Wokingham Local Plan Update

Local Highway Network and M4 Corridor - Transport Assessment Report

August 2024

On behalf of **Wokingham Borough Council**

WOKINGHAM BOROUGH COUNCIL

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1 Introduction

1.1 Local Plan Update

1.1.1 Wokingham Borough Council (WBC) is undertaking a review of the adopted development plan policy. Currently both the Core Strategy and the Managing Development Delivery local plans cover the period to 2026. WBC are preparing a new local plan (the Local Plan Update (LPU)) which will put in place the spatial strategy and planning policies looking forward to 2040.

1.2 Background

1.2.1 To support the preparation of the LPU, in 2021 Stantec was commissioned by WBC to provide transport and highways support to understand the impact of future housing and employment growth options on the highway network. That work aimed to identify transport implications of development and any works that are necessary to help mitigate the identified impacts. This has been supported by a number of transport assessments over this period, leading to the publication of the October 21 Transport Assessment.

1.2.2 This updated study, in addition to a number of smaller residential sites around the Borough, evaluated the cumulative impact of combinations of three potential strategic developments, namely:

- Hall Farm/ Loddon Valley, between Shinfield, Arborfield and Sindlesham
- Land at South Wokingham, to the south of the South Wokingham SDL
- Ashridge, located to the north of Wokingham and the A329(M) and east/south of the M4

1.2.3 The location of the sites is shown in Figure 1 below.

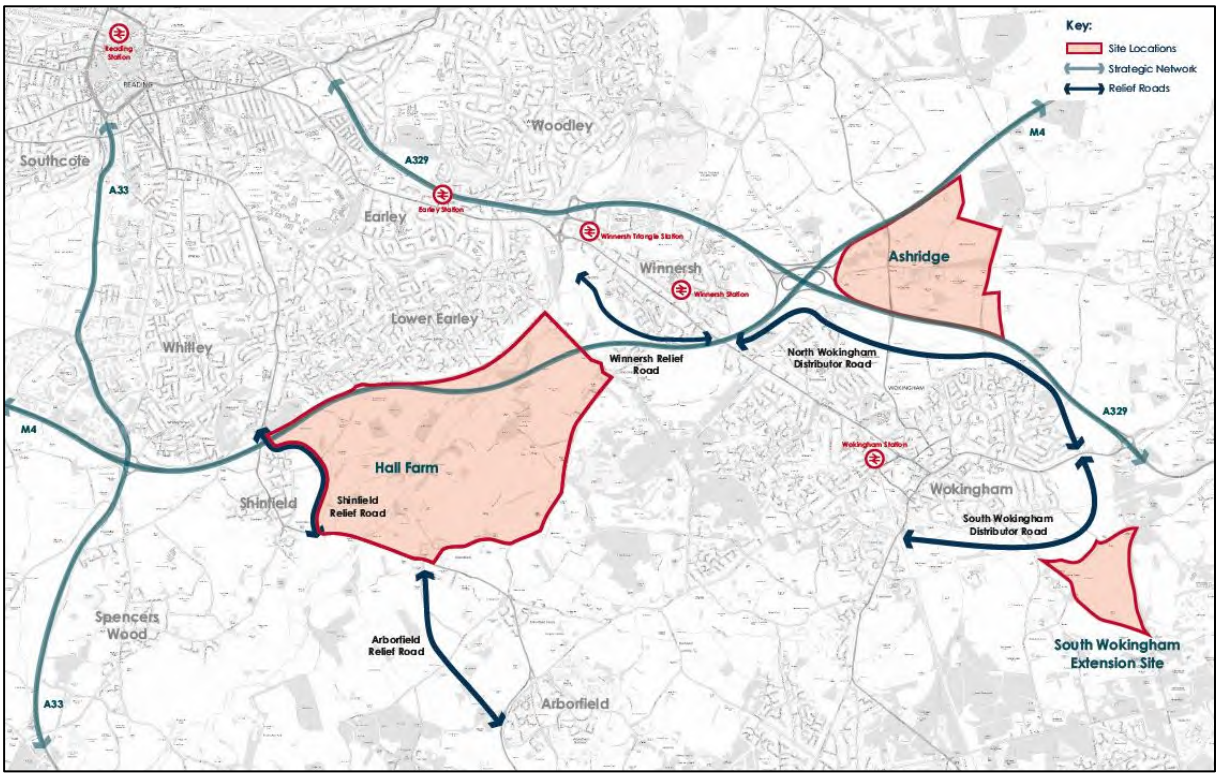


Figure 1: 2021 Study – Assessment of Growth Options. Locations of Assessed Sites

1.2.4 The assessment was undertaken using the WSTM4 (Wokingham Strategic Transport Model 4) strategic transport model with the results of the transport assessment presented within the 'Wokingham Local Plan Update. Transport Assessment Report', October 2021. As a result of this assessment, areas of material impact to highway operation were identified and potential mitigation measures were devised. The mitigation was then included within WSTM4 to confirm these partial/strategic mitigation measures were appropriate.

1.2.5 The October 2021 study concluded that:

- The impact of development extension at South Wokingham was comparatively local with 'hotspots' shown in certain locations such as at Peacock Farm roundabout and where the new development would connect to the South Wokingham Distributor Road (SWDR). Improvements in several locations were identified, but the study concluded that no strategic improvements would be required once the SWDR is completed.

- The modelling of Ashridge showed significant impacts in some locations, which would necessitate further investigation. In particular, the operation of the A329(M) between Coppid Beech and Peacock Farm should be a focus due to forecast increases in flows and delays. The considered option to only provide eastbound facing slip lanes onto the A329(M) to the east of Warren House Road means that a significant amount of development related trips are forced to use inappropriate local roads such as Wokingham Road and the Straight Mile to the north of the site, which are already subject to high flows and pass through local villages using the primary road network (PRN) to access the strategic road network (SRN) and the A329M.

- At Hall Farm / Loddon Valley, the WSTM4 modelling showed that the proposed levels of residential development might be accommodated on the local highway network, however there may be residual impacts which could not be fully mitigated through highway infrastructure and may require ongoing monitoring to assess if the forecast impact is forthcoming or if there are ways to mitigate using sustainable travel modes. Notwithstanding this, improvements were proposed at key junctions including M4 Junction 11 and the Black Boy roundabout.

- Other non-strategic developments result in localised impacts that could be mitigated through a range of highway and/or transport improvements. These can be examined prior to submission of a planning application and agreed with WBC.

1.2.6 The study also highlighted that WSTM4 forecasted significant queuing and delays around M4 J11 which was shown to impact the surrounding roads. As the WSTM4 is a strategic model, it has limited capabilities to model junction operation and the effects of driver behaviour such as vehicle weaving may not be represented accurately. The study therefore recommended to complete a more detailed assessment using a microsimulation model to more accurately assess impacts on the motorway junctions and the local road network.

1.3 Study Scope

1.3.1 Following the 2021 study Stantec was commissioned by WBC and Homes England to refine the strategic transport assessment to evaluate further the major development option known as Hall Farm / Loddon Valley (Hall Farm, Hatch Farm and Four Valleys Development).

1.3.2 The assessment was undertaken for a forecast year of 2038 representing the final year of the LPU at the time the study was scoped. The findings of the study were reported in the "Wokingham Local Plan Update. Local Highway Network and M4 Corridor - Transport Assessment Report", May 2023.

1.3.3 This document updates the findings from the previous study carried out between 2021-2023. It includes revisions such as a new forecast year of 2040, which now represents the final year of

the LPU, as well as modifications to the LPU's development quantum and the masterplans of potential development sites.

1.3.4 As part of the study a comprehensive modelling exercise has been undertaken, which was informed by extensive data collection exercise completed in November 2021. The modelling has included:

- Strategic Modelling – this used the existing Wokingham Strategic Transport Model (WSTM4), which was refined and updated in the study area to represent November 2021 travel conditions and a set of 2040 forecast scenarios (end of the new Local Plan period).
- Microsimulation Modelling – this involved development of a new microsimulation model in VISSIM, which covers a wide area between Bracknell and M4 J11; the model was developed using November 2021 data.
- Junction Models – Existing and new standalone junction models have been used to inform the development of the microsimulation and strategic models as well as to assess individual junctions not covered by the VISSIM model at a more localised level.

1.3.5 To enable the development assessment three scenarios have been produced:

- Reference Case: includes planned development outside Wokingham borough, committed development and infrastructure in the borough (including 2026 LP) but no Hall Farm / Loddon Valley development or other LPU development.
- Development Scenario (Scenario 1A): Reference Case plus Hall Farm/ Loddon Valley development (3,930 dwellings) and other potential development sites (i.e. South Wokingham SDL extension site which totals 1,150 houses, and other smaller potential site allocations with a total quantum of 3,762 dwellings); the on-site infrastructure is included. For avoidance of doubt, larger strategic options at Ashridge and Twyford are not included/modelled.
- Development Scenario with mitigation (Scenario 1B): this is based on Development Scenario but includes additional mitigation that may be required to deliver additional housing and employment.

1.3.6 Forecast assumptions for each scenario are included in Section 2 'Assessment Scenarios' of this report.

1.3.7 The assessment has focused on quantifying the impact of development in the AM and PM peak hours, which were determined to be 0800-0900 and 1700 -1800. The choice of the peak hour was documented within the 'Peak Hour Analysis' technical note, February 2023 (Attachment 1).

1.4 Study Area

1.4.1 The assessment and the micro simulation modelling efforts have concentrated on roads where the development is likely to have significant impacts and the extent of this area is shown on Figure 2. The area considers the key strategic and local links in the immediate area of the sites which together comprise the Hall Farm / Loddon Valley development and has further been defined by the work completed in 2021 and the trip distribution from Hall Farm / Loddon Valley development and where it is deemed to have the biggest impacts.

1.4.2 It is acknowledged that the impact of the development proposals will result in direct and indirect effects on the transport network, where traffic re-routing, peak spreading and mode shift may extend the study area identified.

1.4.3 The SRN and the local primary roads feeding into the SRN are the main areas of interest of this study, and the scope of works and the approach outlined in this report are proportionate to the aim and purpose of this study.

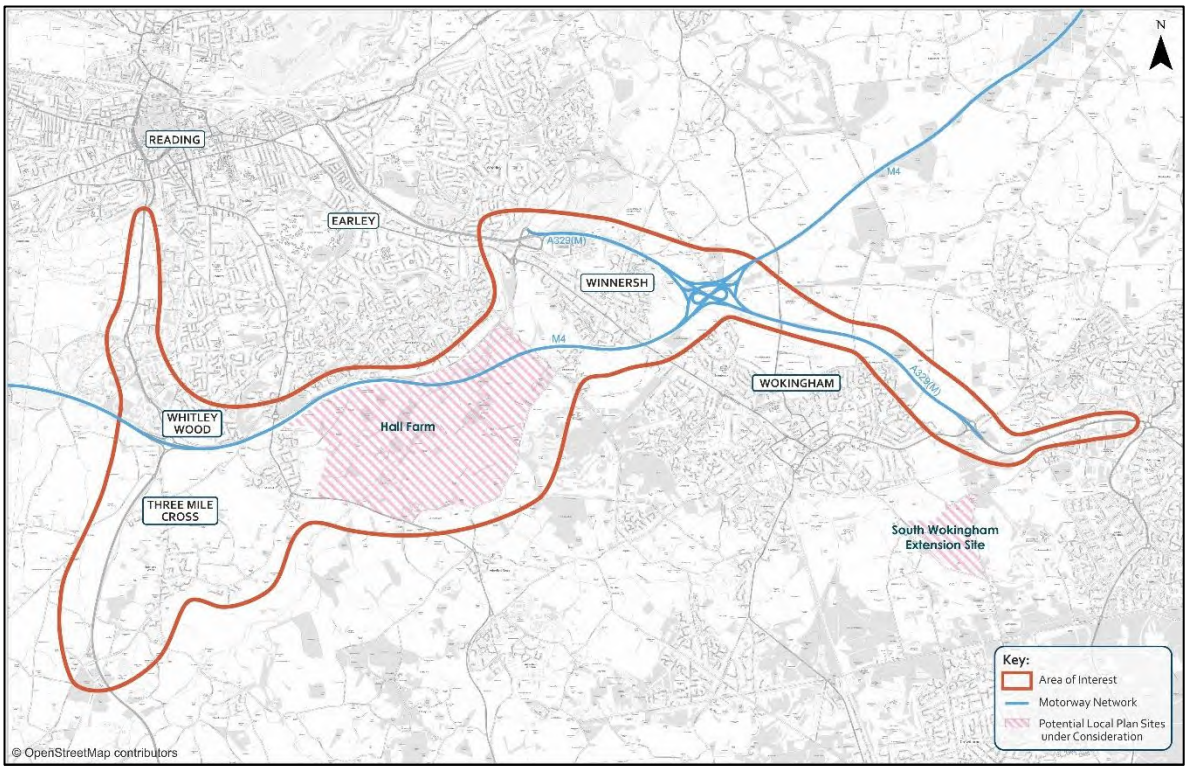


Figure 2: Study Area

1.5 Severity of Impact

1.5.1 NPPF update Dec'23, paragraph 111, states that:

"Development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network would be severe".

1.5.2 This directive is not supported by any guidance regarding the definition of 'unacceptable' or 'severe'; as such there is still a requirement for councils to assess and apply their own interpretation on a plan wide or site-specific basis. The Department for Communities and Local Government issued a response to a Kent County Council request for clarity over this matter, which stated that local authorities are best placed to determine what impacts they consider to be an unacceptable or "severe" impact on their local area, after considering what mitigation measures are appropriate in each circumstance.

1.5.3 The Local Plan assessment considers the collective impact of the proposed developments and proposed mitigation measures within Wokingham Borough. The Infrastructure Delivery Plan (IDP) provides a means to define the possible mitigation schemes for the larger developments, as the quantum of impact is more identifiable, but this is less so for the cumulative impact of the smaller schemes which may only have a more localised impact on the network in the vicinity of their development.

1.5.4 This study is intended to support the 'survey' of needs (as defined in Planning and Compulsory Purchase Act 2004) to explore infrastructure requirements that may be necessary to support planned development and thereby judge the environmental affects and the viability of proposals, appropriate to the stage in planning. This report does not therefore assess

severity of the development or infrastructure which has been included within the assessment scenarios. It does however highlight the scope of mitigation schemes likely to be required to address the potential impact of the larger developments.

1.5.5 In setting out the results of the various assessments, certain illustrative thresholds (e.g. vehicle delay) and associated colour coding schemes have been used to denote differences between scenarios. These do not necessarily imply a greater or lesser degree of acceptable impact, but can be used as a guide for comparison in the context of how each scenario test relates to the others. Factors such as whether a junction performs a key function for pedestrians, cyclists and/or public transport also needs to be taken into consideration, since trips made by more sustainable modes may take precedent over private car trips.

1.5.6 Therefore, the modelling assessment has sought to utilise a criteria based system that shows the differences between the with and without mitigation set of criteria to assess the impact of the potential development sites. By taking this approach, there will be certain locations where the council may choose to accept some degree of inconvenience for car users in order to encourage and promote the use of more sustainable travel.

1.6 Report Structure

1.6.1 This report presents the results of the assessment, which has tested and analysed the impact of the major development option known as Hall Farm / Loddon Valley on the highway network using a suite of transport models. It should be noted that multiple iterations of modelling scenarios were run to derive an optimum mitigation solution and this report only presents the preferred option.

1.6.2 The remainder of this report is structured as follows:

- Section 2 details assessment scenarios and their assumptions and includes a description of the proposed mitigation strategy tested.
- Section 3 provides an overview of the modelling approach adopted to assess the forecast scenarios.
- Section 4 details the metrics used in the impact assessment.
- Section 5 analyses the impact of the development on the Local Road Network (LRN).
- Section 6 analyses the impact of the development on the SRN.
- Section 7 summarises and concludes this report.

2 Assessment Scenarios

2.1.1 This section describes assessment scenarios adopted for this study and a range of trip generation, land use, infrastructure assumptions, which were adopted to develop them.

2.2 Forecast Scenarios

2.2.1 To undertake the development assessment three core forecasts for different development scenario have been considered:

- Reference Case: includes planned development outside Wokingham borough, committed development, which gained planning approval up to 2040, and committed infrastructure in the borough (including infrastructure to be delivered under the adopted Core Strategy and Managing Development Delivery (MDD) but no Hall Farm / Loddon Valley development or other potential development sites being considered through the LPU.

- Development Scenario with on-site infrastructure and access points (Scenario 1A): Reference Case plus Hall Farm/ Loddon Valley development (3,930 dwellings) and other potential development sites being considered through the LPU (i.e., South Wokingham SDL extension site which totals 1,150 houses, and other smaller potential allocations with a total quantum of 3,762 houses); the on-site infrastructure is included. For avoidance of doubt, larger strategic options at Ashridge and Twyford are not included/modelled.

- Development Scenario with additional mitigation (Scenario 1B): this is based on Development Scenario but includes additional mitigation that may be required to deliver additional housing and employment.

2.2.2 The Development Scenarios Without and With partial/strategic Mitigation will be compared against the Reference Case scenario to understand the impacts of potential development sites.

2.2.3 In all the scenarios the positive borough-wide impact of sustainable transport measures on a car trip reduction has been considered. The impact of sustainable measures that will target the Hall Farm / Loddon Valley development and South Wokingham extension have also been considered in the Development Scenarios (Scenario 1A and Scenario 1B).

2.2.4 Table 1 summarises the forecast scenarios, which have been assessed.

Table 1: Summary of Forecast Scenarios

	Reference Case	Scenario 1A	Scenario 1B
Development Growth			
Background growth	✓	✓	✓
Planned development outside Wokingham borough	✓	✓	✓
Committed development in Wokingham Borough (including development at the SDLs allocated in the Core Strategy and MDD)	✓	✓	✓
Hall Farm/ Loddon Valley development (LPU quantum)		✓	✓
South Wokingham SDL extension site (LPU quantum)		✓	✓
Other smaller potential development sites being considered through the Local Plan Update (LPU quantum)		✓	✓

	Reference Case	Scenario 1A	Scenario 1B
Infrastructure Changes			
M4 Smart Motorway	✓	✓	✓
Significant infrastructure schemes that are committed or planned to be delivered as part of the Local Plan delivery in neighbouring authorities	✓	✓	✓
Committed infrastructure changes in Wokingham borough (including infrastructure to be delivered under the adopted Core Strategy and MDD)	✓	✓	✓
On-site infrastructure and site access locations associated with LPU quanta		✓	✓
Additional mitigation that may be required to deliver South Wokingham Extension development			✓
Additional mitigation that may be required to deliver Hall Farm / Loddon Valley development			✓
Sustainable Transport Measures			
Wokingham borough-wide LTP Measures	✓	✓	✓
Hall Farm / Loddon Valley - My Journey targeted sustainable transport measures		✓	✓
South Wokingham Extension – My Journey targeted sustainable transport measures		✓	✓

2.2.5 The composition of each of the assessment scenarios is described in the rest of this section.

2.3 Reference Case

2.3.1 The Reference Case has been used as the basis of comparison with the Development Scenarios and will inform the impacts and mitigation that would be required to deliver development in transport terms. The Reference Case therefore includes all growth up to 2040, which results from development in neighbouring authorities and growth within Wokingham borough, including growth associated with the adopted Core Strategy and MDD, but excluding the growth associated with potential development sites being considered by the LPU. This will utilise the Tempro growth factors (Version 8 Dec 23 update) for the neighbouring authorities and specific local data for Wokingham from committed developments.

2.3.2 The 2040 Reference Case has been developed from 2021 base and makes the following assumptions about development growth and infrastructure changes. These are subsequently detailed.

Wokingham Borough

- Large committed development sites with a planning permission as detailed in Appendix A (including Creative Media Hub for 85,000 m2)
- Planned development in the council's adopted Core Strategy, known as Strategic Development Locations (SDL)
- Committed infrastructure schemes in Wokingham Borough as well as all planned schemes in the adopted Core Strategy and MDD as detailed further in this document

Neighbouring Authorities

- Planned development in neighbouring authorities adopted local plans
- Large committed development sites within the vicinity of the study area with a planning permission as detailed in Appendix B
- Any significant infrastructure schemes that are planned to be delivered as part of the Local Plan delivery in neighbouring authorities. Only those that are likely to have a direct effect on the Hall Farm / Loddon Valley development impact area and located within approximately 2 miles of Wokingham Borough have been included.

Strategic Road Network (SRN)

- M4 Smart Motorway (Junction 3-12)

Other

- Accounted for national growth projections accessible via DfT's National Trip End Model (NTEM dataset 8.0, the latest available at the time of forecast scenario development). Where necessary NTEM growth assumptions (in terms of housing and employment) have been superseded by the greater detailed understanding of the districts/boroughs committed and planned development to avoid double-counting. The overall growth has been constrained to the national forecasts. The growth constraint has been applied at a regional level thus respecting the fact that most vehicular trips are within the same region as people look to minimise the disruption to their daily working life, school and social routines.
- The effect of national changes in fuel and income on car trips have been accounted for by applying fuel and income adjustment factors sourced from Table M4.2.1 of the DfT TAG (Transport Appraisal Guidance) Databook November 2023 v1.22[1] (the latest version available at the time of the assessment). The application of these factors is consistent with DfT TAG guidance for Fixed Trip Matrix (FTM) assignment modelling where route change is the only traveller response modelled and Variable Demand Modelling (VDM) is not undertaken.
- A combined fuel and income adjustment factor that have been applied to the forecast demand is 1.161, which means that the demand for travel is projected to increase by 16.1% between 2021 and 2040 due to people generally becoming wealthier.
- Growth factors for LGV and HGV have been determined from DfT's National Road Traffic Projections 2022 and these have been applied to the base year LGV and HGV trips.
- Roadworks that were observed in November 2021 (at the time of the data collection, which informed base year modelling) have been excluded.

2.3.3 Technical documentation related to development of the Reference Case forecast trip matrices is included within the 'Reference Case – Matrix Development Methodology', June 2024 (Attachment 7).

[1] TAG data book - GOV.UK (www.gov.uk)

Wokingham Borough

Adopted local plan development

2.3.4 The Reference Case includes development planned through the adopted Core Strategy and MDD up to 2026 within the borough, which will accommodate a total of about 10,000 homes mainly delivered within four Strategic Development Locations (SDLs):

- Arborfield Garrison major development
- South of the M4 major development
- North Wokingham major development (inc SDL)
- South Wokingham major development (inc SDL)

2.3.5 A number of planned infrastructure improvements to support SDL growth is also accounted for in the Reference Case, including the following key schemes:

- Arborfield Cross Relief Road (ACRR)(Single Carriageway) - Road opened to traffic in November 2020.
- A sustainable new village with about 3,500 new homes is being built on the former Arborfield Garrison site. Shinfield Parish is also seeing significant development, with about 3,000 new homes being built in extensions to Shinfield Village, Three Mile Cross and Spencers Wood. The ACRR is intended to minimise the impact of traffic growth on the villages of Arborfield and Arborfield Cross and the surrounding rural network
- North Wokingham Distributor Road (NWDR) (Single Carriageway)
- The NWDR connects the A329 near the BP garage on Reading Road, with the A329 London Road near the A329(M) Reading to Bracknell motorway near the Coppid Beech roundabout junction, via the North Wokingham development. The West of Old Forest Road (WOFTR) and Toutley Road phases of the NWDR opened to traffic on 9 May 2022
- South Wokingham Distributor Road (SWDR)
- Following on from the development on William Heelas Way in Montague Park, the SWDR (Single Carriageway) now joins with Waterloo Road, and will in the future run west across Easthampstead Road to Finchampstead Road - connecting at the existing Tesco roundabout

2.3.6 The distributor road is being delivered in four sections: Montague Park or William Heelas Way (completed in Summer 2015), Eastern Gateway (completed in January 2022 with the new roads and new railway bridge officially opened on the same day), Central section and Western Gateway (which are in the final stages of the detailed design and discharge of planning conditions).

- Shinfield Eastern Relief Road (SERR) - completed in late 2017.

A 2km length of single carriageway road running eastwards from a signalised junction south of the Black Boy roundabout, crossing Cutbush Lane and joining the A327, Arborfield Road at a roundabout located between the Parrot Farmhouse and Magpie and Parrot Public House. This roundabout has been recently widened on various approaches compared to the original SERR scheme

- Barkham Bridge widening - the new bridge opened for traffic in March 2021
- Nine Mile Ride Extension – completed in Spring 2022

- Elms Road Link Road in Wokingham town centre - completed in June 2021
- Hatch Farm Way
- A link road connecting B3270 Lower Earley Way North via a signalised junction to a new roundabout junction on the A329 Reading Road via a signalised junction with King Street Lane. The scheme has been delivered in two phases, the first phase was completed in June 2018 and the second phase was opened to traffic in September 2021

2.3.7 Some of the above schemes had been implemented at the time of the traffic surveys.

Large Committed Development Sites – Creative Media Hub

2.3.8 The Creative Media Hub, which includes Shinfield Studios, is now constructed (Aug 24) in Shinfield and partly operational, however the assessment uses the agreed forecast demand on the basis of the site being fully operational. Construction and occupation continues apace and therefore the full build out has been included in the Reference Case. Trip generation for this development within the modelling has used the trip rates included in the consented Shinfield Studios planning applications (210387 and 211841), as detailed below.

Table 2: Vehicle Trip Rates – Car and LGV

Land Use	Trip Rate Source	AM Peak Hour (08:00 – 09:00)		PM Peak Hour (17:00 – 18:00)	
		Arrivals	Departures	Arrivals	Departures
Creative Media Hub (per 100m^2)	Planning applications (210387 and 211841)	0.45	0.09	0.09	0.37

Table 3: Vehicle Trip Rates – HGV

Land Use	Trip Rate Source	AM Peak Hour (08:00 – 09:00)		PM Peak Hour (17:00 – 18:00)	
		Arrivals	Departures	Arrivals	Departures
Creative Media Hub (per 100m^2)	Trips from TRICS surveys (site SC-16-A-05 - Shepperton Studios site)*	0.004	0.007	0.002	0.001

** No data was available on the HGV trip generation in the Creative Media Hub application. Therefore, data has been extracted from TRICS for a similar site*

Borough-wide Impacts of Sustainable Transport Measures

2.3.9 The new 2021-2040 Local Transport Plan (LTP4), which is being drafted, promotes a vision which "will deliver and maintain a safe, reliable and joined-up transport system that connects new and existing communities, businesses, and commercial centres while providing leisure opportunities." The vision will:

- Create Healthy and Safe Places;
- Reduce Environmental Impacts; and
- Develop The Economy.

2.3.10 The draft LTP4 promotes mitigation measures to reduce the demand for travel on the highway network by private vehicle. It is anticipated that the potential range of mitigation measures, which include improved walking and cycling links to public transport interchanges and improved information prior to journey, will result in a reduction of highway trips within Wokingham borough.

2.3.11 Many of these measures are delivered via My Journey, a borough-wide active and sustainable travel behaviour change campaign that aims to help and inspire Wokingham borough residents, employees and visitors of all ages to walk, scoot, cycle or use public transport. The programme includes a range of events, activities, training courses and resources. Some of the most popular training is part of the national Bikeability training scheme. The programme works with 100% of primary and junior schools in the borough, training over 80% of Year 6 students in Bikeability Level 1/2. The Level 3 programme is also rapidly expanding with 45% growth in the number of children trained in 2019/20 compared to 2018/19.

2.3.12 The annual 'My Journey' programme also includes projects that work with new development locations, schools, workplaces and communities across Wokingham borough. Measures that are promoted annually include 'Beat The Street' within new development areas, personalised travel planning sessions across the SDLs, transition projects for primary school children moving into Secondary education, Facebook & YouTube campaigns, new resident workshops and developing school travel plans.

2.3.13 As stated in the "Climate Emergency Action Plan" published by WBC in January 2020, by creating journey routes, providing travel advice, attending community events, organising cycle training, guided walks, and producing personalised travel packs for residents, from 2016-2018 My Journey has seen:

- An 8% increase in the number of residents indicating that they cycle at least once a week
- A 4% increase in the number of residents indicating they walk at least once a week
- From 2015-2018, 1,770 children were trained by Bikeability

2.3.14 And the 2021 update of the "Climate Emergency Action Plan" reports that Cycle September (a month-long competition from Love to Ride, which aims to get more people riding bikes) saw 238 residents taking part, which is 63% up on 2020, and combined 41,261 miles were cycled and in total, 1,305lbs of CO2 was saved if those miles have been driven.

2.3.15 The assessment process has sought to apply an appropriate trip rate reduction to the rates that are used in the trip generation process due to sustainable travel strategy.

2.3.16 The 'Car trip reduction due to Site-Specific Sustainability Measures at Hall Farm/Loddon Valley SDL' technical note (Attachment 3) set out evidence for the forecast reduction to car trips that a range of sustainable initiatives could be expected to deliver. Research has been undertaken and presented within Attachment 3 looking at options and empirical evidence for the application of reductions. This included:

a. Sustainable Travel Reductions - Reporting is often based on a package of measures, often led by soft measures. The Sustainable Towns / Smarter Choices Research[2] [3] is often cited. The evidence provided from the sustainable travel towns research is also referenced in the *DfT TAG Unit M5.2 Modelling Smarter Choices*.

[2] *Cairns S, Sloman L, Newson C, Anable J, Kirkbride A & Goodwin P (2004) 'Smarter Choices – Changing the Way We Travel'*

[3] *The Effects of Smarter Choice Programmes in the Sustainable Travel Towns:Research Report.' Lynn Sloman, Sally Cairns, Carey Newson, Jillian Anable, Alison Pridmore and Phil Goodwin. Report to the Department for Transport - March 2010*

b. 'Evidence from other RTS Studies – Either RTS business cases or schemes that have been implemented and evidence has been collected on usage and indicative mode choice based on post opening studies.
c. Review of similar Stantec studies and Local Plan transport evidence base development

2.3.17 The evidence provided in the technical note and successful approaches adopted by Stantec elsewhere and agreed with the relevant highway authorities, suggests that the potential range of mitigation measures promoted through the 2021-2040 draft LTP are likely to result in a reduction of car trips of up to 18% with targeted travel plans. For the purpose of this study a conservative reduction of 5.5% for car trips within the borough has been adopted[4]. For trips to/from Strategic Development Locations (SDLs) a further reduction of 1.5% have been applied to all car trips. This reflects the promotion of targeted sustainable travel measures via My Journey Programme.

Neighbouring Authorities

2.3.18 In the Reference Case the trip end growth for neighbouring planning authorities has been derived from DfT's NTEM accessible via TEMPro. In NTEM trip end growth is based on housing, population and employment planning projections. In the Reference Case these housing projections have been updated based on up-to-date information about development proposed in the emerging Local Plan. The status of Local Plans in nearby local authorities was reviewed and are summarised as at the time of the modelling work being commenced:

- Bracknell Forest – The Bracknell Forest Local Plan, which outlines the growth strategy for the borough until 2037, was officially adopted on March 19, 2024. However, during the time of this study, it had not yet been adopted.

- Basingstoke and Deane, Hampshire – Basingstoke and Deane 2011-2029 Local Plan was adopted on 26th May 2016. Hart District Council, Hampshire – Hart 2032 Local Plan was formally adopted on 30th April 2020 following receipt of the Planning Inspectors report.

- Reading – The Reading Borough Local Plan was adopted on 4th November 2019.

- Royal Borough of Windsor and Maidenhead – 2013 – 2033 borough Local Plan was adopted on 8th February 2022.

- Slough Borough - the local plan for Slough 2016-2036 has no up to date timetable for its preparation

- South Oxfordshire District - the South Oxfordshire Local Plan 2035 was adopted on 10 December 2020 and has replaced the South Oxfordshire Local Plan 2011 and Core Strategy (2012).

- West Berkshire – West Berkshire current Local Plan sets out our planning policies up to 2026. The Local Plan Review 2022-2039 was submitted to the Secretary of State on 31 March 2023.

2.3.19 It is noted that during the period this report has been completed, some Local Plans have or are in the process of being updated. Similarly transport policies related infrastructure have also evolved. Together these changes may affect cross boundary forecasts, explored under the Duty to Co-operate. For example, the Reading Borough Council (RBC) Local Plan Inspectors Report noted commitments in the Plan relied on the delivery of Park & Ride in Wokingham Borough, as a means to reduce traffic to the town by car. These are not

[4] *This assumption is identical to the approach adopted for the existing local plan transport modelling work as described in the "Demand Forecasting Methodology" report 2009.*

considered to have a material impact on the modelling assessment, as the models are highway based and not multi modal, therefore the outputs show a slightly higher demand.

2.3.20 In cases where the Local Plans were not adopted such as Bracknell Forest Council at the time of this study being undertaken the housing projections included within NTEM have been superseded with the adopted growth targets detailed in the table below. From a final year of a local plan period, a trend-based approach was adopted assuming that growth will continue at the same rate to the time horizon of the Wokingham Local Plan. This approach is in accordance with the DfT's "NTEM Planning Data Version 7 Guidance Note", July 2016.

Table 4: Nearby Local Authorities – Local Plan Targets. Housing

Authority	Local Targets
Basingstoke and Deane	2011-2029 - 15,300 dwellings
Bracknell Forest	2006-2026 – 11,139 dwellings*
Hart	2014-2032-7,614 dwellings
Reading	2013-2036 -16,077 dwellings
Slough	2006 - 2026 Core Strategy - 6,250 minimum new dwellings for this LP period
South Oxfordshire	2011-2035 - 11,785 dwellings
West Berkshire	2006-2026-10,500 dwellings
Windsor and Maidenhead	2013-2033-14,240 dwellings

** Since the study commenced, Bracknell Forest adopted its Local Plan in March 2024. It states that provision will be made in Bracknell Forest for the period 2020/21 to 2036/37 to accommodate at least 10,438 homes (614 dpa) to meet the Borough's Local Housing Need.*

2.3.21 The employment planning projections included within NTEM have also been reviewed but have not been updated with local values as the default approach within DfT's NTEM is to use latest Office for Budget Responsibility (OBR) forecasts of employment, which reflect a long-term trend.

2.3.22 From the information made available by neighbouring authorities, we have identified large development sites that are close to the Wokingham borough boundary and cross checked that areas within the models containing such sites have the right level of growth in NTEM. This is based on information collected from neighbouring authorities in the first part of 2021, which was deemed to be up to date at the time of assembling data. Appendix B presents the list of all the sites.

2.3.23 We have also received information from Reading BC about committed schemes, which may be relevant to the study, and these have been included in the Reference Case. These schemes are:

- Provision of fully segregated cycle tracks along the A327 Shinfield Road from the junction with Elmhurst Road to Shinfield Rise. The scheme commenced construction in 2023.[5]
- Provision of a bus lane on London Road from the borough boundary at the end of the A3290 to Cemetery Junction (referenced in the Reading's published Bus Service Improvement Plan 2021-26 (BSIP)).

2.4 Hall Farm / Loddon Valley

2.4.1 The Reference Case scenario forms the basis for the assessment of potential development sites being considered through the LPU in Scenario 1A (without mitigation) and Scenario 1B

[5] *Active Travel - Reading Borough Council*

(with additional mitigation). The potential development proposals include Hall Farm/ Loddon Valley development, South Wokingham SDL extension site and other smaller proposed site allocations. This and the next sections describe the development proposals for each of these potential site allocations.

Hall Farm / Loddon Valley Land Use Assumptions

2.4.2 Table 5 shows a summary of the land use quanta for Hall Farm / Loddon Valley development, which will consist of a mix of housing and employment.

Table 5: Hall Farm / Loddon Valley Land Use and Quantum (indicative)

Land Use	Local Plan Update quantum
Residential Dwellings	3,930 houses
Local Centres	community centre – 1,440m² food store - 2,500m² mixed retail/café etc.- 3,500 m²
Primary School	2 x 3FE
Secondary School	1 x 12FE
Sixth Form	300 pupils
Sports provision and sports building (m2)	100,000 m² (2 x 3G artificial grass pitches and 4 grass pitches & a leisure centre 1,500m²)
R&D (m^2)	100,000m²

2.4.3 Figure 3 below shows an indicative strategy plan for the Hall Farm / Loddon Valley site prepared by Savills in October 2023. In the absence of any other information and for the purpose of the assessment the total residential and employment quantum is distributed across different development parcels pro-rata to the areas they cover.

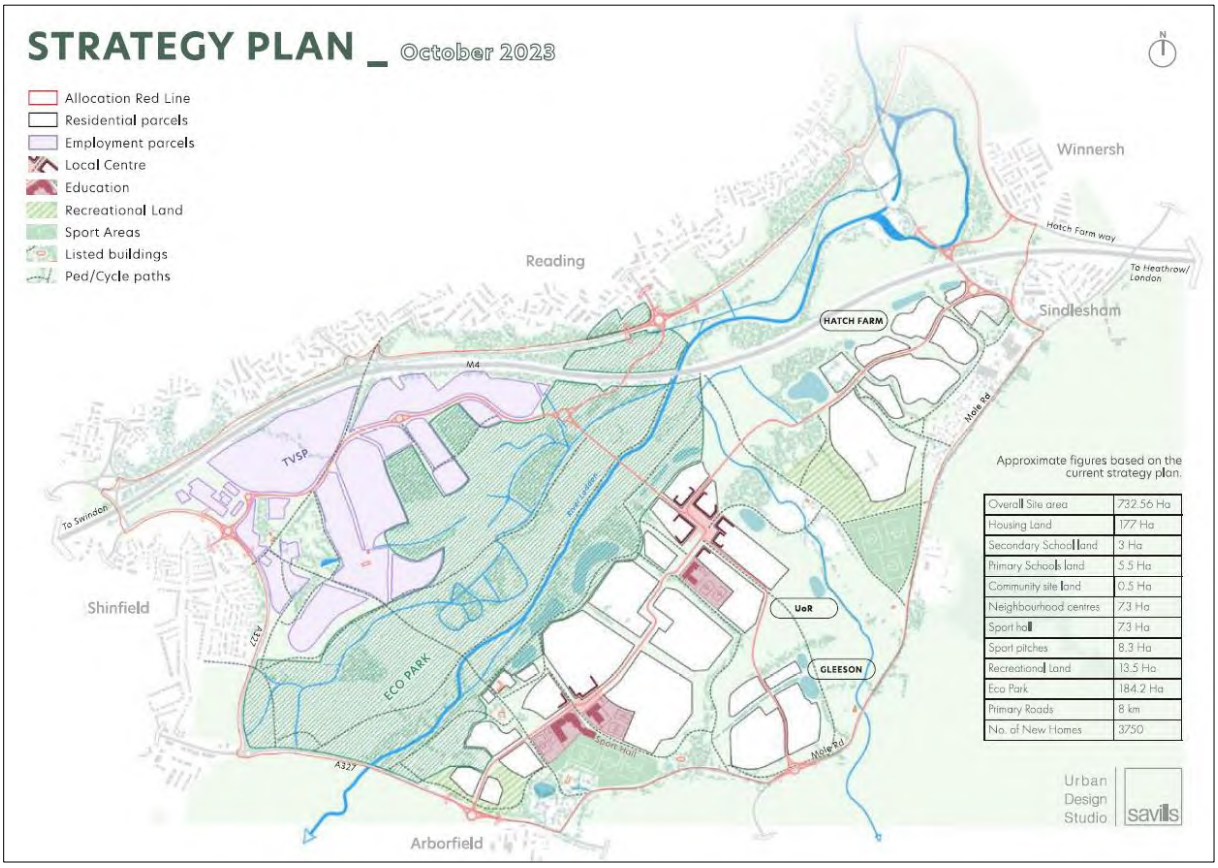


Figure 3: Hall Farm / Loddon Valley – Indicative Strategy Plan (with bridge over the M4)

Trip Generation Assumptions

2.4.4 The trip generation representing the development quanta in the models have been derived from several sources as detailed in Table 6 below for Cars and Table 7 for HGVs. The tables also summarise the trip rates that have been used. Vehicle trip rates have been applied to each of the land uses set out in Table 5. Most of the trip rates originate from the 'Wokingham Strategic Transport Model 4 (WSTM4). Highway Model Forecasting Methodology', August 2019. The rationale for the choice of trip rates adopted to R&D land use type is detailed in the 'TVSP Trip Rates' Technical Note, June 2022 (Attachment 2).

Table 6: Hall Farm / Loddon Valley Vehicle Trip Rates – Car and LGV

Land Use	Trip Rate Source	AM Peak Hour (08:00 – 09:00)		PM Peak Hour (17:00 – 18:00)	
		Arrivals	Departures	Arrivals	Departures
Residential Houses (per unit)	WSTM4 Forecasting Report[6]	0.17	0.41	0.36	0.16
Primary School (per pupil)	WSTM4 Forecasting Report	0.70	0.58	0.04	0.08
Secondary School (per pupil)	WSTM4 Forecasting Report	0.11	0.08	0.02	0.03
Local Centres (per 100m^2)	WSTM4 Forecasting Report	6.75	3.60	3.47	4.64

[6] 'WOKINGHAM STRATEGIC TRANSPORT MODEL 4 (WSTM4). Highway Model Forecasting Methodology', August 2019

Land Use	Trip Rate Source	AM Peak Hour (08:00 – 09:00)		PM Peak Hour (17:00 – 18:00)	
		Arrivals	Departures	Arrivals	Departures
▪ community centre - 2,500m2 ▪ food store - 2,500m2 ▪ mixed retail/café etc.- 3,500 m2		2.64 0.20	2.14 0.04	6.23 1.57	6.89 1.62
Sports provision and sports building ▪ 10 pitches (per pitch) ▪ Leisure centre 1,750sqm (per 100m2)	WSTM4 Forecasting Report	1.30 0.25	0.70 0.27	2.30 1.01	0.80 0.70
R&D (per 100m^2)	Average of 2018 TVSP surveys and TRICS database (Science & Tech Park sites)	1.094	0.099	0.057	0.827

Table 7: Hall Farm / Loddon Valley Vehicle Trip Rates – HGV

Land Use	Trip Rate Source	AM Peak Hour (08:00 – 09:00)		PM Peak Hour (17:00 – 18:00)	
		Arrivals	Departures	Arrivals	Departures
Residential Houses (per unit)	WSTM4 Forecasting Report	0.00	0.00	0.00	0.00
Primary School (per pupil)	WSTM4 Forecasting Report	0.00	0.00	0.00	0.00
Secondary School (per pupil)	WSTM4 Forecasting Report	0.00	0.00	0.00	0.00
Local Centres (per 100m^2) ▪ community centre - 2,500 m2 ▪ food store - 2,500m2 ▪ mixed retail/café etc.- 3,500 m2	TRICS & WSTM4 Forecasting Report	0.00 0.02 0.00	0.00 0.06 0.00	0.00 0.01 0.00	0.00 0.02 0.00
Sports provision and sports building ▪ 10 pitches (per pitch) ▪ Leisure centre 1,750sqm (per 100m2)	WSTM4 Forecasting Report	0.10 0.01	0.10 0.01	0.00 0.00	0.00 0.00
R&D (per 100m^2)	Average of 2018 TVSP surveys and TRICS database (Science & Tech Park sites)	0.01	0.00	0.00	0.01

2.4.5 These trip rates have been further adjusted downwards by 7% to account for the site-specific sustainability measures including promotion of sustainable travel measures via My Journey Programme. Further details on the level of the reduction and the rationale are provided below.

Internalisation

2.4.6 Due to the mixed-use nature of the Hall Farm / Loddon Valley development, a number of vehicle trips will have their origin and destination both within the site and will therefore be internalised. These internalised trips will bear no impact upon the surrounding highway network.

2.4.7 Targets have been set for a high proportion of school trips to be internal to Hall Farm / Loddon Valley. This assumption is based on the strategic development sites being promoted as a self-sustaining "garden village" with amenities provided internally. It is assumed that the schools predominantly accommodate pupils who are residents of the proposed development.

2.4.8 Internalisation rates are noted within Table 8 below. Whilst parental choice varies by school, internalisation for primary and secondary schools has been based on the analysis of the pupil postcodes in Wokingham borough. This has shown that there is generally 57% of primary school pupils living within 1km of their primary school and 72% of secondary school pupils living within 2km of their secondary school.

Table 8: Vehicular Internalisation

Land Use	Hall Farm / Loddon Valley
Local Centres	50%
Primary School	57%
Secondary School	72%
Creative Media Hub/ Hall Farm Employment	5%
Sports Centre	5%

Trip Distribution

2.4.9 Trip distribution for the Hall Farm/Loddon Valley development has been assumed to be the same as the distribution from comparable land use zones within the Shinfield area.

Sustainable Transport Measures

Hall Farm/Loddon Valley Transport Context

2.4.10 The proposed residential development at Hall Farm/Loddon Valley will be well connected to planned employment development at the University of Reading's extended Science Park area to the west of the River Loddon and will also benefit from many facilities within its boundary, including primary and secondary schools, sports facilities, and retail. Consequently, it is envisaged that a number of the vehicle trips associated with the development will be internalised. In many cases these will be shifted to sustainable modes, taking advantage of a comprehensive range of sustainable modes as set out below:

- Option to generate a package on public transport measures which could include a Rapid Transport System (RTS) with levels of priority through the site connecting both internal destinations and external destinations which could include the railway stations at Green Park, Winnersh Triangle, Wokingham and Reading. The RTS would initially be established as a high frequency bus service, but could in future be adapted to serve new technologies as they come forwards.

- Introduction of local bus services to surrounding local towns and key locations.

- Comprehensive walking and cycling routes, including a new direct route over the M4 to Lower Earley.

- Introduction of green routes.

- On site facilities linked by the above to maximise internal trips by sustainable mode, including schools, local and district centres, and employment opportunities at Thames Valley Science Park.

2.4.11 Despite an allowance for internalisation (detailed in Table 8), there will still be a demand for trips to be made between Hall Farm / Loddon Valley and other locations. This will reflect the needs of residents to access facilities not located on site, and for the facilities on site to be

visited by people from elsewhere. To ensure that these external vehicle trips are reduced as far as possible, the sustainable transport infrastructure will extend beyond the boundary.

2.4.12 Strong pedestrian and cycle connections to nearby areas including Shinfield and Lower Earley will enable users of active modes to gain convenient access to and from these locations. Within the development, new cycle infrastructure will be designed in line with LTN 1/20 guidance in order to make it as attractive and useable as possible. Outside of the site boundary, new and improved cycle infrastructure will be designed to LTN 1/20 compliance wherever possible within existing constraints. The routes will tie into routes being developed as part of WBC's Local Cycling and Walking Improvement Plan and those of adjoining boroughs, including Reading Borough.

2.4.13 Beyond these neighbouring areas, an RTS could be a conduit for medium and longer distance journeys. In order to make the RTS an attractive option for travellers and embed its use, it is strongly recommended that the network is delivered at the earliest opportunity. This will require a degree of subsidy and competitive fare pricing to enhance attractiveness, until the service is commercially viable.

2.4.14 The RTS will be a high quality, high frequency service which provides connections between the Hall Farm / Loddon Valley SDL and key destinations in the area. Initially, the RTS is likely to be provided as a bus-based system (currently known as Bus Rapid Transit), however, in due course it can evolve to utilise new technologies, for example autonomous shuttle vehicles. There is the opportunity for other bus services to interchange with the RTS within Hall Farm / Loddon Valley, at one of the Local Centres as a minimum.

2.4.15 Provision of car clubs on site can provide for people who use alternative modes the majority of the time but need to make occasional car journeys. Over the life of the development these are likely to forge the basis for mobility hubs to exploit the potential for micro-mobility and Mobility as a Service (MaaS) options.

2.4.16 Provision of additional lanes on existing roads and on new roads within the Hall Farm / Loddon Valley development, as well as vehicle triggered signal systems can be dedicated for the RTS over private car. This will assist in delivering a fast, regular RTS service to Reading, and key railway stations near Hall Farm / Loddon Valley, such as Winnersh Triangle and Reading Green Park. The direct connections to nearby railway stations open up further opportunity for multimodal trips to the destinations served across the National Rail network.

2.4.17 Individual businesses within Hall Farm / Loddon Valley and Science Park may also consider providing shuttle buses to Winnersh Triangle and/or Reading Green Park railway stations, although it is expected that the RTS should be provided at a frequency and capacity which largely negates the requirement for such shuttle services.

2.4.18 The IDP is being updated and refined alongside the viability assessments, particularly around the Hall Farm / Loddon Valley development, . The emerging IDP includes an allowance of estimated at £6 to 7 million for RTS and local bus services and infrastructure, with additional funding for possible bus priority on and off site. This coupled with funding for walking and cycling and wider infrastructure improvements forms part of an IDP for highways and transport infrastructure. Ahead of Examination in Public the IDP will prioritise proposals in order to balance infrastructure needs accounting for the substantial price inflation which has taken place since the previous IDP.

2.4.19 The IDP will need to be considered against WBC's wider transport and funding strategies and how the development led mitigation and contributions can be integrated into the wider community benefits as set out in the emerging Local Transport Plan 4. The Wokingham Local Transport Plan 4 (LTP) is a strategic document that sets WBC's approach for all aspects of transport across the borough. The LTP4 identifies and supports future transport interventions for funding, addresses priorities for the residents and meets the requirements of national and

local objectives. The LTP4 is supported by the Local Cycling and Walking Infrastructure Plan (LCWIP) and the Local Bus Service Improvement Plan (BSIP). LTP4 seeks to build on and continue the strategies being progressed as outlined in the current LTP3 published 2011.

2.4.20 The promotion of a range of travel modes will also help to manage the impact of the additional car trips on the network. For many years WBC has been running a successful 'My Journey' programme of sustainable transport measures, which provides a broader and a more comprehensive offer than any individual developer travel plan.

2.4.21 The annual 'My Journey' programme in Wokingham borough includes projects for new developments, schools, workplaces, and communities. Key initiatives are 'Beat The Street', personalized travel planning, primary-to-secondary transition projects, social media campaigns, new resident workshops, and school travel plans.

Table 9: Indicative My Journey Annual Programme of activities

Programme Area	Description of Activity
Workplaces Travel Planning & Business Engagement	WBC staff travel survey, analyses and reporting
	WBC Travel Plan Refresh
	Business Roadshow Events
	Electric car charging point map for WBC & wider borough
Residential Travel Planning	Develop and maintain communication links to new developments
	Community events in partnership with WBC community teams
	PTP at Montague Park and Mulberry Grove
	Travel Information Welcome Packs for new residents
	Community Roadshow Events
	Car club viability plan (existing areas and new development)
Active Travel & School Travel Planning	BEAT THE STREET – Walk around the world challenge within SDLs
	Sustainable Transport Transitions Project (Primary to Secondary School)
	Sustainable Transport Transitions Project (School Leavers)
	Adopt Modeshift scheme for WBC schools
Marketing, Communications and Consultation	Widen and reinforce content of My Journey brand
	Development of a mobile responsive My Journey website to support promotion and delivery of travel planning initiatives within new the new development sites.
	My Journey social media, website & newsletter communication forums
	Facebook & YouTube campaigns to promote PTP, Yomp, Beat The Street
	Video to promote A329 cycleway (Stage 2)
	Workshop with new residents to better understand their travel behaviour

2.4.22 As stated in the "Climate Emergency Action Plan" published by WBC in January 2020, by creating journey routes, providing travel advice, attending community events, organising cycle training, guided walks, and producing personalised travel packs for residents, from 2016-2018 My Journey has seen:

- An 8% increase in the number of residents indicating that they cycle at least once a week
- A 4% increase in the number of residents indicating they walk at least once a week, and
- From 2015-2018, 1,770 children were trained by Bikeability

2.4.23 And the 2021 update of the "Climate Emergency Action Plan" reports that Cycle September (a month-long competition from Love to Ride, which aims to get more people riding bikes) saw 238 residents taking part, which is 63% up on 2020, and combined 41,261 miles were cycled and in total, 1,305lbs of CO2 was saved if those miles have been driven.

Impact of Hall Farm / Loddon Valley Targeted Sustainable Transport Measures

2.4.24 The 'Car trip reduction due to Site-Specific Sustainability Measures at Hall Farm SDL' technical note (Attachment 3) identifies evidence for the expected reduction to car trips due to

the impact of sustainable measures. Based on the evidence provided in that technical note, an overall reduction of 7% to all Hall Farm / Loddon Valley car trips has been applied. This reflects an additional 1.5% reduction to a borough-wide reduction of 5.5% and represents a conservative forecast. The additional 1.5% reduction reflects provision of high-quality sustainable travel infrastructure and promotion of sustainable travel measures via My Journey Programme. These assumptions are identical to those accepted in the assessment of the adopted Core Strategy local plan.

2.4.25 A further reduction in highway trips to/from Hall Farm / Loddon Valley can be achieved due to RTS, which would improve accessibility of the site by public transport to a wide area by providing links to such railway stations as Green Park, Winnersh Triangle, Wokingham and Reading. Evidence presented in the 'Car trip reduction due to Site-Specific Sustainability Measures at Hall Farm/Loddon Valley SDL' technical note (Attachment 3) suggests that this reduction could be as high as 10%. Though a conservative estimate of 5% was considered, it was not applied due to limitations of the highway only model used for this study, which does not allow for identification of all origin-destination movements that may benefit from the introduction of RTS to apply the reduction to.

2.4.26 In parallel to the provision for sustainable modes of travel, WBC will need to consider levels of parking at future development and how to encourage a change in attitude to use of the car across the borough to meet national and local climate objectives.

2.4.27 Within certain types of land use and development there will be scope to limit onsite parking and reduce use of the car. In other locations where parking can be managed, but is not being restricted, it will be necessary to encourage the use of sustainable modes and employer's working from home policies. This will allow provision for cars but reduce car use for short or peak hour trips. The emerging local plan offers a real opportunity to deliver changes to future car use and levels of sustainable active travel in the borough.

Site Access

2.4.28 Hall Farm / Loddon Valley site is located in close proximity to the strategic road network with the M4 motorway traversing the north of the site area, and the A327 located to the southwest. To the west of the site is the Shinfield Eastern Relief Road, which connects to the B3270 thus providing a route to Junction 11 of the M4. B3030 Mole Road forms an eastern boundary to the site.

2.4.29 Figure 4 shows on-site infrastructure and access only locations for the Hall Farm / Loddon Valley Development as assumed in Scenario 1A without additional mitigation. These schemes are:

(1) Provision of an additional southbound lane between Black Boy Roundabout and South Avenue and improvements to the roundabout
(2) New arm on Arborfield Relief Road roundabout to accommodate access from Hall Farm / Loddon Valley and possible ICD increase if required.
(3) New bridge over River Loddon
(4) New access to Mole Road
(5) Mill Lane closed to through traffic.
(6) New access to Mill Lane and connection to Winnersh Relief Road
(7) New access to Lower Earley Way landing at the B3270/Meldreth Way Roundabout

2.4.30 It should be noted that the figure is indicative and should not be taken as prescriptive of what must be provided in terms of locations, alignments, and compliance with standards.

2.4.31 Appendix C further details on-site infrastructure assumptions and access locations for Hall Farm / Loddon Valley.

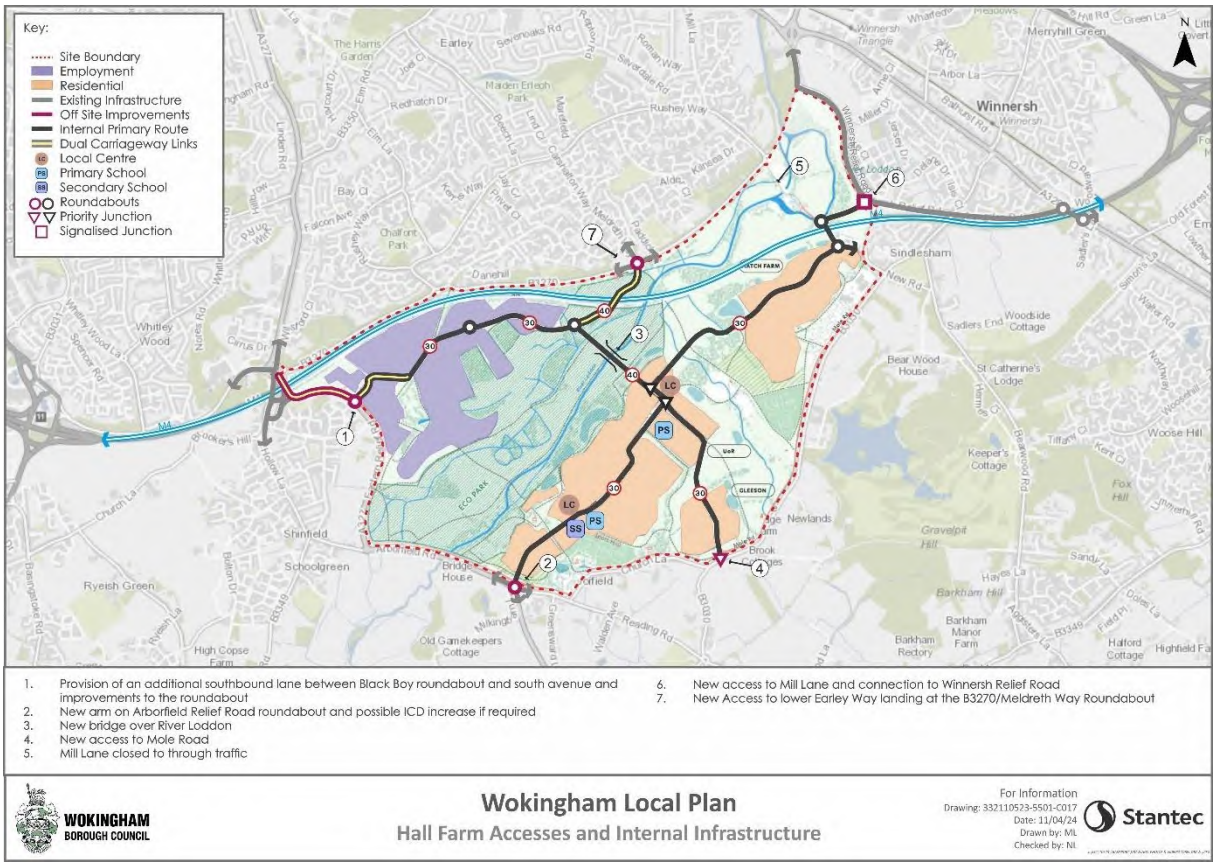


Figure 4: Hall Farm / Loddon Valley – Access and Internal Infrastructure

2.5 South Wokingham Extension

2.5.1 As part of the LPU process WBC is considering an extension of the South Wokingham SDL. The land uses, quanta and transport infrastructure assumed for this site is detailed below. It should be noted that South Wokingham Extension has been included in Scenario 1A and Scenario 1B but not in the Reference Case.

Land Use Assumptions

2.5.2 Table 10 sets out the land uses, quanta and transport infrastructure assumed for South Wokingham Strategic Site extension.

Table 10: South Wokingham Extension Land Use and Quantum

Land Use	Quantum
Residential Houses (dwellings)	1,150
Local Centres (m^2)	500m^2
Primary School	2 x 1FE

2.5.3 The land assumptions at the time of modelling assumed 2 x 1 FE primary schools, however this has now been revised to a single 1 FE primary school, this change does not result in a material change to the modelling output.

2.5.4 Figure 5 below shows an indicative masterplan for the South Wokingham extension prepared by John Simpson Architects in December 2023 on behalf of the site promoters.

Figure 5: South Wokingham Extension – Provisional Master Plan

Trip Generation Assumptions

2.5.5 The trip generation for South Wokingham Extension has utilised the same dwelling, school and local centre trip rates adopted to represent Hall Farm / Loddon Valley development (refer to Table 6).

2.5.6 These trip rates have been further adjusted downwards to account for the site-specific sustainability measures including promotion of sustainable travel measures via My Journey Programme. Further details on the level of the reduction are provided below.

Internalisation

2.5.7 Due to provision of the local centre and improved access to education facilities within South Wokingham Extension, a number of people trips will have both their origin and destination within the site and will therefore be internal to the site. As such, these internalised trips will bear no impact upon the surrounding highway network and will not be material in terms of their chosen mode. Internalisation targets adopted for South Wokingham Extension are the same as those presented for Hall Farm / Loddon Valley in Table 8 and are 50% for Local Centres for

consistency on assumptions for the specific land uses only. (SWE excludes employment and secondary School)

Trip Distribution

2.5.8 Trip distribution for the South Wokingham Extension has been assumed to be the same as the distribution from existing land use zones within South Wokingham SDL area.

Sustainable Transport Measures

2.5.9 To account for an anticipated reduction in car trips due to site-specific sustainability measures at the South Wokingham extension, an overall reduction of 7% to car trips has been applied. This forecast is consistent with the assumptions applied to Hall Farm / Loddon Valley trip generation. This reflects an additional 1.5% reduction to a borough-wide reduction of 5.5% and represents a conservative assumption. The additional 1.5% reduction reflects provision of high-quality sustainable travel infrastructure and promotion of sustainable travel measures via My Journey Programme.

Site Access

2.5.10 Potential development land at South Wokingham Extension is partly within the allocated South Wokingham SDL boundary, which provides an opportunity for further proposed urban expansion close to the existing built area. The site is generally defined by Easthampstead Road to the south and west and Old Wokingham Road to the east.

2.5.11 On-site infrastructure and access only locations for the South Wokingham Extension as assumed in Scenario 1A without additional mitigation are:

(1) New priority junction to provide access from the site to South Wokingham Distributor Road
(2) New roundabout to provide access from the site to Old Wokingham Road
(3) Turn into/ out of Easthampstead Road is banned

2.5.12 These schemes are graphically shown in Figure 6 and Appendix E provides further details. All the figures are indicative, high level and should not be taken as prescriptive of what must be provided in terms of locations, alignments, and compliance with standards.

2.5.13 Relevant to South Wokingham development, all the scenarios include a committed improvement scheme at Waterloo Road/ Peacock Lane/ Old Wokingham Road junction. The scheme will involve converting a priority junction with a minor arm from Waterloo Road to a roundabout to improve traffic flow. A shared footway/cycleway will be provided along the northern edge of the carriageway, with footways and uncontrolled crossing facilities provided on other arms of the junction.

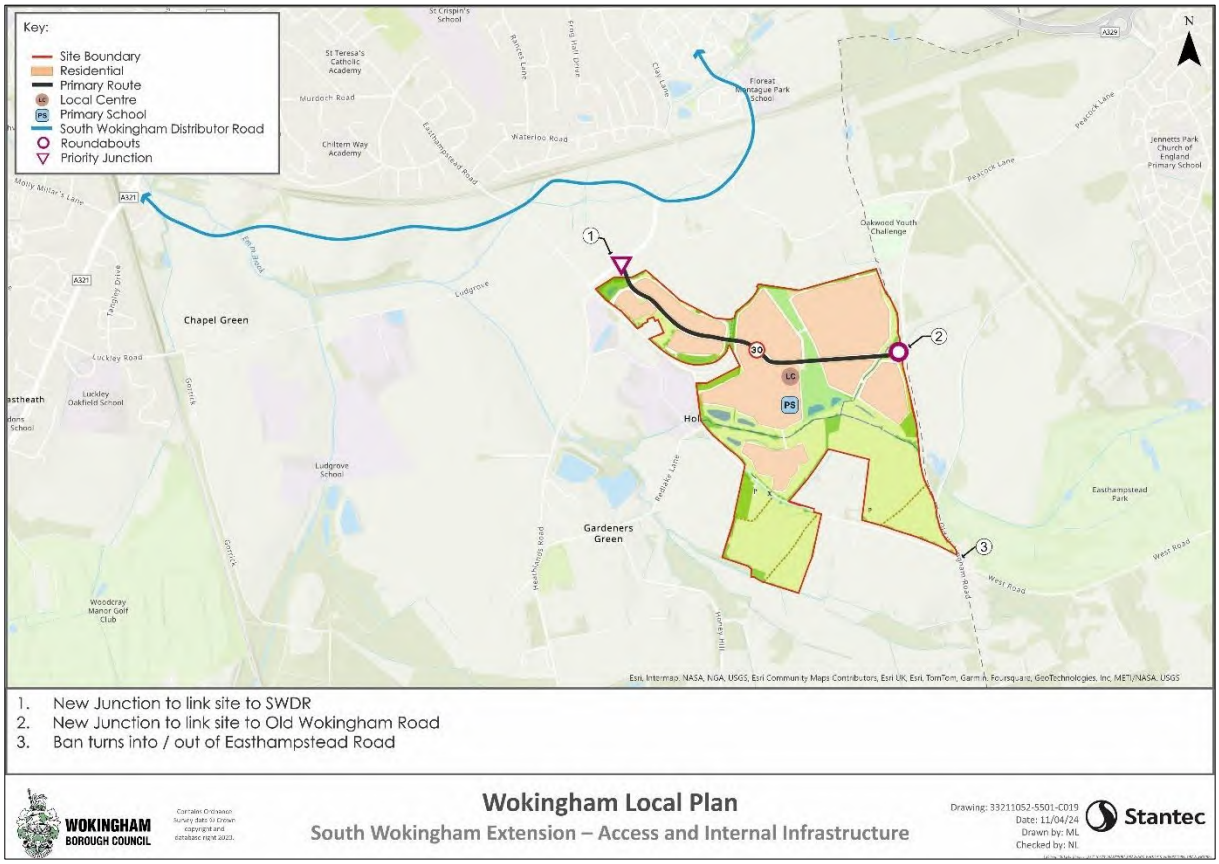


Figure 6: South Wokingham Extension – Access and Internal Infrastructure

2.6 Additional Smaller Sites

2.6.1 As part of the LPU process, WBC are considering the allocation of further smaller sites beyond Hall Farm / Loddon Valley and South Wokingham Extension. A list of these sites that have been assumed within Scenario 1A is provided in Table 11. The list of sites used is indicative of options to enable testing. The testing will also consider a percentage of housing provision across the borough. It should also be noted that some sites may have now been granted planning permission, however at the time of the assessment this was not the case. It should be further noted that not all sites will necessarily be proposed for allocation through the LPU.

Table 11: Additional Smaller Sites

Site address	Site reference	Indicative No. of Dwellings
Arborfield SDL additional capacity		300
Woodlands Farm, Wood Lane	5BA013	
24 Barkham Ride	5BA032	30
High Barn Farm, Commonfield Lane, Barkham	5BA036	
Land east of Park View Drive North, Charvil	5CV001	80
Land west of Park Lane, Charvil	5CV002	75
31 and 33 Barkham Ride	5FI003	80
Greenacres Farm, Nine Mile Ride	5FI004	115
Hillside, Lower Wokingham Road, Finchampstead	5FI024	15
Westwood Yard, Sheerlands Road	5FI028	20
Honeysuckle Lodge, Commonfield Lane	5FI032	
Land on the north side of Orchard Road	5HU006	23
Land north of London Road and east of A329(M), Hurst	5HU051	45

Site address	Site reference	Indicative No. of Dwellings
Land to the rear of 9-17 Northbury Lane, Ruscombe	5RU007	12
Land between 39-53 New Road, Ruscombe	5RU008	20
Land east and west of Hyde End Road, Shinfield	5SH023, 5SH027	220
Land north of Arborfield Road	5SH025	191
Rustlings, The Spring and Land to rear of Cushendell, Shinfield Road	5SH031	10
Land at Sonning Farm	5SO001	25
Sonning Golf Club	5SO008	50
Land west of Trowes Lane	5SW019	81 (Granted)
Land at Bridge Farm, Twyford	5TW005, 5TW009, 5TW010	200
Winnersh Plant Hire, Reading Road	5WI008	85
Land on north west of Old Forest Road	5WI009, 5WI019	50
Land off Wheatsheaf Close	5WI011	24
69 King Street Lane, Sindlesham	5WI014	28
Land south of Gipsy Lane	5WK006	Inclusion subject to Review
Station Industrial Estate	5WK029	40
Woodside Caravan Park, Blagrove Lane	5WK042	
Land at St Annes Drive	5WK043	54
Bridge Retail Park	5WK045	59
Land at the corner of Wellington Road and Station Road, Wokingham	5WK046	20
Land east of Toutley Depot	5WK051	130
Lee Springs, Latimer Road, Wokingham	5WK053	42
WBC council offices, Shute End	5WK054	100
Wokingham Town Centre (general area of search)	N/A	200
Barkham Square	5BA010	500
Land east of Trowes Lane	5SW005	85
Land off Maidensfield (Winnersh Farms)	5WI006	234
Land to the rear of Bulldog Garage and BP Triangle, Reading Road	5WI012, 5WI021	34
Rosery Cottage and 171 Evendons Lane	5WK023	Modified Consent
Land at Blagrove Lane	5WK028, 5WK032, 5WK034, 5WK039	350
Ravenswood Village	5WW009	135 Inclusion subject to Review
Total		**3,762**

2.7 Local Plan Update Mitigation Strategy

2.7.1 This section discusses mitigation proposals for the Local Plan Update development, which has been assessed in Scenario 1B.

Defining Mitigation Proposals

2.7.2 The methodology for defining the future mitigation is based on a number of considerations. It uses key metrics (such as flow, delay, V/C, etc.) from the Reference Case and Scenario 1A (with additional Local Plan Update development) to assess where the local and strategic highway are forecast to experience capacity constraint of a sufficient nature to warrant the need for interventions to accommodate the level of development being considered in the scenario tested. From these outputs, it is possible to assess the impacts on the network and begin to define the possible mitigation requirements such as junction capacity improvements, dualling, new roads and junctions etc.

2.7.3 The mitigation package tested in Scenario 1B was originally put together in the assessment undertaken in 2021, which is reported in the 'Wokingham Local Plan Update. Strategic Transport Assessment Report', October 2021. The mitigation package was then further

refined as part of a study completed in 2023 and tested using the modelling framework. Multiple iterations of the mitigation package have been tested as part of the 2023 study until a preferred solution was reached. This study only reports on the performance of the resultant mitigation package.

2.7.4 The mitigation proposals are not simply related to highway infrastructure. They include public transport, walking and cycling improvements, which are often linked to facilities such as education, retail, medical, community and leisure which are proposed to be included within the developments to maximise the ability to retain person trips[7] within the development footprint and maximise the option of using sustainable transport.

2.7.5 Through the multi-modal approach to mitigation, proposals have been considered in this assessment (e.g. by accounting for the positive impact of sustainability measures in the borough and more specifically those targeting Hall Farm / Loddon Valley), the key focus of the assessment presented in this report is the impact of potential development sites being considered through the LPU on the highway network.

2.7.6 The rest of this section presents the final mitigation package, which has been tested within the modelling. The mitigation is presented separately for Hall Farm / Loddon Valley and South Wokingham extension.

Hall Farm / Loddon Valley – Highway Network Mitigation

2.7.7 Figure 7 shows a mitigation package that is deemed to be required to accommodate residential and employment development at Hall Farm / Loddon Valley. The highway improvement schemes included in the mitigation package are listed below with Appendix D further detailing the assumptions. The improvement schemes will also consider pedestrian and cycle needs incorporating where possible LCWIP proposals. These, however, cannot be explicitly modelled within the tools used and therefore no further details are provided.

2.7.8 The mitigation schemes are additional to the access and internal infrastructure presented in Figure 4.

(8) Additional east/northbound lane on Lower Earley Way
(9) Upgrade to Lower Earley Way/ Hatch Farm Way junction.
(10) Dual carriageway links in both directions on a section of Eastern Relief Road between Black Boy Roundabout and South Avenue
(11) Shinfield Road Gyratory - additional circulatory lane on Black Boy's roundabout
(12) 2 lanes westbound between Whitley Wood Lane and J11
(13) M4 J11 Optimisation and changes to lane markings to accommodate additional lane for traffic movement into B3270
(14) Two-lane northbound exit at Mill Lane/ Rushey Way roundabout
(15) 2 lanes southbound on Lower Earley Way North between the Hatch Farm Way and Mill Lane junctions

[7] A trip undertaken using any mode of transport

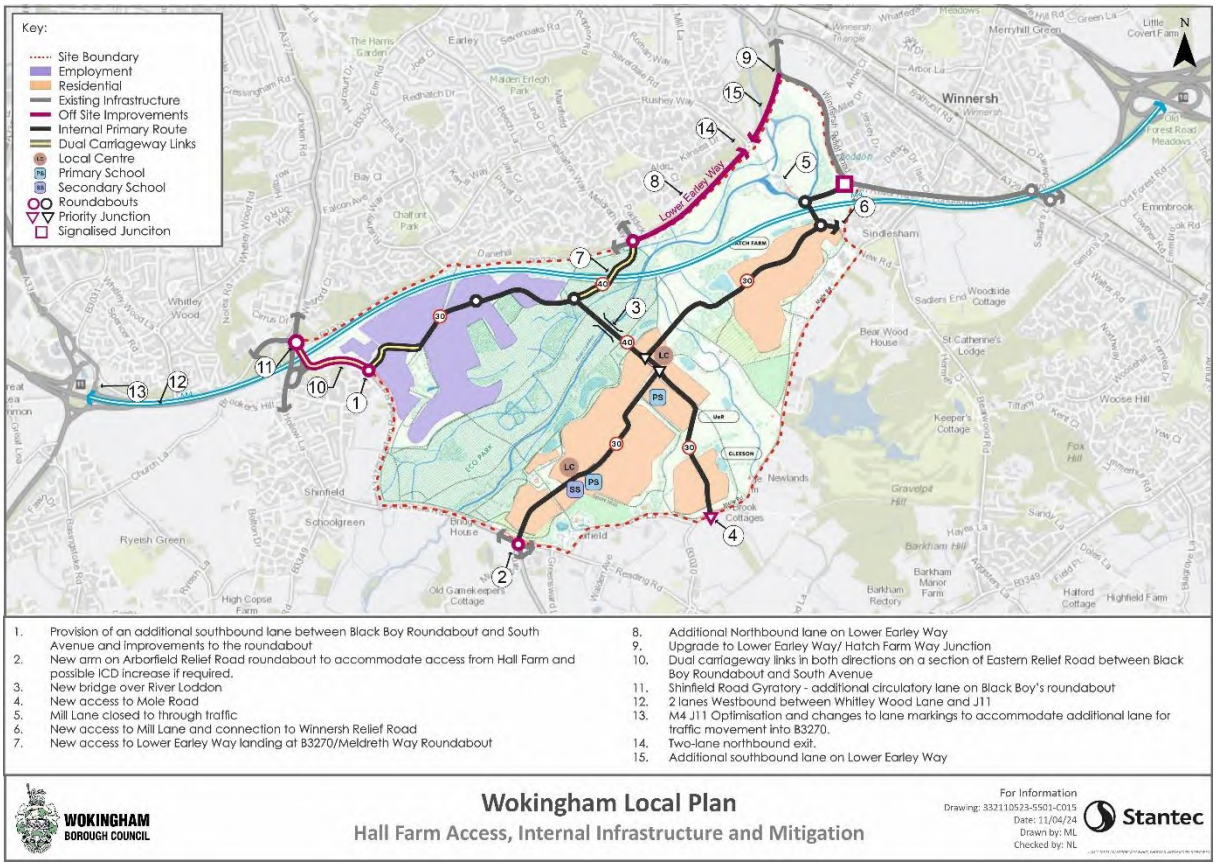


Figure 7: Mitigation Package for Hall Farm / Loddon Valley

2.7.9 The assessments undertaken in this study consider an end state with all development built out and all mitigation provided. In reality, the development will be phased, with a significant proportion, but not all, development being built and occupied by the end of the forthcoming local plan period.

2.7.10 Stantec recommends a strong promotion of hard and soft measures to encourage the use of sustainable modes for trips within the site and those outside. The delivery of the major highway infrastructure and sustainable transport as shown in Figure 7 and discussed previously will be implemented in tandem, but will in part be subject to development build out rates and therefore may be subject to an on going monitoring and manage approach to ensuring that there is not an over delivery of highway improvements, which could induce an increase in car trips.

South Wokingham Extension

2.7.11 The mitigation package for South Wokingham (SW) Extension will require schemes in Wokingham borough and Bracknell Forest borough and proposes a new link through the site, which will tie into the current SDL. The schemes will also include historical schemes being discussed by the two councils and offer the opportunity to improve road safety in the area.

2.7.12 The mitigation schemes are additional to the access and internal infrastructure presented in Figure 6 and include:

(4) Signal optimisation on SWDR

2.7.13 The improvement schemes will also consider pedestrian and cycle needs incorporating where possible LCWIP proposals. These, however, cannot be explicitly modelled within the tools used and therefore no further details are provided.

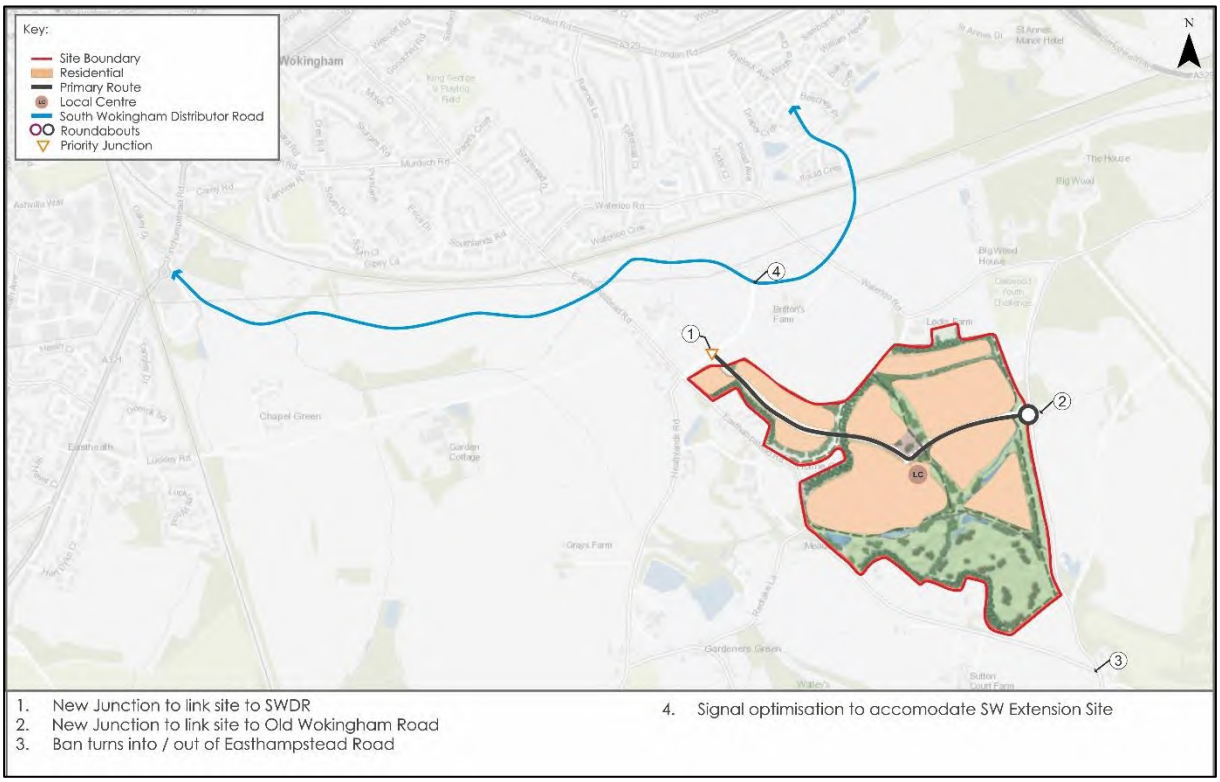


Figure 8: Mitigation Schemes for South Wokingham Extension

2.7.14 Appendix F provides further technical information about the mitigation schemes described above. If the above schemes are taken forward and form a formal part of the IDP and policy, the final schemes should give due consideration to integration with LCWIP proposals.

2.7.15 The modelling includes the introduction of a new roundabout at Peacock Lane/Waterloo Rd was a stand alone highway scheme not linked to any development proposals. The modelling indicates that this junction would not require additional modifications as a result of the surrounding development.

Additional Sites – Highway Network Mitigation

2.7.16 The sites are widespread across the Borough as such the strategic modelling undertaken to inform the original Transport Assessment suggested that individually the sites do not warrant individual strategic mitigation packages (subject to detailed assessment)

2.7.17 However there were some junctions which may witness long term issues due to the cumulative impact of the sites and background growth. These would need to be addressed on a site-by-site basis and individual mitigation would be assessed as part of the Transport Assessment supporting a future planning application or part of wider cross boundary discussions on future infrastructure improvements as per below

- Reading Road corridor
- Coppid Beach (Merge/Diverge Lanes) and Berkshire Way (A329)
- Showcase Roundabout

3 Approach to the Assessment

3.1 Introduction

3.1.1 The assessment of scenarios detailed in Section 2, has involved completing a comprehensive transport modelling exercise, which was informed by extensive data collection undertaken in November 2021.

3.1.2 A three-tier modelling framework has been adopted, which included strategic modelling, microsimulation modelling and local junction modelling. The framework has leveraged the strengths of each modelling tier. Tier 1, strategic modelling, has been used to forecast the wider impacts of the LPU development and to identify key pressure points. Tier 2, microsimulation modelling, further details the assessment by accounting for network details and driver behaviour. And Tier 3 (local junction modelling) informs Tier 1 and Tier 2 modelling by feeding operational details such as optimised signal timings or acting as an independent assessment tool in the area falling outside of the microsimulation model study area.

3.1.3 Strategic Modelling has used the existing Wokingham Strategic Transport Model (WSTM4), which has been refined and updated in the study area to represent November 2021 travel conditions and a set of 2040 forecast scenarios (end of the new LPU plan period).

3.1.4 To complete Microsimulation Modelling, a new model using PTV's VISSIM software has been developed. The model, which covers an area between Bracknell and M4 J11, has been developed using November 2021 data.

3.1.5 Junction Models – existing and new standalone junction models have been used to inform the development of the microsimulation and strategic models as well as to assess individual junctions not covered by the VISSIM model at a more localised level.

3.1.6 The rest of this section describes the data collection, which informed development of transport models and each of the models in turn.

3.2 Data Collection

3.2.1 Multiple data sources have been used to inform development of base year models, which served as the basis for developing forecast scenarios.

3.2.2 Before on-site data collection was commissioned existing sources of traffic data within the area of interest were identified and reviewed and found suitable for model development:

- Traffic count data collected by Wokingham Borough Council and Reading Borough Council, obtained through their traffic count database (Drakewell)
- The National Highways Open Data source WebTRIS includes ATC data on links and junctions on the SRN
- Junction signal data
- Journey time data sourced from INRIX,

3.2.3 In October 2021, after undertaking the gap analysis to understand what data was still needed, additional on-site data collection was commissioned, which included:

- Automatic Traffic Counts (ATCs) over a two-week period between Wednesday 17th November 2021 to Thursday 2nd December 2021

- Manual Classified Turning Counts (MCTCs) over a 12-hour period (between 07:00 to 19:00) on Thursday 30th November 2021 including smaller ANPR cordons for more complicated junctions

- Queue Length Surveys, Pedestrian Surveys and Saturation Flow Surveys undertaken during the MCTC survey

- Automatic Number Plate Recognition (ANPR) for use for the development of the VISSIM model, over a 12-hour period (between 07:00 to 19:00) on Thursday 30th November 2021. Journey Time (JT) surveys were included within the ANPR survey.

3.2.4 Survey locations are graphically shown in Figure 9 and Figure 10.

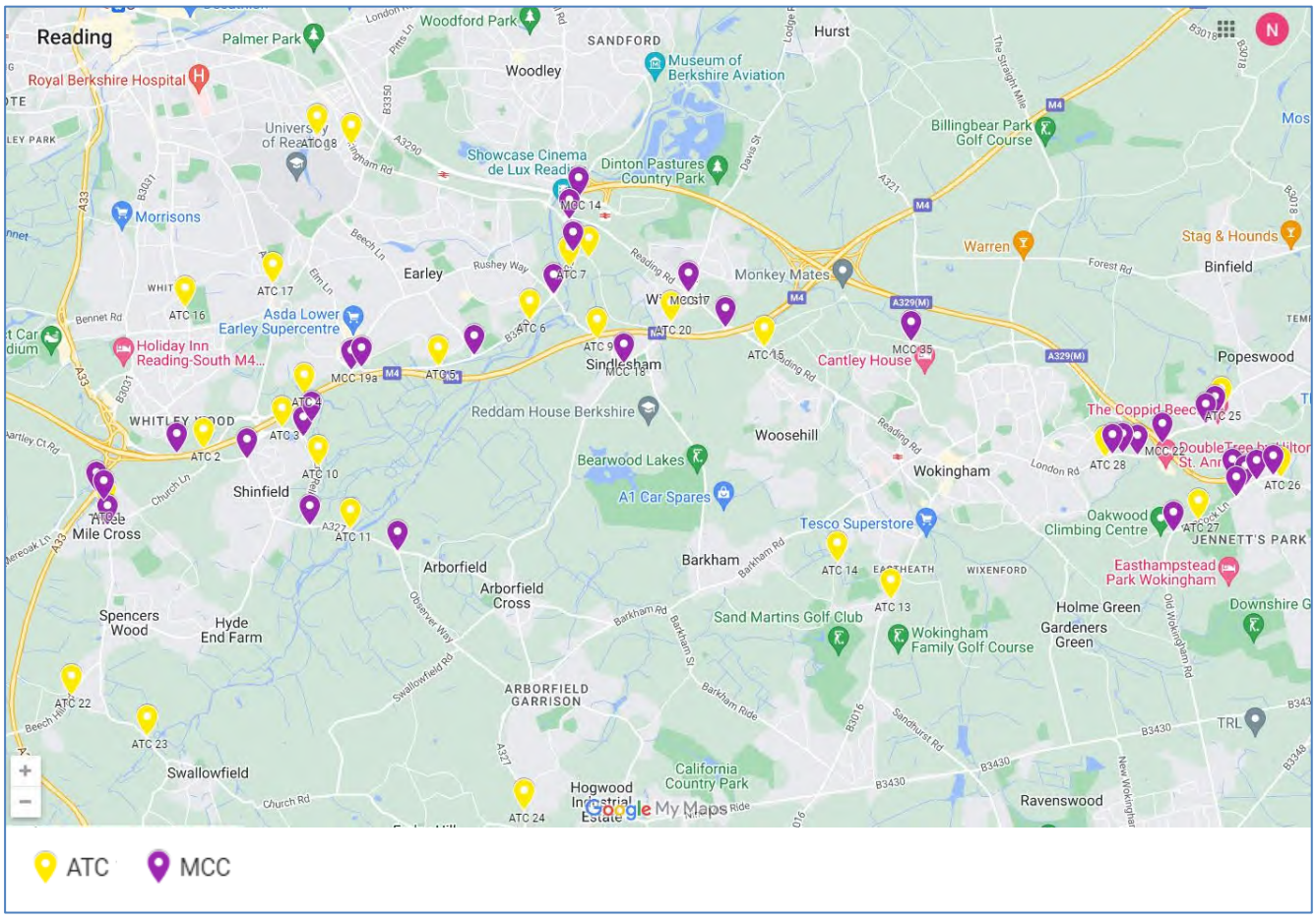


Figure 9: On-site Data Collection. ATCs and MCTC Locations

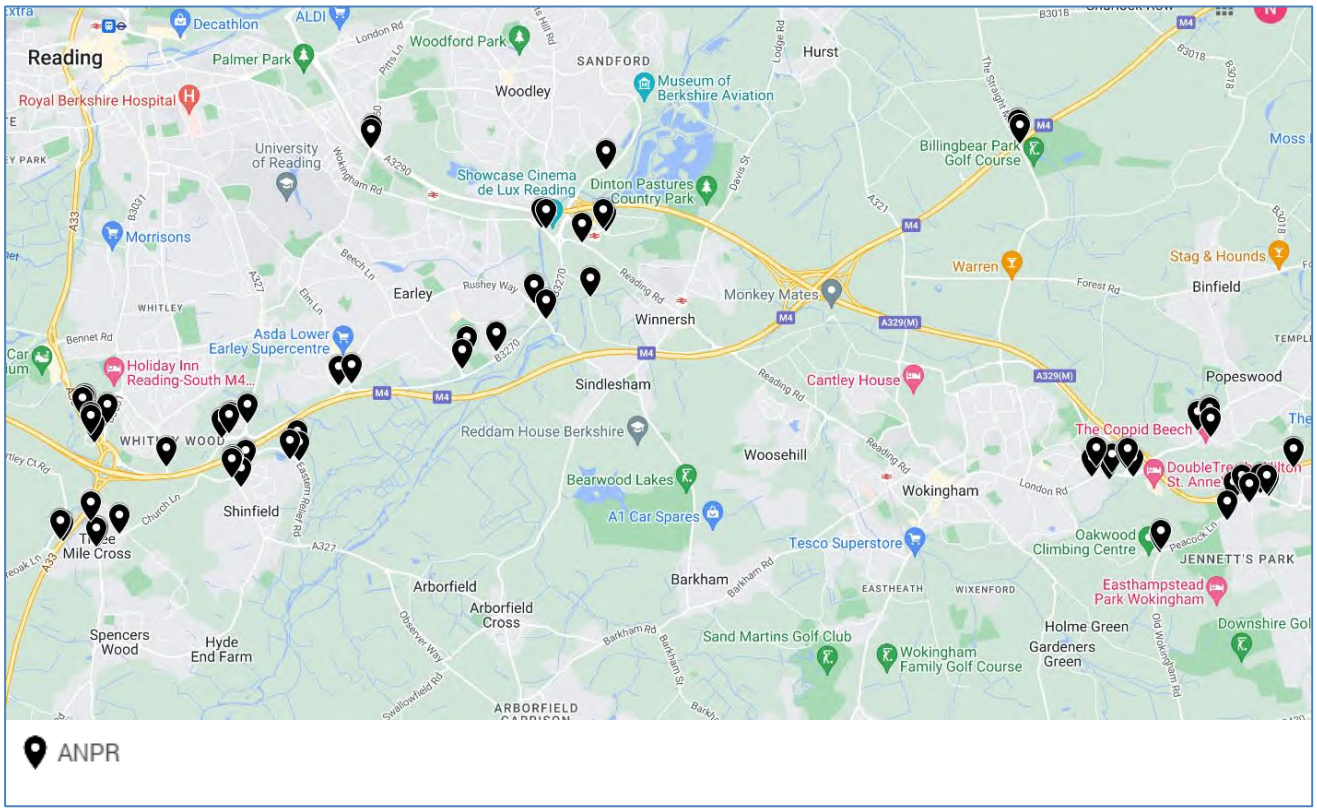


Figure 10: On-site Data Collection Locations. ANPR Locations

3.2.5 Further details related to data collection can be found within the Data Collection Report (Attachment 4) and also within Data Collection sections of the Strategic Model Validation Report (Attachment 5) and Microsimulation Model Validation Report (Attachment 6).

3.3 Strategic Modelling Using WSTM4

Base Year Model. Overview of the Approach to the Update

3.3.1 WBC has developed and maintains its strategic transport model, WSTM4. The model was developed for transport analyses and forecasts from 2015 data (base year of the WSTM4). The model was validated to DfT's TAG (Transport Appraisal Guidance) standards and its development was reported in the 'Wokingham Strategic Transport Model 4 (WSTM4) Local Model Validation Report', May 2018. A copy of the report can be downloaded from the WBC's website via Evidence studies (wokingham.gov.uk)

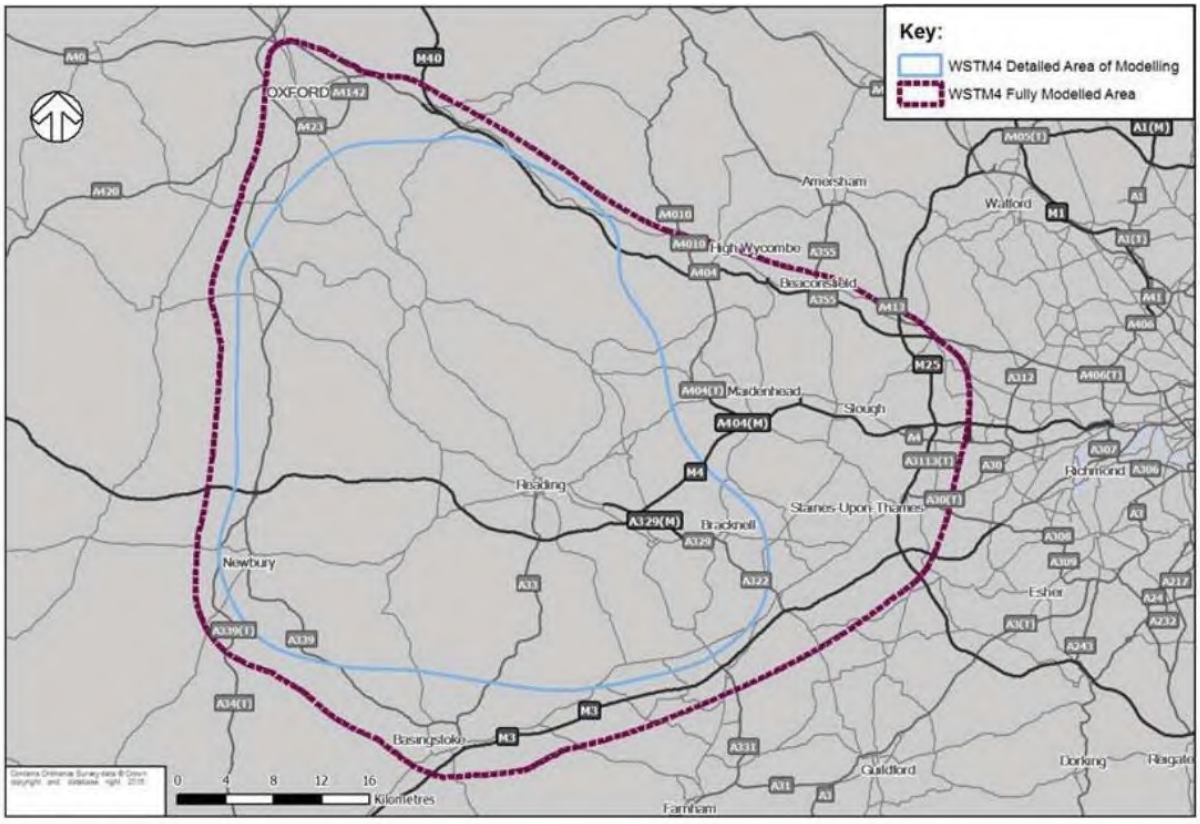
3.3.2 In order to support the assessment of the LP development the WSTM4 model has undergone a local update and a local revalidation exercise using 2021 observed data. The new base year of the model has been set to 2021; however, this is not a full model update and the WSTM4 has been refined for the sole purpose of testing the proposed development and any associated mitigation and to feed into the VISSIM model.

3.3.3 The WSTM4 Fully Modelled Area is shown in Figure 11. The area is bounded by the M40 in the north, by the M25 in the east, by the M3 in the south and by the A339 and A34 in the west. The fully modelled area is further subdivided into:

- Area of Detailed Modelling. Modelling detail in this area would be characterised by representation of all trip movements, small zones, very detailed networks and junction modelling

- Rest of the Fully Modelled Area. The area is characterised by: representation of all trip movements, somewhat larger zones and less network detail than for the Area of Detailed Modelling, and speed/flow modelling (primarily link-based but possibly also including a representation of strategically important junctions)

- The rest of the UK represents the External Area. The External Area is characterised by skeletal networks and simple speed/flow relationships or fixed speed modelling and a partial representation of demand (trips to, from and across the Fully Modelled Area).



Source: WSTM4 Local Model Validation Report, May 2018

Figure 11: WSTM4 Fully Modelled Area

3.3.4 The model update has concentrated on roads where the LPU development is likely to have significant impacts and the extent of this area was shown in Figure 2.

3.3.5 The model update has followed the appropriate guidance provided in Department for Transport's (DfT) TAG Unit M3.1 'Highway Assignment Modelling', May 2020.

3.3.6 The assessment has aimed to identify and address highway congestion hotspots, and therefore a highway only model has been utilised in the assessment. This approach aims to evaluate the worst-case scenario at critical locations on the highway network, which would not be possible if a mode shift response to congestion (typically considered through the adoption of the multi-modal model) or a redistribution of trips away from the area were considered.

3.3.7 The WSTM4 2021 model update and refinement have considered:

- Network changes that have taken place since 2015 (including Observer Way – Arborfield Relief Road, Shinfield Relief Road, Winnersh Relief Road, Eastern Section of the North Wokingham Distributor Road)

- New development built since 2015

- At the time of the data collection in November 2021 there were a number of roadworks happening within the local study area that impacted upon the observed data collection (e.g. the M4 Smart Motorway traffic management) and therefore these were coded within the base year model

- Changes in generalised cost parameters to reflect the latest data from DfT TAG Databook November 2021 (the latest version available at the time of the model update)

3.3.8 In addition, junction coding was reviewed and where necessary updated at the key junctions within the area of interest, which aimed to improve coding of the junctions to better replicate network capacity. All junctions within the WSTM4 area of interest are fully simulated and can replicate capacity constraints.

3.3.9 WSTM4 was developed to represent an average weekday AM peak hour (08:00 - 09:00) and PM peak hour (17:00 - 18:00). Analysis of National Highways permanent count data (WebTRIS) and Wokingham permanent count data (from Drakewell) was undertaken to confirm that these were the busiest morning and evening peak hours in 2021.

3.3.10 Data was selected within the month of November 2021 from Tuesday to Thursday across a period of two last weeks. Both WebTRIS data and traffic data collected on local roads in Wokingham showed slightly earlier AM and PM peak hours. However, the variance between peak hours observed in the last two weeks of November 2021 and the WSTM4 standard peak hours (0800-0900 and 1700-1800) is minor with differences being within 1-2%. As such, it was deemed that using a proportionate approach of retaining the current WSTM4 modelled peak hours was acceptable.

3.3.11 The original WSTM4 model was developed using PTV's VISUM 17.01-04. To take advantage of the latest features of the software, the model has now been updated to use the latest version of VISUM, version 22.

3.3.12 Multiple data types were used in the update of the WSTM4 comprising:

- Automatic Traffic Counts (ATC)

- Manual Classified Turning Counts (MCTC)

- Journey time data

- Traffic signal data

3.3.13 In line with DfT's TAG guidance, where possible existing data was used in order to keep data costs to a minimum while not compromising the integrity of the model.

3.3.14 Complete information regarding observed data that has been used in refining and updating the WSTM4 is provided within the "Wokingham Local and M4 Modelling Assessment Data Collection Report", May 2022 (Attachment 4).

3.3.15 The 2015 WSTM4 prior demand matrices were used as a basis for refining to update 2021 observed traffic flows through Matrix Estimation. The trip distribution from the 2015 model has been maintained and the pre-Matrix Estimation WSTM4 matrices have been used as the prior matrices for the WSTM4 update. These matrices were based on Mobile Network Data (MND) collected in 2015 and other data sources.

Base Year Model. Calibration and Validation Results

3.3.16 Calibration of the network and matrices was undertaken to demonstrate that the model outputs provide a reasonable representation of observed traffic flows and behaviours in the updated model. The calibration process involved the refinement of the network detail to check that link speeds and junction behaviour/operation are well represented.

3.3.17 In accordance with TAG unit M3.1 several model performance checks were completed against a series of criteria including:

- flows on individual links
- flows across screenlines
- turning flows at selected junctions
- journey times
- convergence, and
- impact of matrix estimation

Individual Link Flow Validation

3.3.18 Link flow validation statistics for the updated WSTM4 are shown within the following tables for all vehicles and cars. TAG advises that both absolute and percentage differences between modelled flows and counts, and GEH[8] statistic should be considered. TAG acknowledges that these two measures are broadly consistent and link flows that meet either criterion should be regarded as satisfactory.

3.3.19 Table 12 presents the final AM Peak link validation performance and shows that either TAG link flow criteria or GEH criteria are met for car and total vehicles.

Table 12: AM Peak Individual Link Flow Validation Statistics

Criteria and Measure		**Acceptability Guideline**	**All Vehicles**			**Car**		
Observed	Modelled	Pass Criteria	Total Counts	Meet Criteria	%	Total Counts	Meet Criteria	%
Flow Criteria								
< 700 pph	±100 vph	> 85 %	33	29	88%	38	35	92%
700 - 2,700 vph	±15%	> 85 %	26	25	96%	24	22	92%
> 2,700 vph	±400 vph	> 85 %	6	6	100%	3	3	100%
GEH Criteria								
GEH Statistic for individual links < 5		> 85 %	65	62	95%	65	59	91%
Flow or GEH Criteria								
Above Flow Criteria or GEH Criteria are met		> 85 %	65	59	91%	65	60	92%

3.3.20 Table 13 shows the individual link flow validation performance for the PM Peak. This shows that the criteria have been met for flow or GEH criteria. For individual link flow validation on more minor roads with flow less than 700 vehicles, link flow validation falls slightly below the TAG recommended 85% threshold, however on the majority of these road types they do pass the GEH criteria.

[8] The GEH Statistic is a formula used in traffic modelling to compare two sets of traffic volumes. The GEH formula gets its name from Geoffrey E. Havers, who invented it in the 1970s.

Table 13: PM Peak Individual Link Flow Validation Statistics

Criteria and Measure		**Acceptability Guideline**	**All Vehicles**			**Car**		
Observed	Modelled	Pass Criteria	Total Counts	Meet Criteria	%	Total Counts	Meet Criteria	%
Flow Criteria								
< 700 pph	±100 vph	> 85 %	36	30	83%	41	35	85%
700 - 2,700 vph	±15%	> 85 %	22	19	86%	18	16	89%
> 2,700 vph	±400 vph	> 85 %	7	6	86%	6	5	83%
GEH Criteria								
GEH Statistic for individual links < 5		> 85 %	65	56	86%	65	54	83%
Flow or GEH Criteria								
Above Flow Criteria or GEH Criteria are met		> 85 %	65	57	88%	65	57	88%

Screenline Calibration Results

3.3.21 In addition to validation checks on individual roads, a set of screenlines were chosen for calibration, which are based on those defined in the original WSTM4 base year model. A screenline is an artificial line that joins multiple traffic count sites in a way that creates a border that captures all the traffic passing through the line.

3.3.22 Extra screenlines located in closer proximity to the study area were also added. These screenlines are marked as Outer and Inner as shown in Figure 12.

3.3.23 DfT TAG guidance recommends that the total modelled flow on most of the screenlines should be within 5% difference from observed data. The results presented in the WSTM4 Update LMVR (Local Model Validation Report – Attachment 5) demonstrate that the model meets this requirement with 25 out of 26 post matrix estimation calibration screenlines in the AM peak and all screenlines in the PM peak meeting the acceptability criteria thus providing a good representation of traffic movements.

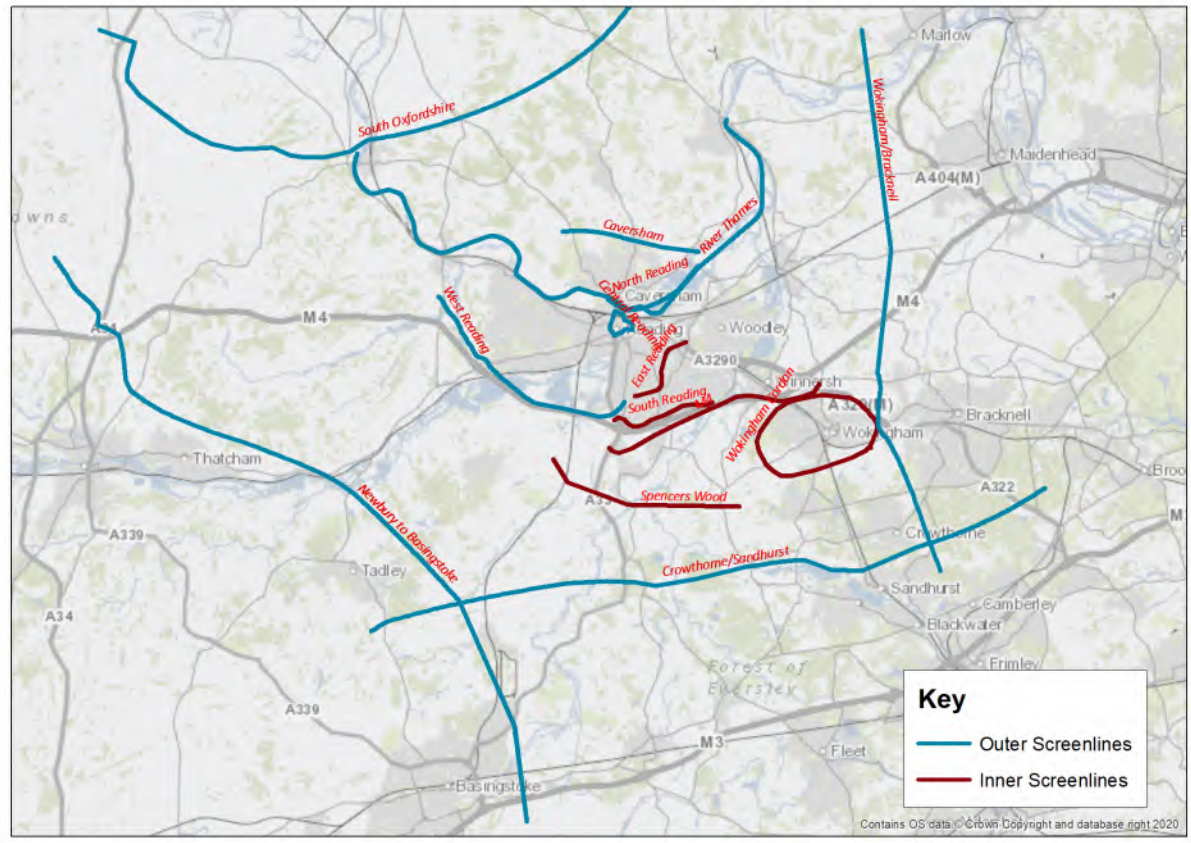


Figure 12: WSTM4 Screenlines

Turning Flow Validation

3.3.24 Turning counts have been assessed at a number of key junctions in the study area. The observed and modelled turning movement validation statistics for these are summarised in Table 14. Turning movements are validated to a reasonable standard close to 85%, in particular for the flow % pass criteria. Specific focus in the validation and calibration of the junction was given for the major movements. Differences between observed and modelled flows have been accounted for in forecasting by utilising a greater level of demand validation within the microsimulation and standalone junction models.

Table 14: Summary of Turning Flow Validation

Site No.	Junction Name	AM Peak			PM Peak		
		GEH % Pass	Flow % Pass	Pass?	GEH % Pass	Flow % Pass	Pass?
1	Basingstoke Road / Three Mile Cross	88%	94%	Pass	94%	94%	Pass
2	Basingstoke Road / Church Lane	67%	78%	Fail	56%	67%	Fail
3	Black Boy Roundabout	69%	81%	Fail	75%	94%	Pass
4	Black Boy /Eastern Relief Road (Southern Jct)	56%	67%	Fail	56%	67%	Fail
5	Eastern Science Park Access	75%	94%	Pass	81%	88%	Pass
6	Shinfield Relief Road / Arborfield Road	56%	78%	Fail	78%	100%	Pass
7	Arborfield Relief Road/ A327	67%	78%	Fail	78%	89%	Pass
8	Lower Earley Way / Meldreth Way	89%	100%	Pass	89%	100%	Pass
9	Lower Earley Way/ Mill Lane	100%	100%	Pass	100%	100%	Pass
10	Winnersh Relief Road / Hatch Farm	78%	78%	Fail	89%	100%	Pass

Site No.	Junction Name	AM Peak			PM Peak		
		GEH % Pass	Flow % Pass	Pass?	GEH % Pass	Flow % Pass	Pass?
11	Showcase Roundabout	81%	81%	Fail	88%	100%	Pass
15	Winnersh Crossroads	75%	94%	Pass	56%	94%	Pass
16	Mill Lane / New Road Roundabout	69%	88%	Pass	88%	94%	Pass
17a	Lower Earley Way / Beeston Way	89%	89%	Pass	78%	78%	Fail
17b	Lower Earley Way / Beeston Way	78%	100%	Pass	78%	100%	Pass
18	B3270 / Whitley Wood Road	56%	56%	Fail	67%	67%	Fail
19	M4 J11	88%	92%	Pass	80%	80%	Fail

Journey Time Validation

3.3.25 Model performance in terms of its ability to replicate observed journey times has been assessed across a selection of routes presented in Figure 13. Model journey times were compared against the median of observed journey times and results of this comparison are presented in Table 15 for the AM and PM peaks. The results show a high level of journey time validation, with 15 out of 16 routes both in the AM and PM peaks passing the 85% threshold for both peaks, indicating a good reflection of observed travel times within the model.

3.3.26 In the AM peak, the route, which does not meet the TAG criteria passes through the A329M in the southbound direction. The modelled time along the route is faster than the average of the observed values. However, the modelled value falls only slightly short of DfT's TAG criteria. In the PM peak the northbound route along the A33 exhibits slower modelled times when compared to observed values. This is mainly due to the model overestimating congestion at the M4 J11.

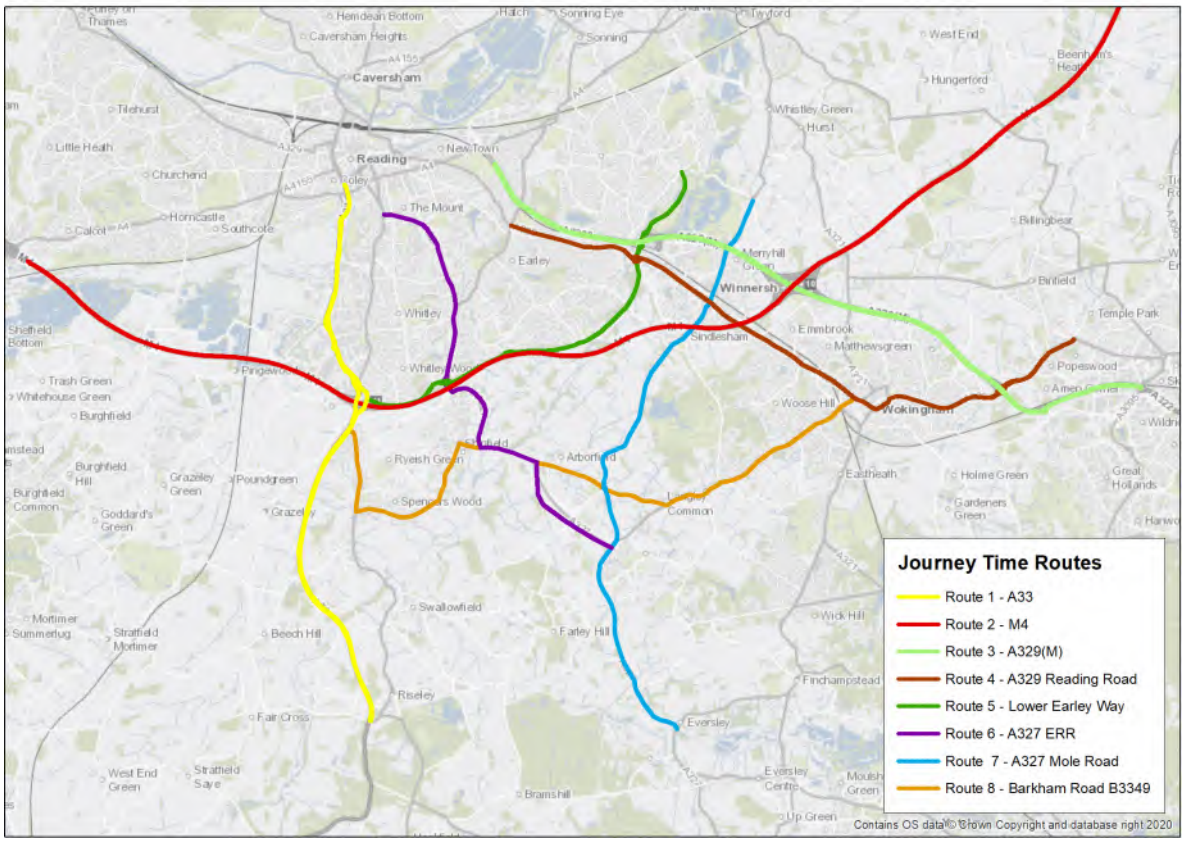


Figure 13: Journey Time Validation Routes

Table 15: AM Peak Journey Time Validation

		AM Peak		PM Peak	
ID	Name	Modelled vs Observed % Difference	Pass?	Modelled vs Observed % Difference	Pass?
1	A33 NB	0%	Pass	24%	Fail
2	A33 SB	14%	Pass	2%	Pass
3	M4 EB	8%	Pass	6%	Pass
4	M4 WB	0%	Pass	5%	Pass
5	A329M SB	-16%	Fail	-8%	Pass
6	A329M NB	-6%	Pass	-13%	Pass
7	A329 Reading Road NB	0%	Pass	13%	Pass
8	A329 Reading Road SB	2%	Pass	9%	Pass
9	Lower Earley Way EB	7%	Pass	-13%	Pass
10	Lower Earley Way WB	8%	Pass	1%	Pass
11	A327 Eastern Relief Road NB	-6%	Pass	-12%	Pass
12	A327 Eastern Relief Road SB	-14%	Pass	-4%	Pass
13	A327 Mole Road NB	-3%	Pass	-4%	Pass
14	A327 Mole Road SB	-7%	Pass	-9%	Pass
15	B3349 Barkham Road EB	-7%	Pass	-7%	Pass
16	B3349 Barkham Road EB	7%	Pass	3%	Pass
		%Pass	**94%**	%Pass	**94%**

Convergence

3.3.27 In the strategic model each user class is assigned over a number of iterations until a level of stability or 'convergence' is achieved. The convergence results of the assignment are shown in Table 16 for the AM Peak and PM Peak. This demonstrates that the vehicle classes converge and meet TAG convergence criteria, which is detailed within TAG Unit M3.1 Table 4.

Table 16: Model Convergence Results

	AM Peak			**PM Peak**		
Mode	**Iteration**	**Delta**	**%Flow**	**Iteration**	**Delta**	**%Flow**
ICA	15	0.0005	0.994	11	0.001	0.989
	16	0.0003	0.993	12	0.001	0.993
	17	0.0003	0.996	13	0.001	0.991
	18	0.0007	0.995	14	0.001	0.992
	19	0.0010	0.995	15	0.000	0.997
	20	0.0002	0.994	16	0.001	0.993
Measure of convergence						
Delta (GAP) - Less than 0.1% or at least stable with convergence fully documented and all other criteria met	Pass			Pass		
Percentage of links (non-ICA) or turns (ICA) with flow change > 98% for four consecutive iterations	Pass			Pass		

Significance of Matrix Estimation

3.3.28 To ensure that matrix estimation was a controlled process, due care and attention was given to the requirements set out in TAG to monitor the impacts of matrix estimation. In accordance with the TAG guidance, it is recommended that the changes brought about by matrix estimation should not be significant.

3.3.29 Several checks were completed, which compared pre- and post- matrix estimation matrices including trip length distribution, changes at matrix cell and trip end level as well as sector level. The results (detailed in the WSTM4 LMVR, Attachment 5) were plausible and it was concluded that the fidelity of the prior matrices was not compromised in order to meet the validation standards.

Base Year Model Summary

3.3.30 The existing WSTM4 strategic model has been updated to represent 2021 travel conditions in the study area and has been used as the basis for the assessment of LPU development. The model maintains key highway assignment features of the existing 2015 WSTM4 Base Year model but includes a set of network enhancements to reflect the infrastructure delivered in the borough between 2015 and 2021.

3.3.31 The WSTM4 2015 Prior matrices were used as a basis for Matrix Calibration and were assigned to the refined WSTM4-HE 2021 Base year Update Model. A process of matrix estimation was undertaken to reflect travel behaviours observed in November 2021.

3.3.32 Overall, the network and matrix calibration processes produced a model, which reflects November 2021 observed travel conditions well. The final model performance largely meets DfT's TAG criteria for the calibration and validation of transport models. A high standard of model validation was achieved particularly in the local area of the Hall Farm / Loddon Valley scheme and the surrounding study area. Furthermore, the high level of the model validation achieved across the wider Wokingham area from the existing WSTM4 model was retained.

3.3.33 It has been concluded that 2021 WSTM4 model represents a suitable basis for testing development scenarios to inform the LPU process.

3.4 Microsimulation Modelling

Base Year Model Overview

3.4.1 To address known limitations of the strategic modelling (including an aggregated representation of traffic flow, expressed in terms of total flows per time period and averaged travel time per time period, and a general assumption that all vehicles obey the same rules of behaviour), a microsimulation model was developed. The microsimulation model explicitly represents individual vehicles by using car following, lane changing and gap acceptance rules, and therefore attempts to replicate the behaviour of individual drivers. This makes the microsimulation model particularly appropriate for examining complex traffic problems, e.g. complex junctions.

3.4.2 The microsimulation model has been developed using PTV VISSIM 2022 (SP3). VISSIM is an industry recognised transport modelling software which is ideal for the testing and assessment of highway schemes to identify strengths and limitations of alterations of junctions along a corridor. It also allows the user and client team to easily view, interpret and gain a good understanding of a scheme or a change of a network through 3D visualisation and spatially orientated view.

3.4.3 The development and validation of the microsimulation model is fully described within the 'M4 and A329M VISSIM Microsimulation. Local Model Validation Report', May 2022 (Attachment 6). This section provides a comprehensive summary of that.

3.4.4 The VISSIM model covers the section of the M4 between J11 and J10, the A329M between Coppid Beech and Winnersh. The model also includes Lower Earley Way, which runs parallel to the M4. The modelled area is graphically shown in Figure 14.

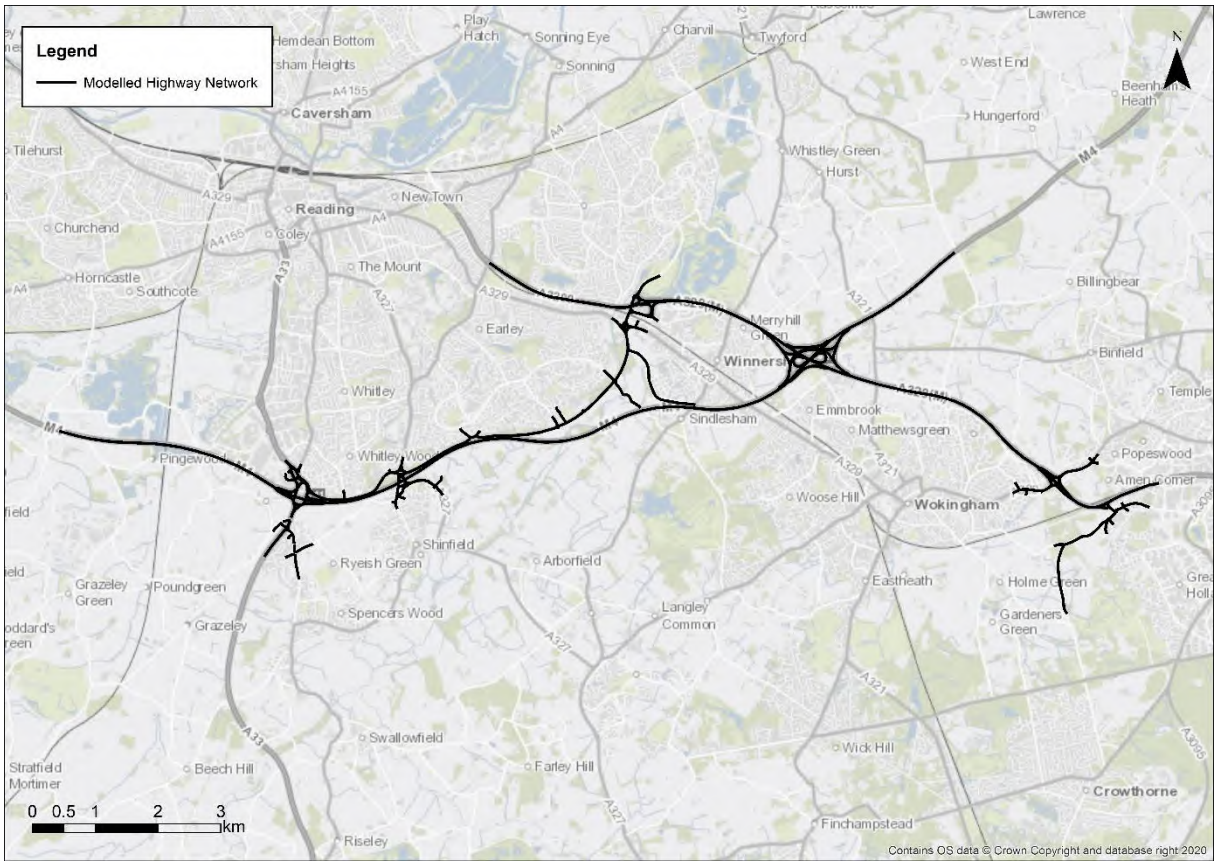


Figure 14: Extent of the Wokingham VISSIM Model

3.4.5 The model consists of fifty-one zones. The locations of the ANPR survey have been used to define the zone structure of the model.

3.4.6 The base model represents a neutral weekday in a neutral month with a base year of 2021. The peak hours are as follows, both peak hours include a 30-minute 'warm up' and 'cool down' period prior to and following the peak hour, which allows sufficient vehicles to enter the network prior to the recording of the peak hours.

- AM peak - 08:00 to 09:00
- PM peak - 17:00 to 18:00

3.4.7 The peak hours were selected to align with the WSTM4 model. The length of the warm up and cool down periods were determined by the time taken for a vehicle on the longest route to fully transverse the network, rounded up to the nearest 15 minutes.

3.4.8 The network was developed using 25cm aerial photography obtained from Getmapping from 2019, MCTC survey videos and signal time survey observations. Objects including links and connectors, reduced speed areas, priority rules, conflict areas and data collection points were coded into the model to replicate on site conditions and locations of the traffic surveys.

3.4.9 At the time of the surveys there were a number of major roadworks happening within the local study area that impacted upon the observed data collection and therefore these roadworks were coded within the base year model:

- M4 junction 3 to 10 Smart Motorways – minor lane closures and reduced speed limits in place

- Wharfdale Road/A329, Winnersh Triangle – Temporary speed limits and lane closures
- Waterloo Road, closure of road due to SWDR construction

3.4.10 The roadworks were later removed in the forecasting process.

3.4.11 Bus routes were coded based on their fixed timetables (November 2021). Bus flows were not validated against observed bus flows at the junctions. It is likely bus flows based on timetables will be higher than observed bus flows due to some buses being cancelled or having their route cut short. Therefore, the model utilises actual versus timetabled frequencies so is considered to provide a more realistic situation.. A total of eleven and twelve bus services were incorporated within the network during the AM and PM peak hour models.

3.4.12 There are a number of methods of coding traffic signals within VISSIM, the three core examples include:

- Fixed Timing - where the associated green times do not alter during the modelled period.
- Limited variable signal timing using VISVAP - where minimum and maximum signal lengths are used alongside the coding of detectors within the model to identify associated demand allowing the model to adjust the green time accordingly.
- The use of external software such as PC MOVA or SCOOT allowing for a more detailed modelling of a particular signal controlled junction.

3.4.13 The Wokingham area model includes 21 signalised junctions, and due to the number of junctions and understanding how they operate, it was concluded that VAP (Vehicle Actuated Programming) would provide the most suitable and time effective method of signal control representation within the VISSIM model. VAP allows traffic signals to respond dynamically to actual traffic conditions, adjusting signal timings based on real-time vehicle presence, which helps optimise traffic flow and realistically simulate traffic scenarios.

3.4.14 Pedestrian crossings were modelled at nineteen signalised junctions on their static routes.

3.4.15 The microsimulation model represents behaviour of three user classes as outlined below.

- Vehicle Class 1 - Cars
- Vehicle Class 2 - LGV
- Vehicle Class 3 – HGV
- Vehicle Class 4 – Buses

Matrix development

3.4.16 To develop the matrices for the 2021 base year model, the ANPR data has been the primary source. The 51 ANPR locations have formed the corresponding zones of the network. The data was split into 15-minute intervals by the user classes as outlined within the sections above.

3.4.17 During the traffic survey review process, it was identified that there were a number of locations within the ANPR data that showed low match rates, when compared to the manual classified count undertaken as part of the review of the ANPR survey. As a result, the matrices have been through a matrix estimation process (ME) to uplift trip ends to the traffic counts thus providing a more accurate base matrix for the AM and PM peak hours.

Traffic Assignment Method

3.4.18 There are two methods of assigning traffic within VISSIM:

- The first, fixed routing, is where specific routes within the model are coded between the origin and demand zones and a distribution is applied based on observed data, alongside the fixed routes, vehicle inputs are coded to provide associated demand for each origin within the network. This type of assignment is usually used for less complicated networks with limited route choice, and

- Dynamic Assignment, in this assignment an Origin/Destination (OD) matrix is applied, and the model makes its own decision of where traffic routes to get from an origin to a destination.

3.4.19 Due to the scale, network complexity and route choice, the model has used the Dynamic Assignment method of assignment.

Base Year Model Calibration

Overview

3.4.20 Prior to the validation of the model, the comparison between observed data and modelled data, the calibration of the model was undertaken. This process is used to check the general operation of the model, vehicle behaviour and interaction within the network. As part of the model calibration the following elements have been reviewed:

- Network links and connections

- Reduced speed areas

- Priority rules

- Queue lengths

Links and Connectors

3.4.21 The 'look back' distances on connectors have been coded so that vehicles are in the correct lane prior to the junction. It has been checked that link attributes match on street conditions in terms of the numbers of lanes, speed and turning movements. Additional changes to the network have also been undertaken during the validation and calibration process to replicate observed traffic behaviour. All static network changes have been made within both peak hours.

Reduced Speed Areas

3.4.22 The areas where vehicles decelerate in speed (e.g. approaches to roundabouts, junctions and intersections as well as curves along the network and narrow road widths) were coded and subsequently adjusted to provide realistic representation of the observed conditions. Reduced speed areas also assist in the validation of journey time routes within the model to better replicate average speeds within the network**.**

Priority Rules

3.4.23 A range of parameters must be coded within VISSIM to set an adequate gap acceptance for vehicles to enter a junction. Priority rules are coded within VISSIM to replicate priority give way junctions, this includes the coding of a stop line and an associated conflict marker, with lookback distances and time gaps set as per the VISSIM manual. Associated priority rules have been coded for light vehicles and heavy vehicles separately.

Queue Lengths

3.4.24 To measure queue lengths within the model, queue counters have been coded at every give way or signal stop location within the model. Queue lengths are not used in the validation of the model; they do, however, provide an indication of how a model is performing and if any changes are required at the junctions within it.

Convergence

3.4.25 Prior to running of the model for validation purposes, the VISSIM model has first to be converged. This process includes running of the model multiple times to balance the volumes and travel times between zones representing origins and destinations.

3.4.26 The criteria for checking of the acceptability of model convergence is set out in Transport for London's (TfL) modelling guidance. The microsimulation assignment model is deemed to converge when:

- 95% of all path Traffic Volumes change by less than 5% for at least four consecutive iterations, and
- 95% of Travel Times on all paths change by less than 20% for at least four consecutive iterations

3.4.27 Interrogation of the model found that the Travel Time convergence achieved is significantly above the 95% criterion set out above. The model, however, falls slightly short of achieving the Traffic Volume criterion with the models converging to a level of 83% and 82% for the AM and PM peak period. However, a review of the VISSIM files, which contain the convergence criteria, identified that the level of convergence is relatively stable between the runs for both the AM and PM peak hours. With the variance in the volume deviation for both peak hours being ~0.05 and with the travel time convergence being consecutively above the 0.95% for five iterations it has been concluded that the model convergence is as good as is achievable. Table 17 provides detail on the convergence of the final model runs.

Table 17: Final Four Consecutive Run Convergence Statistics

Peak Period	Run	Travel Time	Volume Deviation
AM	92	0.98	0.84
	93	0.97	0.79
	94	0.99	0.79
	95	0.99	0.83
PM	130	0.98	0.82
	131	0.99	0.86
	132	0.99	0.81
	133	0.97	0.82

3.4.28 Furthermore, due to the length of time it takes to run each model run and the associated high number of iterations undertaken as well as a review of traffic validation, the level of convergence was found to be appropriate. However, to limit the variance between each model run for the collection of the validation statistics, the models have been run for 20 iterations with +1 random seed each run, starting at a seed value of 43.

Base Year Model Validation

Model Random Seed

3.4.29 Random seed function provides realistic representation of the varying traffic conditions. Vehicle randomisation is modelled to generate vehicles with varying driver characteristics, in a random, non-linear basis within the stochastic model. The number of random vehicles loaded equals the total vehicle volume of every time period. To achieve unbiased and robust results of the randomisation process, AM and PM models run twenty iterations with the random seed increasing by one per run. The average results for both AM and PM runs were used for the calibration and validation process.

Validation Statistics

3.4.30 The base model is validated by comparing the observed surveyed flows with modelled flows. This includes comparing the model to independent link counts (ATC), turning counts (MCTC) and journey times along selected routes. The model has been run over twenty iterations, with each iteration producing slightly different results, which is reflective of the random nature of driver behaviour within a highway network.

3.4.31 The average of these iterations over the peak period has been used to inform the validation of the model.

3.4.32 The same DfT's TAG criteria used to assess the validation of the strategic model has been used to understand how well the microsimulation model represents traffic behaviour. This sets out a desired minimum level which should be aimed for, however there may be situations where not meeting the criteria may be acceptable and this would require explanation.

3.4.33 Table 18 provides a summary of the TAG link and turning flow validation criteria and acceptability guidelines. TAG acknowledges that these two measures are broadly consistent and link flows that meet either criterion should be regarded as satisfactory.

Table 18: DfT TAG Flow Validation Criteria Guidelines

Criteria	Description of Criteria	Acceptability Guideline
1 Flow Criteria	Individual flows within 100 vph of counts for flows less than 700 vph	>85% of cases
	Individual flows within 15% of counts for flows from 700 to 2,700 vph	>85% of cases
	Individual flows within 400 vph of counts for flows more than 2,700 vph	>85% of cases
2 GEH Criteria	GEH < 5 for individual flows	>85% of cases

3.4.34 For journey time validation, the validation criteria, which is detailed in Table 19, is the percentage difference between modelled and observed journey times.

Table 19: Journey Time Validation Criterion and Acceptability Guideline

Criteria	Description of Criteria	Acceptability Guideline
	Modelled Times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	>85% of routes

3.4.35 Using TAG guidance, the following validation for link, turning counts and journey times were achieved.

Turning Flow Validation

3.4.36 Table 20 and Table 21 provide a summary of the turning flow validation statistics for each peak period at junctions shown in Figure 15.

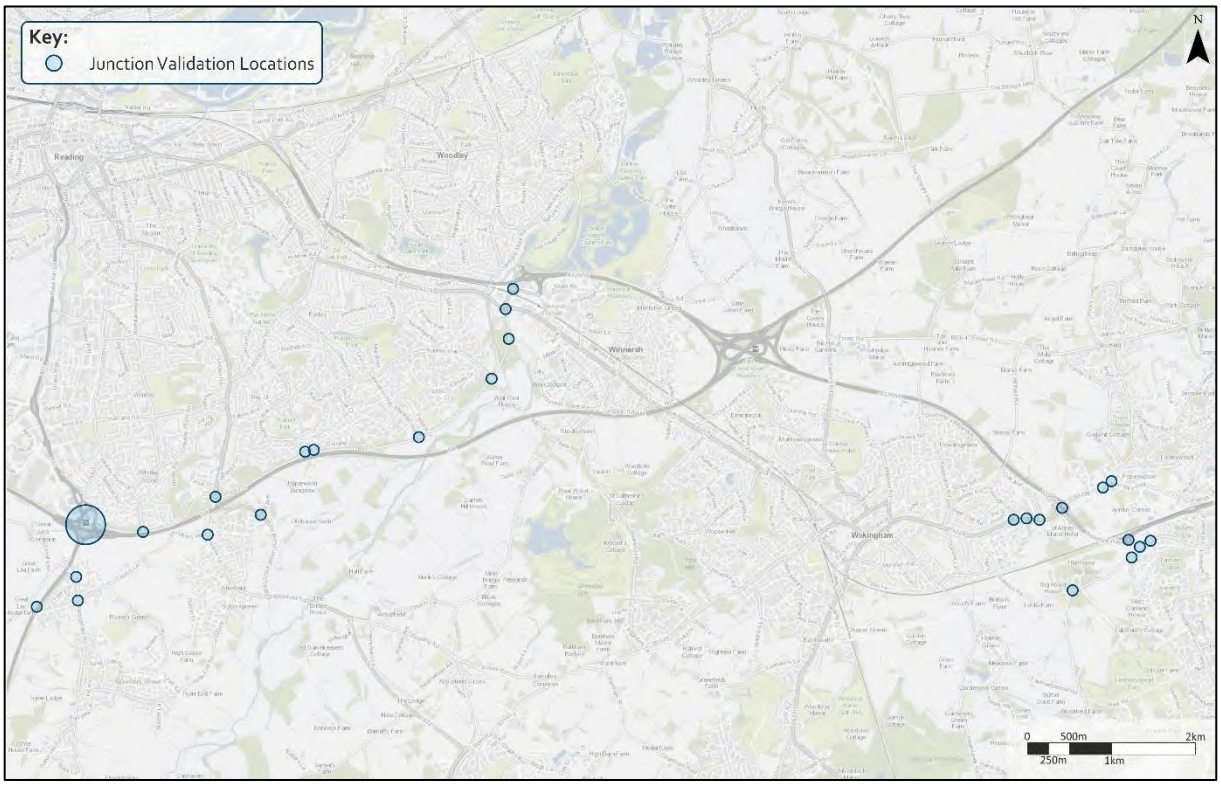


Figure 15: Microsimulation Model. Junction Validation Locations.

Table 20: Microsimulation Model. Turning Flow Validation Statistics, AM Peak

Peak Period	GEH Criterion				Flow Criterion				GEH or Flow Criteria			
	Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Cars	LGV	HGV	Total
Pass	312	310	305	306	277	286	287	278	318	325	327	318
Fail	15	17	22	21	10	2	0	12	9	2	0	9
AM	95%	95%	93%	94%	97%	99%	100%	96%	97%	99%	100%	97%

Table 21: Microsimulation Model. Turning Flow Validation Statistics, PM Peak

Peak Period	GEH Criterion				Flow Criterion				GEH or Flow Criteria			
	Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Cars	LGV	HGV	Total
Pass	304	319	304	303	271	287	287	268	312	327	327	313
Fail	23	8	23	24	16	0	0	20	15	0	0	14
PM	93%	98%	93%	93%	94%	100%	100%	93%	95%	100%	100%	96%

3.4.37 The results show that in both peak periods the model meets both GEH and Flow criteria with 97% of turning counts in the AM and 96% of turning counts in the PM meeting one of the criteria.

Link Flow Validation

3.4.38 Table 22 and Table 23 provide a summary of the flow validation statistics for the GEH and link flow criteria for both peak periods on links presented in Figure 16.

Table 22: Microsimulation Model. Link Flow Validation Statistics, AM Peak

Peak Period	GEH Criterion				Flow Criterion				GEH or Flow Criteria			
	Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Cars	LGV	HGV	Total
Pass	21	19	20	20	20	22	22	20	21	22	22	20
Fail	1	3	2	2	2	0	0	2	1	0	0	2
AM	95%	86%	91%	91%	91%	100%	100%	91%	95%	100%	100%	91%

Table 23: Microsimulation Model. Link Flow Validation Statistics, PM Peak

Peak Period	GEH Criterion				Flow Criterion				GEH or Flow Criteria			
	Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Cars	LGV	HGV	Total
Pass	19	20	18	19	19	22	22	19	19	22	22	19
Fail	3	2	4	3	3	0	0	3	3	0	0	3
PM	86%	91%	82%	86%	86%	100%	100%	86%	86%	100%	100%	86%

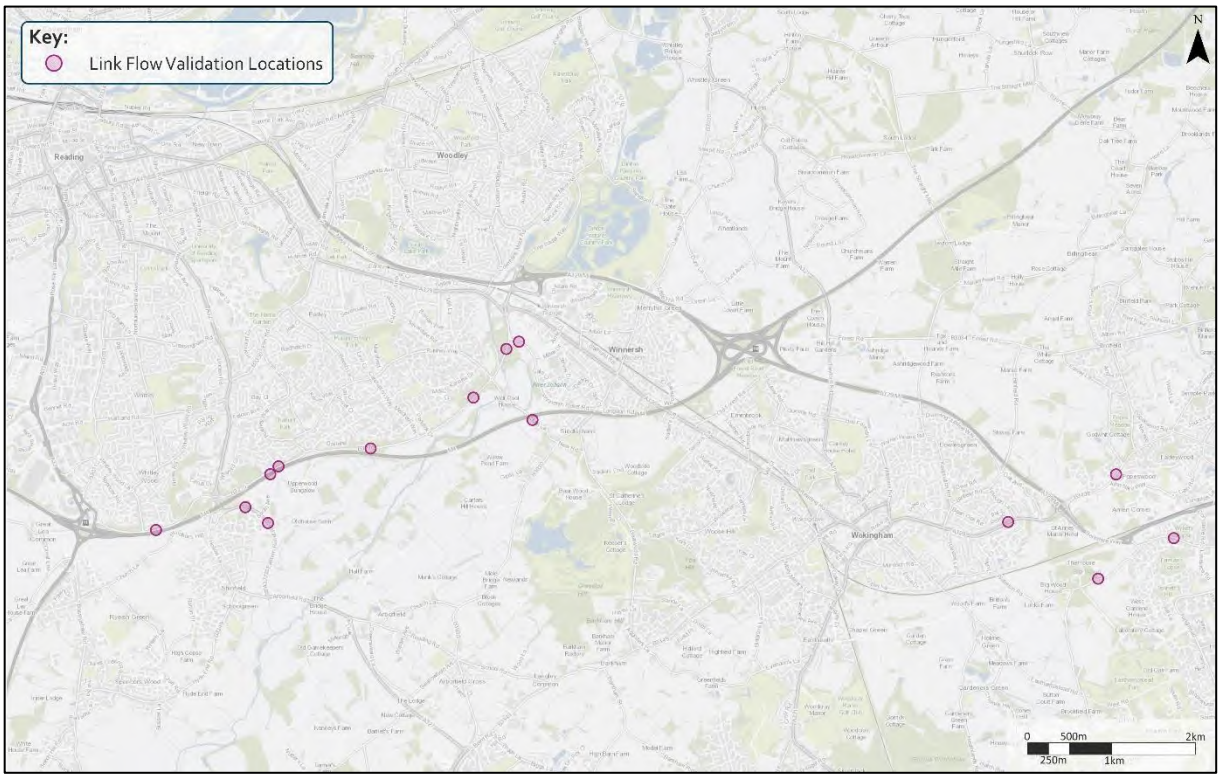


Figure 16: Microsimulation Model. Link Flow Validation Locations.

3.4.39 As shown within the tables the model validation criteria are met for the AM and PM peak hours. In the PM peak HGV validation falls slightly short of the GEH criteria. However, the validation of the model against the flow criteria is met and therefore is acceptable.

Journey Time Validation

3.4.40 Table 24 provides a summary of the journey time validation statistics for both peak periods. Figure 17 details routes and results further.

Table 24: Journey Time Validation Statistics

AM Journey Time Validation						
VISSIM ID	Route	Observed Time	Modelled Time	Difference (mins)	Difference %	DMRB
1	A33 Basingstoke Road - SB	03:59	03:48	-00:00:11	-5%	Pass
2	A33 Basingstoke Road - NB	03:16	03:15	-00:00:01	-1%	Pass
3	M4 - EB	08:38	08:27	-00:00:11	-2%	Pass
4	M4 - WB	08:33	08:01	-00:00:32	-6%	Pass
5	A33 to Beeston Way	06:55	06:27	-00:00:28	-7%	Pass
6	Beeston Way to A33	08:26	08:14	-00:00:12	-2%	Pass
7	Beeston Way to Bader Way	09:31	09:38	00:00:07	1%	Pass
8	Bader Way to Beeston Way	09:34	09:08	-00:00:26	-4%	Pass
9	A329M to Peacock Lane	07:58	08:10	00:00:12	3%	Pass
10	Peacock Lane to A329M	07:47	08:25	00:00:38	8%	Pass
11	M4 West to A33 North	03:44	02:49	-00:00:55	-25%	Pass
12	A33 North to M4 West	04:36	03:21	-00:01:15	-27%	Fail
13	M4 West to A33 South	04:34	05:31	00:00:57	21%	Pass
14	A33 South to M4 West	02:49	03:03	00:00:14	9%	Pass
15	M4 East to A33 North	10:02	09:15	-00:00:47	-8%	Pass
16	A33 North to M4 East	10:02	09:47	-00:00:15	-2%	Pass
17	M4 East to A33 South	09:14	09:59	00:00:45	8%	Pass
18	A33 South to M4 East	10:50	12:01	00:01:11	11%	Pass

Pass	17
Fail	1
%Pass	**94%**

PM Journey Time Validation						
\VELTIMEMEASUREMENT		Observed Time	Modelled Time		Difference %	DMRB
1	A33 Basingstoke Road - SB	03:13	04:03	00:00:50	26%	Pass
2	A33 Basingstoke Road - NB	02:50	03:24	00:00:34	20%	Pass
3	M4 - EB	08:44	08:13	-00:00:31	-6%	Pass
4	M4 - WB	08:39	07:56	-00:00:43	-8%	Pass
5	A33 to Beeston Way	05:47	06:52	00:01:05	19%	Fail
6	Beeston Way to A33	06:40	07:16	00:00:36	9%	Pass
7	Beeston Way to Bader Way	11:04	08:09	-00:02:55	-26%	Fail
8	Bader Way to Beeston Way	07:32	08:01	00:00:29	6%	Pass
9	A329M to Peacock Lane	08:28	08:29	00:00:01	0%	Pass
10	Peacock Lane to A329M	08:33	08:29	-00:00:04	-1%	Pass
11	M4 West to A33 North	02:55	02:37	-00:00:18	-10%	Pass
12	A33 North to M4 West	03:53	04:08	00:00:15	6%	Pass
13	M4 West to A33 South	05:18	05:41	00:00:23	7%	Pass
14	A33 South to M4 West	03:02	02:58	-00:00:04	-2%	Pass
15	M4 East to A33 North	09:37	09:47	00:00:10	2%	Pass
16	A33 North to M4 East	09:05	10:12	00:01:07	12%	Pass
17	M4 East to A33 South	09:31	09:28	-00:00:03	0%	Pass
18	A33 South to M4 East	10:51	11:29	00:00:38	6%	Pass

Pass	16
Fail	2
%Pass	**89%**

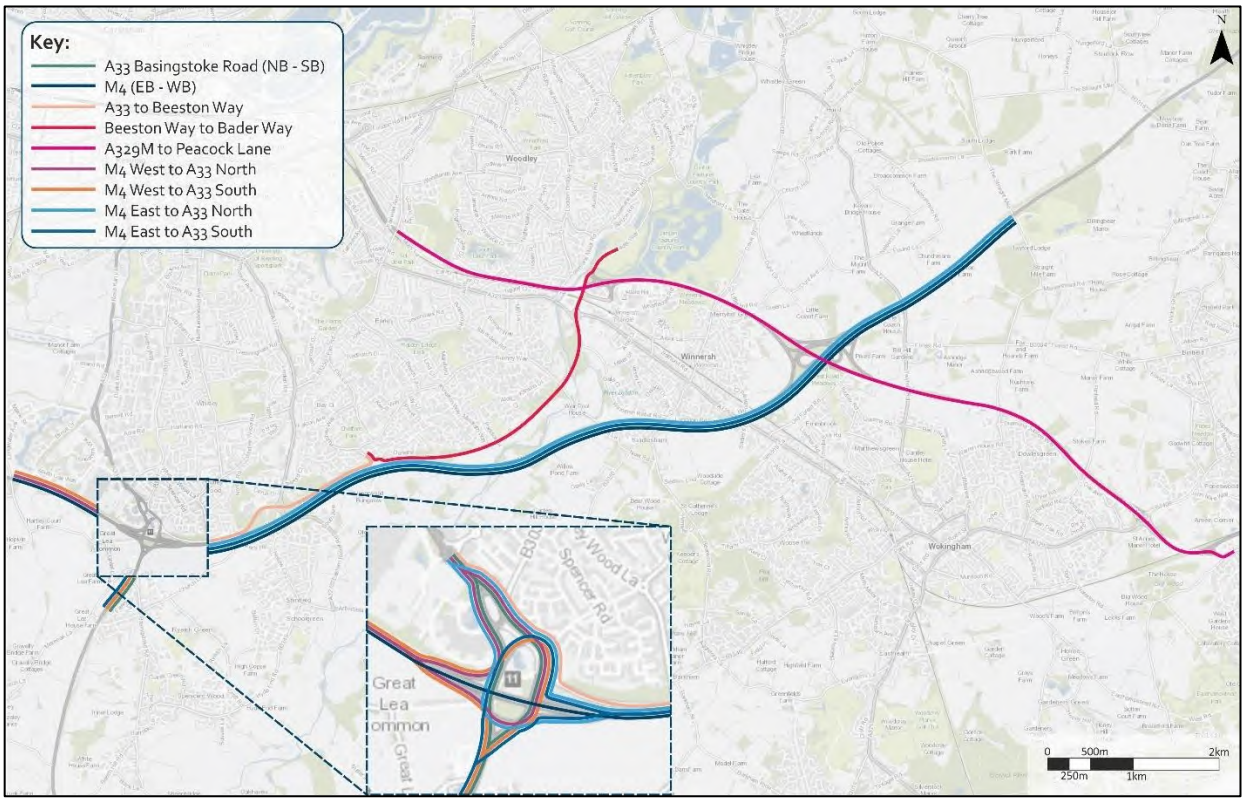


Figure 17: Microsimulation Model. Journey Time Routes.

3.4.41 The results show that both the AM and PM peak hour models validate against available journey time data, demonstrating the model accurately represents travel times through the model.

3.4.42 The routes that do not meet the criteria include:

- Route 12 (A33 North to M4 West) in the AM, which runs approximately 1:15 minutes too fast (4:36 observed vs 3:21 modelled)
- Route 5 (A33 to Beeston Way) in the PM, which runs 1:05 too slow in the model (5:47 observed vs 6:52 modelled)
- Route 7 (Beeston Way to Bader Way) in the PM, which runs 2:55 too fast (11:04 observed vs 8:09 modelled)

3.4.43 Route 7 passes through the temporary road works at Winnersh Triangle. However, due to the roadworks being included within the base year model, this route is not of concern but was further reviewed during the development of the forecast models.

Summary

3.4.44 Overall, through the outputs presented above, the base model demonstrates that the validation of link flow, turning flow and journey time is good and meets TAG criteria and thus provides a good replication of the observed traffic conditions during November 2021 and a solid basis for forecasting

3.5 Local Junction Modelling

Junction Models built to inform Signal Optimisation

3.5.1 A set of standalone junction models have been developed in LinSig or TRANSYT to inform the development of the base year strategic and microsimulation models and signal optimisation in

forecast models. For this purpose, standalone junction models have been developed at the locations listed below:

(1) Basingstoke Road / Three Mile Cross
(2) Black Boy Roundabout including the A327/ Eastern Relief Road/ Shinfield Road junction to the south
(3) Winnersh Relief Road / Hatch Farm Way
(4) Showcase Roundabout
(5) M4 J11
(6) A3290 /Wharfdale Road
(7) Wharfdale Road - A329(M) slips
(8) A3290 / A329M

Figure 18: Standalone Junction Model Locations (LinSig and Transyt)

3.5.2 All junction models have been developed in LinSig, apart from the M4 J11 model, which was developed in TRANSYT.

3.5.3 Each of these junctions have been calibrated and validated towards the survey data that was available at each location. In order to achieve validation of the models, the survey queue lengths were analysed against the model queue lengths.

3.5.4 For these signalised junctions, the phases and stages were set up accordingly to the signal timing sheets provided for each controller, with the signal timings applied directly from the average timings found from the surveys completed.

3.5.5 In addition to the signal timings, the saturation flow information from the surveys were analysed for each signalised lane approach of the junctions to determine the minimum, average and maximum observed saturation flows. In addition to the surveyed data, the RR67[9] saturation flow values were also calculated using the geometrical properties for each approach, to provide a saturation flow value for where surveys were not up to standard,

[9] A common method for estimating saturation flows based on TRL'. Research Report 67 (RR67) based on junction geometric parameters.

available, or to check that the recorded values were acceptable based on these calculated values.

3.5.6 The saturation flows for each approach lane were then altered between the ranges of the minimum, average, maximum and calculated RR67 saturation flow values, to achieve a balanced mean max queue difference between the AM and PM modelled and observed queues.

3.5.7 Where applicable for the signalised junctions, bonus greens[10] or underutilised green time was applied based on the observations of the signal timing information. This was directly added to each appropriate phase as required to assist with achieving a validated model by queue lengths. The modified signal timing options are limited by certain link exit restraints which in part dictate the ability to move traffic through the junction, however using variable signal timing options can partly manage this throughput.

Junction Models used in Assessment

3.5.8 The assessment of development impacts in the area of interest has largely relied on results of the strategic and microsimulation models. However, a few junctions fell outside of the extent of the VISSIM modelled network and have been assessed using standalone junction models built using software packages included Junctions 10 and LinSig.

3.5.9 There are a total of three junctions which have been analysed in isolation to the microsimulation model, which have been calibrated and validated to the data available from the surveys data described in section 3.2 ‘Data Collection’. These junctions are:

(1) A327 / Arborfield Road / Eastern Relief Road
(2) A327 / Reading Road / Observer Way
(3) Winnersh Crossroads

3.5.10 The locations of the junctions are presented in Figure 19 below.

Figure 19: Standalone Junction Model Locations Outside VISSIM Modelled Area

[10] See TAL3/97: Green time efficiencies achieved from cycle time variations to make best use of flares

3.5.11 For the junctions located on the A327, which are roundabouts, modelling has been completed using the Junctions10 software package. The geometric inputs to each model have been based upon measurements taken from aerial data or drawings provided by WBC with video footage used to determine the operation of the junction. The operation of both junctions was slightly affected by roadworks as recorded in the Data Collection report. Therefore changes to modelled parameters have been made based on our experience and professional judgement to represent how the junction would operate in free flow conditions.

3.5.12 As Winnersh Crossroads is a signalised junction, it was validated using a combination of the signal timings, saturation flow and queue surveys. The signal timing surveys were used to determine the phases and staging setup for the model, as well as the cycle times and stage timings used for the junction. The observed stage sequence was input into the model and the appropriate observed timings were added to generate the cycle times required.

3.5.13 The saturation flow surveys were used to determine the minimum, average and maximum rates of flow for each lane approach to the junction. These were compared against the RR67 values obtained using on street geometry, gathered from aerial photography. The best fit values which produced queue lengths close to those observed were used to calibrate the models.

3.5.14 The queue lengths modelled were analysed to ensure that they were within a specific value of the observed queue lengths. It has been assumed that modelled queue lengths, which are within 5 PCUs of the recorded values, would satisfy a validation process. This is considered to be a general acceptable range for junction queue length validation and has been the criteria requirement used within the local modelling for validation.

3.5.15 The below tables provide the validation results in terms of the saturation flow values used per link, and then the resultant queues compared against the recorded survey data.

Table 25: Winnersh Crossroads Validation

Name	Mean Max Queue (PCU)					
	AM			PM		
	Recorded	Modelled	Diff	Recorded	Modelled	Diff
Robin Hood Lane – Outside lane	21.0	21.2	0.2	17.0	17.0	0.0
Robin Hood Lane – Nearside lane						
Reading Road WB – Outside lane	8.0	7.0	-1.0	9.0	6.1	-2.9
Reading Road WB – Middle lane	9.0	9.1	0.1	9.0	8.1	-0.9
Reading Road WB – Nearside lane						
Kings Street Lane – Outside lane	2.0	1.5	-0.5	1.0	0.5	-0.5
Kings Street Lane – Middle lane	17.0	17.3	0.3	13.0	12.6	-0.4
Kings Street Lane – Nearside lane						
Reading Road EB – Outside lane	5.0	9.4	4.4	5.0	11.1	6.1
Reading Road EB – Middle lane	19.0	15.1	-3.9	19.0	13.5	-5.5
Reading Road EB – Nearside lane						

3.5.16 As can be seen with the above table, the resultant queues on the Winnersh Crossroad Junction have values which are reasonably close to that which were recorded as part of the surveys.

3.6 Interaction Between Different Models

3.6.1 The assessment has utilised a 3-tier modelling framework in which a microsimulation model and a series of junction models have been developed for the area of interest. The strategic model cannot be expected to be validated at every single junction and the availability of more detailed microsimulation and junction models aims to address this limitation.

3.6.2 With this approach the microsimulation model and individual junction models operate alongside the strategic model, with all three types of models linked by the data exchange mechanisms to ensure analytical consistency. In this approach the demand for each of the forecast scenarios is predicted using the strategic model, which takes into account wider strategic impacts such as re-routing. The demand growth forecast by the strategic model (calculated as a forecast scenario demand minus base year demand) is then applied to the base year validated VISSIM or junction base year flows to ultimately produce more accurate forecast flows and study area assessment results.

3.6.3 The underlying assumptions for each of the assessment scenarios have been described in detail in Section 2 of this report.

3.6.4 A set of technical procedures have been adopted to produce the Reference Case forecasts, which Scenario 1A and Scenario 1B are based on, and these are fully described within the ‘Reference Case – Matrix Development Methodology’, June 2024 (Attachment 7).

4 Key Metrics Used for Assessment

4.1 Introduction

4.1.1 Data extracted from different types of models for a number of assessment scenarios has been used to assess the transport impact of LPU development growth. This section describes and presents the key metrics used.

4.2 Growth in Demand

4.2.1 The assessment metrics and the results should be considered in the context of trip growth. Table 26 shows growth in demand across the WSTM4 modelled area between 2021 base and 2040 forecast scenarios. The WSTM4 modelled area covers a large area is bounded by the M40 in the north, by the M25 in the east, by the M3 in the south and by the A339 and A34 in the west.

4.2.2 It is estimated that in comparison with 2021 Base traffic will increase by 19.9% in the AM peak hour and by 19.1% in the PM peak hour in 2040 as a result of background growth, development happening outside of the borough, 2026 SDL sites in Wokingham, upgrade of the M4 to smart motorway, and accounting for a residual impact of Covid restrictions on data collection, which informed base year model development.

4.2.3 The LPU growth (in Scenarios 1A and 1B) accounts for a further increase of 2.7% and 2.1%, which is equivalent to an increase of 7,518 vehicles trips in the morning peak and 5,869 vehicle trips in the evening peak.

Table 26: Traffic Growth in the Strategic Model.

Scenario	AM Peak	PM Peak
2021 Base	229,854	236,715
2040 Reference Case	275,623	281,865
Base vs Ref Case, Growth - vehicles	45,769	45,150
Base vs Ref Case, % Growth	19.9%	19.1%
2040 Scenario 1A/ 1B (without and with Mitigation)	283,042	287,645
Base vs Scenario 1A/ 1B, Growth - vehicles	53,287	51,019
Base vs Scenario 1A/ 1B, % Growth	23.2%	21.6%
Ref Case vs Scenario 1A/ 1B, Growth - vehicles	7,518	5,869
Ref Case vs Scenario 1A/ 1B, % Growth	2.7%	2.1%

4.2.4 Table 27 summarises how demand for travel is forecast to change in the microsimulation area covering a much smaller area including the M4, B3270 and A329(M). The table shows that there is an increase in total trips from base year to the Reference Case scenario of 38% in the AM peak hour and 38.2% in the PM peak hour, which is significantly higher than the demand increase across the whole WSTM4 modelled area. This is largely due to opening of the M4 smart motorway scheme from Spring 2022, which increases capacity on the M4,reduces congestion on the M4 and redistributes traffic to the M4 from the M3 and parallel local roads .

4.2.5 The increase in trips due to the LPU growth in the area of interest is forecast to be higher (at 8.4% in the AM and 6.9% in the PM) than in the wider modelled area (2.7% and 2.1% respectively) thus highlighting the area where the impact is likely to be the greatest. LPU growth and infrastructure improvements are estimated to introduce additional 3,032 vehicles to the area of microsimulation modelling in the AM peak hour and 2,529 vehicles in the PM peak hour with other LP development trips travelling outside of the area. There will also be

existing traffic that traverses through the microsimulation area in the Reference Case but will find alternative quicker routes outside of the area and avoid travelling through the microsimulation area all together.

Table 27: Traffic Growth in the Microsimulation Model

Scenario	AM Peak	PM Peak
2021 Base	26,268	26,567
2040 Reference Case	36,255	36,711
Base vs Ref Case, Growth - vehicles	9,987	10,144
Base vs Ref Case, % Growth	38.0%	38.2%
2040 Scenario 1B	39,287	39,240
Base vs Scenario 1B, Growth - vehicles	13,019	12,673
Base vs Scenario 1B, % Growth	49.6%	47.7%
Ref Case vs Scenario 1B, Growth - vehicles	3,032	2,529
Ref Case vs Scenario 1B, % Growth	8.4%	6.9%

4.3 Strategic Modelling

4.3.1 In Stantec's experience using VISUM based models, it has been found that using one or even two types of output is not sufficient to gain a detailed picture of the impact of new development and/or infrastructure on the operation of the network. This section details the various outputs from WSTM4 which have been used to analyse the modelled forecast scenarios.

4.3.2 The WSTM4 Base Year model was validated following DfT TAG criteria and is based on comparing modelled and observed journey times on the main corridors (including delays), turning count and link flow volumes. The model was not validated on Level of Service or Relative Queue Length at each junction.

4.3.3 To assess the impact of the development proposal the following metrics have been considered and extracted from the model:

- Actual flows and actual flow differences
- Delays and delay differences
- Journey times on selected routes
- Maximum junction turn V/C (Volume over Capacity)

4.3.4 Using such metrics provide an indicative high-level understanding of impacts of developments, in comparison to the Base and to the Reference case at a strategic level, and therefore should not be taken as a definitive precise value of the impacts at a local level. Microsimulation and junction modelling has been undertaken in order to understand impacts more precisely at a local level.

Actual Flows and Actual Flow Differences

4.3.5 Appendix G presents actual flows for the 2021 Base and all the assessment scenarios. All flows are displayed in vehicles.

4.3.6 Appendix H presents the Flow difference output plots reported. Increases in flow are shown in green whereas decreases in flow are shown in blue. The actual flow differences provide a

comparison between the traffic flows on a link in two different scenarios. In the case of this assessment the comparison is between 2021 Base and 2040 Reference Case (the 2040 Forecast scenario with no LPU development), and the Reference Case against the scenarios including forecast LPU developments. When reviewing these outputs, it should be noted that new links added to the model are likely to show up as significant flow increases as there are no flows in the reference case to compare to.

Delays and Delay Difference

4.3.7 Appendix I presents actual delays forecast by the strategic model in each of the assessment scenarios. Delays of less than 30 seconds are shown in green, the values, which are between 30 seconds and two minutes, are shown in amber and those, which are greater than two minutes are shown in red. The values are displayed in seconds. The colour coding used is to allow differentiation of flow differences, there is no inference of severity, as this will be dependent on circumstances at each location as set out in Section 1.5.

4.3.8 Appendix J includes the delay difference output plots. The figures provide a comparison between 2021 Base and 2040 Reference Case (the 2040 Forecast scenario with no LPU development), and the two LPU scenarios, Scenario 1A (without mitigation) and Scenario 1B (with mitigation).

4.3.1 For the purposes of visually representing delay a RAG (Red, Amber, Green) colour coding system has been adopted to highlight congestion impacts. This system is applied consistently throughout all scenario assessments and includes the following delay categorisation.

- Green - Less than 30 seconds delay
- Amber – Between 30 seconds and 2 minutes
- Red – Greater than 2 minutes

Journey Times

4.3.2 Travel times provide a representation of network performance that is easier for a wide audience of readers to understand. A series of eight routes, which are shown in Figure 20, were identified to assess journey times across the network. These are the same routes used int the validation of the strategic model.

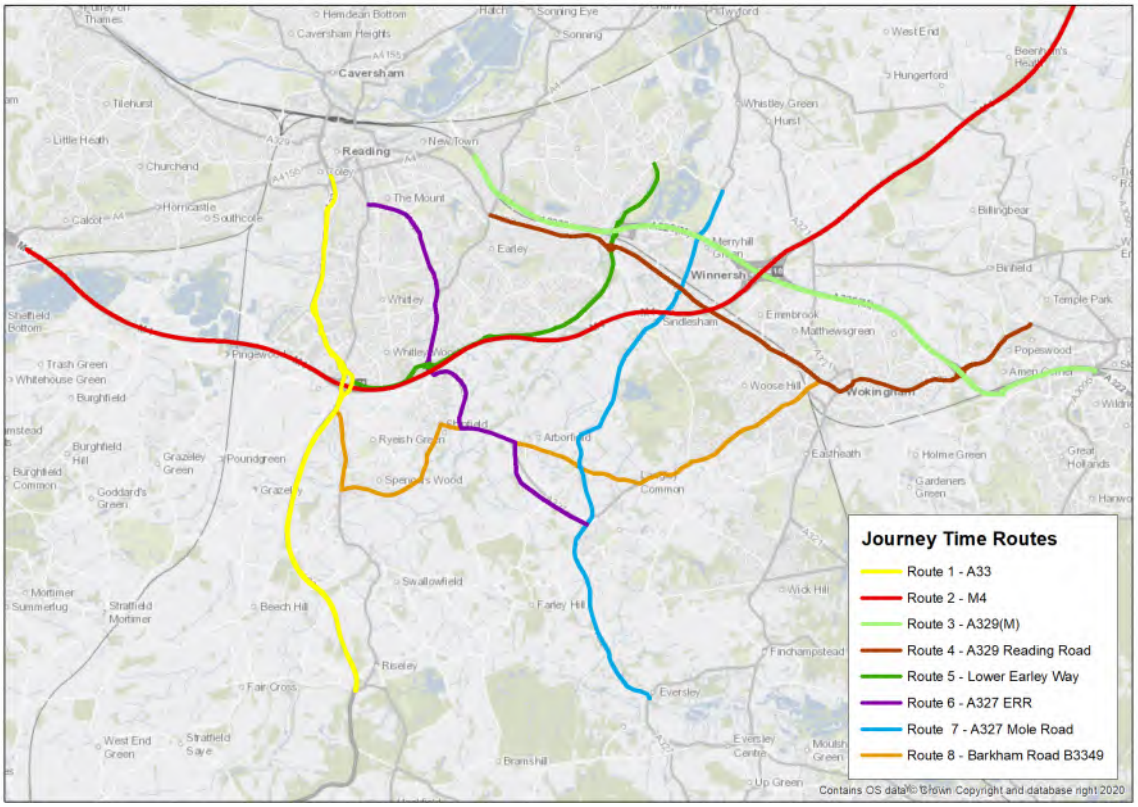


Figure 20: Journey Time Validation Routes

4.3.3 Appendix K presents the results of the journey time routes in each of the scenarios, as well as comparisons between the different scenarios. The tables included in Appendix K demonstrate the absolute difference (in seconds) and percentage difference between 2021 Base and 2040 Reference Case, and between Scenario 1A/1B and the Reference Case.

Volume to capacity (V/C) for the worst performing turn at a junction

4.3.4 Volume to capacity (V/C) for the worst performing turn at a junction is a bespoke parameter produced that highlights volume to capacity constraints at a junction/node. This is able to determine particular turning movements and where capacity constraint is being reached and therefore the movement at the junction will exhibit congestion.

4.3.5 A categorisation for the maximum turn Volume to Capacity (V/C) ratio has been established, with only V/C ratios exceeding 85% being shown and those over 100% shown as red. This threshold was considered appropriate for visually identifying areas of the network where junction turn delay is likely to occur. The following categorisation is used to visualise the maximum turn V/C.

- Blue - Greater than 0.85 V/C and less than 0.9 V/C
- Amber – Between 0.9 V/C seconds and 1 V/C
- Red – Greater than 1 V/C

4.3.6 Appendix L includes the V/C output plots produced for this assessment.

4.4 Microsimulation Modelling

4.4.1 Microsimulation modelling has focused on the assessment of the Reference Case and Scenario 1B. The Reference Case has included planned development outside Wokingham borough, committed development and infrastructure in the borough but no Hall Farm / Loddon Valley development or other 2040 LPU development. Scenario 1B builds upon the Reference Case and also includes LPU development quantum and mitigation. Further details related to forecasting assumptions in each of the scenarios have been provided in Section 2 of this report.

4.4.2 Scenario 1A was not considered to be suitable for the assessment due to being an unrealistic scenario with additional growth but no additional infrastructure required to mitigate the development.

4.4.3 To assess the impact of the development proposal the following metrics has been considered and extracted from the model:

- Journey times on selected routes
- Relative delays
- Flow, delays, average queue length and average delays on junction approaches

Journey Times

4.4.4 Journey time information has been extracted from the VISSIM model for key routes covering the whole microsimulation area as shown in Figure 21.

4.4.5 Appendix M presents journey time results for each of the modelled scenarios, as well as their comparison (Table 34 and Table 35 for the AM and PM peaks). The tables demonstrate the absolute difference (in seconds) and percentage difference between 2040 Reference Case and Scenario 1B.

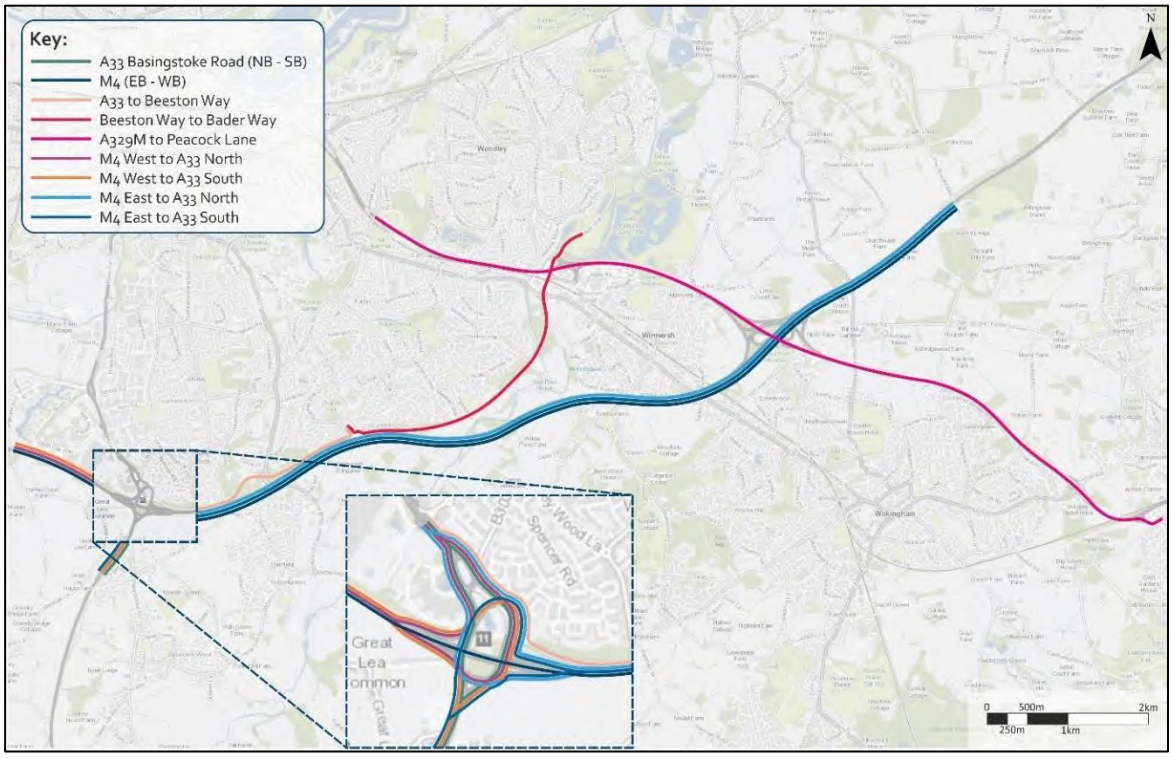


Figure 21: Microsimulation Assessment. Journey Time Routes

Delay Heatmaps

4.4.6 In order to draw a visual comparison between the congestion of the Reference Case scenario and Scenario 1B, delay heatmaps have been extracted from the VISSIM modelled scenarios and presented within Appendix N of this report.

4.4.7 The heatmap colour symbology is intended to reflect delays similar to that of Google Maps, where the darkest colour red reflects very slow moving to standing traffic, through to amber which represents slow moving traffic, and green which represents free flow conditions. The acceptability of any level of delay shown is, in Stantec's opinion, a judgement based on comparison of existing conditions and the acceptability of other factors such as positive and negative impact on sustainable transport users.

4.4.8 In VISSIM the symbology is derived from the "relative delay" function, which calculates link delay time as a share of total travel time.

Junction Metrics

4.4.9 Junction metrics have been extracted from each junction within the VISSIM modelled area. The outputs include the total flow and average queue length of each approach arm for the AM and PM peak hours. Appendix O presents junction metrics.

4.4.10 Delays at each approach arm are average delays calculated by aggregating delay estimates from individual turns weighted by associated traffic flows so that the average values are representative of traffic volumes. Comparably, average queue lengths are based on a flow weighted average of each lane of the approach to the junction.

4.5 Local Junction Modelling

4.5.1 The validated local junction models created in Junctions 10 and LinSig were used to model both the Reference Case as well as Scenario 1B.

4.5.2 The effect of the development has been assessed against the Reference Case scenario modelling. Appendix P presents results for the three junctions, which fall outside the VISSIM modelled area but are included within the area of interest. The results are detailed in Attachment 8. These junctions are:

- A327 / Arborfield Road / Eastern Relief Road
- A327 / Reading Road / Observer Way
- Winnersh Crossroads

4.5.3 Using the Junctions10 modelling program, the Ratio of Flow to Capacity (RFC) for each arm is typically reported to provide an understanding of junction performance. This value varies depending on two primary factors, namely the capacity of the arm and the level of traffic demand.

4.5.4 An RFC value of zero means that there is 100% spare capacity on the arm and an RFC value of 1.00 means that there is 0% theoretical spare capacity on the arm. Values of between 0.85 and 1.0 (i.e., between 85% and 100% of capacity utilised) mean the junction is above practical capacity, but below theoretical capacity. Practical capacity considers that there may be variations in traffic demand and disruptions to traffic flow such as vehicle breakdowns over the hour. This would mean that there would be periods within the peak hour that the arm is overcapacity. Therefore, if an arm is between 0.85 and 1.00 RFC, there may be periods within the hour with significant queueing, but other periods with low to moderate queuing. . If an arm exhibits a ratio of 1.00 or greater (i.e., over 100% of capacity utilised), it is an indication that it is over capacity and therefore will experience significant queuing and delay throughout the entire assessment hour.

4.5.5 In addition to RFC, the queues and delays are reported, which can be used to determine if there will be any implications from blocking back of queuing vehicles, or if there are any significant delays occurring at the junction. Queue lengths reported by the modelling software are the sum of all theoretical lanes at the give-way line, whilst the delay is reported as the maximum delay calculated over time segments of the average delay per arriving vehicle.

4.5.6 Using the LinSig modelling program, the Practical Reserve Capacity (PRC) value is typically referred to as an understanding of junction performance. Generally, the maximum desirable PRC value for new junctions is 90% on each arm, which provides a 10% capacity buffer. However, a PRC greater than 90% is not necessarily regarded as unacceptable, particularly for existing junctions.

4.5.7 Much like with Junctions 10, LinSig also produces calculated values for queue lengths and delay. The queue lengths generated by the software provide the mean max queue lengths for each long lane modelled for the junction. Where short flares exist with a long lane, these queue lengths are combined together to provide a single queue length value for that approach. The delay is also calculated per long lane approach on a junction, which can be provided as either the average delay per PCU on each arm, or the total delay per each individual PCU.

4.5.8 In all cases, capacity assessments should be weighed against a wider set of criteria than just the results of the assessment. Additional questions should be asked such as ‘Do queues block back through the next junction along?’ and ‘Does a junction improvement include significant benefits for active travel modes?’.

5 Local Highway Network Analysis

5.1 Introduction

5.1.1 This section considers the impact on the local highway network of the various scenarios modelled, presented in the context of the different assessment metrics described in Section 4.

5.1.2 The area of detailed analysis focusses on key junctions on the network which are located in proximity to the potential strategic allocations at Hall Farm / Loddon Valley and South Wokingham and the area of interest of this study.

5.2 Strategic Model Assessment Results

Flow Difference

5.2.1 Appendix H includes the flow difference outputs extracted from the WSTM4. These consider Scenarios 1A and 1B against the Reference Case. The Reference Case has also been compared against the Base. Where infrastructure changes take place between different scenarios, the modelling software cannot automatically identify the changes in network coding and therefore there may be instances where links show no changes in flows, interpretation of results is therefore provided.

AM Peak Hour

5.2.2 In the **Reference Case**, the morning peak hour is expected to see substantial increases in traffic flow on key links within the model area. Significant traffic growth is forecasted on the M4 and on the A329(M) between Bracknell and Reading compared to the base scenario. This is due to the removal of traffic management measures on the M4 following the smart motorway upgrade (completed following the base scenario) and the continued growth outside of Wokingham Borough, linked to population, economic and development.

5.2.3 On the LRN there is also a notable increase in demand for routes to and from the south via the A33 corridor. Traffic flow is also expected to increase on new infrastructure planned to accommodate the growth in Wokingham by 2026. This, for example, includes the South Wokingham Distributor Road (SWDR), which was incomplete at the time of the 2021 data collection.

5.2.4 Certain links are forecast to show a reduction in flow in the Reference Case when compared to the Base. Easthampstead Road In Wokingham is forecast to have a reduction in flow in both directions as a result of a committed upgrade of the Old Wokingham Road/ Peacock Lane/ Waterloo Road junction from a priority junction to a roundabout.

5.2.5 In Reading borough, a committed scheme that aims to provide a fully segregated cycle track along the A327 Shinfield Road is forecast in the morning peak hour to result in a local re-assignment to Northcourt Avenue, which runs parallel to the A327. Whereas provision of a bus lane on London Road at the end of the A3290 to Cemetery Junction is likely to lead to traffic avoiding A4 London Road by finding alternative routes thus resulting in traffic reduction on these roads.

5.2.6 **Scenario 1A** (with LPU growth) will see additional 7,518 vehicle trips added to the network, which is forecast to result in material flow increases on a number of existing roads. As would be expected, these are primarily roads on the periphery of Hall Farm / Loddon Valley, including the A327, Eastern Relief Road, sections of Lower Earley Way, Hatch Farm Way, Reading Road, and Barkcham Road. Flow increases are also forecast on B3349 Hyde End Road. Selected changes in flows are quantified below:

- A327 between Observer Way and Shinfield Eastern Relief Road – increase in flow by 155 vehicles in the northbound direction (from 733 vehicles in the reference case to 887

vehicles in scenario 1a). In the southbound an increase by 181 vehicles (from 1,026 vehicles in the reference case to 1,207 vehicles).

- Shinfield Eastern Relief Road – flow increases by 152 vehicles in the northbound direction (from 837 vehicles in the reference case to 989 vehicles in scenario 1a), and by 129 vehicles in the southbound direction (from 540 vehicles in the reference case to 669 vehicles in scenario 1a).

- A327 Shinfield Road, north of Black Boy roundabout – flow increases by 268 vehicles in the southbound direction (from 789 vehicles in the reference case to 1,056 vehicles in scenario 1a).

- Hatch Farm Way – eastbound flow increases by 92 vehicles (from 674 vehicles in the reference case to 766 vehicles in scenario 1a) and westbound flow increases by 362 vehicles (from 910 vehicles in the reference case to 1,272 vehicles in scenario 1a). This increase in traffic is not solely due to an increase in development trips and the closure of Mill Lane also contributes to this increase.

- Barkham Road between B3349 School Road and Barkham Ride – flow increases by 245 vehicles in the eastbound (from 602 vehicles in the reference case to 847 vehicles in scenario 1a) direction and by 208 vehicles in the westbound direction (from 527 vehicles in the reference case to 735 vehicles in scenario 1a).

- Observer Way – flow increases in the northbound direction range between 179-223 vehicles, with the reference case flow at 586-686 vehicles. For the southbound flow increases between 145 and 182 vehicles, with reference case flow between 421 and 502 vehicles .

- B3349 Hyde End Road - by 220 vehicles in eastbound direction (from 415 vehicles in the reference case to 635 vehicles in scenario 1a), and by up to 96 vehicles in the westbound direction (from 425 vehicles in the reference case to 521 vehicles in scenario 1a).

5.2.7 Flow increases are also forecast on roads around South Wokingham Extension:

- Heathlands Road – up to 148 vehicles in the northbound direction and up to 50 vehicles in the southbound direction

- Peacock Lane between the Old Wokingham Road/ Peacock Lane/ Waterloo Road junction and Peacock Lane/Vigar Way roundabout – flow is forecast to increase by 18 vehicles in the eastbound direction, and by 177 vehicles in the westbound direction

5.2.8 A notable rerouting of traffic is observed in Bracknell between Peacock Lane and Berkshire Way. This is largely due to the area's existing congestion issues, which make it highly sensitive to any variations in local traffic volumes.

5.2.9 In Scenario 1A, compared to the Reference Case, certain routes are predicted to experience a decrease in traffic flow:

- A decrease in traffic flow of up to 366 vehicles is also anticipated on the northbound A33 approach to M4 J11. This is probably because of heightened congestion in the area, which hinders the movement of traffic.

- The eastbound traffic on Lower Earley Way, from the Black Boy roundabout to Hatch Farm Way, is expected to decrease by up to 425 vehicles. This is likely due to increased delays on this route, with some redistribution to new or other alternative routes.

- Easthampstead Road in South Wokingham is predicted to see a drop in traffic flow by 311 vehicles in the northbound direction and 30 vehicles in the southbound direction as

the turn into/ out of Easthampstead Road from Old Wokingham Road is banned in Scenario 1A.

5.2.10 **Scenario 1B** has the same level of LPU vehicular trips resulting from proposed development as Scenario 1A but includes additional mitigation. The distribution and locations of traffic flow changes in Scenario 1B are akin to those in Scenario 1A. However, the introduction of mitigation measures in Scenario 1B leads to some notable differences from Scenario 1A:

- The implementation of signal optimisation at M4 J11 in Scenario 1B enhances the network performance on the A33 approach from the south, thereby increasing the amount of traffic that can pass through.

- The introduction of various mitigation schemes along the Lower Earley Way, between the Black Boy roundabout and Hatch Farm Way, allows a greater volume of traffic to traverse the area. However, this results in a decrease of 189 vehicles in the westbound flow on Hatch Farm Way at the signalised junction with Earley Way North, which is a result of balancing queues and delays across all arms at this junction.

PM Peak Hour

5.2.11 In the PM peak hour the impact of trips resulting from proposed development on flows is similar to that described for the AM peak hour.

5.2.12 In the **Reference Case** there are substantial flow increases forecast on key links in the model area. The M4 and A329(M) are forecast to have significant traffic growth in comparison to the base scenario, reflecting the significance of the removal of traffic management measures on the M4 due to smart motorway upgrade and the impact of planned growth outside of Wokingham borough.

5.2.13 There is notable additional demand on the A327,A33 corridors, B3030 Mole Road and B3270 Lower Earley Way. Significant flow increases are also forecast on new infrastructure planned to support growth set out in adopted local plans in Wokingham such as South Wokingham Distributor Road (SWDR), which was not fully implemented at the time of the 2021 data collection.

5.2.14 Certain links are forecast to show a reduction in flow in the Reference Case when compared to the Base. Easthampstead Road In Wokingham is forecast to have a reduction in flow in both directions because of a committed upgrade of the Old Wokingham Road/ Peacock Lane/ Waterloo Road junction from a priority junction to a roundabout. In Reading borough, provision of a bus lane on London Road at the end of the A3290 to Cemetery Junction (a committed scheme) is predicted to lead to traffic reduction on the A4 London Road and A3290 as traffic finds alternative quicker routes, predominantly on Wokingham Road and Palmer Park Avenue.

5.2.15 **Scenario 1A** (with LPU growth) will see additional 5,869 vehicles trips added to the network, which is forecast to result in material flow increases on a number of existing roads. As would be expected, these are primarily roads on the periphery of Hall Farm / Loddon Valley, including the A327, Langley Common Road, Observer Way, Eastern Relief Road, Mole Road and Hyde End Road. Selected changes in flows are quantified below:

- A327 between Observer Way and Shinfield Eastern Relief Road – increase in flow by 254 vehicles in the eastbound direction (from 1,000 vehicles in the reference case to 1,254 vehicles in scenario 1a).

- Shinfield Eastern Relief Road – flow increases by 279 vehicles in the southbound co direction (from 709 vehicles in the reference case to 988 vehicles in scenario 1a).

- Barkham Road between B3349 School Road and Barkham Ride– flow increases by circa 123 vehicles in the eastbound direction (from 622 vehicles in the reference case to 745

vehicles in scenario 1a), and by 257 vehicles in the westbound direction (from 432 vehicles in the reference case to 690 vehicles in scenario 1a).

- B3030 Mole Road – northbound flow increases by 42 vehicles (from 470 vehicles in the reference case to 511 vehicles in scenario 1a), whereas southbound flow increases by 141 vehicles (from 663 vehicles in the reference case to 803 vehicles in scenario 1a).

- Hatch Farm Way – eastbound flow increase by 252 vehicles (from 798 vehicles in the reference case to 1050 vehicles in scenario 1a), and westbound flow increases by 271 vehicles (from 623 vehicles in the reference case to 894 vehicles in scenario 1a).

- B3349 Hyde End Road by up to 154 vehicles in the westbound direction (from 437 vehicles in the reference case to 111 vehicles in scenario 1a),

5.2.16 The addition of development in South Wokingham does not have as significant an influence on flow difference as Hall Farm / Loddon Valley does on the wider network, with there being some localised increases in the South Wokingham area.

5.2.17 Certain links are forecast to show a reduction in flow in Scenario 1A when compared to the base scenario:

- Lower Earley Way is forecast to have a reduction in eastbound flow from the Black Boy roundabout to Lower Earley Way/ Beeston Way roundabout, potentially attributable to increased delays along the Lower Earley Way corridor, which hinders traffic to pass through

- Easthampstead Road in South Wokingham is predicted to see a drop in traffic flow by 42 vehicles in the northbound direction and 121 vehicles in the southbound direction as the turn into/ out of Easthampstead Road from Old Wokingham Road is banned in Scenario 1A

5.2.18 In **Scenario 1B**, which has the same level of additional Local Plan Update vehicular trips loaded onto the network as Scenario 1A but includes additional mitigation, the pattern of locations of flow increases and decreases is similar to Scenario 1A.

5.2.19 Notable differences between Scenario 1B and Scenario 1A are:

- Reassignment of traffic from Eversley Road to Observer Way or circa 100 vehicles in the northbound direction

- Increased flow along Lower Earley Way North between Meldreth Way junction and Hatch Farm Way as a result of mitigation schemes introduced along this corridor. This will include a level of reassignment from local roads due to previous congestion on primary link

Local Highway Network Delay Difference

5.2.20 Appendix J presents delay difference plots between Scenario 1A, Scenario 1B and the Reference Case.

AM Peak Hour

5.2.21 In comparison with the base model, the **Reference Case** generally shows increases in delays. There are, however, very few areas where there are substantial delay increases (over 30 seconds). The modelling suggests that the impacts are related to junction operations rather than physical limitations such as bridge crossings. There are isolated locations as opposed to entire movement corridors. Notable increases in delays over 30 seconds are shown on:

- The eastbound and westbound M4 J11 off-slips

- Whitley Wood Lane approach to the B3270/ Whitley Wood Lane approach priority junction
- B3030 Mole Road approach to the Mole Road/ Mill Road/ New Road junction
- Wokingham Road eastbound approach to Loddon Bridge/ Wokingham Road junction
- The Bader Way approach from the north to the junction with the A3290
- A329 Berkshire Way approach from the east to the Jennett's Park roundabout
- Multiple junctions in Reading including junctions along the A327 and A33 and in Reading town centre

5.2.22 **Scenario 1A** with the additional Local Plan Update growth forecasts delay increases of over 30 seconds on:

- The eastbound and westbound M4 J11 off-slips
- A33 northbound approach to the Mereoak Lane junction
- Eastbound section of Lower Earley Way between Meldreth Way roundabout and Hatch Farm Way. This is likely to be attributed to the addition of traffic from Hall Farm / Loddon Valley
- King Street Lane northbound approach to the signalised junction with Hatch Farm Way
- A329(M) westbound off-slip leading to Wharfedale Roundabout
- A329(M) leading to Coppid Beech junction from the west
- B3030 Mole Road approach to the Mole Road/ Mill Road/ New Road junction
- Northbound approach to the Jennett's Park roundabout in Bracknell
- Southbound approaches from Old Wokingham Road and Heathlands Road to Nine Mile Ride
- Northbound approach to the Shinfield Road/Whitley Wood Road signalised T Junction Reading

5.2.23 **Scenario 1B** shows a similar level of delays when compared to the Reference Case. However, as the analysis presented in the next section shows, travel times reduce across the network in Scenario 1B when compared to Scenario 1A. There are also a few locations, where mitigation introduced in Scenario 1B results in a significant drop in delays, these are:

- A33 northbound approach to the Mereoak Lane junction, and
- Northbound approach from the Lower Earley Way North to the signalised junction with Hatch Farm Way.

PM Peak Hour

5.2.24 As with the AM Peak Hour, the PM Peak Hour in the Reference Case shows isolated locations where delay increases are forecast in excess of 30 seconds. The most material of these are:

- B3030 Mole Road approach to the Mole Road/ Mill Road/ New Road Roundabout
- North and south approaches to Hatch Farm Way/ King Street Lane junction

- A329(M) westbound off-slip leading to Wharfedale Roundabout
- A329(M) leading to Coppid Beech junction from the west
- Southbound approaches from Old Wokingham Road and Heathlands Road to Nine Mile Ride
- Northbound approach to Peacock Lane/Vigar Way roundabout in Bracknell
- Multiple junctions in Reading including junctions along the A327 and A33 and in Reading town centre

5.2.25 **Scenario 1A**, with the additional Local Plan Update growth, forecasts delay increases of note and greater than 30 seconds on:

- Northbound section of Lower Earley Way North between Rushey Way roundabout and Showcase gyratory
- A329(M) westbound off-slip leading to Wharfedale Roundabout
- Wokingham Road eastbound approach to Loddon Bridge/ Wokingham Road junction
- Most approaches to Coppid Beech roundabout
- Westbound approach from Peacock Lane to Waterloo Road/ Peacock Lane/ Old Wokingham Road junction

5.2.26 In **Scenario 1B**, the delay levels are comparable to those in the Reference Case. However, the subsequent analysis shows that travel times across the network are shorter in Scenario 1B compared to Scenario 1A. Furthermore, certain locations experience a substantial decrease in delays due to the mitigation measures implemented in Scenario 1B. One such location is the northbound approach from Lower Earley Way North to the signalised junction with Hatch Farm Way."

Journey Times

5.2.27 To understand the impact of the development proposals on the performance of the LRN, journey times for select routes (as shown in Figure 22) have been obtained from the WSTM4. These selected routes cover not only the primary area of interest but also extend beyond it. Appendix K includes the complete set of journey time results.

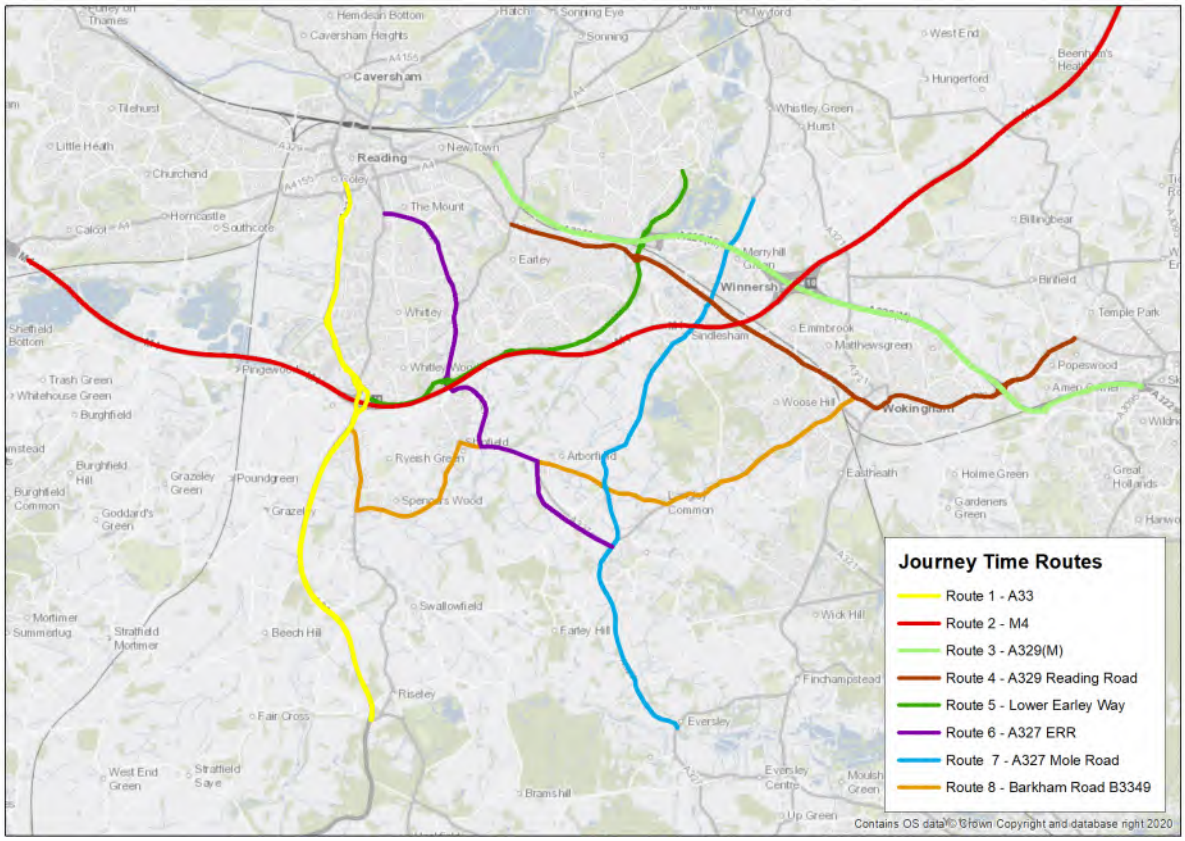


Figure 22: WSTM4 Journey Time Routes

AM Peak Hour

5.2.28 The journey time routes reviewed are forecast to be on average 14% higher than the Reference Case, with the exception of the eastbound B3270 Lower Earley Way. This could reflect a reduced demand for local trips towards M4 J10, possibly due to the implementation of the smart motorway since the base year.

5.2.29 In the Scenario 1A analysis, the impact of strategic development is apparent in comparison to the Reference Case. All routes are forecast to see a journey time increase, which are on average 9.4%, with the northbound journey time on the A33 route increasing by over five minutes in comparison to the Reference Case.

5.2.30 As would be expected, the immediate routes around Hall Farm / Loddon Valley are affected most, with increases of greater than three minutes forecast on Lower Earley Way eastbound, Mole Road northbound and Barkham Road westbound. Increases slightly further away are less pronounced, for example on the A329(M).

5.2.31 The introduction of mitigation in Scenario 1B forecasts increases in journey times when compared to the Reference Case, which are on average 7.6% and many are lower than increases in the unmitigated Scenario 1A.

5.2.32 It is estimated that the travel time on the A329(M) southbound route will increase in Scenario 1B compared to Scenario 1A by nearly two minutes. This could be due to mitigation measures in other areas, which may free up capacity and allow more vehicles to flow towards Reading Road. The change in travel times is noticeable at the intersection of A329 Wokingham Road and B3350 Church Road in Earley, but there is no significant variation in travel times elsewhere along the route.

5.2.33 To summarise, across all LRN routes, journey times increase on average by nearly 14.0% in the Reference Case when compared to 2021 Base and increase by another 9.4% in Scenario 1A with additional LPU trips. The introduction of mitigation in Scenario 1B improves travel times on average by 1.8% when compared to Scenario 1A but does not bring them down to the Reference Case level. The overall journey time increase between Scenario 1B and the Reference Case is 7.6%. The proposed mitigation at Black Boy and the new development accesses ensures the journey time in Scenario 1A is similar to the Reference Case. The mitigation for Scenario 1A at Black Boy are linked to signal optimisation and not physical measures, which are included in Scenario 1B.

PM Peak Hour

5.2.34 The Reference Case in the PM Peak Hour forecasts journey time increases on all routes, and range between 23 seconds and nearly five minutes observed on the A327 route in the northbound direction, which stretches between Arborfield and the Mount in Reading. The reason for this increase is WSTM4 takes account of the segregated cycle lane on the A327 Shinfield Road in Reading Borough. The cycleway limits link capacity and results in some reductions in junction capacity on the corridor. As traffic flows increase (in Scenario 1A/1B) this appears to result in increasing queues that extend back along the corridor adversely affecting queues and delays.

5.2.35 In Scenario 1A there are further increases in journey times on all routes, which are on average 5.6%.

5.2.36 With the addition of mitigation, Scenario 1B forecasts improvements when compared to Scenario 1A. However, for the northbound A329(M)/A3290(?), journey times are expected to increase, potentially indicating a worsening of the congestion initially identified in the Reference Case.

5.2.37 To summarise, across all LRN routes, journey times increase on average by 12.8% in the Reference Case when compared to 2021 Base and increase by another 5.6% in Scenario 1A with additional Local Plan Update trips. The introduction of mitigation in Scenario 1B improves travel times on most routes with the exception of the A327 northbound route but does not bring them down to the Reference Case level. The overall journey time increase between Scenario 1B and the Reference Case is 5.7%.

Local Highway Network Maximum Turn V/C

5.2.38 Appendix L includes these outputs. It should be noted that the results do not highlight whether the capacity constraint is on a major or minor arm of each junction, or whether there are multiple arms with capacity constraint.

5.2.39 In the **Reference Case** in the morning peak hour, it is forecast that several junctions along the A327 Shinfield Road corridor in Reading will have a Volume over Capacity (V/C) ratio exceeding 1. This congestion is expected to lessen south of the Black Boy Roundabout. These findings indicate that traffic issues are anticipated in Reading's network before considering the additional traffic from strategic development in Wokingham. As with other signalised junctions and corridors the impact can be managed across individual links and the impact down and upstream on the corridors.

5.2.40 The V/C ratios at numerous junctions around M4 J11 and in the Wokingham area near the Showcase roundabout are close to 1.0. In other locations, several junctions in Bracknell are forecast to have a V/C ratio of exactly 1, including at Jennett's Park Roundabout. In Wokingham, the Coppid Beech junction is estimated to have a turn with a V/C ratio of 0.98.

5.2.41 Under **Scenario 1A**, many of the junctions previously identified as congested are predicted to experience further performance deterioration.

5.2.42 **Scenario 1B** generally predicts a decrease in the V/C ratios, which is a result of additional mitigation measures implemented on the network, compared to Scenario 1A..

5.2.43 The results in the PM peak hour show a similar pattern.

Strategic Model Assessment Summary

5.2.44 The strategic modelling results are in line with expectations, that planned growth in traffic generated inside and outside of Wokingham Borough creates a material impact on highway network operation in Reference Case Scenario. Conditions worsen with introduction of Local Plan development particularly around Hall Farm / Loddon Valley and South Wokingham extension presented in Scenario 1A. The additional highway capacity provided in Scenario 1B is estimated to deliver betterment to travel conditions when compared to Scenario 1A.

5.2.45 Across all scenarios, the Local Plan Update development will have an effect on the highway network, but initial modelling demonstrates that most direct effects can be mitigated. At this juncture, adverse effects can be minimised through strategic interventions like the link through Hall Farm/Loddon Valley between the A327 and Lower Earley Way, along with a package of mitigation to exploit the potential for sustainable travel, building on LTP4 and My Journey. The results from the strategic model forecast that there is a benefit associated with the partial mitigation packages linked to development at Hall Farm / Loddon Valley and South Wokingham but these would fall short of nil-detriment.

5.2.46 The strategic modelling contemplates the need for new road infrastructure to ensure these are viable/deliverable and associated environmental effects can be considered. However, to align with WBC's LTP, CEAP (Climate Emergency Action Plan) and transport policies, WBC will consider where and how it is possible to embrace a 'monitor and manage' style approach to defer the need for additional road capacity and exploit opportunities to deliver sustainable transport alternatives subject to development build out and realisation of forecasted impact..

5.3 Microsimulation Model Assessment Results

5.3.1 Traditional strategic models including the WSTM4 are limited in their treatment of driver behaviour, signals and temporal segmentation. In the WSTM4 signals are modelled with fixed timings, representation of driver behaviour is simplified and represented as average across modelled morning and evening peak hours.

5.3.2 The microsimulation model developed for this project provides a much richer treatment of signals allowing for vehicle actuation. The model is based on the behaviour and interactions of individual drivers and vehicles. A microsimulation model can illustrate traffic dynamics, such as lane changes/weaving, gap acceptance, car-following and signal control, thereby capturing 'real world' delays.

5.3.3 Therefore, for this study a hybrid approach has been adopted, which is a method that integrates microsimulation and macrosimulation models. The strategic model generates traffic demand, assigns it to routes and an output provides an indication of congestion hotspots, changes in flows and delays. The microsimulation model aims to refine the results of the strategic model by considering a greater level of detail in which it represents the highway network and driver behaviour.

5.3.4 The outputs associated with the microsimulation modelling are included at the appendices referenced in each subsection below. The outputs of the microsimulation model are presented in the context of the development impact produced by the strategic model but represent a more detailed analysis on the modelled area, which stretches between M4 J11 (west) and A329 Berkshire Way (east) in Bracknell.

Journey Times

5.3.5 To understand the impact of the development proposals on the performance of the LRN, journey times for select routes have been extracted from the VISSIM model. Table 28 below compares the 2040 Reference Case and 2040 Option 1B LRN journey times. Appendix M includes the full set of results.

Table 28: Local Road Network – Microsimulation Vehicle Travel Time Results for 2040 Ref Case vs 2040 Scenario 1B

Peak	Journey Time Route	Vehicle Journey Time Route Description	2040 Ref Case (minutes)	2040 Scenario 1B(minutes)	Difference - Scenario 1B minus Ref Case (minutes)
AM Peak	1	A33 Basingstoke Road - SB	04:19	05:07	00:48
	2	A33 Basingstoke Road - NB	04:25	06:10	01:45
	5	A33 to Beeston Way	06:55	08:43	01:47
	6	Beeston Way to A33	09:17	08:36	-00:40
	7	Beeston Way to Bader Way	14:36	17:30	02:54
	8	Bader Way to Beeston Way	10:17	09:32	-00:45
	9	A329M to Peacock Lane	09:01	08:39	-00:22
	10	Peacock Lane to A329M	09:39	11:02	01:23
	11	M4 West to A33 North	03:05	04:29	01:24
	12	A33 North to M4 West	04:03	04:53	00:50
	13	M4 West to A33 South	05:58	07:43	01:45
	14	A33 South to M4 West	03:19	04:20	01:02
	Average		**07:05**	**08:04**	**00:59**
PM Peak	1	A33 Basingstoke Road - SB			-00:27
	2	A33 Basingstoke Road - NB	07:37	07:09	-00:42
	5	A33 to Beeston Way	04:53	04:11	-00:22
	6	Beeston Way to A33	09:14	08:52	-08:42
	7	Beeston Way to Bader Way	17:34	08:51	00:03
	8	Bader Way to Beeston Way	09:10	09:12	01:12
	9	A329M to Peacock Lane	09:15	10:27	01:44
	10	Peacock Lane to A329M	09:52	11:36	-01:44
	11	M4 West to A33 North	15:23	13:39	00:22
	12	A33 North to M4 West	02:33	02:55	-00:20
	13	M4 West to A33 South	07:10	06:50	01:00
	14	A33 South to M4 West	06:01	07:01	-00:02
	Average		**03:33**	**03:31**	**-00:40**

AM Peak Hour

5.3.6 During the morning peak hour, the **Reference Case** forecasts an average delay increase of 1 minute and 5 seconds across all routes on the local highway network, compared to the Base (Appendix M details results). A particularly notable increase is forecast on Route 7 heading north, which follows the B3270 Lower Earley Way from the Beeston Way roundabout to The Bader Way. Here, the delay is forecast to be nearly five minutes. The analysis indicates that this additional delay in the 2040 Reference Case is primarily due to significant congestion at the junction of Rushey Way, B3270 Lower Earley Way and Mill Lane.

5.3.7 When comparing **Scenario 1B** (Table 28), which includes additional trips from the Local Plan update and mitigation measures to the Reference Case, an average increase of 59 seconds is forecast across all routes on the LRN. The most substantial increase is expected on Route 7 heading north, where the additional development contributes an extra delay of 2 minutes and 54 seconds to the previously forecasted delay of 4 minutes and 58 seconds in the Reference Case. However, unlike the Reference Case, the additional delay in Scenario 1B is observed on the approach to the B3270 dumbbell roundabouts via Beeston Way and the eastbound approach to the Meldreth Way / B3270 roundabout.

5.3.8 As further analysis will show at the Meldreth Way roundabout, the AM queue on the approach from the west extends to 884m in Scenario 1B, an increase of 854m compared to the Reference Case. This queue does not block the upstream junction with Cutbush Lane. The

queue length and associated delays could potentially be reduced by extending the length of the flare on the eastbound approach, which is currently around 12m. Given the scale of this improvement, it will be subject to future modelling linked to the development and as such is not included within the current mitigation measures.

PM Peak Hour

5.3.9 The PM Peak Hour forecast shows an average increase across all journeys of 2 minutes 41 seconds in the **Reference Case** when compared to the Base (Appendix M details results).

5.3.10 There is a notable increase in delays of over 10 minutes along westbound Route 6 'Beeston Way to A33', which is a result of considerable queuing and slow-moving traffic on B3270 between Black Boy Roundabout and M4 J11 that is not present in the Base.

5.3.11 In the PM, Route 10 'Peacock Lane to A329M' shows a significant increase in delays of 6 minutes and 55 seconds when compared to 2021 Base. This is due to congestion on Peacock Lane on the approach from the east to the Vigar Way / Peacock Lane roundabout.

5.3.12 When comparing **Scenario 1B** with the Reference Case, there is an estimated average reduction of 40 seconds in delays across all routes. The optimisation of signals at M4 J11 and the addition of a second westbound lane on the B3270 result in a significant reduction in delays along Route 6 'Beeston Way to A33' moving westbound, which was previously identified as a congestion hotspot in the Reference Case.

5.3.13 In Scenario 1B, the optimisation of signals at the Jennett's Park roundabout also results in an improvement in the performance of the Vigar Way / Peacock Lane roundabout, which was highlighted in the Reference Case.

Delay Heatmaps

5.3.14 Appendix N includes the delay heatmap outputs. These outputs graphically illustrate modelled network performance and the analysis presented in this section describes results based on a visual comparison of the Reference Case and Scenario 1B figures. Quantitative results are presented in the next section of this report.

AM Peak Hour

5.3.15 The Reference Case and Scenario 1B show similar patterns in terms of where delays occur on the highway network.

5.3.16 In the Reference Case, expected delays are seen on the northbound approach of A33 to M4 J11 and the westbound off-slip of M4. Scenario 1B forecasts additional delays on these routes.

5.3.17 Moving further east, all approaches to the Black Boy roundabout, as well as the eastbound approaches to the Beeston Way and Meldreth Way roundabouts, show noticeable delays in Scenario 1B.

5.3.18 The closure of Mill Lane to through traffic in Scenario 1B leads to improved operation of the Lower Earley Way North/Rushey Way roundabout, which had significant queues and delays in the Reference Case.

5.3.19 Visually, the Hatch Farm Way/Lower Earley Way junction is expected to operate with the same efficiency in Scenario 1B as it did in the Reference Case.

5.3.20 Based on the heatmaps in Bracknell, the approach from the east to the Peacock Lane/Vigar Way roundabout is predicted to experience delays and queuing in Scenario 1B.

PM Peak Hour

5.3.21 In the Reference Case, delays are forecast on both the southbound and northbound approaches of A33 to M4 J11, coming from Reading and Basingstoke respectively. Scenario 1B presents a similar pattern.

5.3.22 The Reference Case forecasts delays at the Black Boy roundabout, mainly on the westbound approach, with lesser delays on the gyratory. In Scenario 1B, these delays are more pronounced, especially on the northbound and southbound approaches.

5.3.23 The Hatch Farm Way/Lower Earley Way junction is visually expected to operate as efficiently in Scenario 1B as it did in the Reference Case.

5.3.24 Delays are predicted on the westbound approach on London Road at the Coppid Beech roundabout in the Reference Case. These delays are eliminated in Scenario 1B due to subtle changes in lane configuration, spiral markings and signal optimisation.

5.3.25 At Jennett's Park roundabout, Scenario 1B forecasts an increase in delays on the A329 Berkshire Way approach compared to the Reference Case.

Average Queue Length and Delay

5.3.26 Appendix O presents results of this analysis. Not all junctions are included due to the large number of junctions in the model.

5.3.27 Across the junctions included in the analysis there is no overarching trend to which locations are affected more or less by the addition of strategic development. At some junctions average queue and delay increases on every arm in both peak hours when comparing Scenario 1B to the Reference Case. At other junctions some arms are forecast to experience an increase in delay and queuing whilst other arms at the same junction see a decrease in these metrics.

AM Peak Hour

5.3.28 Table 29 below shows the weighted average queue length and delay for selected junctions. In a microsimulation model, the weighted average queue length is a measure of traffic congestion. The weighted average queue length represents the average length of the queue across all junction arms weighted by flow estimated on those arms. The weighted average delay is another measure used to assess traffic congestion. It represents the average delay experienced by vehicles at the junction, with the average being weighted based on the volume of traffic on each arm of the junction. In other words, arms with higher traffic volumes will contribute more to the average delay than those with lower volumes.

5.3.29 Appendix O provides more detailed analysis, including queue and delay results for each individual junction arm.

Table 29: AM Peak weighted average queue lengths and delay for selected junctions

Junction	Weighted Average Queue Lengths (metres)			Weighted Delay (seconds per vehicle)		
	2040 Ref Case	2040 Scenario 1B	Difference (Scenario 1b - Ref Case)	2040 Ref Case	2040 Scenario 1b	Difference (Scenario 1b - Ref Case)
M4 Junction11	88.6	124.1	35.5	119.9	166.8	46.9
M4 Junction10	16.6	14.1	-2.5	33.6	10.1	-23.5
Basingstoke Road / Three Mile Cross	48.4	80.7	32.2	60.5	146.7	86.2
Basingstoke Road / Church Lane	24.3	27.7	3.4	42.8	57.9	15.1
Black Boy Junction	54.6	90.1	35.5	15.6	81.6	66.0
Eastern Relief Road / Hawthorn	3.6	4.2	0.6	0.1	0.6	0.5
B3270 / Meldreth Way	13.2	30.7	17.5	10.1	188.4	178.3
B3270 / Rushey Way / Mill Lane	60.8	43.2	-17.6	283.1	92.1	-191.0
B3270 / Hatch Farm Way	55.9	42.1	-13.8	89.9	171.9	81.9
A329 / B3270 / A3290	68.2	74.5	6.3	116.4	130.2	13.7
A3290 / Wharfedale Rd	15.7	27.1	11.4	15.2	77.6	62.3
Wharfedale Rd / A329M	21.3	41.2	19.9	15.4	60.5	45.1
A3290 / A329M / Bader Way	28.1	26.2	-1.9	33.9	27.7	-6.2
Brookers Hill / Shinfield Road / Hollow Lane	16.2	19.3	3.1	6.8	7.8	1.0
Coppid Beech Roundabout	35.1	26.9	-8.2	27.0	24.7	-2.3
A329 London Road / Oak Avenue	24.2	16.9	-7.3	20.5	13.4	-7.1
Jannett's Park Roundabout	18.7	42.8	24.1	27.4	92.6	65.2
Peacock Lane / Vigar Way	20.3	23.4	3.0	35.4	37.5	2.1
Peacock Lane / Osprey Avenue	18.7	58.5	39.9	15.5	77.9	62.5
Peacock Lane / Sparrowhawk Way	7.8	4.0	-3.8	5.0	2.1	-2.9
A329 London Road / William Heelas Way	32.2	26.0	-6.3	44.3	32.3	-12.0
A329 London Road / Plough Lane	4.6	6.3	1.7	2.0	8.0	6.0
B3408 London Road / Russell Chase / John Nike Way	35.6	36.8	1.2	37.4	39.5	2.0
B3270 / Beeston Way	23.4	37.1	13.7	37.0	212.7	175.7
B3270 / Cutbush Lane	8.1	16.0	7.9	3.6	12.4	8.8

5.3.30 Locations with notable comparative changes between the scenarios include:

- Basingstoke Road / Three Mile Cross signalised junction
- Overall junction delay is predicted to increase by 86 seconds. The average queue length on the northbound A33 approach is forecast to increase from 49m in the Reference Case to 187m in Scenario 1B and the average delay is estimated to increase from 41 seconds to 103 seconds. These findings align with the results presented earlier.
- Black Boy roundabout
- Overall junction delay is predicted to increase by 66 seconds. This is due to increased queue lengths on A327 Shinfield Road (north) and B3270 (east) arms.
- The average queue length on the A327 Shinfield Road arm (north) is forecast to increase from 10m in the Reference Case to 254m in Scenario 1B and the average delay is estimated to increase from 44 seconds to 134 seconds respectively with some risk that conditions could be severe.
- The average queue length on the B3270 (east) arm is forecast to increase from 20m in the Reference Case to 178m in Scenario 1B and the average delay is estimated to increase from 50 seconds to 197 seconds respectively with some risk that conditions could be severe.
- The changes on the other arms are insignificant.
- B3270 Lower Earley Way arm (west) of the Lower Earley Way /Meldreth Way roundabout

- In the morning peak hour, the average queue length on this arm is forecast to increase by 862m from 23m in the Reference Case to 884m in Scenario 1B with delays increasing from 22 to 96 seconds with some risk that conditions could be severe.

- As outlined in the 'Journey Time' results section, there is potential to mitigate these increased queue lengths and associated delays. One proposed solution is to extend the length of the flare on the approach, which is currently approximately 12 meters. This extension could potentially reduce both the queue length and the associated delays.

- B3270 Lower Earley Way arm (south) of the Lower Earley Way /Rushey Way roundabout

- As a result of the Mill Lane closure to through traffic in Scenario 1B and dualling of the Lower Earley Way North between Meldreth Way roundabout and Rushey Way roundabout, the average queue length on this arm is forecast to reduce from 564m to 142m in the Scenario 1B when compared to the Reference Case suggesting that planned mitigation could address severe risks.

- Lower Earley Way/ Hatch Farm Way signalised junction

- In Scenario 1B, the projected throughput at this junction is expected to be 37% greater than in the Reference Case. This increase, coupled with the proposed improvement scheme at this location, which reduces the number of approaching lanes on Hatch Farm Way from three to two, leads to an increase in the queues on the Hatch Farm Way arm. The queue length is expected to increase from 54m in the Reference Case to 442m in Scenario 1B. However, the impact on delays is minimal, with an increase from 53 seconds to 66 seconds.

- Showcase cinema roundabout.

- Overall delay at this junction increases by 14 seconds. Queues on the A329 Reading Road approach are forecast to increase from 413m in the Reference Case to 552m in Scenario 1B, whilst conditions could be considered severe the magnitude of change is modest. These forecasts... a result of the signal optimisation at this location, which have prioritised the A3290 and B3270 movements in the Scenario 1B with the LPU trips included. The A3290 and B3270 movements have been prioritised to reduce the likelihood of queues extending to the A329 (M) / A3290 and the Lower Earley Way / Hatch Farm Way junctions. Therefore, queuing traffic on the A329 Reading is necessary to ensure that the A329(M) / A3290 junctions operate efficiently. The Reading Road link, shows an increase in queues which fluctuates subject to timeline and wider mitigation, therefore would be monitored as mitigation can only be provided locally at the junction.

- In Bracknell, Jennett's Park roundabout is forecast to have increased queues and delays on Berkshire Way (east) arm, which leads to a 65 second overall increase in delay at the roundabout. The average queue on this approach is forecast to reach 245m in Scenario 1B (an increase from 27m in the Reference Case). The delays on the same arm increase from 24 to 125 seconds. The delay on this approach exceeds the cycle time for this junction, which is less than a minute. This means traffic on this arm could expect to wait for the second or third cycle to clear the junction. The increase in delay on this arm is due signal optimisation at this roundabout, which aimed to prioritise the flow on the Berkshire Way (west) arm, the queue from which can otherwise block Coppid Beech roundabout. A merge / diverge assessment has been undertaken for the Coppid Beech / A329 (M) southbound merge. This merge / diverge assessment shows that the current arrangement can accommodate the future Scenario 1b traffic. The full results for this merge / diverge assessment are in a separate report. Some junctions in Bracknell located south of the Jennett's Park Roundabout (e.g. Peacock Lane / Vigar Way roundabout, and Peacock Lane / Osprey Avenue, Peacock Lane / Butler Drive junction), will experience increased queueing and congestion in Scenario 1B.

PM Peak Hour

5.3.31 Table30 below shows the weighted average queue length and delay for selected junctions. Appendix O includes full queue and delay results.

Table 30: PM Peak weighted average queue lengths and delay for selected junctions

Junction	Weighted Average Queue Lengths (metres)			Weighted Delay (seconds per vehicle)		
	2040 Ref Case	2040 Scenario 1B	Difference (Scenario 1b - Ref Case)	2040 Ref Case	2040 Scenario 1b	Difference (Scenario 1b - Ref Case)
M4 Junction11	142.0	126.5	-15.5	131.5	106.3	-25.2
M4 Junction10	14.7	14.4	-0.3	40.9	50.9	10.0
Basingstoke Road / Three Mile Cross	57.8	55.7	-2.2	80.3	84.3	4.0
Basingstoke Road / Church Lane	14.6	20.0	5.4	23.6	42.2	18.6
Black Boy Junction	66.7	124.2	57.5	23.7	75.5	51.7
Eastern Relief Road / Hawthorn	6.8	9.0	2.2	1.1	8.7	7.7
B3270 / Meldreth Way	5.7	17.4	11.7	1.3	20.3	19.0
B3270 / Rushey Way / Mill Lane	38.5	10.2	-28.3	134.7	8.1	-126.5
B3270 / Hatch Farm Way	34.2	41.6	7.4	33.0	55.6	22.5
A329 / B3270 / A3290	54.8	69.2	14.4	67.1	127.4	60.3
A3290 / Wharfedale Rd	18.8	27.9	9.2	13.9	26.3	12.4
Wharfedale Rd / A329M	34.3	26.4	-7.8	26.0	26.4	0.3
A3290 / A329M / Bader Way	39.4	47.8	8.4	62.0	99.0	37.0
Brookers Hill / Shinfield Road / Hollow Lane	13.8	22.7	8.8	5.2	8.9	3.7
Coppid Beech Roundabout	45.4	55.0	9.6	84.9	37.4	-47.5
A329 London Road / Oak Avenue	21.6	25.1	3.5	21.6	23.9	2.2
Jannett's Park Roundabout	47.1	139.7	92.6	104.5	412.1	307.6
Peacock Lane / Vigar Way	28.7	35.9	7.2	43.8	92.3	48.5
Peacock Lane / Osprey Avenue	69.5	71.9	2.4	67.8	89.7	21.9
Peacock Lane / Sparrowhawk Way	7.8	5.3	-2.5	12.3	6.1	-6.3
A329 London Road / William Heelas Way	24.6	29.1	4.5	34.1	47.4	13.3
B3408 London Road / Russell Chase / John Nike Way	40.9	42.5	1.6	60.5	56.8	-3.7
Basingstoke Road / Tabby Drive	29.2	29.1	-0.1	72.4	89.1	16.7
B3270 / Beeston Way	16.8	17.0	0.2	23.3	29.2	5.9
B3270 / Cutbush Lane	9.5	14.0	4.5	6.1	104.9	98.7

5.3.32 Locations with notable comparative changes between the scenarios include:

- Black Boy roundabout

  Overall delay at this junction increases by 67 seconds. The average queue length on the A327 Shinfield Road (north) is estimated to increase from 24m in the Reference Case to 222m in Scenario 1B with some risk that conditions could be severe. At the same time, the average delay is expected to rise from 78 seconds to 188 seconds.

  On the B3270 (east), the average queue length is forecast to increase from 44m in the Reference Case to 137m in Scenario 1B. The average delay is also estimated to rise from 62 seconds to 96 seconds.

  The variations on the other arms are deemed to be negligible.

- Lower Earley Way/ Hatch Farm Way signalised junction

  A 34 second increase in overall junction delay is predicted. In Scenario 1B, the projected throughput at this junction is expected to be almost 33% greater than in the Reference Case. Whilst forecast flows are significantly higher the impact on delays and queues is minimal.

- Showcase Cinema Roundabout

  Overall junction delay is predicted to increase by 55 seconds. the queue length on the A329 Reading Road approach is estimated to rise from 237m in the Reference Case to 456m in Scenario 1B with increasing risks that conditions could become severe. This increase is due to the signal optimisation at this location, which has been designed to accommodate a higher

volume of traffic passing through the junction in Scenario 1B, which includes the LPU trips. As in the AM peak, the increase on queue lengths on the A329 Reading Road is necessary to ensure queues on the A3290 do not extend back to the A329(M) / A3290 junction.

- In Bracknell, as like the AM peak Jennett's Park roundabout will experience longer queues and delays on the eastern approach of Berkshire Way, with overall junction delay increasing by 47 seconds. Under Scenario 1B, the average queue length on this approach is expected to reach 806m, a significant increase from the 176m observed in the Reference Case. Consequently, the delay on the same route is projected to rise from 84 seconds to 507 seconds. This is a result of the signal optimisation at the roundabout, which was tested to prioritise traffic flow on the western arm of Berkshire Way to prevent blockage at the Coppid Beech roundabout.

  Additionally, a few other junctions in Bracknell, located south of the Jennett's Park Roundabout (such as the Peacock Lane / Vigar Way roundabout, and Peacock Lane / Osprey Avenue and Peacock Lane / Butler Drive junction), are also forecast to see increased queueing and congestion under Scenario 1B.

Microsimulation Model Assessment Summary

5.3.33 The microsimulation assessment completed for this study has aimed to complement the assessment using the WSTM4 by allowing a much richer treatment of signals and travel behaviour. Changes in journey times, delays and average queue lengths have been considered.

5.3.34 Overall, the analysis presented has demonstrated that the network with additional Local Plan Update development and mitigation can operate reasonably well despite a slight deterioration on some local routes when Scenario 1B (with Local Plan update growth) is compared to the Reference Case.

5.3.35 Changes in queues and delays have been quantified at a number of locations across the area of interest. There is no overarching trend to which locations are affected more or less by the addition of strategic development. At some junctions and junction approaches average queue and delays increase when comparing Scenario 1B to the Reference Case. At other junctions some arms are forecast to experience a reduction in delay and queuing.

5.4 Local Junction Modelling Results

5.4.1 Three junctions falling outside of the microsimulation modelled area have been assessed using standalone junction models created in the industry standard software packages respectively noted below. These are:

- A327 / Arborfield Road / Eastern Relief Road (Junctions 10)
- A327 / Reading Road / Observer Way (Junctions 10)
- Winnersh Crossroads (LinSig)

5.4.2 The effect of proposed strategic development and the mitigation package in Scenario 1B has been assessed against the Reference Case.

Junction A327 / Arborfield Road / Eastern Relief Road

5.4.3 The A327 / Arborfield Road / Eastern Relief Road junction has been modelled to include the improvement scheme which has been recently implemented as part of an existing permitted local application. As seen from the results presented in Appendix P the junction in 2040 Scenario 1B, with the LPU growth included, still operates within acceptable parameters, however, all the approaches will experience an increase in delays due to additional development trips. The greatest increase in delay and queue observed is on the Eastern Relief Road in the PM peak. Here queue lengths increase from 1 to 6 PCUs and delay increases from 7 to 21 seconds.

Junction A327 / Reading Road / Observer Way

5.4.4 A scheme has been prepared for the A327 / Reading Road / Observer Way junction which provides an additional arm serving the Hall Farm / Loddon Valley development as well as an increased ICD (to 60m) to provide additional capacity.

5.4.5 The results in Appendix P show that, under the 2040 Scenario 1B, the majority of junction arms continue to function within the acceptable limits despite all the approaches expected to see increased delays due to the addition of trips from new development. The A327 Reading Road approach from the west stands out as it is projected to experience an increase in its RFC from 0.64 in the Reference Case to 0.93 in Scenario 1B, while delay on this arm increases from 6 to 29 seconds. This indicates that it may be approaching capacity in 2040 with the inclusion of the LPU development growth.

Winnersh Crossroads

5.4.6 The A329/B3030 Winnersh Crossroads junction is considered to provide the optimal traffic capacity whilst preserving active travel connections, so the validated model has been updated with the Reference Case and Scenario 1B flows. The model was allowed to reoptimise the cycle times and signal timings for each scenario, as it is expected that wider mitigation proposals will redistribute some traffic thereby supporting some reallocation of green times to other movements within the junction.

5.4.7 The data presented in Appendix P indicates that the Degree of Saturation (DoS) is expected to stay under 90% during both morning (AM) and evening (PM) peaks in the Reference Case scenarios. In the case of Scenario 1B, the DoS is forecast to stay under 90% during the AM peak. However, during the PM peak, the DoS is estimated to exceed 93% for half of the junction movements. Consequently, when the DoS value goes beyond 90% for any lane in the network, the Practical Reserve Capacity (PRC) begins to fall into negative figures.

5.4.8 Significantly, the results of the assessments do not change materially between the Reference Case and Scenario 1B.

5.5 Local Plan Update Development Summary

Hall Farm / Loddon Valley

5.5.1 The modelling assessments forecast that prior to the addition of strategic development on the highway network, there will be constraints across the LRN. The traffic associated with the Hall Farm / Loddon Valley development will add significant demand to key corridors in the immediate vicinity, including A327, Barkham Road, Lower Earley Way in Scenario 1A without mitigation. However, with the mitigation set out in Scenario 1B a substantial amount of alleviation is delivered.

5.5.2 Though the impact of the development is substantially mitigated, there is limited scope on the network to provide a level of highway improvement which would achieve nil detriment. However, the connections through the site between the A327 and B3030 Mole Road to B3270 Lower Earley Way and Hatch Farm Way offer huge potential to redistribute traffic away from congested areas. To achieve this, these streets must preserve a 30mph design speed. . Stantec recommends that if the development is to proceed further, a strong focus is placed on measures which can deliver a high proportion of trips being made on foot, by cycle and by public transport, with a Monitor and Manage approach being used to trigger highway interventions only when unavoidable, or where sustainable transport measures ultimately prove unsuccessful.

South Wokingham Extension Development Summary

5.5.3 The impact associated with the South Wokingham SDL extension is less pronounced on the local network than Hall Farm / Loddon Valley, but there are notable locations which should be considered as part of a future planning application.

5.5.4 Impacts on Coppid Beech roundabout and local junctions in Bracknell (e.g. Jennett's Park roundabout, Peacock Lane / Vigar Way roundabout, Peacock Lane / Osprey Avenue and Peacock Lane / Butler Drive junction) could potentially be material if there is not enough focus given on ensuring trips from the SDL extension are made via sustainable modes where possible. A scenario testing approach would be helpful as part of a Transport Assessment for the site, to consider any additional highways improvements which might be required should the sustainable mode shares which are targeted in due course not be attainable.

6 Strategic Road Network Analysis

6.1 Introduction

6.1.1 This section presents an analysis of the SRN in the vicinity of the proposed strategic developments.

6.2 Discussion with National Highways

6.2.1 Stantec and WBC have engaged with National Highways regarding the developments being considered for inclusion in the Local Plan Update. The approach to the assessment was discussed at several Microsoft Teams based meetings, which took place in late 2021- early 2022 attended by representative of WBC, Stantec, National Highways and the latter's consultant, Jacobs.

6.2.2 Subsequently, WBC shared the findings of a transport assessment conducted in 2023 with National Highways. National Highways provided feedback on these findings. The revised models referenced in this document have intended to address the feedback from National Highways on the modelling.

6.3 M4 Mainline Operation

6.3.1 The WSTM4 assessment outputs show there to be immaterial changes in flows or journey times along the M4 within any of the development scenarios in comparison to the Reference Case within the AM and PM Peaks.

6.3.2 Appendix H includes the flow difference outputs extracted from the WSTM4. These consider Scenario 1A and 1B against the Reference Case. The Reference Case has also been compared against Base.

6.3.3 In the Reference Case in the AM Peak hour there are substantial flow increases forecast on the M4 mainline in comparison to the base scenario, reflecting the significance of the smart motorway upgrade since the 2021 Base scenario.

6.3.4 Scenario 1A (with LPU growth) will see an additional 7,518 vehicles trips added to the model network in the AM peak hour. However, the flow increases on the M4 mainline between J11 and J10 will be immaterial, the flow is forecast to increase by a maximum of 36 vehicles on the M4 westbound between J10 and J11 direction (from 5,408 vehicles in the reference case to 5,444 vehicles in scenario 1a). In the PM peak hour with the addition of 5,869 vehicle trips on the model network, the flow increase on the same section of the M4 is forecast to be 21 vehicles in the eastbound direction (from 4,999 vehicles in the reference case to 5,019 vehicles in scenario 1a) and 56 vehicles in the westbound direction (from 5,818 vehicles in the reference case to 5,875 vehicles in scenario 1a).

6.3.5 In Scenario 1B, which has the same level of LPU vehicular trips loaded onto the network as Scenario 1A but includes additional mitigation, the magnitude of flow changes is similar to those in Scenario 1A. In the AM peak hour, the flow changes range between 8 vehicles and 68 vehicles and in the PM peak, the flow changes are between -39 and 65 vehicles.

6.3.6 To understand the impact of the development proposals on the performance of the M4 mainline, journey times have been extracted from the WSTM4. The M4 routes cover the section of motorway between M4 J12 and J8/9. Appendix K includes the full results.

6.3.7 The impact of the removal of traffic management measures for smart motorway roadworks is apparent, as in both peak hours the model is forecasting a material decrease in journey time in both directions in the Reference Case when compared to the base.

6.3.8 In the Scenario 1A analysis, the impact of strategic development on travel times on the M4 mainline is immaterial (+0.1% on average) in comparison to the Reference Case.

6.3.9 The introduction of mitigation in Scenario 1B forecasts immaterial changes in journey times when compared to Scenario 1A (less than 2 seconds on each route).

6.3.10 More detailed assessment of the M4 mainline operation was undertaken using the microsimulation model with journey time results presented in Appendix M (routes 3 and 4). The results show that in Scenario 1B (with the development and mitigation included) journey times are lower than Reference Case modelled journey times, which is largely the impact of further optimisation of M4 J11 signal timings in Scenario 1B to manage queueing at this location.

6.4 M4 Junction 11 Operation

6.4.1 In the WSTM4 reference case models, J11 is forecast to have a maximum turn V/C ranging from 0.89 to 0.97 on certain sections of the junction in the AM Peak Hour and 0.87 to 1.0 in the PM peak hour. The max V/Cs across the junction are shown as being tidal to Reading, with the AM Peak A33 northbound approach nodes being flagged, whilst PM Peak southbound approach nodes are flagged. This indicates that parts of the junction will be approaching capacity before the introduction of the LPU development and there is a likelihood of queuing and delay.

6.4.2 With the introduction of traffic from LPU development in Scenario 1A, the V/Cs at J11 are predicted to slightly worsen, with some locations showing a V/C exceeding 1.0. In Scenario 1B, the implementation of mitigation measures at M4 J11 and other parts of the highway network slightly improve the maximum V/Cs and bring the predicted operation of the junction closer to that in the Reference Case.

6.4.3 The WSTM4 results indicate that the junction is close to capacity across all scenarios, however the LP scenario 1B does not show any significant net detriment in comparison to the Reference Case due to significant level of mitigation included in Scenario 1B.

6.4.4 The VISSIM microsimulation model shows that during the morning peak hour, the average queue length on the eastbound off-slip from the M4 increases from 43m in the Reference Case to 202m in Scenario 1B. However, during the evening peak hour, the changes on this off-slip or other junction approaches are not as high as they are in the morning. The junction's optimisation in Scenario 1B, along with the addition of an extra westbound lane on the B3270, results in decreased queues and delays on the B3270 approach.

6.4.5 The negligible impact of LPU development on M4 J11 is further demonstrated by the journey time routes in Scenario 1B, which show either reduced or similar journey times compared to the Reference Case.

6.5 M4 Junction 10 Operation

6.5.1 Junction 10 shows no issues with Max V/C or absolute delay at any of the merges within the WSTM4 model in the Reference Case or any of the assessment scenarios. Within the VISSIM model the delay heatmaps indicate the model operating within capacity and predominantly free flow conditions being observed within the Reference case and the Scenario 1B model.

6.6 Section Summary

6.6.1 The analysis conducted using the strategic model and the microsimulation model has shown that the proposed level of development could be accommodated on the SRN.

6.6.2 There are immaterial changes in flows or journey times along the M4 within any of the development scenarios in comparison to the Reference Case in both peaks.

6.6.3 The M4 J11 improvements (2004) were developed to support growth to 2026 so it is unsurprising these are forecast to operate close to capacity in the Reference Case. The LP scenarios supported by the introduction of the associated mitigation measures (as listed below) are not showing a significant net detriment on the junction performance in comparison to the Reference Case.

- signal optimisation of the junction,
- the addition of the extra turn lane onto the B3270 and
- the addition of extra westbound lane on the B3270 approach.

6.6.4 The analysis of the M4 J10 demonstrates that it would operate within capacity with predominantly free flow conditions forecast within the Reference case and the Scenario 1B models.

7 Summary and Conclusion

7.1 Summary

7.1.1 Stantec has been appointed by Wokingham Borough Council (WBC) to provide transport support in relation to the development of WBC's Local Plan Update (LPU).

7.1.2 Following the original study, at the end of 2021 Stantec was commissioned by WBC and Homes England to refine the transport assessment to evaluate further the major development option known as Hall Farm / Loddon Valley (Hall Farm, Hatch Farm and Four Valleys Development). The assessment was undertaken for a forecast year of 2038 representing the final year of the Local Plan Update (LPU) at the time the study was scoped. The findings of the study were reported in the "Wokingham Local Plan Update. Local Highway Network and M4 Corridor - Transport Assessment Report", May 2023.

7.1.3 This document updates the findings from the earlier study conducted between 2021-2023. It includes updates such as a new forecast year of 2040, now the final year of the LPU, and amendments to the LPU's development quantum and the masterplans of the development sites.

7.1.4 Three assessment scenarios have been considered:

- Reference Case: includes planned development outside Wokingham borough, committed development and infrastructure in the borough (including 2026 LP) but no Hall Farm / Loddon Valley development or other Local Plan Update development.
- Development Scenario (Scenario 1A): Reference Case plus Hall Farm/ Loddon Valley development (3,930 dwellings) and other Local Plan Update development (i.e. South Wokingham SDL extension site which totals 1,150 houses, and other smaller Local Plan Update site allocations with a total quantum of 3,762 dwellings); the on-site infrastructure is included. For avoidance of doubt, larger strategic options at Ashridge and Twyford are not included/modelled.
- Development Scenario with mitigation (Scenario 1B): this is based on Development Scenario but includes additional mitigation that may be required to deliver additional housing and employment.

7.1.5 A three-tier modelling framework has been adopted, which included strategic modelling, microsimulation modelling and local junction modelling. The framework has leveraged the strengths of each modelling tier. Tier 1, strategic modelling, has been used to forecast the wider impacts of the LPU development and to identify key pressure points. Tier 2, microsimulation modelling, further details the assessment by accounting for network details and driver behaviour. And Tier 3 (local junction modelling) informs Tier 1 and Tier 2 modelling by feeding operational details such as optimised signal timings or acting as an independent assessment tool in the area falling outside of the microsimulation model study area.

- Strategic Modelling – this used the existing Wokingham Strategic Transport Model (WSTM4), which was refined and updated in the study area to represent November 2021 travel conditions and a set of 2040 forecast scenarios (end of the new Local Plan period).
- Microsimulation Modelling – this involved development of a new microsimulation model in VISSIM, which covers a wide area between Bracknell and M4 J11; the model was developed using November 2021 data.
- Junction Models – Existing and new standalone junction models have been used to inform the development of the microsimulation and strategic models as well as to assess individual junctions not covered by the VISSIM model at a more localised level.

7.1.6 The quantum and land uses at the Hall Farm / Loddon Valley site offer an opportunity for trips to be internalised to that site, and also for a proportion of trips associated with the development to be made via sustainable modes. Therefore a series of assumptions have been made in these respects for internalisation of a proportion of vehicle trips associated with the local centres, primary and secondary schools, employment and the proposed sports centre. The potential local centre and one 1 FE Primary School at the South Wokingham SDL extension also allows for a degree of trip internalisation.

7.1.7 It will be extremely important to provide a series of sustainable transport measures in and around the Hall Farm / Loddon Valley development in order to limit dependence on private car. One key measure would be a Rapid Transport System (RTS) which could deliver a high frequency service connecting locations within the development to key destinations outside. This should include local railway stations, so as to enable public transport to be an attractive option for journeys beyond the immediate vicinity of the proposed development. The RTS will initially be established as a bus service, but in future could be adapted to serve new technologies, for instance autonomous shuttles.

7.1.8 The provision of comprehensive pedestrian and cycle routes on-site and locally will also be a key factor in encouraging the use of sustainable modes, when combined with measures such as WBC's existing My Journey initiative.

7.1.9 Based on research undertaken by Stantec, a 7% reduction in car trips generated by Hall Farm / Loddon Valley and the South Wokingham extension has been adopted, as well as a borough wide reduction of 5.5%. The additional 1.5% for Hall Farm/Loddon Valley and South Wokingham extension is considered to be conservative given the opportunities which the site locations offer but allows for a robust assessment of highway impact.

7.1.10 In mitigating the impact of the strategic developments on the highway network, the starting point for this study was the concept mitigation included within Stantec's 2021 assessment. Using the 2021 package as a start point, this study has refined that package further, adding some additional mitigation, and modifying some of the previously included concepts.

Local Highway Network Analysis

Strategic Model Assessment Summary

7.1.11 The modelling forecasts that planned growth in traffic generated inside and outside of Wokingham Borough creates a material impact on highway network operation in Reference Case Scenario. This worsens with the introduction of additional growth at Hall Farm / Loddon Valley, South Wokingham Extension and other sites spread across the borough in Scenario 1A. The additional highway capacity provided in Scenario 1B is estimated to deliver betterment to travel conditions when compared to Scenario 1A.

7.1.12 Across all scenarios, the development at Hall Farm and additional development at South Wokingham will have material effects on the highway network, but initial modelling demonstrates that most direct effects can be mitigated. At this juncture, strategic interventions like the link through Hall Farm between the A327 and Lower Earley Way along with a package of mitigation to exploit the potential for sustainable travel, building on LTP4 and My Journey, will minimise adverse effects. WBC will expect to work with neighbouring authorities to manage residual effects on the network, if forecast demand is forthcoming, so as to minimise requirement for highway improvements and promote sustainable measures. This would be explored further as part of the IDP and viability assessments and follow a monitor and manage approach both inside the borough and with neighbouring authorities.

7.1.13 The results from the strategic model forecast that there is a material benefit associated with the mitigation packages linked to development at Hall Farm / Loddon Valley and South Wokingham. They also demonstrate that the mitigation will not create a nil detriment situation. This is not unexpected given that the majority of highway impacts fall on existing areas, where the scope to provide improvement is limited.

Microsimulation Model Assessment Summary

7.1.14 The microsimulation assessment completed for this study has aimed to complement the assessment using the WSTM4 by allowing a much richer treatment of signals and travel behaviour. Changes in journey times, delays and average queue lengths have been considered.

7.1.15 During the preparation of the microsimulation model, Scenario 1A failed to converge. Despite a number of attempts to resolve this, the convergence failed to improve, effectively indicating that the network within the model is saturated and that substantial mitigation is required. Scenario 1B, which includes mitigation, converges and complies with the accepted standards and criteria.

7.1.16 Overall, the analysis presented has demonstrated that the network with additional LPU development and mitigation can operate reasonably well despite a slight deterioration on some local routes when Scenario 1B (with LPU growth) is compared to the Reference Case.

7.1.17 There is no overarching trend to which locations are affected more or less by the addition of strategic development. At some junctions and junction approaches average queue and delays increase when comparing Scenario 1B to the Reference Case. At other junctions some arms are forecast to experience a reduction in delay and queuing.

Strategic Road Network Analysis

7.1.18 The analysis conducted using the strategic model and the microsimulation model has shown that the proposed level of development could be accommodated on the SRN. There are immaterial changes in flows or journey times along the M4 within any of the development scenarios in comparison to the Reference Case in both peaks.

7.1.19 M4 J11 is forecast to operate close to capacity in the Reference Case, where the RBC LP considered mitigations in WBC through enhanced Park & Ride and other mode shift mitigation. The LP scenarios do not show any significant net detriment on the junction performance in comparison to the Reference Case, which is due to signal optimisation of the junction and the addition of the extra turn lane onto the B3270.

7.1.20 The analysis of M4 J10 forecasts that it would operate within capacity with predominantly free flow conditions forecast the Reference case and the Scenario 1B models.

7.2 Conclusion

7.2.1 The strategic and microsimulation modelling assessments both forecast that in a scenario where unmitigated strategic development takes place at Hall Farm / Loddon Valley, there will be a significant impact to the local highway network, to the point where some parts of the network are likely to become locked for large parts of the AM peak hour.

7.2.2 The provision of the concept mitigation package for Hall Farm / Loddon Valley as set out in this report will substantially improve this situation, with forecasts showing that queuing and delay will be significantly reduced. Notwithstanding this, it is forecast that there will still be locations at which conditions such as queuing and delay will be greater than in the Reference Case scenario, with the forecasts showing that the mitigation package does not return the network to a nil detriment situation.

7.2.3 Due to its smaller scale, the South Wokingham SDL extension does not have the same level of impact on the highway network, but there will be some improvements required nonetheless.

7.2.4 As a highway impact study, this assessment has been conservative about the opportunities to achieve modal shift from private car to sustainable modes such as walking, cycling and public transport. WBC will be promoting the development and delivery of more sustainable travel measures to influence travel patterns throughout the plan period through ongoing policy's and through the planning application process.

7.2.5 Overall, the conclusion is that the proposed quantum and locations of local plan development can be accommodated on the highway network with the proposed package of mitigation and sustainable transport measures on the premise that it is accepted that the vehicular impact generally mitigated across the wider road network, but certain localised junctions may not be fully mitigated and will need to be considered as part of the planning application process or a monitoring process to asses, if the forecast impact is forthcoming. This seeks to consider the councils commitment to promote sustainable travel schemes over highway improvements were possible.