Mainline	3,699	3,103	3,806	3,233	107	130
	Merge	131	3	18	98	-113	95
SB Diverge	Mainline	2,939	3,479	3,003	3,457	64	-22
	Diverge	3	3	-	98	-3	95

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 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.

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)

Approach	Scenario	Reference Case		LP		Difference	
		AM	PM	AM	PM	AM	PM
NB Diverge	Mainline	4,037	3,212	4,073	3,399	36	187
	Diverge	1,471	1,930	1,478	1,930	7	-
SB Merge	Mainline	3,291	3,528	3,342	3,531	51	3
	Merge	1,458	1,412	1,462	1,404	4	-8

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 / A272 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	Base Year 2015	Reference Case	Preferred Scenario	Mitigated Scenario
A23 Bolney Junction	A23 Bolney Junction West Roundabout	100.0	100.0	100.0	100
A23 Hickstead Junction	A2300 northbound slip to A23	95.2	139.7	145.1	145.35
A23 Hickstead Junction	A23 Hickstead Junction SB On-slip	62.2	95.6	99.9	100.1
A23 Pyecombe Junction	A23 at Pangdean Farm	98.0	113.1	115.8	115.86
A23 Pyecombe Junction	A23 NB Offlsip diverge	88.1	96.1	99.7	99.69
A23 Pyecombe Junction	A23 Access from West Road West of Pyecombe	86.3	96.7	102.7	102.72
A23 Pyecombe Junction	A23 NB On-slip Pyecombe Junction	88.1	100.6	100.1	100.09
A23 Pyecombe Junction	A23 NB Off-slip West of Pyecombe Junction	88.0	99.9	100.3	100.29
A23 Sayers Common Junction	B2118 merge onto A23 northbound	85.2	126.1	128.8	129.04
M23 J10	M23 J10 NB Off-slip Approach to Roundabout	128.0	100.7	100.7	100.6
M23 J10	M23 J10 Off-slip	92.5	83.8	85.4	85.52
M23 J10	M23 Northbound slip road merge at J10	92.9	100.0	99.9	99.82
M23 J11	A23 northbound slip road entry before M23 J11	77.8	108.0	110.0	109.77
M23 J11	Exit onto A264 WB at M23 Junction 11 roundabout	58.9	100.8	100.9	101.09
M23 J11	M23 J11 Roundabout NB Off-slip Approach	81.5	100.4	102.6	102.81
M23 J11	A264 Exit at M23 Junction 11 roundabout	100.3	101.2	101.2	101.2
M23 J9	M23 J9 Off-slip	38.3	95.4	97.6	97.14

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

Label	Junction Name	Base Year 2015	Reference Case	Preferred Scenario	Mitigated Scenario
A23 Bolney Junction	A23 Bolney Junction West Roundabout	100	100.0	100.0	100
A23 Hickstead Junction	A2300 northbound slip to A23	82.36	79.8	86.1	83.23
A23 Hickstead Junction	A23 northbound off-slip at the roundabout at Hickstead	117.52	117.4	117.6	117.53
A23 Hickstead Junction	West Hickstead Lane Approach to HA23 Hickstead Roundabout Junction	101.19	101.4	98.0	97.53
A23 Hickstead Junction	A23 Hickstead Junction SB On-slip	94.41	94.7	96.6	95.6
A23 Pyecombe Junction	A23 at Pangdean Farm	117.64	117.6	118.6	118.55
A23 Pyecombe Junction	A23 NB Offlsip to A273	101.05	100.8	101.4	101.44
A23 Pyecombe Junction	A23 NB On-slip Pyecombe Junction	78.79	76.6	83.6	83.59
A23 Pyecombe Junction	A23 NB Off-slip West of Pyecombe Junction	78.21	75.9	83.1	83.13
M23 J10	M23 J10 Off-slip	102.05	101.9	101.9	101.97
M23 J10	M23 Northbound slip road merge at J10	100.02	100.0	99.9	100.04
M23 J11	M23 J11 Roundabout NB Off-slip Approach	99.46	97.7	101.4	100.88
M23 J11	A264 Exit at M23 Junction 11 roundabout	88.85	77.5	85.0	78.02
M23 J11	M23 southbound slip at M23 junction 11 roundabout	102.72	102.9	104.2	103.58
M23 J9	M23 J9 Off-slip	90.31	101.7	101.7	102.08

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. Flow increase of 15 PCU within the LP preferred scenario causing additional delay (on slip flow of 128 in Ref compared to 143 in LP Preferred scenario highlights limited capacity of NB merge). **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 HA23 Hickstead Roundabout Junction

7.3.6 Reduction of V/C within the PM LP preferred 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 - Significantly higher SB mainline flow with LP scenario results in less capacity for merge and therefore higher V/C for both the mainline and merge. AM SB mainline flow at **2678** Reference Case vs **3028** LP Preferred scenario.

7.3.8 PM - Similar to AM with increase in SB mainline flow within the LP scenario increasing the V/C. PM Mainline flows at 3299 Ref Case vs 3549 LP Preferred scenario. This increase is caused by the addition of **620** trips stemming from Local Plan sites at this point within the network. Further Assessment Required

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

7.3.9 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

7.3.10 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.

7.3.11 PM A23 – Clayton Hill off slip diverge at capacity within reference case, LP has negligible impact. No mitigation required.

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

7.3.12 Close to capacity within reference case AM, increase in flow in LP preferred 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

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

A23 Pyecombe Junction - A23 NB Off-slip Diverge

7.3.14 PM increase of mainline flow increasing V/C within the LP preferred 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

7.3.15 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

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

M23 J10 – SB Off-slip Diverge

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

M23 J11 – NB Off-slip Diverge

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

M23 J11 – EB A24 EB Exit

7.3.19 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

7.3.20 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 – A24 WB Approach to Gyratory

7.3.21 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

7.3.22 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

7.3.23 PM LP Preferred scenario V/C increase of Horsham Road WB approach due to increase in flow within the LP scenario. The additional LP trips approaching the junction within the PM equate to 26 vehicles. Suggesting further re-routing of background trips causing the increase in V/C.

M23 J11 Slip Roads

7.3.24 For completeness, the following table highlights the proportion of Local Plan trips at all slip roads for J11.

Table 7-35: Local Plan Trip Proportions

Time Period	Slip Arm	Background Trips (Excluding Local Plan Trips)	Local Plan Trips
AM	J11 NB On Slip	1341	91
	J11 SB On Slip	1450	222
	J11 NB Off Slip	2206	2
	J11 SB Off Slip	1157	356
PM	J11 NB On Slip	812	23
	J11 SB On Slip	1744	158
	J11 NB Off Slip	1412	15
	J11 SB Off Slip	1562	150

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 on the merge-diverge assessment, is on the southbound merge at the A2300 junction and this may require further discussion with West Sussex County Council and Highways England. Should mitigation be required, HDC will require further discussions with Highways England on an appropriate scheme given the cross-boundary impacts and the need for a proportionate approach on the part of HDC.

7.4.3 In terms of junction operation, further investigation is required at M23 Junction 11 (Pease Pottage). WSCC have provided a Transyt model for use for use to assess the impacts at M23 junction 11 and ongoing liaison with HE and Crawley Borough Council will be undertaken to review the outcome of further modelling.

8 Summary and Conclusions

8.1 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 2036.

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 only required to achieve no exceedance in 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 The proposed measures at the following junctions 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:

- A283/A29 Mini Roundabouts, Pulborough (sustainable mitigation)
- A283/Amberley Road Roundabout, Storrington (sustainable mitigation)
- A29/ High Street Roundabout, Pulborough (sustainable mitigation)
- B2237/Wimblehurst Road (signal optimisation)
- Moorhead Roundabout (signal optimisation)
- Albion Way/B2237 (signal optimisation)
- East Street / Park Way Junction (signal optimisation)
- A281/New Street Junction (signal optimisation)
- A264/Langhurst Wood Road (signal optimisation)

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:

- A24 / A272 Buck Barn
- A24 Hop Oast Roundabout
- A24 Washington Roundabout
- A24 / Steyning Road

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.

8.4.4 For Cowfold, further interrogation of the modelling has been undertaken to understand traffic using Cowfold. Whilst the majority of traffic on this section of the A272 is using it to get to Mid Sussex towns, there is a reasonable proportion which is using the A272, A281 and B2110 and accessing the A23 at Handcross to travel northwards. Through concentrating physical mitigation along the main A24/A264 route, along with a signing strategy and reduced speed limits on the A272, A281 and B2110, this should be adequate to provide mitigation for Cowfold. Such a strategy would also help to address air quality issues relevant to the Cowfold Air Quality Management Area.

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 and M23 is already over capacity within the reference case scenario. 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. Whilst this is in itself of concern, it is not something the Local Plan has scope to address and should be coordinated through other mechanisms such as future reviews of the Roads Investment Strategy (RIS) and strategies coordinated by Transport for the South East.

8.5.2 One location where the Local Plan traffic does appear to have a clearer impact on the 'merge-diverge' assessment (which has looked at what happens where slip roads join or leave the A23), is on the southbound merge at the A2300 junction at Hickstead. This will require further discussion with West Sussex County Council and Highways England, in terms of an appropriate mitigation scheme and a realistic and collectively driven way to support its delivery. HDC will require ongoing discussions with Highways England on an appropriate scheme given the cross-boundary impacts and the need for a proportionate approach on the part of HDC.

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

8.6.3 Traffic through Cowfold is a key issue for delivery of the Local Plan, however the Local Plan's impacts on the junction and therefore on the village are only likely to become critical towards the end of the Plan period. It is felt that a combination of signing and physical measures, such as reduced speed limits on the B2110 between Lower Beeding and Handcross, should reduce the traffic using the A272/A281/B2110 route to reach the A23 and thus alleviate the impacts of the Local Plan and go some way to addressing air quality issues. Physical highway mitigation measures in Cowfold have been explored, but do not mitigate the impacts.

8.6.4 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 Local Plan Scenarios Analysis Horsham Highway Model Data Collection Report

Appendix B Horsham Highway Model Data Collection Report

Appendix C Horsham Highway Model Local Model Validation Report

Appendix D Horsham Highway Model Forecast Report

Appendix E Reference Case Developments

Appendix F TRICS Trip Rate Derivation

Appendix G Zones used for Trip Distribution

Appendix H Reference Case v. Preferred Scenario Flow Differences

Appendix I Reference Case v. Preferred Scenario Delay Differences

Appendix J Washington Roundabout Detailed Junction Modelling Outputs

Appendix K Buck Barn Detailed Junction Modelling Outputs

Appendix L A24/Steyning Road Detailed Junction Modelling Outputs

Appendix M A24 Hop Oast Detailed Junction Modelling Outputs

Appendix N M23/A23 Merge Diverge Assessments

Appendix O High Level Mitigation Costs