

# Evaluation of Transport Impacts Study to inform the Vale of White Horse District Council Local Plan 2031: Part 1 Strategic Sites and Policies

**ATKINS**

## Final Report

Oxfordshire County Council

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# Notice

This document and its contents have been prepared and are intended solely for Vale of White Horse District Council's information, working in partnership with Oxfordshire County Council, to inform the Vale of White Horse Evaluation of Transport Impacts (ETI) Study.

The ETI work has been completed iteratively with early stages being prepared by CH2M Hill and later stages being prepared by Atkins Limited. The Vale of White Horse District Council and Oxfordshire County Council are content that the different stages have been prepared using consistent methodology and approaches and form an effective assessment of transport impacts of the Local Plan 2031

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Stage 3 work has to date been undertaken by Atkins Limited and for consistency has used the highway model files provided by CH2M Hill. Atkins Limited created highway demand to reflect the proposed VOWH Local Plan 2031 Development Sites but used the existing underlying matrices and highway network the model files as found and produced outputs in accordance with the methodologies adopted in previous stages and therefore cannot be responsible for any omissions or errors in the resulting from work prior to Atkins Limited's involvement or that have influenced Atkins Limited's involvement for Stage 3.

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This document has 69 pages including the cover.

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# Executive summary

- 1 The Local Plan 2031 sets out a policy framework for the delivery of sustainable development across the Vale of White Horse (VoWH) district up to 2031. It sets out the spatial strategy and strategic policies for the district to deliver sustainable development. It identifies the number of new homes and jobs to be provided in the area and makes provision for retail, leisure and commercial development and the infrastructure needed to support them.
- 2 The Evaluation of Transport Impacts (ETI) has been undertaken to inform the selection of strategic development sites to be allocated in the Local Plan 2031 and to help identify a package of highway mitigation to ensure the plan contributes towards the delivery of sustainable development.
- 3 The ETI work has focused upon the highway impact of the Local Plan assessed in five stages. Stage 1 of the ETI focused on the South East Plan levels of development and devised a mitigation package to address issues associated with this development in VoWH. Work to inform the selection of strategic development sites started in Stage 2 by investigating the impacts of possible upper limits of development in geographic clusters within VoWH. This, along with considerations of Landscape Capacity Study, Strategic Flood Risk Assessment, Sustainability Appraisal and the Green Belt Review resulted in a distribution for the full allocation of strategic development sites that was tested in Stage 3 and was subsequently consulted on. Stage 4, in response to the consultation, tested the impact of additional sites over and above the strategic allocation. Further revisions, in light of transport and wider issues, resulted in the final strategic development sites. These were tested as part of Stage 5 and mitigation options considered both medium and larger scale highway improvements. Whilst public transport and smarter choices do form part of the mitigation package, they were not tested as the approach adopted focused upon highways-only modelling.

## ETI Stage 1

- 4 The VoWH District Council published a complete draft of their emerging local plan in February 2013. This was based on the South East Plan<sup>1</sup> and set out a housing target for 13,294 new homes and provision for 14,300 new jobs. The ETI was used to test the proposed growth to help the council understand the impact of the emerging plan on the highway network and to ensure that any appropriate mitigation was identified and included within the plan.
- 5 From the work carried out to test the highway impact of the levels and distribution of growth across the Vale, it has been shown that the package of strategic highway measures provide appropriate levels of mitigation, that is considered both affordable and deliverable with the plan time period. However, even with these planned measures, it is recognised that some parts of the network would still have issues to be addressed, both through further consideration of sustainable transport improvements, and focused highway improvements.
- 6 This assessment, referred to as ETI Stage 1 is the benchmark against which the other stages are tested.

## ETI Stage 2

- 7 In response to the Oxfordshire SHMA, which set out an objectively assessed need for 20,560 new homes across the VoWH up to 2031, ETI Stage 2 tested a total of 27 sites grouped into five geographical clusters. Each site was tested at the theoretical maximum of development that the sites could accommodate if all constraints were ignored. This ensured the ETI tested the 'worst case' scenario for each geographical group of sites. This approach also ensured that VoWH District Council

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<sup>1</sup> Regional Strategies (such as the South East Plan) were deleted from planning policy during 2013. Local Authorities have since been given responsibility for identifying an appropriate housing target for their council area to be informed by an up-to-date Strategic Housing Market Assessment (SHMA).

had a good understanding of transport impacts associated with the development to inform site selection, alongside other evidence, for inclusion within the consultation. It is important to remember that the selection of sites was informed by a range of factors.

### ETI Stage 3

- 8 The work undertaken as part of Stage 2 helped to inform the selection of sites which was consulted upon as part of the Housing Delivery Update (February 2014). The Stage 3 modelling work enabled VoWH District Council to fully understand the impacts of the new housing target (20,560 homes up to 2031).
- 9 The level of development associated with the Housing Delivery Update Consultation February 2014 (ETI Stage 3) is forecast to result in a 4% increase in journey distance in the morning peak as a result of journeys being made on longer and possibly less-suitable routes to avoid congestion compared to ETI Stage 1. This level and distribution of growth is also forecast to result in a 10% increase in delay in the morning peak and an 8% increase in the evening peak; with network speeds in the Vale dropping by 3% and 2% in the morning and evening peak respectively compared to ETI Stage 1.

### ETI Stage 4

- 10 A further stage of additional site testing was conducted following the Housing Delivery Update, as some new sites were identified through the consultation process. These additional sites were tested to ensure all reasonable alternatives had been considered and the VoWH District Council was able to use an understanding of highway impact on their final selection of sites for inclusion within the final draft (Publication Version) of the Local Plan.
- 11 This fourth stage of ETI tested seven new site options for possible inclusion within the final draft (Publication Version) Local Plan. Two of these sites could accommodate significant levels of growth and consequentially are associated with more significant impacts on the highway network. However, highway impact is only one factor used to determine the suitability of sites and this is particularly true for the sites tested at Stage 4 of the ETI. The conclusion of this stage led to the final allocation and distribution of sites that form the Local Plan - Publication Version (November 2014).

### ETI Stage 5

- 12 The testing of the Stage 5 scenario consisted of a distribution of 20,560 homes and 23,000 jobs in the Vale along with South East Plan levels of development in the other districts in Oxfordshire. A test without additional highway mitigation was undertaken to understand the impact of the development on the highway network. This led to the formulation of three highway mitigation scenarios: one medium scale scenario and two larger scale scenarios.
- 13 The medium scale schemes (Stage 5A) aimed to address traffic problems on the A417, A420, A338 and A4130 whilst larger scale schemes focused on potential approaches to managing traffic between Oxford, Abingdon and Didcot. These large scale schemes focused on addressing problems on the A34 in two ways: one option (Stage 5B) considering diverting traffic away from the A34 by an improved crossing near Culham, utilising the A415 and A4074 as alternative routes between Didcot, Oxford and Abingdon whilst the other option (Stage 5C) considers widening the A34 between Hinksey Hill and Milton Interchanges.
- 14 The highway transport demand associated with Stage 5, but without additional mitigation, is forecast to generate approximately 6% more delay in the morning peak hour and 4% more delay in the evening peak hour compared with Stage 1. The incremental addition of Scenario 5A is still forecast to result in delay approximately 1-2% greater than the Stage 1 results in the morning and evening peak hour.
- 15 The addition of the larger scheme under Stage 5B reduces delay by 6% and 5% in the morning peak hour and evening peak hour respectively compared with Stage 1. The addition of the larger scheme under Stage 5C reduces delay by 5% in the morning peak hour and 8% in the evening peak hour respectively relative to the Stage 1 results. This suggests that within the VoWH, while the A34

intervention would have the greatest impact, the scenario with a new Culham Crossing and a Clifton Hampden Bypass (Stage 5B) makes the greater contribution to reducing forecast levels of delay on the county highway network than the A34 Widening between Hinksey and Milton scenario.

- 16 The scenario of widening the A34 (Stage 5C) has a marginally greater impact in the VoWH, however, these impacts would not be realised without junction improvements and a scheme to alleviate the congestion around the Oxford Western bypass section. Significant improvements to the A34 are, and need to be, assessed as a holistic corridor. The scale of such an intervention is likely to be a long term and complex project. It is for this reason, coupled with the wider local connectivity benefits, that the Culham crossing and Clifton Hampden Bypass (Stage 5B) is considered by Oxfordshire County Council (OCC) to be a more appropriate scheme to form part of this transport strategy.
- 17 The addition of the new Culham Crossing and a Clifton Hampden Bypass forecast an improvement on the A34 and on the local road network between Didcot and Oxford, although the testing revealed that a number of residual congestion issues remained despite the mitigation. The various corridor schemes that are being developed will need to consider those residual impacts and direct mitigation by relevant developers should also form part of the mitigation of these problems and those identified as part of the planning application process.
- 18 In addition to the package of strategic highway schemes listed above a range of schemes are either being delivered or are programmed for delivery to improve travel by sustainable modes. These align with OCC's Local Transport Plan 3 (LTP3) objectives which include reducing congestion; improving accessibility to work, education and services; reducing carbon emissions from transport and developing and increasing the use of public transport, walking and cycling. Publication of the updated Local Transport Plan (LTP4) in 2015 includes commitments to complete feasibility work, detailed designs and implement the schemes identified as being required for the Local Plan Publication Version/ETI Stage 5.
- 19 Having tested the highway impact of the Local Plan growth proposals, it is clear that the Stage 5 ETI mitigation package largely mitigates the additional network impacts, compared to those in Stage 1. However, some congestion issues remain across the Vale as described in this report.

# 1. Introduction

## 1.1. Background

- 1.1.1. This report sets out the main findings of the Evaluation of Transport Impacts (ETI) Study that has informed the preparation of the Vale of White Horse District Council Local Plan 2031 Part 1: Strategic Sites and Policies<sup>2</sup>.
- 1.1.2. The Local Plan 2031 sets out a policy framework for the delivery of sustainable development across the district up to 2031. It sets out the spatial strategy and strategic policies for the district to deliver sustainable development. It identifies the number of new homes and jobs to be provided in the area and makes provision for retail, leisure and commercial development and the infrastructure needed to support them.
- 1.1.3. One of the main purposes of the ETI has been to inform the selection of strategic development sites to be allocated in the Local Plan 2031 and to help identify a package of highway mitigation to ensure the plan contributes towards the delivery of sustainable development. The ETI forms part of the evidence base to inform the Local Plan 2031 alongside other evidence, including: Landscape Capacity Study, Strategic Flood Risk Assessment, Sustainability Appraisal, Green Belt Review, and others.

## 1.2. ETI Process

- 1.2.1. The ETI and Local Plan have been prepared iteratively to inform each stage of the process (Table 1-1). This has ensured that the VoWH District Council has a detailed understanding of the impact of their proposals on the highway network at each stage of developing the Local Plan 2031. An understanding of transport impacts has therefore been used, for example, to inform the selection of strategic development sites to be allocated in the Local Plan 2031.
- 1.2.2. The process focuses upon the impacts of development scenarios on the highway network. The early stages of the ETI was undertaken by the consultants CH2M Hill, using the Central Oxfordshire Transport Model (COTM). COTM is a multi-modal model and allows mode choice and trip frequency choice to be tested, based upon costs of travel, and this is reflected in the demand for highway travel. In contrast, the later stages of work were undertaken by the consultants Atkins, using the highway aspects of the COTM only. Checks were made to ensure that the results were consistent across both approaches and similar conclusions would be drawn regardless of the approach adopted.
- 1.2.3. The purpose of the ETI was to inform the selection of strategic development sites to be allocated in the Local Plan 2031. The Local Plan includes the allocation of land for employment. The levels and location of employment are shown in Appendix A.

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<sup>2</sup> The plan period for the Vale Local Plan was originally 2011 to 2029. This was altered in 2014 to become 2011 to 2031 and is referred to throughout this report as the Local Plan 2031.

## 1.3. Scope of the report

- 1.3.1. This report sets out the main findings of the Evaluation of Transport Impacts (ETI) Study. The ETI has followed the local plan process and has five main stages, which are mapped together in Table 1-1. Stage 1 of the ETI focused on the South East Plan levels of development and devised a mitigation package to address issues associated with this development in VoWH. Work to inform the selection of strategic development sites started in Stage 2 by investigating the impacts of possible upper limits of development in geographic clusters within VoWH. This, along with considerations of Landscape Capacity Study, Strategic Flood Risk Assessment, Sustainability Appraisal and the Green Belt Review resulted in a distribution for the full allocation of strategic development sites that was tested in Stage 3 and subsequently consulted on. Stage 4, in response to the consultation, tested the impact of additional sites over and above the strategic allocation. Further revisions, in light of transport and wider issues, resulted in the final strategic development sites. These were tested as part of Stage 5 and mitigation options considered as part of stages 5A, 5B and 5C.
- 1.3.2. This report describes the modelling approach and five stages in the following sections:
- The approach to modelling is described in Chapter 2, which presents an overview of the processes adopted and introduces the model outputs used in the following chapters;
  - ETI Stage 1 (Draft Local Plan Consultation February 2013), is described in Chapter 3. Although this work was originally undertaken by the consultants CH2M Hill, the work presented in this Chapter has been undertaken by Atkins to ensure consistent results between this stage and others to follow. Importantly, the conclusions are consistent with those previously reported.
  - ETI Stage 2 (Assessment of Additional Site Options 2013), is described in Chapter 4 and has been copied directly from work undertaken by the consultants CH2M Hill.
  - ETI Stage 3 (Housing Delivery Update February 2014), is presented in Chapter 5 and was the first ETI Stage undertaken by Atkins. It was the first to include the levels of housing identified in the Oxfordshire Strategic Housing Market Assessment (SHMA) and was consulted upon in spring 2014.
  - ETI Stage 4 (Assessment of Additional Site Options 2014), was undertaken to explore additional options following the consultation and is described in Chapter 6.
  - ETI Stage 5 (Local Plan - Publication Version November 2014), is presented in Chapter 7 and describes the impacts of the final proposed strategic development site package and the performance of the final highway mitigation package.
  - Chapter 8 summarises the whole study.

**Table 1-1 Local Plan and ETI Stage Map**

Date	Local Plan Stage	ETI Stage
<p><b>February 2013</b></p>	<p><b>Draft Local Plan Consultation (Feb 13)</b></p> <ul style="list-style-type: none"> <li>• This was the first complete draft of the local plan published for consultation.</li> <li>• It was based on the South East Plan and included proposals to deliver 13,294 homes and 14,300 new jobs.</li> </ul>	<p><b>Stage 1</b></p> <p>This work was undertaken by CH2M Hill using the Central Oxfordshire Transport Model (COTM). This model has a 2007 base year and produced forecasts for the whole county for transport demand and its impacts on the network in 2030.</p> <p>The work reported in September 2013 and comprised of two sub stages:</p> <ul style="list-style-type: none"> <li>• Stage 1a comprised of the Local Plan development assumptions applied to a forecast year transport network agreed with the County and District Officers.</li> <li>• Stage 1b considered a package of mitigation measures to support the Local Plan growth (tested at Stage 1a), for which funding has been secured for many of the schemes. These identified mitigation measures and individual schemes are already therefore proceeding through the design, planning and implementation phases.</li> </ul>
<p><b>2013</b></p>	<p><b>Assessment of Additional Site Options</b></p> <ul style="list-style-type: none"> <li>• The VoWH District Council has worked with the other Oxfordshire authorities to prepare an up-to-date Strategic Housing Market Assessment (SHMA) for Oxfordshire.</li> <li>• The SHMA identified an increased housing target for the county and for the Vale of White Horse District.</li> <li>• For this reason, the Council tested a range of new (additional) strategic development site options for possible inclusion in the Local Plan 2031.</li> <li>• The assessment of these additional site options helped to inform the proposed selection of sites included within the Housing Delivery Update published in February 2014.</li> </ul>	<p><b>Stage 2</b></p> <p>This work was undertaken by CH2M Hill using COTM.</p> <p>The work was completed in September 2013 and considered potential development sites that were tested in five geographical clusters. The aim of this stage was to identify the impacts associated with development in each of the potential locations being tested. This informed the council decisions for how much development could occur within each cluster and guide the formulation of strategic development sites for inclusion within the consultation.</p> <p>Levels of employment were consistent with Stage 1</p>

Date	Local Plan Stage	ETI Stage
February 2014	<p><b>Housing Delivery Update (Feb 14)</b></p> <ul style="list-style-type: none"> <li>The Council published an update to its Local Plan 2031 in February 2014.</li> <li>The Housing Delivery Update set out a new housing target based on the Oxfordshire SHMA of 20,560 homes and an updated projected job growth figure of 23,000 new jobs.</li> <li>The Housing Delivery Update also set out a series of new proposed strategic development sites to meet the new housing target.</li> </ul>	<p><b>Stage 3</b></p> <p>This stage was undertaken by Atkins using a modified version of the Central Oxfordshire Transport Model (COTM).</p> <p>This work was completed in February 2014 and tested the growth and proposed strategic development sites, as set out in the Housing Delivery Update Consultation (Feb 2013), along with a new package of mitigation.</p> <p>Levels of employment were consistent with Stage 1.</p>
2014	<p><b>Assessment of Additional Site Options</b></p> <ul style="list-style-type: none"> <li>Following consultation on the Housing Delivery Update the Council considered a range of additional potential development sites that were identified through the consultation.</li> <li>The assessment of these additional site options helped to inform the final selection of sites for inclusion within the Publication Version of the Local Plan 2031.</li> </ul>	<p><b>Stage 4</b></p> <p>Following the Housing Delivery Update consultation a further stage of ETI work was undertaken by Atkins in response to the consultation process.</p> <p>Stage 4 was devised to test additional development sites to compare against the early stages of the ETI work completed to date. This work was undertaken by Atkins and was completed in July 2014.</p> <p>Levels of employment changed to 23,000.</p>
November 2014	<p><b>Local Plan - Publication Version (Nov 2014)</b></p> <ul style="list-style-type: none"> <li>The Council published its final draft Local Plan in November 2014. This document is the version for submission to the Secretary of State in early 2015.</li> <li>The Local Plan - Publication Version was informed by the previous stages of developing the local plan described above.</li> </ul>	<p><b>Stage 5</b></p> <p>Stage 5 tests the final growth and strategic development sites as included within the Local Plan – Publication Version.</p> <ul style="list-style-type: none"> <li>the first stage (S5) identifies the highway issues with the final draft Local Plan</li> <li>the second stage demonstrates the impacts of medium scale mitigation measures (S5A)</li> <li>whilst the third stage considered two large scale mitigation measures (S5B and S5C).</li> </ul> <p>Levels of employment were consistent with Stage 4.</p>

## 2. Modelling Approach

### 2.1. Background

- 2.1.1. The ETI work to inform the preparation of the Local Plan 2031 has been completed in stages with two different consultants preparing different stages. The Vale of White Horse District and Oxfordshire County Council have confirmed their acceptance of the approach and confidence the work has been completed using consistent methodology. This chapter briefly describes the methodology and approach to the transport modelling work.
- 2.1.2. The table below summarises the approach adopted for each stage of the work and which consultant undertook the work. Upon the completion of technical work for Stage 3, checks were made to ensure that the two different approaches produced consistent results, and that the same conclusions would be drawn regardless of the technical approach adopted.
- 2.1.3. The approach changed from adopting a fully multi-modal modelling<sup>3</sup> approach in Stages 1 and 2 to a highways-only<sup>4</sup> modelling approach in Stages 3 to 5. The highways-only modelling approach followed Department for Transport approved approach (WebTAG) and remains a sufficiently robust means of testing different land use and transport scenarios. A comparison of the two approaches for Stage 1 was undertaken and the conclusions were comparable. The recently available Oxford Strategic Model (OSM) was used to confirm that the conclusions drawn from this newer model were consistent with the highways-only version of COTM. This was demonstrated in Appendix F. The OSM will be used for future scheme business case work.

**Table 2-1 Summary of approach by ETI stages**

Stage	Approach	Consultant
<b>Stage 1</b> Draft Local Plan Consultation (Feb 13)	Full COTM multi-modal model adopted allowing mode choice and trip frequency choice to occur based upon costs of travel and this is reflected in the final demand for highway travel. Fixed highway demand approach adopted with no feedback between cost of travel and mode/trip frequency to test that this approach was consistent to the 'multi-modal approach'. The inclusion of the fixed highway demand results ensure a consistency of results and narrative throughout the report.	CH2M Hill  Atkins
<b>Stage 2</b> Assessment of Additional Site Options	Variable demand approach adopted using full COTM multi-modal model. Not updated by Atkins	CH2M Hill
<b>Stage 3</b> Housing Delivery Update (Feb 14)	Fixed highway demand approach using COTM highway networks and Draft Local Plan (Feb 13) land use assumptions but revised approach to highway demand forecasting.	Atkins
<b>Stage 4</b> Assessment of Additional Site Options	Fixed highway demand approach using COTM highway networks and Draft Local Plan (Feb 13) land use assumptions but revised approach to highway demand forecasting.	Atkins
<b>Stage 5</b> Local Plan - Publication Version (Nov 2014)	Fixed highway demand approach using COTM highway networks and Draft Local Plan (Feb 13) land use assumptions but revised approach to highway demand forecasting.	Atkins

<sup>3</sup> A multi-modal model typically includes car and goods vehicle trips on the highway network and bus and rail trips on the public transport network. Individual trips (origin to destination) are aggregated into a matrix and assigned to the respective networks using modelling software. This software estimates the cost of the journeys and the multi-modal model enables demand to change trip frequency or trip mode in response to changes in cost between a base year and future forecast year.

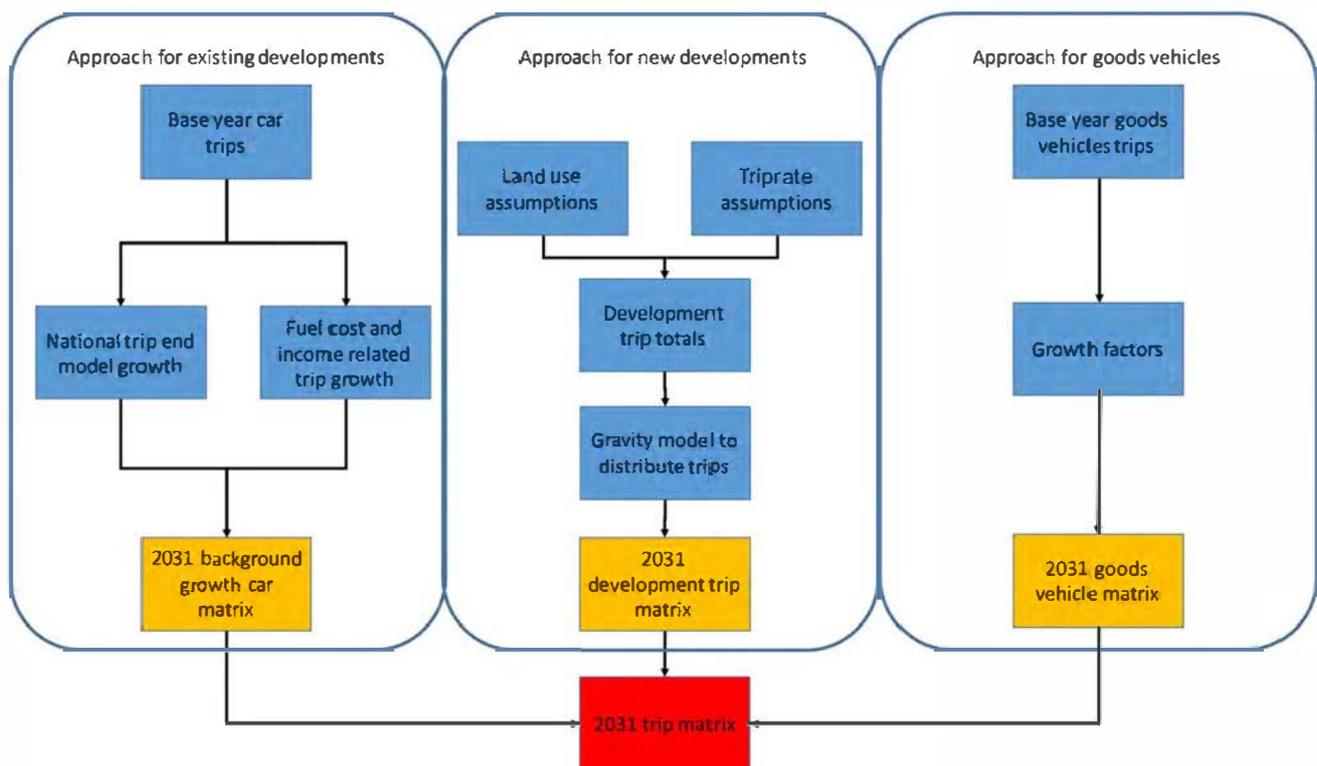
<sup>4</sup> A model that includes car and goods vehicle trips on the highway network only. Individual trips (origin to destination) are aggregated into a matrix and assigned to the network using modelling software.

## 2.2. Forecasting demand for highway travel

### Overall approach

- 2.2.1. The demand for highway transport was forecast for highway-only modelling following Department for Transport (DfT) guidelines<sup>5</sup>. Although these guidelines describe an approach to model application for DfT appraisal purposes, it represents best practice for other modelling purposes as it ensures a consistent approach through the planning, funding and scheme design process. This process is shown in Figure 2-1 and is summarised below:
- Apply background growth and fuel and income related trip growth to base year demand for travel
  - Apply trip rates to new land use assumptions to derive the total number of trips to be made to and from each new development
  - Use a gravity model (explained below) to distribute these new development trips across the modelled area
  - Apply growth factors to reflect changes in goods vehicle demand for travel
  - Combine to create a highway demand matrix
- 2.2.2. In Figure 2-1 the inputs are shown in blue with the interim highway demand shown in orange. The final highway demand for 2031 is shown in red. The process is described in more detail below.

Figure 2-1 Forecasting approach



<sup>5</sup> WebTAG Unit M4 describes the approach to model forecasting for DfT business cases. This approach is considered best practice for all modelling purposes although the degree to which the approach should be adopted ultimately depends on the purpose of the modelling.

## Forecasting assumptions

### Assumptions for existing developments

- 2.2.3. The National Trip End Model<sup>6</sup> (NTEM) provides forecasts of background growth across the country and ensures that forecasts between Planning Authorities have a consistent approach to traffic growth. In this instance the NTEM forecasts are used to provide background growth, which is the difference between the national forecast and those developments in the Local Plans. The difference between the Local Plans and proposed growth in VoWH and the NTEM forecast is shown in Table 2-2.
- 2.2.4. Within Oxfordshire, the housing and employment growth in the VoWH in Stage 1 is forecast to be very similar to NTEM assumptions and is greater than that assumed in NTEM for Stages 3 and 5. The level of planned growth in Stage 1 would be 1767 houses fewer than the NTEM assumption in VoWH. The approach adopted was not to undertake a NTEM adjustment in VoWH as the ETI process focused on comparing different levels of development in VoWH consistently. In the VoWH and other instances where the background growth from the NTEM was less than a district's local plan, NTEM adjustments were set to zero. There is no guidance relating to such situations and discussions with DfT have concluded that these were reasonable assumptions for land use testing.

**Table 2-2 Background Growth Assumptions (2007 to 2031)**

District	Proposed growth		NTEM Assumptions		NTEM adjustments	
	Housing	Jobs	Housing	Jobs	Housing	Jobs
Cherwell	7517	12480	14452	10228	6935	0
Oxford	4108	6191	11221	12958	7113	6767
South Oxfordshire	10429	2856	11703	7579	1274	4723
Vale of White Horse						
Stage 1	13294	14300	15061	8815	0	0
Stage 3	20560	14300	15061	8815	0	0
Stage 5	20560	23000	15061	8815	0	0
West Oxfordshire	5208	2323	8056	5319	2848	2996

Source: TEMPRO v6.2

- 2.2.5. Outside of Oxfordshire the demand was factored to NTEM forecast at a county level for counties in the South East and at a unitary level in Wiltshire to ensure that forecast growth for neighbouring Swindon was separately identified. The rest of the country had growth factors applied at a regional level.
- 2.2.6. The forecasting approach advised by the DfT acknowledges that fuel cost and income growth have an impact on the amount of travel undertaken and provides factors to be applied in the case of fixed demand modelling. The following fuel and income factors were applied to the 2007 base year trips to generate a 2031 forecast of demand from existing developments:
- Fuel factor from 2007 to 2031 = 1.03
  - Income factor from 2007 to 2031 = 1.05

<sup>6</sup> The NTEM dataset represents the Department's standard assumptions about growth in demand, expressed in units of Trip Ends. Trip Ends are an initial estimate of the total number of trips to or from a zone. In NTEM, these trip ends are split by trip purpose, mode and either time period or car availability. Spatially they are split into the NTEM zoning system, which covers the whole of Great Britain with at least one zone for each Local Authority / District area

## Assumptions for new developments

2.2.7. The ETI Stage 1 development assumptions were provided by VOWH and OCC and matched local plan levels of development for each district across the county. Additional demand within VoWH for Stages 3 and 5 was provided by the VoWH. Details of the number of houses and jobs for each district in Oxfordshire are shown in Table 2-3 and 2-4 respectively.

**Table 2-3 Housing assumptions in each scenario**

District	Stage 1	Stage 3	Stage 5
Cherwell	7517	7517	7517
Oxford	4108	4108	4108
South Oxfordshire	10429	10429	10429
<b>Vale of White Horse</b>	<b>13294</b>	<b>20560</b>	<b>20560</b>
West Oxfordshire	5208	5208	5208
Grand Total	46869	54299	54299

**Table 2-4 Employment assumptions in each scenario**

District	Stage 1	Stage 3	Stage 5
Cherwell	12480	12480	12480
Oxford	6191	6191	6191
South Oxfordshire	2856	2856	2856
<b>Vale of White Horse</b>	<b>14300</b>	<b>14300</b>	<b>23000</b>
West Oxfordshire	2323	2323	2323
Grand Total	37080	60080	60080

Note: The Stage 5 levels of employment allow for 6800 induced and non-B land use jobs. These have not been modelled as their details were unknown.

2.2.8. Having established the scale and location of growth, the next step was to convert those dwellings and jobs into trips. This was done by applying a trip rate derived from TRICS<sup>7</sup> to the residential and employment land uses using the trip rates described in Table 2-5. Applying these trip rates to the developments resulted in an initial set of total trips to and from each development. These trip ends were adjusted using matrix furnishing<sup>8</sup> in the final element of trip matrix development to ensure that trip origins/departures matched trip destinations/arrivals.

**Table 2-5 Hourly trip rates**

Land use	Morning Peak Hour		Evening Peak Hour	
	Arrival	Departure	Arrival	Departure
Residential	0.18	0.45	0.39	0.25
B1	0.36	0.05	0.03	0.29
B2	0.18	0.11	0.07	0.15
B8	0.07	0.03	0.05	0.08
Generic B	0.20	0.06	0.05	0.18

Source: TRICS, various suburban locations across southern England

<sup>7</sup> TRICS is a national database containing counts of trips by mode entering and exiting new developments. The database was interrogated to obtain trip rates for new developments in suburban locations across the south of England, rather than just Oxfordshire to obtain a sufficiently high sample rate of observed movements.

<sup>8</sup> An iterative analytical factoring technique used to apply constraints to origin-destination demand matrices

- 2.2.9. The final stage of creating trip patterns for highway demand from the new developments was to use a gravity model approach to distribute trips to and from each new development to other locations, including new developments. The gravity model is a standard approach to creating trip distribution patterns based upon the principle that people are generally more attracted to facilities (such as work, education, retail) closer to where they live than those further away. The gravity model approach was derived from the distribution of the distance of base year<sup>9</sup> trips in order to reflect travel behaviour in the area. Such an approach would reflect, as far as possible within the confines of modelling assumptions, the balanced provision of housing and employment in the VoWH.

### Assumptions for goods vehicles

- 2.2.10. The process to date has described how car demand was forecast. In addition, factors for changes in light and heavy goods vehicles were supplied by DfT and applied as follows:
- LGV growth from 2007 to 2031 = 1.53
  - HGV growth from 2007 to 2031 = 1.15

## 2.3. Other considerations

- 2.3.1. Highway interventions are only one part of mitigation measures for solving problems on the highway network: public transport and smarter choices have a well-documented record in enabling more people to travel along a particular transport corridor<sup>10</sup>. The transport strategy that has been identified through the ETI work, to accompany the Stage 5 (Local Plan Publication Version) growth, will include proposals relating to public transport and smarter choices. Oxfordshire County Council will consult on the complete strategy in early 2015 as part of LTP4. This is briefly summarised in Chapter 7.
- 2.3.2. Whilst not able to test these public transport and smarter choices elements in the approach (fixed highway demand) adopted throughout this report, the new Oxfordshire Strategic Model (OSM) has been used to test the full mitigation package, including public transport measures. The OSM was developed in 2013/14 and contains a multi-modal demand mode and highways and public transport models. A Technical Note in Appendix F describes how the ETI results undertaken using a highway only model remain valid when compared to a more recently development multi-modal model whilst also demonstrating the impact of the public transport interventions in improving accessibility.

## 2.4. Model outputs

- 2.4.1. The SATURN highway model is able to produce a wide variety of outputs. At a network-wide level within the VoWH the following metrics describe network performance and guide decision making about the overall impact of the developments and their mitigation:
- Delays (pcu/hr) – the time difference between travel during the peak hours and during congestion-free conditions
  - Congestion (pcu/hr) – measured by differences in the total time on the network in the Vale
  - Traffic (pcu/km) – the total distance travelled on the network in the Vale
  - Speed (km/hr) – average speed on the network in the Vale.

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<sup>9</sup> The base year model (2007) was developed from observed travel patterns and the assignment of this demand was calibrated against observed traffic data to provide a modelled representation of typical traffic conditions.

<sup>10</sup> DfT, 2010, *The effects of Smarter Choice programmes in the Sustainable Travel Towns: full report*

2.4.2. The highway model is also able to produce forecast flows and volume to capacity ratios at a link (section of road) and junction level and plots of these values are presented. The report focuses on the performance of the following seven key corridors within the VoWH as these are critical to providing access to planned development within the Vale Plan and where plans for mitigation are likely to be focussed to deal with revised levels of transport demand (Appendix B):

- A34 from Chilton to Hinksey Hill
- A420 from Shrivenham to Botley
- A417 from Wantage to Upton
- A415 from A420 to Abingdon
- A338 from Wantage to A420
- A4130 from Rowstock to Didcot
- A4185 from Chilton to Rowstock

2.4.3. The model also provides estimates of journey times along roads and at junctions, enabling forecasts of journey time between places to be estimated. Forecasts of average journey times over all of the possible modelled routes between the key origins and destinations of Wantage, Harwell Campus, Milton Park, Didcot and Abingdon are used to assess the impact of the development and mitigation measures.

## 3. ETI Stage 1 – Draft Local Plan Consultation February 2013

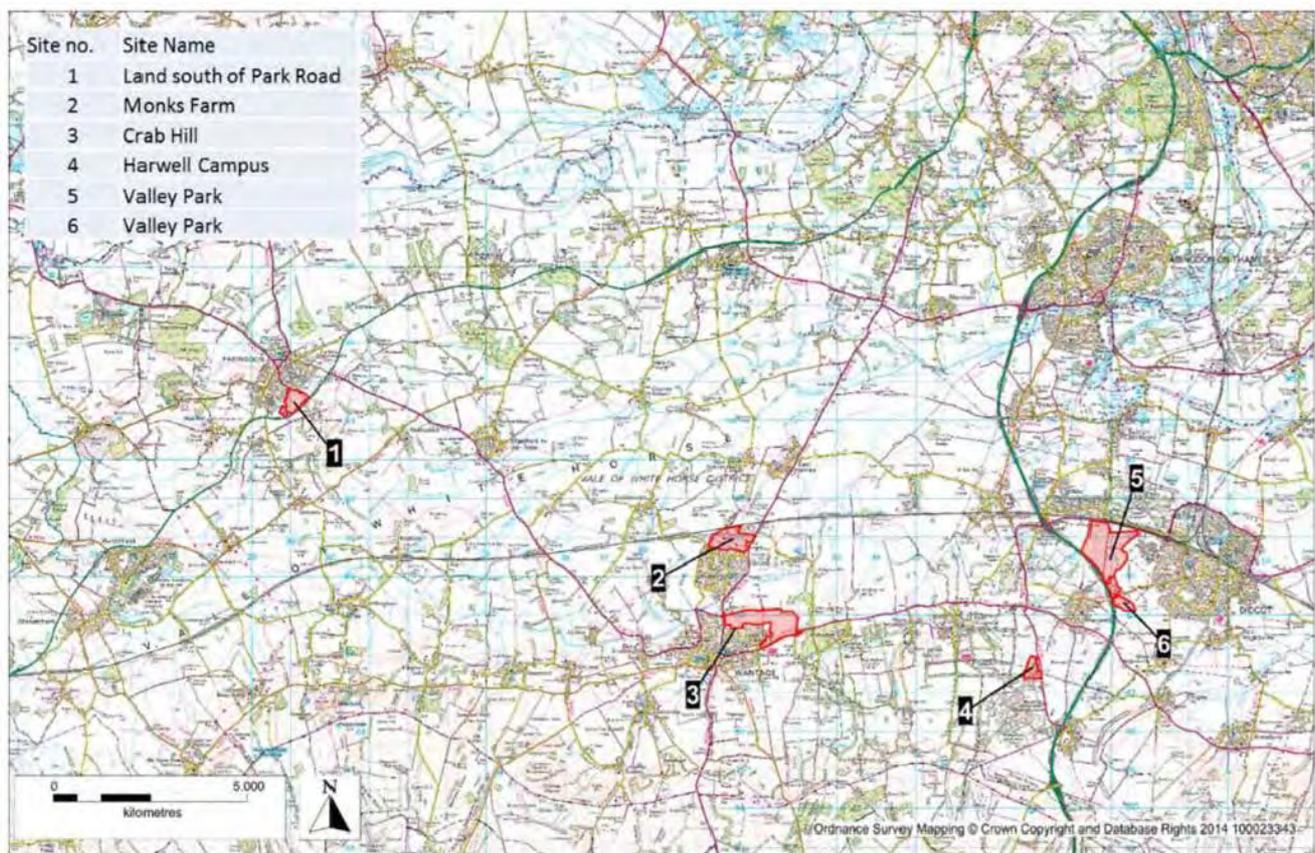
### 3.1. Introduction

3.1.1. The first stage of ETI tested the growth and development sites set out in the Draft Local Plan Consultation published in February 2013. It also identified an appropriate package of highway mitigation to support the growth and ensure the proposed development was consistent with the delivery of sustainable development.

### 3.2. Land use and transport assumptions

3.2.1. The VoWH District Council published a complete draft of their emerging Local Plan in February 2013. This was based on the South East Plan<sup>11</sup> and set out a housing target for 13,294 new homes and to provide for 14,300 new jobs. The ETI was used to test the proposed growth to help the council understand the impact of the emerging plan on the highway network and to ensure that any appropriate mitigation was identified and included within the plan. The proposed growth is shown in Figure 3-1.

Figure 3-1 ETI Stage 1 - key development locations



<sup>11</sup> Regional Strategies (such as the South East Plan) were deleted from planning policy during 2013. Local Authorities have since been given responsibility for identifying an appropriate housing target for their council area to be informed by an up-to-date Strategic Housing Market Assessment (SHMA).

3.2.2. ETI Stage 1 concluded that that the following interventions, also shown in Figure 3-2, were required to support the Draft Local Plan Consultation (February 2013):

- Wantage Eastern Link Road;
- Featherbed Lane;
- Steventon Lights;
- Milton Interchange;
- Chilton north facing slips;
- Hagbourne Hill Improvements;
- Harwell Link Road (B4493 to A417);
- Science Bridge;
- Harwell Oxford entrance and
- Rowstock roundabout

3.2.3. Other inventions include enhanced bus, walking and cycling provision. These cannot be measured in a fixed highway assignment model so the trip rates adopted are for car journeys only as trips by other modes have not been included in the demand for highway travel.

3.2.4. Other highway interventions were included in the model in other parts of Oxfordshire as was consistent with the local plans of other districts.

**Figure 3-2 Stage 1 transport interventions**



### 3.3. Impacts

#### Network-wide performance

- 3.3.1. The highway network performance for ETI Stage 1, using the metrics described in Section 2.4, are shown in Table 3-1 for the morning and evening peak hour. The results are based upon an assignment of the demand for highway travel described in Chapter 2 and although the model covers the whole of Oxfordshire, they reflect traffic conditions on the highway network in the VoWH only. These statistics form the baseline against which the combination of other land use scenarios and transport interventions are judged.

**Table 3-1 ETI Stage 1 Network performance on the VoWH road network**

	AM peak hour	PM peak hour
Delay (pcu/h)	4554	4 118
Total time (pcu/h)	12276	11917
Total distance (pcu/km)	540180	549537
Average speed (km/h)	44	46

Based on assignment from Atkins created matrices as described in Chapter 2 rather than C2HM Hill assignments

#### Corridor performance

- 3.3.2. The key corridors for highway network analysis were described in Section 3.2 and shown in Appendix B. This section describes the corridor performance of the scenarios for the morning and evening peak hours. Appendix C presents this information graphically. The analysis focuses on network performance, where the network is said to be operating:
- at operational capacity (i.e. conditions are such that traffic speed has dropped on links and minor incidents such as a turning vehicle have exaggerated impacts on traffic flow) with a volume to capacity ratio between 85% and 95%; and
  - at capacity (i.e. it is not practically possible for additional traffic to proceed along the link) with a volume to capacity ratio of 95% and above.

#### A34

- 3.3.3. The A34 connects some of the major settlements within Oxfordshire. Of relevance to the VoWH, it connects Oxford, Abingdon on Thames, Didcot, Milton Park and Harwell Campus. It is also part of the national Strategic Road Network linking Oxfordshire to Hampshire and Southampton ports to the south and routes to the north via the M40 and M1.
- 3.3.4. In the morning peak the largest forecast flows are between the junction with the A415 and the Milton Interchange, with a northbound flow of 3800pcu and a southbound flow of 4000pcu. The largest evening peak forecast flows are 4000pcu in the northbound direction between Chilton and Abingdon and 3500pcu in the southbound direction on the section south of Hinksey Hill.
- 3.3.5. The ETI (Stage 1) shows that the A34 is forecast to be operating at or above operational capacity in the northbound and southbound directions between Botley and Lodge Hill and between Marcham and Milton in the morning peak. In the evening peak the northbound section between Chilton and Botley is operating at or above operational capacity. In the southbound direction the A34 is operating at or above operational capacity between Botley and Lodge Hill.

#### A417

- 3.3.6. The A417 provides one of two east-west routes through the VoWH, in this case between Wantage and Blewbury. The route consists of traffic travelling from Wantage, Grove and

Faringdon to Oxford, Abingdon (via A34), Harwell Campus (via A4185), Didcot (via A4130) and Wallingford.

- 3.3.7. In the morning peak the largest forecast traffic flow in the eastbound direction is 1700pcu, between Ardington and West Hendred and largest traffic flow on the westbound section is 1100pcu, between Featherbed Lane and West Hendred. In the evening peak the largest traffic flow along the eastbound section of the route is 1300pcu, on the approach to Featherbed Lane and largest traffic flow on the westbound section is 1700pcu, on the approach to the Charlton Village Road junction.
- 3.3.8. The stage 1 results show that the A417 is operating at or above operational capacity in the eastbound and westbound directions between Wantage and Featherbed Lane for the morning and evening peak respectively.

### **A338**

- 3.3.9. The A338 caters for north-south movements between Wantage and Grove and Oxford via A420 or A415 and A34.
- 3.3.10. In the morning peak the largest traffic flow in the northbound direction is 1000pcu, between East Hanney and Frilford and largest traffic flow in the southbound direction is 900pcu, between East Hanney and Grove. In the evening peak the largest traffic flow in the northbound direction is 1000pcu, between Grove and East Hanney and largest traffic flow in the southbound direction is 950pcu, between Frilford and East Hanney.
- 3.3.11. The Stage 1 results show that the A338 is forecast to be operating below operational capacity in the morning peak. In the evening peak the A338 is forecast to be operating below operational capacity except in the southbound direction between East Hanney and Grove, which is forecast to be operating above operational capacity.

### **A420**

- 3.3.12. The A420 provides a route between Swindon and towns and villages (including Shrivenham and Faringdon) along its route to Oxford.
- 3.3.13. In the morning peak the largest forecast traffic flow is 1900pcu, on the approach to Botley Interchange in the northbound direction whilst the largest traffic flow in the southbound section is 1300pcu on the exit from Botley Interchange. In the evening peak the largest traffic flow in the northbound direction is 1200pcu, to the west of where the A420 meets the A415 and largest traffic flow on the southbound section is 2000pcu, on the exit from Botley Interchange.
- 3.3.14. The ETI (Stage 1) shows that the A420 westbound is generally forecast to be operating below operational capacity in the morning peak in both direction but at or above operational capacity on short stretches near Buckland, Fyfield and Cumnor in the eastbound direction. In the evening peak the A420 is forecast to be operating below operational capacity except at Buckland where it operates at or above operational capacity in both directions. The westbound sections near Fyfield and Cumnor are also forecast to operate at or above operational capacity in the evening peak.

### **A415**

- 3.3.15. The A415 provides the second east-west route through the Vale between the A420, Marcham and Abingdon and carries traffic travelling from Witney, Wantage and Grove to Abingdon and Didcot via A34.
- 3.3.16. In the morning peak the largest traffic flow in the eastbound direction is 1400pcu, on the approach to the Marcham Interchange. The largest traffic flow in the westbound direction is 600pcu, between Marcham and Frilford. In the evening peak the largest forecast traffic flows are

on the approach and exit to the Marcham interchange with an eastbound flow of 900pcu and a westbound flow of 1400pcu.

- 3.3.17. The ETI (Stage 1) shows that the A415 is forecast to be operating below operational capacity in the morning peak in the westbound direction. In the eastbound direction the A415 is forecast to be operating at or above operational capacity between Kingston Bagpuize and Frilford and between Marcham and the A34. In the evening peak the section between Kingston Bagpuize and Frilford is forecast to perform at operational capacity whilst the westbound section between the A34 and Frilford is also at or above operational capacity.

### **A4130**

- 3.3.18. The A4130 links the A417 to Milton Park and Didcot. In the morning peak the largest forecast traffic flows are on the approaches to the Milton Interchange with an eastbound flow of 1700pcu and a westbound flow of 1400pcu. In the evening peak the largest forecast traffic flows are of 1500pcu in both the eastbound and westbound directions. The eastbound section is on the approach to the Avon Way junction and the westbound on the section south of the Milton Road junction.
- 3.3.19. The ETI (Stage 1) results show that the A4130 is forecast to be operating at capacity in the morning peak on parts of the northern distributor., Elsewhere the A4130 is forecast to perform below capacity although assumptions have been made that the accesses and egresses associated with Valley Park and Great Western Park would be designed to perform no worse than at operational capacity in 2031.

### **A4185**

- 3.3.20. The A4185 connects Chilton and Rowstock and carries traffic travelling between Harwell Campus and Didcot, Oxford and Abingdon via the Milton Interchange.
- 3.3.21. In the morning peak the largest forecast traffic flow along the northbound section of the route is 1800pcu, on the exit from the Chilton Interchange. The largest traffic flow on the southbound section is 1000pcu, on the section south of the A417. In the evening peak the largest traffic flow along the northbound section of the route is 1200pcu, between Harwell and the A417. The largest traffic flow on the southbound section is 1700pcu, on the approach to the Chilton Interchange.
- 3.3.22. The ETI (Stage 1) shows that the section between Chilton Interchange and Harwell Campus is forecast to perform at capacity.

## **3.4. Summary**

- 3.4.1. From the work carried out to test the highway impact of the levels and distribution of growth across the Vale as part of the February 2013 consultation stage, it has been shown that the package of strategic highway measures provide appropriate levels of mitigation, that is considered both affordable and deliverable with the plan time period. However, even with these planned measures, it is recognised that some parts of the network still have issues to be addressed, both through further consideration of sustainable transport improvements, and focused highway improvements. As such, results from this stage are considered to provide a suitable base for comparison with higher levels of development as set out in subsequent stages, but that this further work will need to consider the potential for further significant interventions to deal with higher levels of growth. This is set out in more detail in subsequent sections of the report.

## 4. ETI Stage 2 - Assessment of Additional Site Options 2013

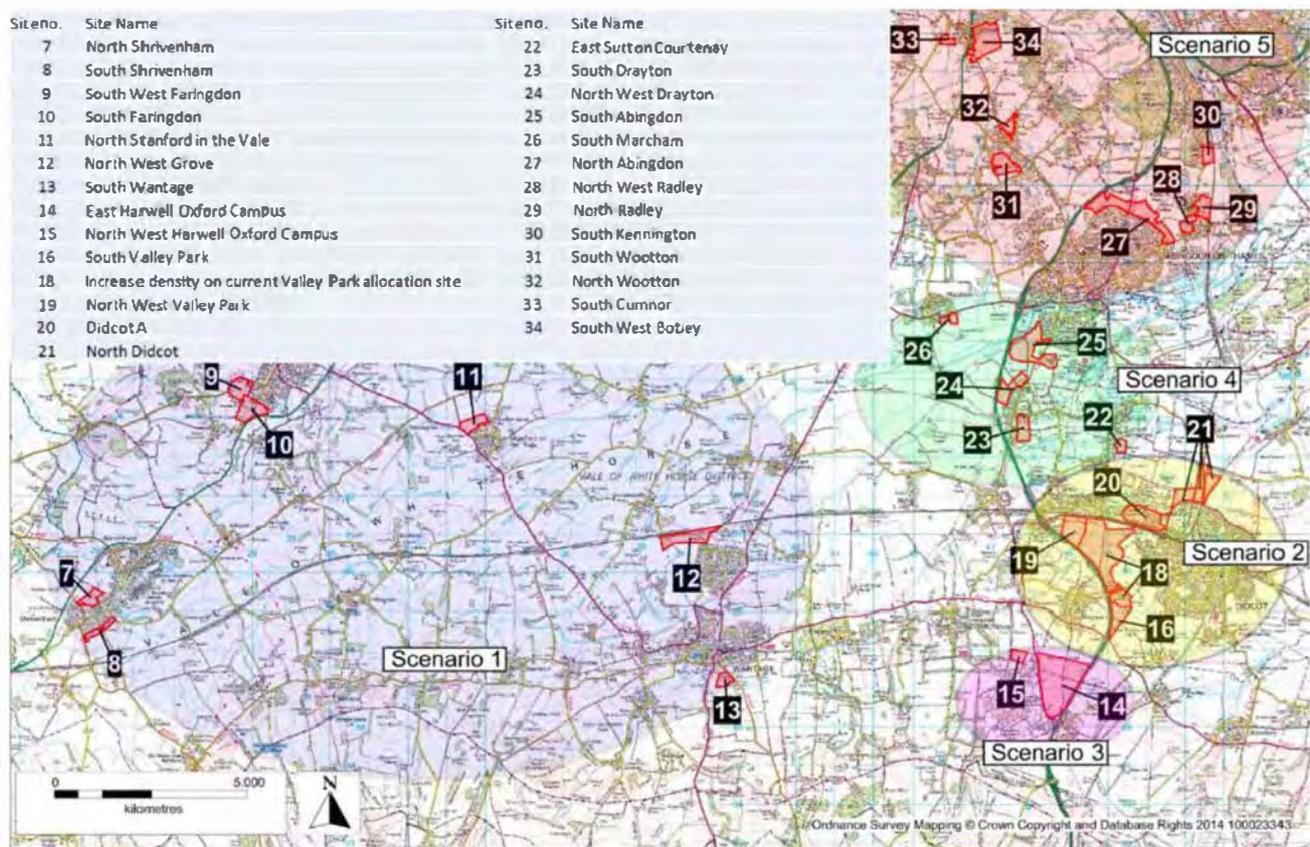
### 4.1. Introduction

- 4.1.1. The Vale of White Horse District Council worked with the other Oxfordshire authorities to prepare an up-to-date Strategic Housing Market Assessment (SHMA) for Oxfordshire, which identified a new 'objectively assessed need' for housing, for both the county and the district. The Oxfordshire SHMA set out an objectively assessed need for 20,560 new homes across the Vale of White Horse up to 2031. For this reason, the council undertook a comprehensive assessment of additional development sites for possible inclusion in the Local Plan 2031.
- 4.1.2. In total, 27 sites were tested at this stage, which were grouped into five geographical clusters (Table 4-1). Each site was tested at the theoretical maximum of development the sites could accommodate if all constraints were ignored. This ensured the ETI tested the 'worst case' scenario for each geographical group of sites. This approach also ensured the Council had a good understanding of transport impacts associated with the development to inform site selection, alongside other evidence, for inclusion within the consultation.

### 4.2. Land use and transport assumptions

- 4.2.1. The Stage 2 modelling work compared the impacts of the five contingency site scenarios (Figure 4-1 and Table 4-1) against each other and the Stage 1 scenario. This was done as a series of five scenario tests. Employment assumptions remained consistent with Stage 1. This work also assumed no change in the transport network between this stage and Stage 1.

Figure 4-1 ETI Stage 2 - key development locations



**Table 4-1 ETI Stage 2 land use assumptions**

Scenario	Site	Total Site Area (ha)	Number of Dwellings
<b>Scenario 1 Western Vale</b>	South West Faringdon	25.5	635
	South Faringdon	32.0	800
	South Shrivenham	11.6	290
	North Shrivenham	31.5	790
	North Stanford in the Vale	19.9	500
	North West Grove	40.0	1000
	South Wantage	12.0	305
	<b>Total</b>		<b>4320</b>
<b>Scenario 2 Adjoining Didcot</b>	South Valley Park	22.9	575
	North West Valley Park	38.6	825
	Increase density Valley Park	140.0	3150
	Didcot A	17.0	425
	North Didcot	44.5	1115
	<b>Total</b>		<b>6090</b>
<b>Scenario 3 Harwell and Milton parishes</b>	East Harwell Campus	140.0	3500
	North West Harwell Campus	11.0	275
	<b>Total</b>		<b>3775</b>
<b>Scenario 4 South of Abingdon</b>	East Sutton Courtenay	8.8	220
	South Abingdon-on-Thames	63.0	1575
	North West Drayton	28.0	705
	South Drayton	20.0	500
	South Marcham	8.6	215
	<b>Total</b>		<b>3215</b>
<b>Scenario 5 North and west of Abingdon</b>	North Abingdon-on-Thames	69.4	1735
	South West Botley	53.9	1350
	South Cumnor	11.7	295
	South Kennington	11.8	295
	North West Radley	12.7	320
	North Radley	18.5	465
	South Wootton	26.3	660
	North Wootton	11.7	295
	<b>Total</b>		<b>5415</b>

## 4.3. Impacts (without mitigation)

4.3.1. This work was undertaken exclusively by CH2M Hill and is reported as such.

### Corridor performance

4.3.2. The key corridors for highway network analysis were described in Section 2.4 and shown in Appendix B. This section describes the corridor performance of the scenarios for the morning and evening peak hours and Appendix C presents this information graphically. The analysis focuses on network performance, where the network is said to be operating:

- at operational capacity (i.e. conditions are such that traffic speed has dropped on links and minor incidents such as a turning vehicle have exaggerated impacts on traffic flow) with a volume to capacity ratio between 85% and 95%; and
- at capacity (i.e. it is not practically possible for additional traffic to proceed along the link) with a volume to capacity ratio of 95% and above.

### A34

4.3.3. The impacts in the morning peak hour were found to be:

- Scenario 1 shows that generally the modelled A34 link flows remain comparable with that tested in Stage 1.
- Scenario 2 shows there are decreases in flows between Scenario 2 and Stage 1 of approximately 200 trips on the southbound sections between Hinksey and Lodge Hill, Lodge Hill and Marcham, and Marcham and Milton. Northbound there is a decrease of approximately 200 trips between West Ilsley and Chilton.
- Scenario 3 shows there is an increase of approximately 750 trips on the northbound section of the A34 between Chilton and Milton resulting from the additional development at Harwell Oxford.
- Scenario 4 shows that generally the modelled A34 link flows remain comparable between Stage 1 and Scenario 4.
- Scenario 5 shows there is an increase of approximately 300 northbound trips on the A34 between Lodge Hill and Hinksey Interchange.

4.3.4. The impacts in the evening peak hour were found to be:

- Scenario 1 shows there is a decrease of approximately 200 trips on the northbound section between Marcham Interchange and Milton Interchange.
- Scenario 2 shows that generally the modelled A34 link flows remain comparable between Stage 1 and Scenario 2.
- Scenario 3 shows there is an increase in southbound flows of approximately 250 trips on the section between Milton Interchange and Chilton as a result of the additional development at Harwell Oxford. There is a reduction of approximately 350 trips on the southbound A34 between Chilton and West Ilsley.
- Scenario 4 shows that generally the modelled A34 link flows remain comparable between Stage 1 and Scenario 4.
- Scenario 5 shows there is an increase of approximately 100 trips on the northbound A34 between Lodge Hill Slips and Hinksey Interchange and 150 trips on the northbound section between Milton Interchange and Marcham Interchange.

### A417

4.3.5. The impacts in the morning peak hour were found to be:

- Scenario 1 shows there are increases in eastbound flow of approximately 30 trips between Featherbed Lane and Rowstock and 70 trips east of the Hagbournes, between Stage 1 and Contingency Scenario 1.
- Scenario 2 shows an increase in actual westbound flows on the A417 between Rowstock and Wantage. There is an increase in actual flows of approximately 280 trips on the westbound A417 between Harwell and Rowstock and on the eastbound A417 east of the

Hagbournes as a result of the additional development proposed at Valley Park under Site Contingency Test 2.

- Scenario 3 shows there is an increase of approximately 400 trips on the eastbound A417 between Rowstock and Harwell as a result of the additional development proposed for Harwell Oxford under Contingency Test 3. There is a reduction of westbound A417 flows east of Rowstock of approximately 120 trips.
- Scenario 4 shows there is an increase in actual flows of approximately 100 vehicles eastbound on the A417 east of the Hagbournes.
- Scenario 5 shows that generally the actual A417 traffic flows are comparable to the Stage 1 scenario.

4.3.6. The impacts in the evening peak hour were found to be:

- Scenario 1 shows there is an increase of approximately 50 eastbound trips east of Rowstock.
- Scenario 2 shows an increase in actual flows on the eastbound A417 between Wantage and Rowstock of approximately 200 trips. There is an increase of approximately 400 trips on the eastbound A417 between Rowstock and Harwell.
- Scenario 3 shows an increase in eastbound flows of approximately 200 trips on the A417 west of Rowstock. There is an increase in eastbound A417 flow of approximately 120 trips between Rowstock and Harwell. On the westbound A417 east of Rowstock there is an increase of approximately 200 trips.
- Scenario 4 and Scenario 5 show that generally the actual A417 traffic flows are comparable to Stage 1.

### **A338**

4.3.7. The impacts in the morning peak hour were found to be:

- Scenario 1 shows that generally the A338 actual traffic flows are comparable to Stage 1. There are increases in the northbound flows in the region of 50 trips between Wantage and Mably Way and 20 trips north of Frilford Lights towards the A420.
- Scenario 2 shows there is a reduction in southbound traffic flows compared to Stage 1. Northbound actual traffic flows are comparable to the Stage 1.
- Scenario 3, Scenario 4 and Scenario 5 shows that generally the A338 actual traffic flows are comparable to Stage 1.

4.3.8. The impacts in the evening peak hour were found to be:

- Scenario 1 shows that generally the A338 actual traffic flows are comparable to the Stage 1 scenario. There is an increase of approximately 50 trips on the northbound A338 between Mably Way and Grove.
- Scenario 2, Scenario 3, Scenario 4 and Scenario 5 shows that generally the A338 actual traffic flows are comparable to the Stage 1 scenario.

### **A4130**

4.3.9. The impacts in the morning peak hour were found to be:

- Scenario 1 shows there is an increase in westbound flows on the A4130 between Didcot and the Milton Interchange of approximately 40 trips. There is a small reduction in the number of trips using the Didcot Northern Bypass. This may be due to the operation of the junction of the A4130 with the proposed hamburger link at Milton Interchange. There is a reduction of approximately 300 trips using the eastbound A4130 west of the junction with Mendip Heights.
- Scenario 2 shows an increase of approximately 200 trips using the eastbound Didcot Northern Bypass. There is a reduction of approximately 360 trips using the eastbound A4130 east of Milton Interchange. The number of trips using the Milton Link is comparable to Do-Minimum. This may be due to the operation of the junction of the A4130 with the proposed Milton hamburger link.

- Scenario 3, Scenario 4 and Scenario 5 all show that generally the A4130 actual traffic flows are comparable to the Stage 1 scenario. The main difference compared to the Stage 1 scenario is a reduction of approximately 300 eastbound A4130 trips west of Mendip Heights.

4.3.10. The impacts in the evening peak hour were found to be:

- Scenario 1 shows eastbound flows on the A4130 remain comparable to the Stage 1 scenario. There is a decrease of approximately 100 eastbound trips on the A4130 west of Mendip Heights. There is a decrease in the number of trips using the Didcot Northern Bypass. Westbound A4130 traffic flows into Milton Interchange increase by approximately 100 trips. The number of trips using the Milton hamburger link is comparable to Stage 1 scenario. This may be due to the operation of the junction of the A4130 with the proposed hamburger link at Milton Interchange.
- Scenario 2 shows an increase of approximately 80 trips on the A4130 east of the Milton Interchange. There is an increase of approximately 200 westbound trips on the Didcot Northern Perimeter Road. The number of trips using the Milton hamburger link is comparable to Stage 1 scenario. This may be due to the operation of the junction of the A4130 with the proposed Milton hamburger link.
- Scenario 3, Scenario 4 and Scenario 5 show that generally the actual A4130 actual traffic flows are comparable to the Stage 1 scenario.

### **A4185**

4.3.11. The impacts in the morning peak hour were found to be:

- Scenario 1 shows that generally the actual A4185/A4130 traffic flows remain comparable to the Stage 1 scenario. There is a decrease of approximately 60 trips on the eastbound A4130 between Steventon and Milton Interchange.
- Scenario 2 shows there is an increase of approximately 50 trips on the southbound A4185 between Rowstock and Harwell Oxford. There is an increase of approximately 70 trips on the westbound A4130 between Milton Interchange and Steventon Lights. There is an increase of approximately 100 trips on the northbound A4130 between Featherbed Lane and Steventon Lights. There is a reduction in actual flows of approximately 150 trips on the eastbound A4130 between Steventon Lights and Milton Interchange.
- Scenario 3 shows there is an increase of approximately 750 trips on the northbound A4185 between Harwell Oxford and Rowstock as a result of the additional development proposed for Harwell Oxford under the Contingency Site 3 Scenario. This leads to an increase in northbound A4130 actual flows between Rowstock and Steventon Lights.
- Scenario 4 and Scenario 5 show that generally the A4130/A4185 actual traffic flows are comparable to the Stage 1 scenario.

4.3.12. The impacts in the evening peak hour were found to be:

- Scenario 1 shows that generally the actual A4185/A4130 traffic flows remain comparable to the Stage 1 scenario. There is an increase of approximately 70 trips on the southbound A4130 between Steventon Lights and Featherbed Lane.
- Scenario 2 shows there is an increase in actual flows of approximately 100 trips on the southbound A4130 between Steventon Lights and Rowstock. There is an increase of approximately 90 trips on the northbound A4185 between Harwell Oxford and Rowstock.
- Scenario 3 shows an increase in southbound A4185 actual flows of approximately 700 trips between Rowstock and Harwell Oxford. Increases in southbound actual traffic flows are also modelled between Milton Interchange and Rowstock.
- Scenario 4 and Scenario 5 show that generally the A4130/A4185 actual traffic flows are comparable to the Stage 1 scenario.

## 4.4. Summary

- 4.4.1. The ETI assessment of the additional site options helped to inform the selection of new proposed strategic development sites for inclusion in the Housing Delivery Update published in February 2014.
- 4.4.2. The Council published a summary of how this stage of the ETI informed the selection of sites alongside the Housing Delivery Update Consultation. A high level summary for each geographical cluster is set out below. Further detail of the additional work being progressed to inform new highway mitigation or improvements to public transport for each of these areas is set out in Chapter 7 (Stage 5).

### **Scenario 1: Western Vale**

The impact of over 4,000 new dwellings was tested in this area and less than half this amount of development was proposed in the consultation with no new sites in Wantage or Grove. The ETI showed that whilst there were some impacts, the A420 was still operating within its capacity.

### **Scenario 2: VOWH area adjoining Didcot Town**

The ETI shows that there are some further challenges to overcome in this area before housing growth could be significantly enhanced and for this reason the February 2014 consultation identified only modest growth around Didcot within the Vale. However, there are also further opportunities to help mitigate the impact of traffic growth in this area and work has been undertaken to identify further highway and public transport improvements in and around Didcot (refer to Chapter 7).

### **Scenario 3: Harwell and Milton Parishes, west of the A34**

The proposals for growth within this area, as set out in the Housing Delivery Update (Feb 2014) were close to those tested within the ETI at this stage (Stage 2). This was partly because the ETI demonstrated that development in this area could be accommodated reasonably well by the road network, and where existing proposals will help to mitigate any impacts (for example upgrading the Chilton and Milton A34 interchanges, Featherbed Land, and Rowstock Roundabout). This area also has good potential for public transport improvements (refer to Chapter 7).

### **Scenario 4: South of Abingdon**

By contrast, the Council minimised any proposed development in this area as it is already affected by traffic congestion. The proposed growth set out in the Housing Delivery Update accounted for less than 20% of the potential the sites in the area could accommodate (if constraints including transport were ignored). Individual development sites selected for inclusion in the consultation were also medium scale to reduce further impacts and the two most problematic sites were excluded altogether (North West Drayton and South Abingdon). The Council, working with Oxfordshire County Council, have consistently stated that development to the south of Abingdon could only take place if a new south Abingdon bypass is delivered for which there is currently no identified funding.

### **Scenario 5: North and West of Abingdon**

The Council selected around 30% of the potential development tested in this area for inclusion within the consultation and selected predominantly small sites that are well connected by public transport. Furthermore, work has been ongoing to examine the opportunities for upgrading the A34 interchange at Lodge Hill (refer to Chapter 7).

## 5. ETI Stage 3 - Housing Delivery Update February 2014

### 5.1. Introduction

5.1.1. This stage of the ETI was the first time the new housing target (20,560 dwellings) for the Vale was modelled together and so tested the full sites package set out in the Housing Delivery Update Consultation (February 2013). The work followed on from Stage 2, which helped to inform the selection of sites, and it is important to remember that the selection of sites was informed by a range of factors, of which the ETI was only one.

### 5.2. Land use and transport assumptions

5.2.1. The Stage 3 modelling work was undertaken to help the council to fully understand the impacts of the new housing target (20,560 homes up to 2031) and the proposed mix of development sites consulted on in February 2014. The distribution of these developments was added to the Stage 1 - Draft Local Plan Consultation (Feb 2013) allocations and is shown in Table 5-1 and Figure 5-1. Strategic sites at Monks Farm, Crab Hill and some 2100 dwellings at Valley Park were also included within the land use assumptions along with other completed and committed sites.

**Table 5-1 ETI Stage 3 (Housing Delivery Update Feb 14) Strategic Sites**

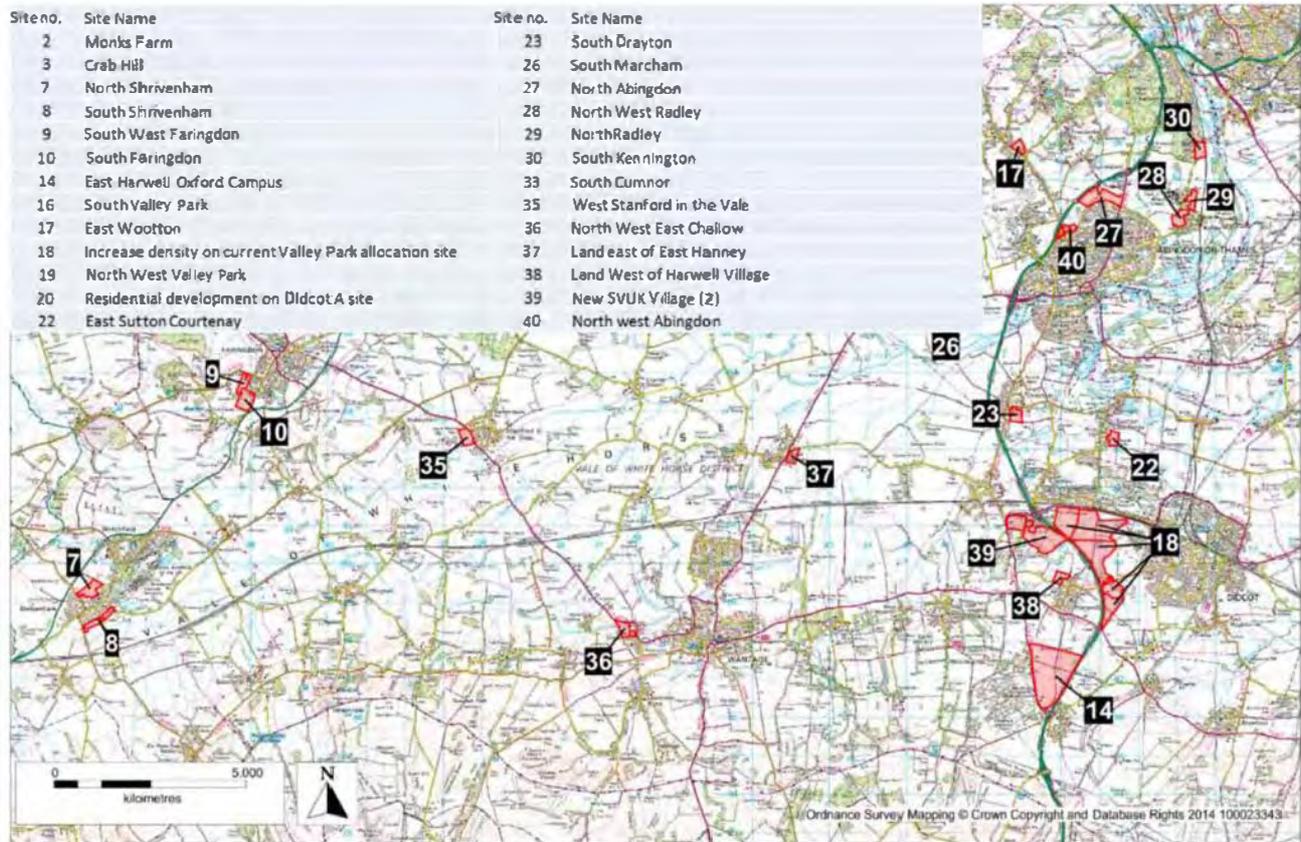
Strategic Site	Dwellings	Strategic Site	Dwellings
South West Faringdon	200	East Sutton Courtenay	220
South Faringdon	200	South Drayton	200
South Shrivenham	200	South Marcham	200
North Shrivenham	400	North Abingdon-on-Thames	410
West Stanford in the Vale	290	North West Abingdon-on-Thames	200
North West of East Challow	200	South Cumnor	200
East Hanney	200	South Kennington	270
Valley Park (additional)	400	North West Radley	240
East Harwell Campus	1400	North Radley	200
Milton Heights	1400	East Wootton	200
West of Harwell	200		

5.2.2. ETI Stage 1 concluded that the following highway interventions, also shown in Figure 5.1, were required to support the South East Draft Local Plan Consultation (Feb 2013) growth and they were also assumed to be present in this scenario test:

- Featherbed Lane;
- Steventon Lights;
- Milton Interchange;
- Chilton north facing slips;
- Hagbourne Hill Improvements;
- Harwell Link Road (B4493 to A417);
- Science Bridge;
- Harwell Oxford entrance and
- Rowstock roundabout

5.2.3. Employment assumptions remained consistent with Stage 1.

**Figure 5-1 Stage 3 land use assumptions**



## 5.3. Impacts (without additional mitigation to Stage 1)

### Network-wide performance

5.3.1. The impacts of the developments associated with the Draft Local Plan Consultation (ETI Stage 1) and the Housing Delivery Update (ETI Stage 3) for the VoWH highway network are shown in Table 5-2 for the morning and evening peak hour. The relative impacts of Stage 1 and 3 are that the extra development without mitigation results in an 8-10% increase in delay and a 2-3% decrease in highway speeds on the Vale network.

**Table 5-2 ETI Stage 3 Network performance on the VoWH road network**

	AM Peak		PM Peak	
	Stage 1	Stage 3	Stage 1	Stage 3
<b>Delay (pcu/h)</b>	4554	5018	4118	4455
% Change from Stage 1		10%		8%
<b>Total time (pcu/h)</b>	12276	13078	11917	12583
% Change from Stage 1		7%		6%
<b>Total distance (pcu/km)</b>	540180	560465	549537	568336
% Change from Stage 1		4%		3%
<b>Average speed (km/h)</b>	44	43	46	45
% Change from Stage 1		-3%		-2%

## Corridor performance

- 5.3.2. The key corridors for highway network analysis were described in Section 2.4 and shown in Appendix B. This section describes the corridor performance of the scenarios for the morning and evening peak hours and Appendix C presents this information graphically. The analysis focuses on network performance, where the network is said to be operating:
- at operational capacity (i.e. conditions are such that traffic speed has dropped on links and minor incidents such as a turning vehicle have exaggerated impacts on traffic flow) with a volume to capacity ratio between 85% and 95%; and
  - at capacity (i.e. it is not practically possible for additional traffic to proceed along the link) with a volume to capacity ratio of 95% and above.

### A34

- 5.3.3. The morning peak is forecast to have the largest flows in the northbound direction between the junction with the A415 and the Milton Interchange and on the approach to the Hinksey Hill junction with flow of 3800pcu. In the southbound direction, the largest flows are forecast to occur between the junction with the A415 and the Milton Interchange with a flow of 4000pcu. The largest evening peak forecast flows are 4000pcu in the northbound direction between Chilton and Abingdon and 3500pcu in the southbound direction on the section south of Hinksey Hill.
- 5.3.4. This scenario shows that the A34 is forecast to be operating at or above operational capacity in the northbound direction between Milton and Botley and in the southbound direction between Botley and Lodge Hill and between Marcham and Milton in the morning peak. In the evening peak the northbound section between Chilton and Botley is operating at or above operational capacity. In the southbound direction the A34 is operating at or above operational capacity between Botley and Lodge Hill and between Abingdon (A415) and Milton.

### A417

- 5.3.5. In the morning peak the largest forecast traffic flow along the eastbound section of the route is 1700pcu, between Ardington and West Hendred and largest traffic flow on the westbound section is 1200pcu, between Featherbed Lane and West Hendred. In the evening peak the largest forecast traffic flow along the eastbound section of the route is 1500pcu, on the approach to Featherbed Lane whilst the largest forecast traffic flow on the westbound section is 1800pcu, away from the junction with Featherbed Lane, although demand on this section is much higher than capacity.
- 5.3.6. This scenario shows that the A417 is operating at or above operational capacity in the eastbound direction between Wantage and Featherbed Lane for the morning peak. In the evening peak it is forecast to be operating at or above operational capacity between Wantage and Featherbed Lane in the westbound direction and on the approach to Featherbed Lane in the eastbound direction.

### A338

- 5.3.7. In the morning peak the largest forecast traffic flow in the northbound direction is 1000pcu, between East Hanney and Frilford and largest forecast traffic flow in the southbound direction is 900pcu, between East Hanney and Grove. In the evening peak the largest forecast traffic flow in the northbound direction is 1000pcu, between Grove and East Hanney and largest forecast traffic flow in the southbound direction is 1000pcu, south of East Hanney.
- 5.3.8. This scenario shows that the A338 is forecast to be operating below operational capacity in the morning peak. In the evening peak the A338 is forecast to be operating below operational capacity except in the southbound direction near East Hanney and Grove, which is forecast to be operating above operational capacity.

### **A420**

- 5.3.9. In the morning peak the largest forecast traffic flow along the northbound section of the route is 2000pcu, on the approach to Botley Interchange and largest forecast traffic flow on the southbound section is 1300pcu, on the exit from Botley Interchange. In the evening peak the largest traffic flow along the northbound section of the route is 1300pcu, to the west of where the A420 meets the A415 and largest forecast traffic flow on the southbound section is 2000pcu, on the exit from Botley interchange.
- 5.3.10. This scenario shows that the A420 westbound is forecast to be operating at or above capacity on stretches near Buckland, Fyfield and Cumnor in the eastbound direction and at operational capacity near Buckland in the westbound direction in the morning peak. In the evening peak the A420 is forecast to be operating below operational capacity except at Buckland where it operates at or above operational capacity in both directions. The westbound sections near Fyfield and Cumnor are also forecast to operate at or above operational capacity in the evening peak.

### **A415**

- 5.3.11. In the morning peak the largest forecast traffic flow in the eastbound direction is 1400pcu, on the approach to the Marcham Interchange. The largest forecast traffic flow in the westbound direction is 700pcu, between Marcham and Frilford. In the evening peak the largest forecast traffic flows are on the approach and exit to the Marcham Interchange with an eastbound flow of 900pcu and a westbound flow of 1400pcu.
- 5.3.12. This scenario shows that the A415 is forecast to be operating below operational capacity in the morning peak in the westbound direction. In the eastbound direction the A415 is forecast to be operating at or above operational capacity between Kingston Bagpuize and Frilford and between Marcham and the A34. In the evening peak the eastbound section between Kingston Bagpuize and Frilford is forecast to operate above operational capacity along with the westbound section between the A34 and Frilford.

### **A4130**

- 5.3.13. In the morning peak the largest forecast traffic flows are of 1600pcu in both the eastbound and westbound directions. The westbound section is at capacity on the approach to the Milton Interchange and the eastbound on the section south of the Milton Road junction. In the evening peak the largest traffic flows are of 1500pcu in both the eastbound and westbound directions. The eastbound section is at capacity on the approach to the Avon Way junction and the westbound on the section south of the Milton Road junction.
- 5.3.14. This scenario shows that the A4130 is forecast to be operating above capacity in the morning peak on the westbound approach to the Avon Way roundabout and Milton Interchange. In the evening peak the eastbound approach to the Avon Way roundabout is forecast to be operating above capacity.

### **A4185**

- 5.3.15. In the morning peak the largest forecast traffic flow along the northbound section of the route is 1800pcu, on the exit from the Chilton Interchange. The largest traffic flow on the southbound section is 1100pcu, on the section south of the A417. In the evening peak the largest traffic flow along the northbound section of the route is 1400pcu, between Harwell and the A417. The largest traffic flow on the southbound section is 1700pcu, on the approach to the Chilton Interchange.
- 5.3.16. This scenario shows that the section between Chilton interchange and Harwell Campus is forecast to perform at capacity.

## 5.4. Summary

- 5.4.1. The level of development associated with the Housing Delivery Update Consultation February 2014 (ETI Stage 3) is forecast to increase highway demand by 1.5% in the morning peak and 1.7% in the evening peak. This is forecast to result in a 4% increase in journey distance in the morning peak as a result of journeys being made on longer and possibly less-suitable routes to avoid congestion. This is also forecast to result in a 10% increase in delay in the morning peak and an 8% increase in the evening peak; with network speeds in VoWH dropping by 3% and 2% in the morning and evening peak respectively.

The following links are forecast to perform at or above operational capacity

- A34 operating at or above operational capacity in both directions between Milton and Botley in the morning and evening peak.
- A417 operating at or above operational capacity between Wantage and Featherbed Lane in the morning peak and in the other direction in the evening peak.
- A420 operating at or above operational capacity in both directions near Buckland and in short sections near Cumnor on the eastbound section in the morning and evening peaks
- A415 operating at or above operational capacity between Kingston Bagpuize and Frilford, with particular problems at the Frilford junctions with the A338 and between Marcham and the A34.
- A4130 operating at capacity approaching Avon Way roundabout.

- 5.4.2. After Stage 3 a range of potential highway mitigation measures to address problems associated with the Stage 3 level of housing demand were considered. Consideration was given to how public transport and smarter choices could help alleviate some of these problems and this forms the basis of the mitigation measures identified for Stage 5.

## 6. ETI Stage 4 – Additional Housing Sites

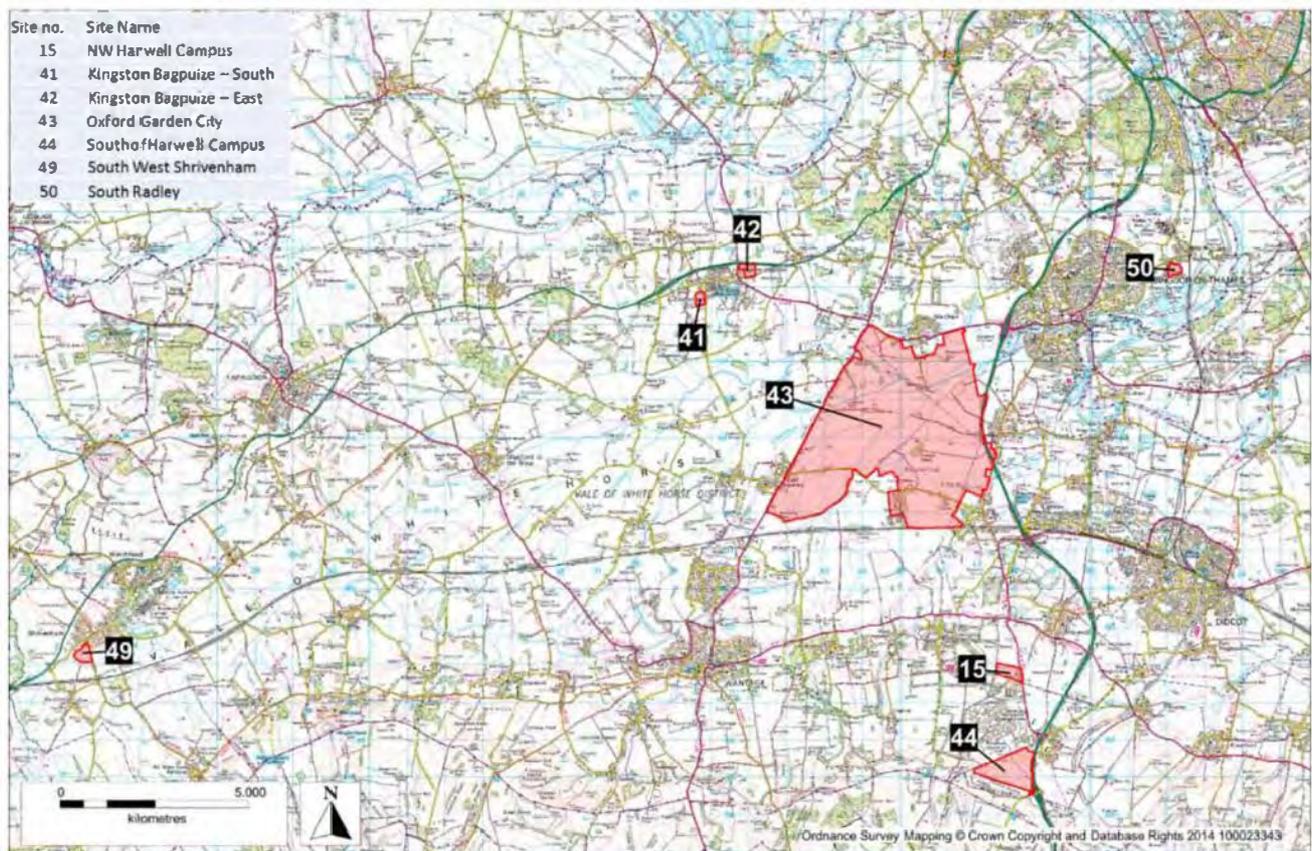
### 6.1. Introduction

6.1.1. A further stage of additional site testing was conducted following the Housing Delivery Update, published for consultation in February 2014, as some new sites were identified through the consultation process. These additional sites were tested to ensure all reasonable alternatives had been considered and the council was able to use an understanding of highway impact on their final selection of sites for inclusion within the final draft (Publication Version) of the Local Plan.

### 6.2. Land use and transport assumptions

6.2.1. The ETI Stage 4 work compared the impacts of seven further sites (Figure 6-1 and Table 6-1) against each other. The scenarios were created by adding the contingency sites to the Stage 3 highway transport demand matrices and assigning those to the same highway networks. Employment assumptions remained consistent with Stage 1.

Figure 6-1 ETI Stage 4 (Additional Housing Sites)



**Table 6-1 ETI Stage 4 (Additional Housing Sites)**

ETI Scenario	Site Description	Houses
S4a	South West Shrivenham	400
S4b	South Radley	260
S4c	East Kingston Bagpuize with Southmoor	280
S4c	South Kingston Bagpuize with Southmoor	200
S4d	NW Harwell Campus (including land to west of the original proposed allocation for 400 units)	550
S4e	South of Harwell Campus	1400*
S4f	Oxford Garden City	5600*

\*Potential for development post 2031

### 6.3. Impacts (without additional mitigation to Stage 1)

- 6.3.1. The network-wide performance impacts of the different development scenarios on the VoWH highway network are shown in Table 6-2 for the morning peak hour and Table 6-3 for the evening peak hour. The relative impacts of sites 4a to 4d is limited due to the relatively small increases in dwellings and consequently small increase in trips.
- 6.3.2. Scenarios 4e and 4f include a much greater increase in the number of dwellings and consequently results in increased delay compared with the other scenarios. For instance, Stage 4f is forecast to increase delay by 7% compared with Stage 4a and would require substantial mitigation to accommodate such levels of development. However, these sites were only tested to understand their potential impacts in 2031 although in reality they would only be providing potential delivery options post 2031.

**Table 6-2 ETI Stage 4 Network performance on the VoWH road network (morning peak hour)**

	Stage 4a	Stage 4b	Stage 4c	Stage 4d	Stage 4e	Stage 4f
Delay (pcu/h)	5097	5092	5110	5109	5137	5453
Total time (pcu/h)	13251	13223	13254	13263	13314	13702
Total distance (pcu/km)	570291	569056	569611	570236	572503	577203
Average speed (km/h)	43.0	43.0	43.0	43.0	43.0	42.1

**Table 6-3 ETI Stage 4 Network performance on the VoWH road network (evening peak hour)**

	Stage 4a	Stage 4b	Stage 4c	Stage 4d	Stage 4e	Stage 4f
Delay (pcu/h)	4773	4769	4787	4774	4859	4909
Total time (pcu/h)	12977	12964	12993	12987	13042	13212
Total distance (pcu/km)	573740	573288	573959	574603	572703	580198
Average speed (km/h)	44.2	44.2	44.2	44.2	43.9	43.9

## 6.4. Summary

- 6.4.1. This stage of ETI has tested seven new site options for possible inclusion within the final draft (Publication Version) Local Plan. Two of these sites could accommodate significant levels of growth and consequentially are associated with more significant impacts on the highway network. However, highway impact is only one factor used to determine the suitability of sites and this is particularly true for the sites tested at Stage 4 of the ETI. The VoWH have published a Topic Paper setting out the rationale for their site selection process and further details of why the Stage 4 sites were selected or not are set out within this paper<sup>12</sup>.

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<sup>12</sup> VOWH: Strategic Sites Selection Topic Paper (Nov 2014) <http://www.whitehorsedc.gov.uk/services-and-advice/planning-and-building/planning-policy/local-development-framework/core-strateg-6>

## 7. ETI Stage 5 – Local Plan – Publication Version

### 7.1. Introduction

- 7.1.1. The ETI has been prepared iteratively and has informed each stage of Local Plan production. Stages 3, 4 and 5 are closely related. Stage 4 tested additional site options which were identified through the Housing Delivery Update Consultation (February 2014) and Stage 5 considers the impact of the final site package.
- 7.1.2. The Stage 5 testing ensures the council was fully informed about the highway impacts associated with the final package of sites included in the final draft (Publication Version) plan published in November 2014. This stage is important to ensure the final package of mitigation to inform the Local Plan 2031 is optimised to ensure any highway impact associated with development is minimised.
- 7.1.3. Stage 5 tests the final growth and strategic development sites as included within the Local Plan – Publication Version. The Stage 5 contains three sub-stages: the first (S5) identifying the issues with the final draft Local Plan whilst the second stage demonstrating the impacts of medium scale mitigation measures (S5A) and the third stage compares two large scale mitigation measures (S5B and S5C). Details of the performance of each scenario and details of the mitigation measures are provided below.

### 7.2. Land use and transport assumptions

- 7.2.1. ETI Stage 5 represents the VoWH's final draft Local Plan. It makes provision to deliver 20,560 dwellings in the district between 2011 and 2031 (including the allocation of 13,960 additional dwellings through strategic development site allocations) and land to provide for 23,000 new jobs. This is more than 7,000 dwellings than planned for in the Draft Local Plan (February 2013). The housing distribution is shown in Table 7-1 and Figure 7-1. Strategic sites that were already included in the Draft Local Plan (February 2013), such as Monks Farm, Crab Hill and some 2100 dwellings at Valley Park were also included within the land use assumptions along with other completed and committed sites such as Grove Airfield.

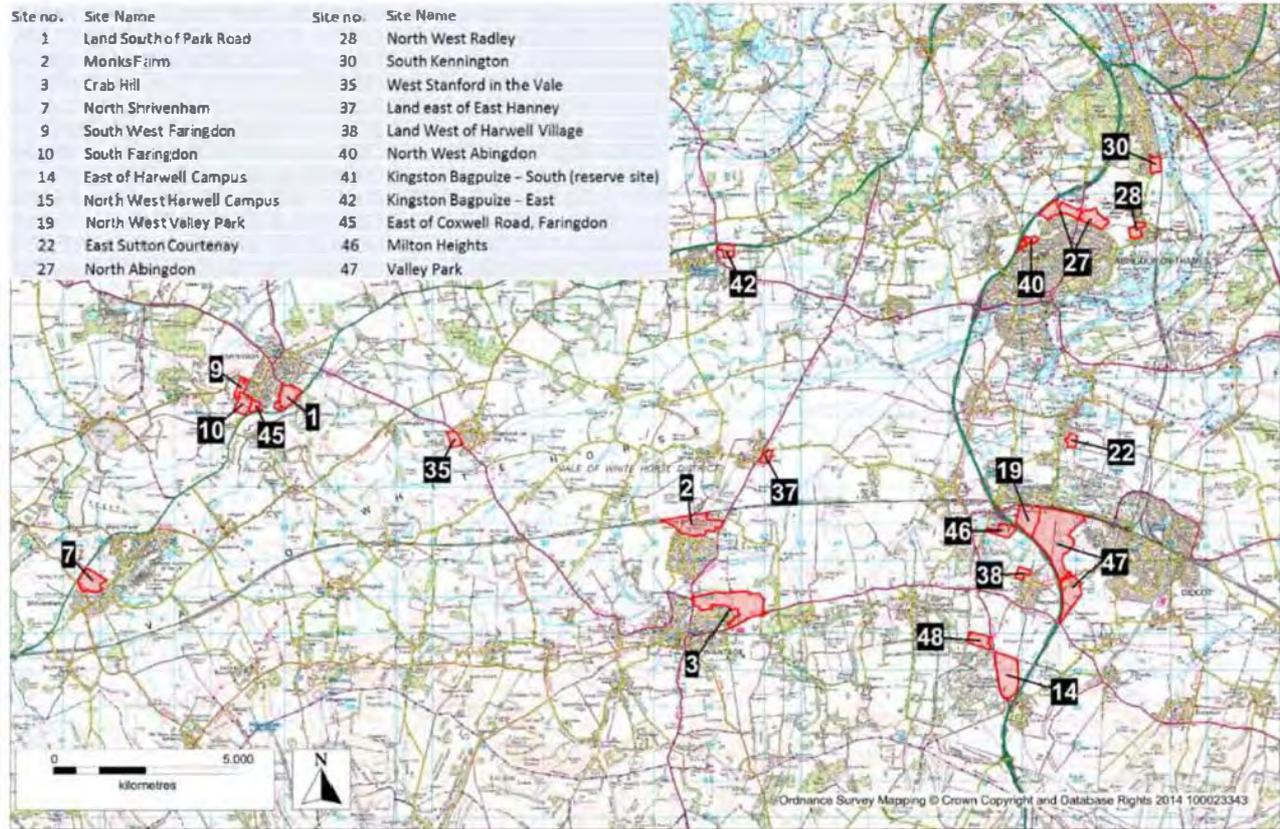
**Table 7-1 ETI Stage 5 (Local Plan – Publication Version) Strategic Sites**

Strategic Site	Dwellings	Strategic Site	Dwellings
Land South of Park Road, Faringdon	350	Stanford in the Vale	200
East of Coxwell Road, Faringdon	200	Valley Park	2550
Crab Hill, Wantage	1500	North West Valley Park	800
Monks Farm, Grove	750	East of Harwell Campus	850
East Sutton Courtenay	220	North West Abingdon	200
East Hanney	200	North Abingdon	800
SW Faringdon	200	South Kennington	270
South Faringdon	200	North West Radley	240
North Shrivenham	500	Milton Heights	400
West of Harwell	200	North of Harwell Campus	550
Kingston Bagpuize East	280		

Note: Sites at Monks Farm, Crab Hill and some 2100 dwellings at Valley Park were also included within the land use assumptions

7.2.2. The land use assumptions for this stage are consistent between all Stage 5 scenarios tested.

**Figure 7-1 ETI Stage 5 (Local Plan – Publication Version) Strategic Sites**



7.2.3. To maintain consistency between previous stages of analysis, this section presents analysis from a highways only modelling platform. However, as has been explained in Chapter 2, public transport and smarter choices measures are an integral part of the overall transport strategy. These are discussed further in this Chapter and Appendix F shows results from the new Oxfordshire Strategic Model, which has recently been created to test multi-modal responses to land use and transport changes.

## 7.3. Impacts without additional mitigation to that identified in Stage 1

### Network-wide performance

- 7.3.1. The impacts of the developments on VoWH highway network are shown in Table 7-2 for the morning and evening peak hour. The relative impacts of Stage 1, 3 (shown for information only) and 5 are the result of different levels of planned housing being applied in each case.
- 7.3.2. The highway transport demand associated with Stage 5, but without additional mitigation, is forecast to generate approximately 4800pcu hours delay in the morning peak hour and 4300pcu hours delay in the evening peak hour compared with 4500pcu hours and 4100pcu hours forecast in Stage 1 in the morning and evening peaks respectively. Average network speeds of 43.4km/h and 45.6km/h are also forecast on the VoWH highway network in the morning and evening peaks hours respectively for ETI Stage 5, which is 1% slower than ETI Stage 1.

**Table 7-2 ETI Stage 5 Network performance on the VoWH road network**

	Morning peak hour			Evening peak hour		
	Stage 1	Stage 3	Stage 5	Stage 1	Stage 3	Stage 5
<b>Delay (pcu/h)</b>	4554.1	5017.7	4818	4117.9	4455	4293
% Change from Stage 1b		10%	6%		8%	4%
<b>Total time (pcu/h)</b>	12276.2	13077.9	12800	11916.7	12582.7	12315
% Change from Stage 1b		7%	4%		6%	3%
<b>Total distance (pcu/km)</b>	540180.2	560464.8	555110	549536.7	568336.1	562021
% Change from Stage 1b		4%	3%		3%	2%
<b>Average speed (km/h)</b>	44	42.9	43.4	46.1	45.2	45.6
% Change from Stage 1b		-3%	-1%		-2%	-1%

7.3.3. It does indicate that the level of mitigation proposed for the Draft Local Plan Consultation February 2013 (ETI Stage 1) has the ability to accommodate some additional housing without large increases in delays or change to the proportion of total time spent delayed (37% in Stage 1 and Stage 5); although as will be discussed below, it will not be without some links being forecast to operate at or above operational capacity.

### Corridor performance

7.3.4. The key corridors for highway network analysis were described in Section 2.4 and shown in Appendix B. This section describes the corridor performance of the scenarios for the morning and evening peak hours without additional mitigation and Appendix C presents this information graphically. The analysis focuses on network performance, where the network is said to be operating:

- at operational capacity (i.e. conditions are such that traffic speed has dropped on links and minor incidents such as a turning vehicle have exaggerated impacts on traffic flow) with a volume to capacity ratio between 85% and 95%; and
- at capacity (i.e. it is not practically possible for additional traffic to proceed along the link) with a volume to capacity ratio of 95% and above.

### A34

7.3.5. In the morning peak the largest forecast flow is between Hinksey Hill and the Lodge Hill interchanges where northbound flow is forecast to be approximately 3800pcu and southbound flow is forecast to be 4000pcu. Similar levels of flow are also forecast for the section north of Milton Interchange. In the evening peak flows of 4000pcu are forecast on the northbound section between Chilton and Milton and approaching Hinksey Hill whilst flows of 3500pcu on the section south of Hinksey Hill in the southbound direction are also forecast.

7.3.6. The A34 is forecast to carry a significant amount of through traffic between the south of England and areas north of M40 J9. In the morning peak hour approximately 900 vehicles travel northbound from south of Chilton to M40 J9 and 1000pcu travel southbound. In the evening peak along the same route 1000pcu travel northbound and 900pcu travel southbound. This accounts for approximately one quarter of available capacity on the A34 and highlights the importance of this route for strategic journeys; the challenge is accommodating these and local journeys within a finite amount of road space.

7.3.7. Scenario 5 shows that the A34 is forecast to be operating at or above operational capacity in the northbound and southbound direction between Milton and Botley in the morning peak. In the evening peak the northbound section between Chilton and Botley is forecast to operate at or above operational capacity whilst in the southbound direction the A34 is forecast to operate at or above operational capacity between Botley and Milton.

### **A417**

- 7.3.8. In the morning peak the largest forecast traffic flow in the eastbound direction is 1700pcu between Ardington and West Hendred whilst the largest flow on the westbound section is forecast to be 1000pcu between Featherbed Lane and West Hendred. In the evening peak the largest forecast flow in the eastbound direction is 1300pcu approaching Featherbed Lane and 1650pcu between Ardington and West Hendred in the westbound direction.
- 7.3.9. This scenario shows that in the morning peak the A417 is operating at or above operational capacity in the eastbound direction between Wantage and Featherbed Lane. In the evening peak the A417 is operating at or above operational capacity in the westbound direction between Featherbed Lane and Wantage and in the eastbound direction on the approach to Featherbed Lane.

### **A338**

- 7.3.10. In the morning peak the section of the route between East Hanney and Frilford is forecast to have the largest forecast flow (1000pcu) in the northbound direction whilst in the southbound direction the largest forecast flow of 900pcu is forecast between East Hanney and Grove. In the evening peak the largest flows are forecast to be the same scale and at the same location, albeit in the opposite direction of travel.
- 7.3.11. Scenario 5 shows that the A338 is forecast to be operating below operational capacity in the morning peak. In the evening peak the A338 is forecast to be operating below operational capacity except in the southbound direction near Grove and East Hanney which is forecast to be operating at operational capacity.

### **A420**

- 7.3.12. In the morning peak the largest flow in the northbound direction is forecast to be 2000pcu approaching the Botley Interchange and maximum traffic flow on the southbound section is 1300pcu exiting the Botley Interchange. In the evening peak the maximum traffic flow is 2000pcu leaving the Botley Interchange.
- 7.3.13. This scenario shows that the A420 westbound is forecast to be operating below operational capacity in the morning peak except at Buckland where it operates at or above operational capacity and there are also short sections of the A420 near Fyfield and Cumnor which also operate at or above operational capacity in the eastbound direction. In the evening peak the A420 is forecast to be operating below operational capacity except at the eastern approach to Buckland where it operates at or above operational capacity and again the sections near Fyfield and Cumnor are also forecast to operate at or above operational capacity in the westbound direction.

### **A415**

- 7.3.14. On this route the largest forecast eastbound flow is 1300pcu approaching the Marcham Interchange whilst the largest westbound flow is forecast to be 700pcu between Marcham and Frilford. In the evening peak the largest flows are found accessing and egressing the western side of the Marcham Interchange with 900pcu forecast approaching the interchange and 1400pcu forecast to be exiting the interchange.
- 7.3.15. Scenario 5 shows that the A415 is forecast to be operating below operational capacity in the morning peak in the westbound direction. In the eastbound direction the A415 is forecast to be operating at or above operational capacity between Kingston Bagpuize and Frilford and between Marcham and the A34. In the evening peak the eastbound section between Kingston Bagpuize and Frilford is forecast to operate at capacity along with the westbound section between the A34 and Frilford. Analysis has shown the traffic signals at Frilford are sensitive to the amount of traffic using this route and consequently to delays on this route.

### A4130

- 7.3.16. In the morning peak the largest flow in the eastbound direction is forecast to be 1000pcu exiting the Milton Interchange whilst 1500pcu are forecast to be approaching the Milton Interchange from Didcot. In the evening peak the maximum traffic flow is also observed on the Didcot access and egress to the Milton Interchange of approximately 900pcu in both directions.
- 7.3.17. This scenario shows that the A4130 is forecast to be operating at capacity in the morning peak on the westbound approach to the Milton Interchange.

### A4185

- 7.3.18. In the morning peak the largest forecast traffic flow is 1500pcu between the Chilton Interchange towards Harwell Campus whilst the largest traffic flow on the southbound section is forecast to be 1100pcu on the section south of the A417. In the evening peak the flow between Harwell and the A417 is forecast to be 1100pcu and the flow approaching Chilton Interchange is forecast to be 1400pcu.
- 7.3.19. Scenario 5 shows that during the morning and evening peaks this link is forecast to operate below operational capacity, although gets close to this between Chilton Interchange and Fermi Avenue.

#### Summary of key highway issues without additional mitigation

- A34 operating at or above operational capacity in both directions between Milton and Botley in the morning and evening peak.
- A417 operating at or above operational capacity between Wantage and Featherbed Lane in the morning peak and in the other direction in the evening peak.
- A420 operating at or above operational capacity in both directions near Buckland and in short sections near Cumnor and Fyfield in the morning and evening peaks.
- A415 operating at or above operational capacity between Kingston Bagpuize and Frilford, with particular problems at the Frilford junctions with the A338 and between Marcham and the A34.
- A4130 operating at capacity approaching Milton Interchange.

## 7.4. Highway mitigation scenario definition - ETI Stage 5A, B & C

- 7.4.1. The testing of the Stage 5 (S5) scenarios consist of a fixed housing and employment distribution, shown above. The highway mitigation scenarios take two forms: medium scale and large scale. After Stage 3 a range of potential highway mitigation measures to address problems associated with the Stage 3 level of housing demand were considered. These included improvements for north-south movements along the A420, A338 and A34 corridors as well as improvements for east-west movements along the A415 and A417 corridors, including looking at particular junctions. New routes were also considered. A review of the effectiveness and deliverability of these interventions formed the basis for the development of mitigation scenarios for Stage 5.
- 7.4.2. The medium scale schemes which aim to address traffic problems on the A417, A420, A415 and A4130 and include:
- Widening along the A4130 from Milton Interchange to Science Bridge to accommodate the additional traffic from developments at Great Western Park, Valley Park and Didcot A and to facilitate a public transport corridor east of Science Bridge, into Didcot.
  - South facing slips at Lodge Hill would provide better access for traffic travelling to and from Abingdon whilst relieving Abingdon of some traffic travelling through the town.
  - Improvements to the traffic signal timings at Frilford signals.
  - In addition to the mitigation measures above, Oxfordshire County Council are progressing corridor studies along the A420, A338 and A417. These studies typically have the following objectives:
    - Improve capacity by reducing non-motorised and motorised user conflicts;
    - Improve public transport frequency and reliability along the corridors;
    - Thus enable more people to travel;

- Address the competing requirements of road users and the adjacent communities; and thus improve safety at accident hot-spots.

7.4.3. From a modelling perspective it was not possible to model the outcome of the corridor studies as they are focused on improving the people carrying capacity of those links, not just vehicle capacity. The measures to improve the environment for walking and cycling are expected to increase active travel by these modes whilst not affecting vehicle capacity. Similarly, improvements to bus services, bus priority and the waiting and walking environment for public transport users is expected to increase travel by bus and enable more people to travel along these corridors. The overall impact on highway network of these measures is expected to be small. Whilst some motorists may change mode from the car it is expected that this will result in other vehicles re-routing to take the available road space.

7.4.4. The larger scale schemes focus on potential approaches to managing traffic between Oxford, Abingdon and Didcot; addressing problems on the A34 in two ways:

- One option considers an improved Thames crossing near Culham, utilising the A415 and A4074 as alternative routes between Didcot, Oxford and Abingdon.
- The other option considered widening the A34 between Hinksey and Milton.

7.4.5. The resultant Scenarios are listed in Table 7-3 and shown graphically in Figures 7.2 to 7.4

**Table 7-3 ETI Stage 5 scenario definition**

Scenario	Description
ETI Stage 5	<ul style="list-style-type: none"> <li>• No additional highway mitigation</li> </ul>
ETI Stage 5 A	<ul style="list-style-type: none"> <li>• Scenario 5 with A4130 widening between Milton Interchange and Science Bridge, Lodge Hill south facing slip roads and improvements to the traffic signals at the A415 / A338 junctions at Frilford</li> <li>• Corridor studies along the A420, A338 and A417.</li> </ul>
ETI Stage 5 B	<ul style="list-style-type: none"> <li>• Scenario 5A with a new Thames crossing at Culham and a Clifton Hampden Bypass</li> </ul>
ETI Stage 5 C	<ul style="list-style-type: none"> <li>• Scenario 5A with A34 widening between Hinksey and Milton.</li> </ul>

Figure 7-2 Stage 5A highway mitigation measures

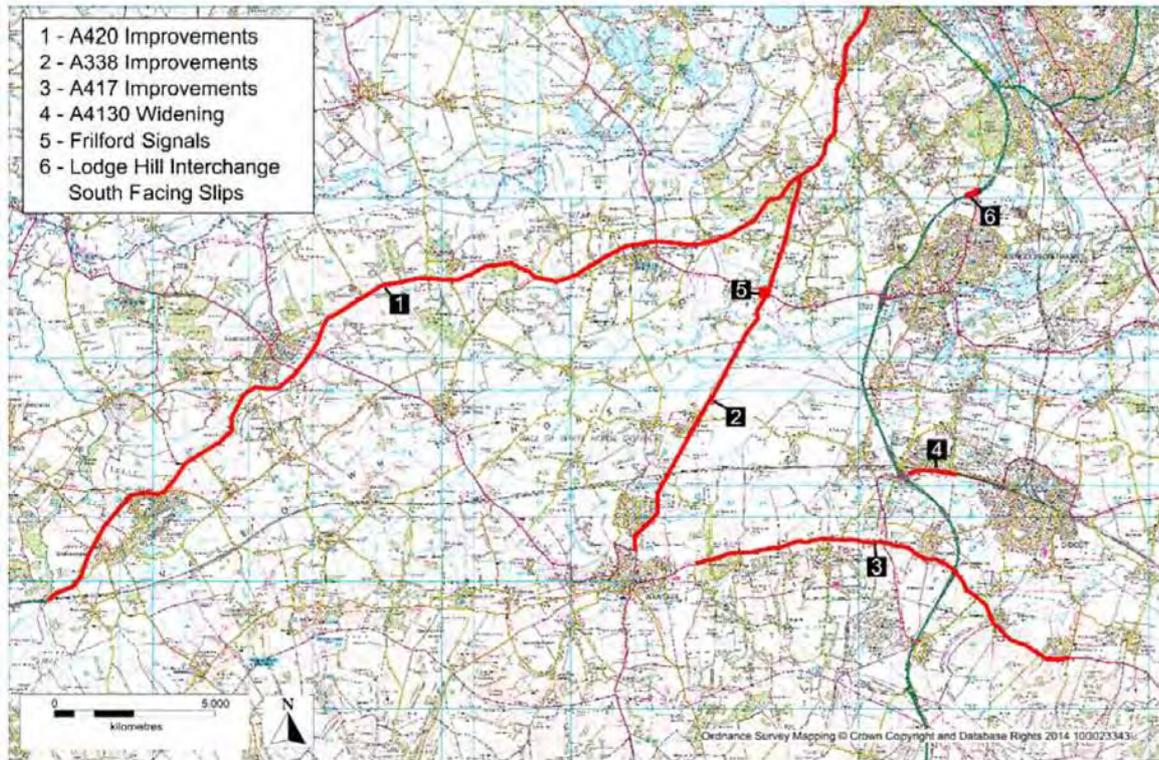
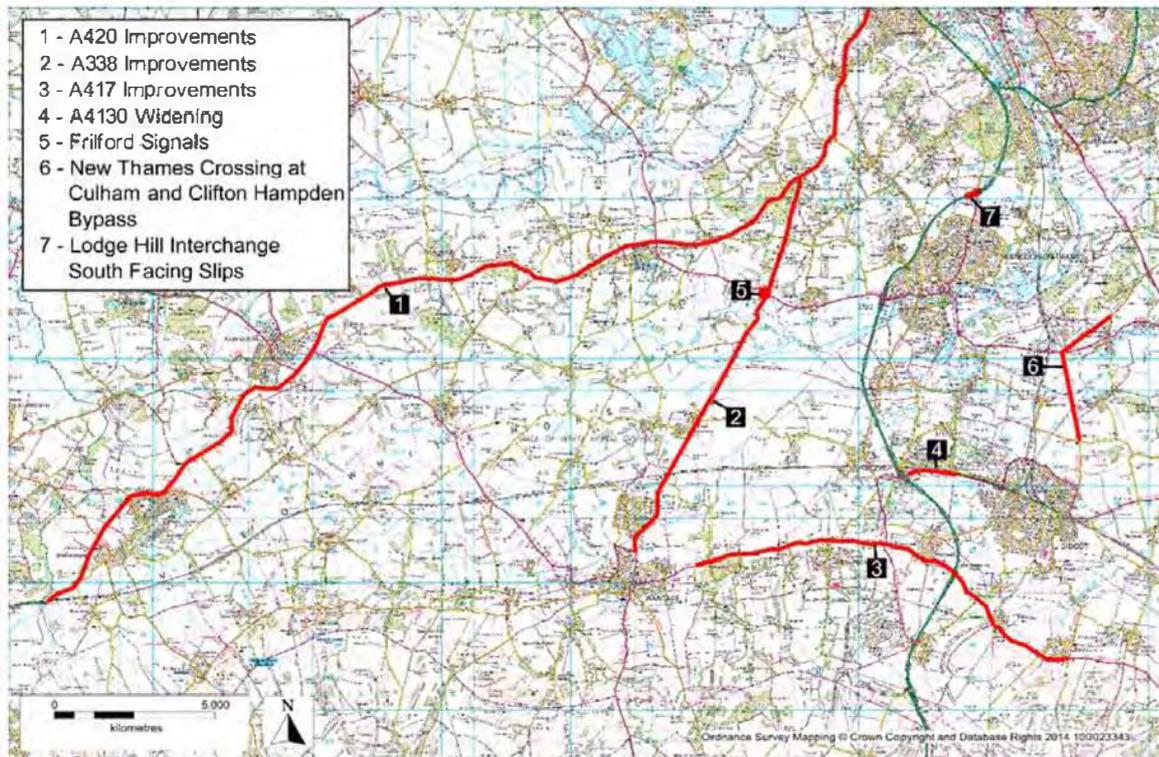
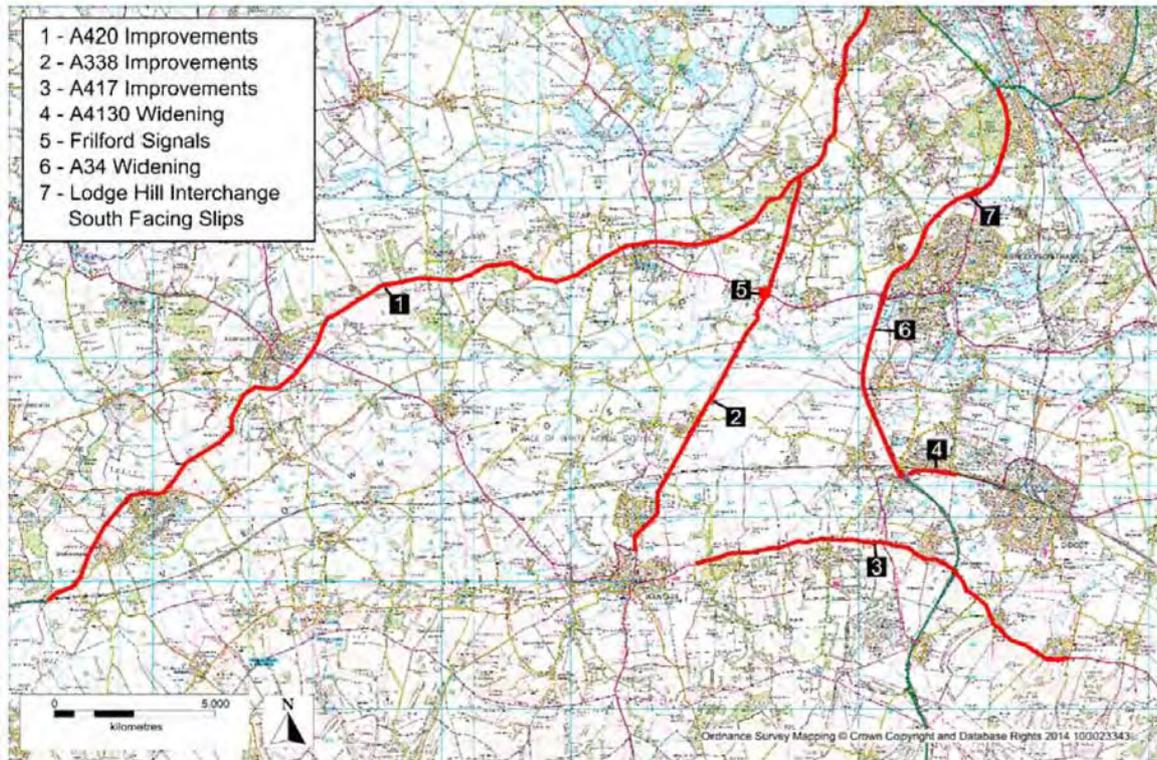


Figure 7-3 Stage 5B highway mitigation measures



**Figure 7-4 Stage 5C highway mitigation measures**



## 7.5. Impacts with highway mitigation only - Stage 5A, B & C

### Network-wide performance

- 7.5.1. The impacts of the developments and different mitigation scenarios on VoWH highway network are shown in Table 7-4 for the morning peak hour and Table 7-5 for the evening peak hour. The relative impacts of Stage 1, Stage 3 (shown for information only) and the Stage 5 are shown and the result of the mitigation measures described in Table 7-3 can be ascertained.
- 7.5.2. The incremental addition of Scenario 5A is still forecast to result in delay approximately 1-2% greater than the Stage 1 results in the morning and evening peak hour. The addition of the larger scheme (new river crossing) under 5B reduces delay by 6% and 5% in the morning peak hour and evening peak hour respectively compared with Stage 1, while the larger scheme (A34 widening) under 5C reduces delay by 5% in the morning peak hour and 8% in the evening peak hour respectively relative to the Stage 1 results. This suggests that within the VoWH, the A34 intervention would have the greatest impact.

**Table 7-4 ETI Stage 5 Network performance on the VoWH road network (morning peak hour)**

	Stage 1	Stage 3	Stage 5	Stage 5A	Stage 5B	Stage 5C
<b>Delay (pcu/h)</b>	4554	5018	4818	4652	4265	4330
% Change from Stage 1		10%	6%	2%	-6%	-5%
<b>Total time (pcu/h)</b>	12276	13078	12801	12869	12345	12410
% Change from Stage 1		7%	4%	5%	1%	1%
<b>Total distance (pcu/km)</b>	540180	560465	555110	561852	554883	569876
% Change from Stage 1		4%	3%	4%	3%	5%
<b>Average speed (km/h)</b>	44.0	42.9	43.4	43.7	44.9	45.9
% Change from Stage 1		-3%	-1%	-1%	2%	4%

**Table 7-5 ETI Stage 5 Network performance on the VoWH road network (evening peak hour)**

	Stage 1	Stage 3	Stage 5	Stage 5A	Stage 5B	Stage 5C
<b>Delay (pcu/h)</b>	4118	4455	4294	4140	3930	3789
% Change from Stage 1		8%	4%	1%	-5%	-8%
<b>Total time (pcu/h)</b>	11917	12583	12315	12308	11993	11932
% Change from Stage 1		6%	3%	3%	1%	0%
<b>Total distance (pcu/km)</b>	549537	568336	562021	559332	553488	575126
% Change from Stage 1		3%	2%	2%	1%	5%
<b>Average speed (km/h)</b>	46.1	45.2	45.6	45.4	46.2	48.2
% Change from Stage 1		-2%	-1%	-2%	0%	5%

7.5.3. The large scale highway interventions will affect not only the VoWH highway network but much of the southern part of Oxfordshire. To confirm that these interventions have a positive impact across a wider area, network-wide performance indicators for the whole county are shown in Table 7-6 and 7-7 for the morning and evening peak hours respectively. It can be seen that the scenario with a new Thames crossing at Culham and a Clifton Hampden Bypass (S5B) makes the greater contribution to reducing forecast levels of delay on the county highway network than the A34 widening between Hinksey and Milton scenario. The introduction of the Thames crossing at Culham and a Clifton Hampden Bypass (S5B) is forecast to result in a reduction of forecast delay of 4% and 2% in the morning and evening peak hour respectively compared with the Stage 1 (Draft Local Plan Consultation Feb 2013). The introduction of the A34 improvements (S5C) is forecast to result in a reduction of forecast delay of 0% and 1% in the morning and evening peak hour respectively compared with the Stage 1.

7.5.4. Part of the reason for the diluted performance of the A34 improvements across the county network is that the intervention includes only improvements to the main carriageway and not the slips. It also excludes improvements to the A34 to the west of Oxford, which is also congested. As such, significant improvements to the A34 are, and need to be, assessed as a holistic corridor. The scale of such an intervention is likely to be a long term and complex project. It is for this reason, coupled with the wider local connectivity benefits, that the Thames crossing at Culham and Clifton Hampden Bypass is considered by OCC to be a more appropriate scheme to form part of this transport strategy. The remainder of this chapter considers the impacts of the intervention scenarios in more detail.

**Table 7-6 ETI Stage 5 Network performance on the county road network (morning peak hour)**

	Stage 1	Stage 5	Stage 5A	Stage 5B	Stage 5C
<b>Delay (pcu/h)</b>	9771.6	10125.0	9992.7	9421.3	9727.9
% Change from Stage 1		4%	2%	-4%	0%
<b>Total time (pcu/h)</b>	42441.7	42963.6	42994.8	42488.0	42485.7
% Change from Stage 1		1%	1%	1%	1%
<b>Total distance (pcu/km)</b>	2143589.3	2162071.8	2167245.0	2171198.0	2174159.5
% Change from Stage 1		1%	1%	1%	1%
<b>Average speed (km/h)</b>	50.7	50.3	50.4	51.1	51.2
% Change from Stage 1b		-1%	-1%	1%	1%

**Table 7-7 ETI Stage 5 Network performance on the county road network (evening peak hour)**

	Stage 1	Stage 5	Stage 5A	Stage 5B	Stage 5C
Delay (pcu/h)	9461.1	9767.1	9690.9	9284.7	9369.2
% Change from Stage 1		3%	2%	-2%	-1%
Total time (pcu/h)	42338.6	42993.3	42928.6	42518.9	42544.2
% Change from Stage 1		2%	1%	0%	0%
Total distance (pcu/km)	2172031.0	2189086.3	2183809.3	2187897.8	2203389.8
% Change from Stage 1		1%	1%	1%	1%
Average speed (km/h)	51.3	50.9	50.9	51.5	51.8
% Change from Stage 1		-1%	-1%	0%	1%

## Detailed performance of specific mitigation scenarios

### Changes in traffic flow

- 7.5.5. The relative impacts of each highway mitigation scenario (S5A, S5B and S5C) in terms of changes in traffic flow are shown in Appendix D and E for the morning and evening peaks against the Stage 5 scenario without mitigation (S5).

### Stage 5A

- 7.5.6. The addition of the south facing Lodge Hill slips offers an alternative route to and from the A34 for traffic from Abingdon and avoids traffic routing through Abingdon to access or egress the A34. In the morning peak it is forecast to reduce flow by approximately 100pcu on the A4183 in both directions and to reduce southbound flow on Copenhagen Drive corridor to the A415 by approximately 500pcu. The impact on Abingdon is more modest in the evening peak.
- 7.5.7. The impact on the Marcham Interchange in the morning peak is forecast to decrease demand on the southbound on slip by approximately 900pcu but is forecast to increase traffic on the A415 between the interchange and Marcham by 600pcu and by 800pcu between the interchange and Abingdon. In the evening peak there is forecast to be increased use of the Lodge Hill Interchange and decreased use of the Marcham Interchange.
- 7.5.8. Further work would be required to investigate the impacts on the south facing Lodge Hill slips on the A34 and surrounding area as it is recognised that the A34 is at operational capacity in this area; although benefits for the town of Abingdon seem positive.

### Stage 5B and Stage 5C

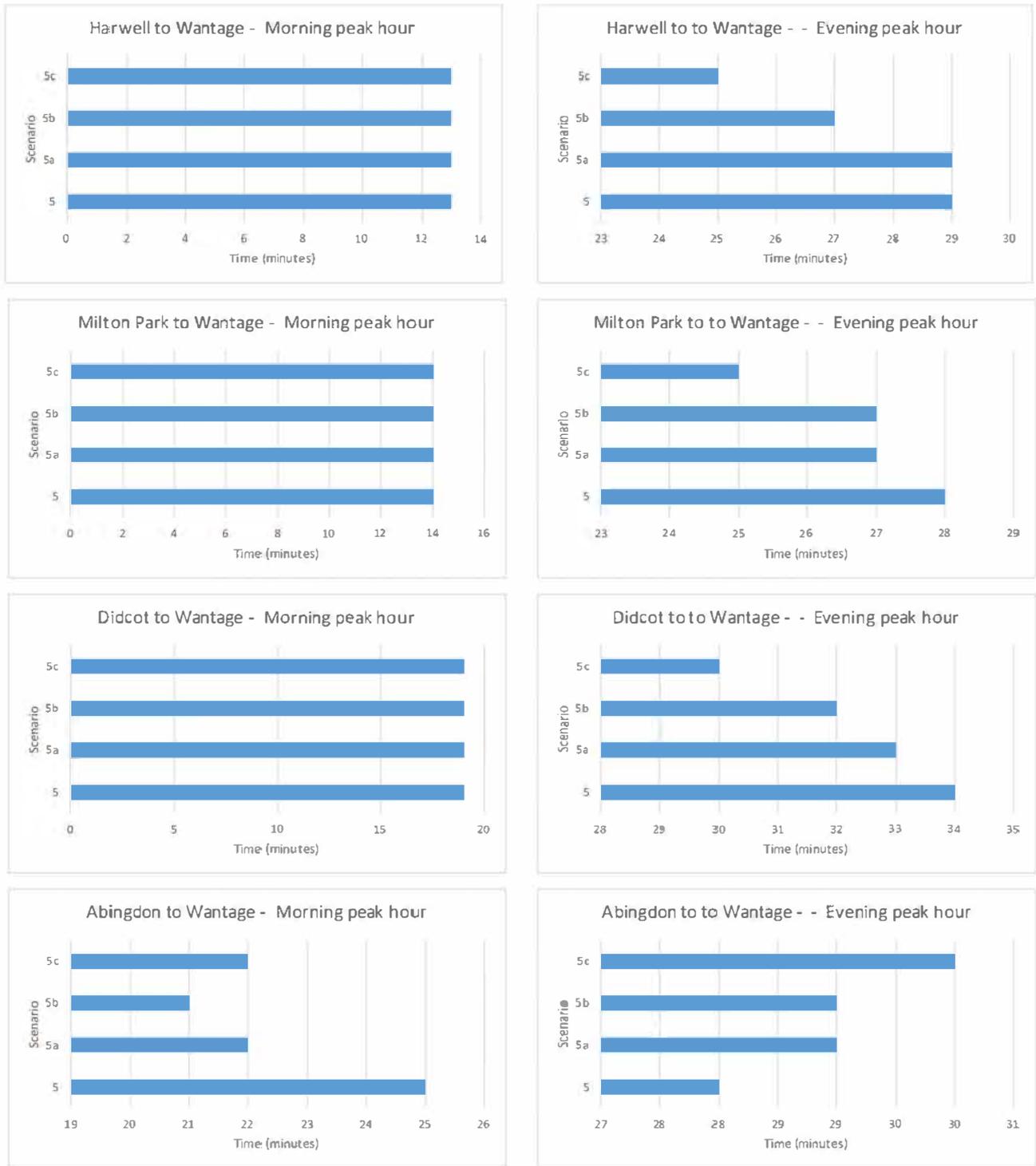
- 7.5.9. The Thames crossing at Culham and a Clifton Hampden Bypass scenario (S5B) is forecast to increase traffic on the A415 between Abingdon and Clifton Hampden and between Didcot (via its northern distributor) to Clifton Hampden. This then results in an increase in traffic on the A4074 to and from Oxford in the morning peak. However, the scheme is also forecast to reduce flow on the A34 between Marcham and Hinksey Hill and on the roads through Sutton Courtenay and Long Wittenham.
- 7.5.10. The scenario with A34 widening between Hinksey and Milton Interchanges (S5C) forecasts increased flow on the A34 along this improved section. The greatest change in flow is between Milton and Lodge Hill Interchanges and less impact further north as there is no increased capacity for this extra flow to leave the A34. The impact on local roads is relatively small, although the B4017 is forecast to experience reductions in flow of approximately 200pcu. This relatively small change on the local road network suggests that the increased capacity actually enables queued traffic to make their journeys rather than attracting large traffic volumes from other roads.

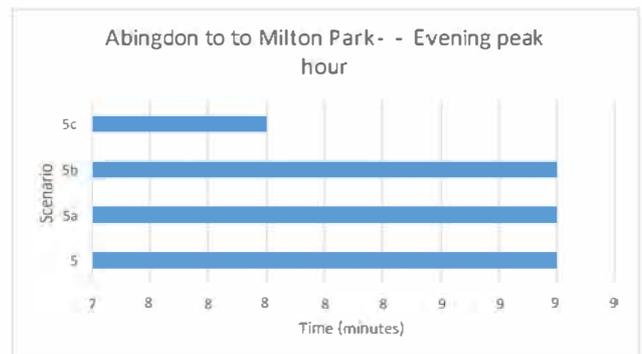
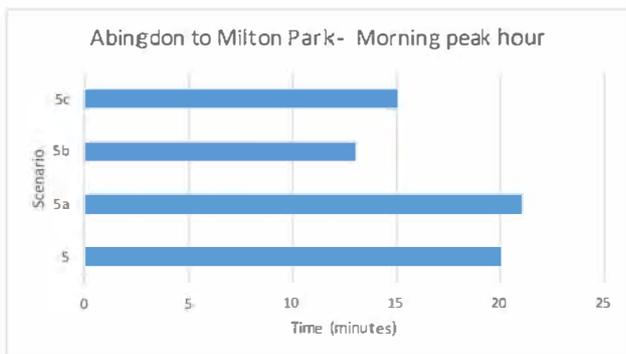
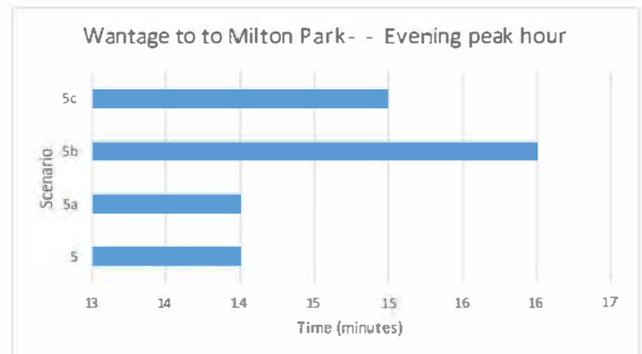
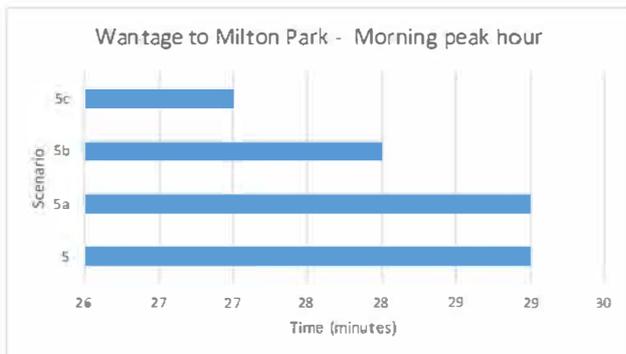
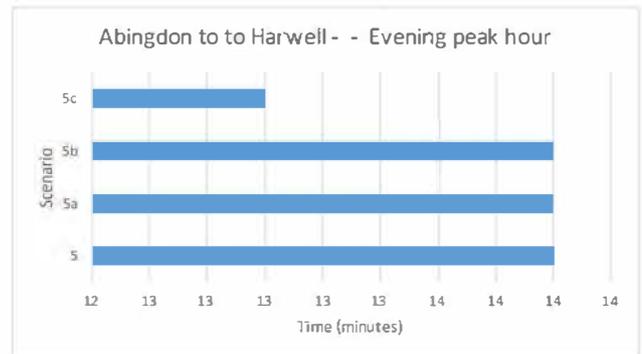
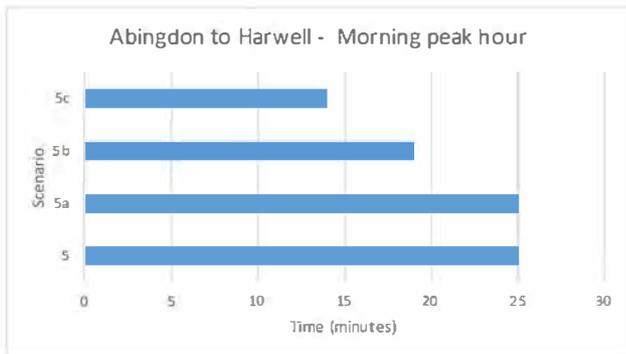
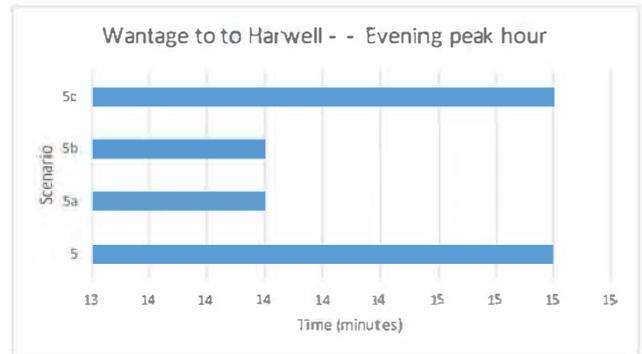
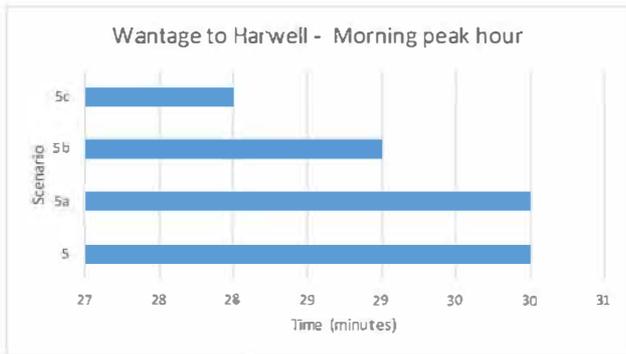
- 7.5.11. In both instances further work would be required to fully understand all of the impacts of these scenarios and to move towards designing and remodelling these interventions.

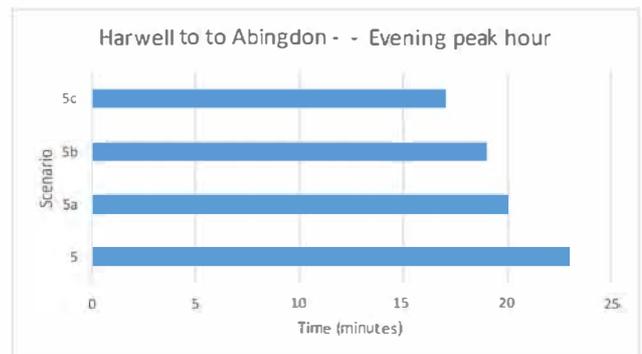
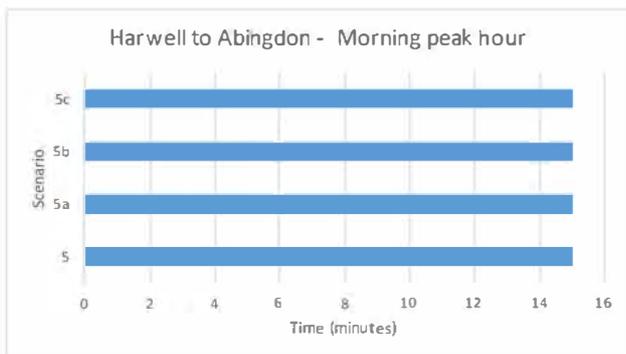
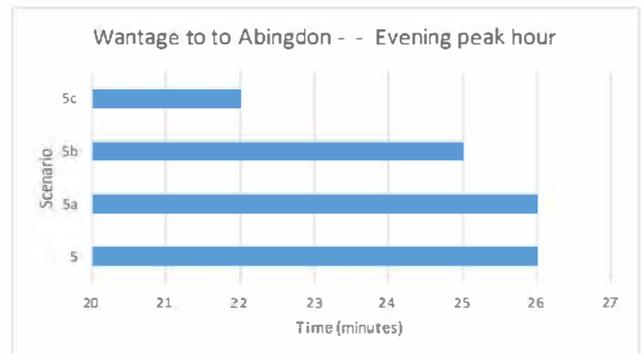
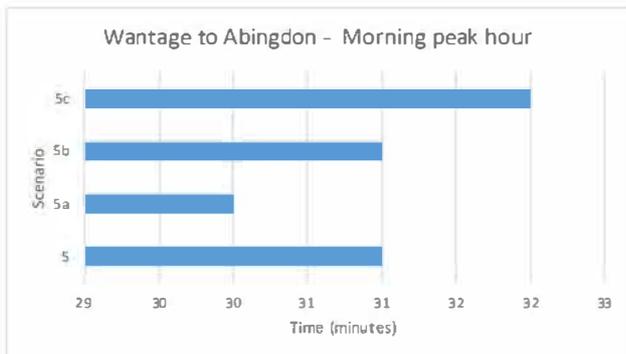
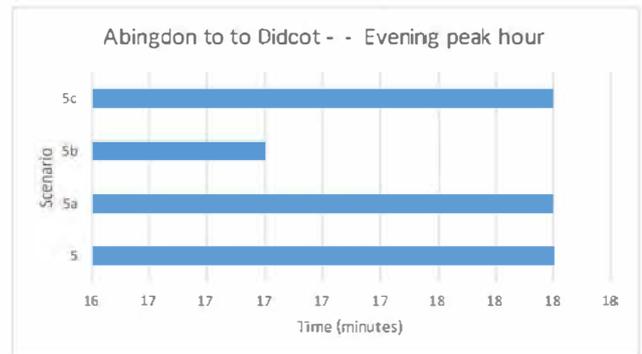
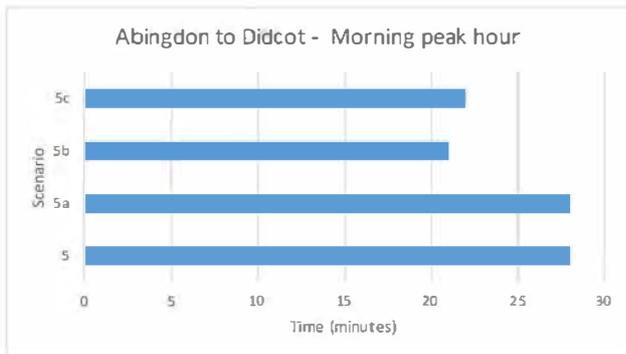
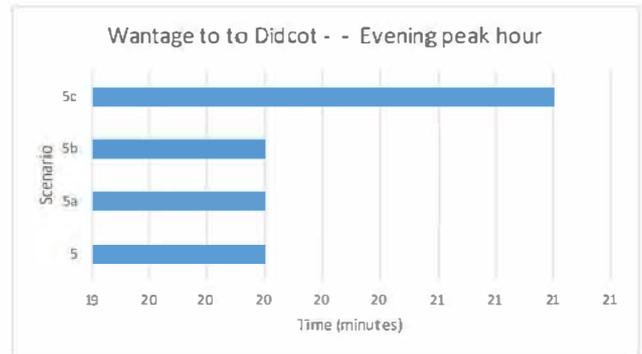
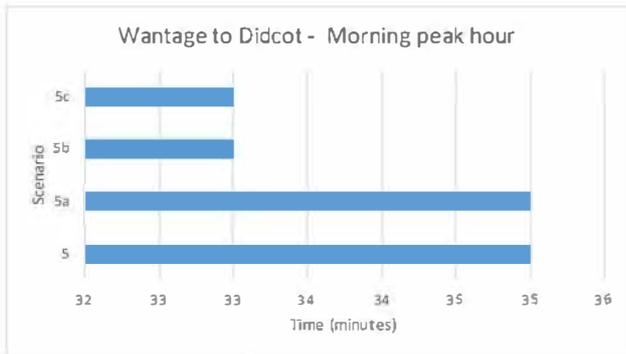
### **Journey time analysis**

- 7.5.12. As part of the assessment of the mitigation measures, journey time data between some key locations (Wantage, Harwell Campus, Milton Park, Didcot and Abingdon) has been extracted from the highway model. These results are shown in Figure 7-5 and compare journey times in each highway mitigation scenario (S5A, S5B and S5B) for the morning and evening peaks against the Stage 5 scenario without mitigation (S5).
- 7.5.13. The introduction of the A4130 widening between Milton Interchange and Science Bridge, Lodge Hill south facing slip roads and improvements to the traffic signals at the A415 / A338 junctions at Frilford in Stage 5A is forecast to have the effect of improving slightly (<10%) journey times between Abingdon and Wantage in the morning peak and between Harwell Campus and Abingdon in the evening peak.
- 7.5.14. The addition of the Thames crossing at Culham and a Clifton Hampden Bypass to Scenario 5B has a more dramatic effect on forecast journey times. In the morning peak the largest forecast reduction in journey time is to be experienced from Abingdon to Wantage (16%), Harwell Campus (24%), Milton Park (35%) and Didcot (25%). A similar pattern is forecast to occur in the evening peak, albeit in the opposite direction of travel.
- 7.5.15. Finally, the addition of A34 widening between Hinksey and Milton Interchanges as part of Scenario 5C has a similarly dramatic effect on forecast journey times as queuing traffic is released and journey times improved. In the morning peak the largest effect is forecast to be experienced from Abingdon to Wantage (12%), Harwell Campus (44%), Milton Park (25%) and Didcot (21%). A similar pattern is forecast to occur in the evening peak, albeit in the opposite direction of travel along with reductions in journey times to Wantage from Harwell Campus, Milton Park and Didcot.

**Figure 7-5 Journey times between key routes**









### Corridor performance

7.5.16. The key corridors for highway network analysis were described in Section 2.4 and shown in Appendix B. This section describes the corridor performance of the scenarios for the morning and evening peak hours and Appendix C presents this information graphically. The analysis focuses on network performance, where the network is said to be operating:

- at operational capacity (i.e. conditions are such that traffic speed has dropped on links and minor incidents such as a turning vehicle have exaggerated impacts on traffic flow) with a volume to capacity ratio between 85% and 95%; and
- at capacity (i.e. it is not practically possible for additional traffic to proceed along the link) with a volume to capacity ratio of 95% and above.

### A34

7.5.17. Scenario 5A shows that the A34 is forecast to be operating at or above operational capacity in the morning and evening peak between Marcham and Milton. In the morning peak the southbound section between Botley and Lodge Hill operates at or above operational capacity and in the evening peak the section between Botley and Lodge Hill operates at operational capacity in both directions.

7.5.18. Scenario 5B is forecast to reach operational capacity in similar locations to those observed in Scenario 5A. In the morning peak improvements are seen on the northbound section between Milton and Marcham and on the southbound section between Hinksey and Lodge Hill.

7.5.19. Scenario 5C is forecast to perform below operational capacity in both directions between Hinksey and Milton. Between Hinksey and Botley, where this is no change in capacity, the A34 is forecast to be operating at or above operational capacity in both directions. In the evening peak the A34 is forecast to be operating below operational capacity between Hinksey and Chilton and on the northbound section between Marcham and Chilton it is forecast to be operating at operational capacity.

### A417

7.5.20. Scenario 5A and 5B show that in the morning peak the A417 is operating at or above operational capacity in the eastbound direction between Wantage and Featherbed Lane. In the evening peak the A417 is operating at or above operational capacity in the westbound direction between

Featherbed Lane and Wantage and in the eastbound direction on the approach to Featherbed Lane.

- 7.5.21. Scenario 5C shows that in the morning and evening peaks the eastbound section between Wantage and Featherbed Lane is operating at or above operational capacity. In the evening peak the section between Wantage and Featherbed Lane is operating at capacity in both directions.

### **A338**

- 7.5.22. Scenario 5A shows that the A338 is forecast to be operating below operational capacity in the morning peak. In the evening peak the A338 is forecast to be operating below operational capacity except in the southbound direction near Grove and East Hanney which is forecast to be operating at operational capacity.
- 7.5.23. Scenario 5B shows that the A338 is forecast to be operating below operational capacity in the morning peak except for a section north of Frilford which is operating at operational capacity in the northbound direction. In the evening peak the A338 is forecast to be operating below operational capacity except for a southbound section north of Grove and East Hanney.
- 7.5.24. Scenario 5C shows that the A338 is forecast to be operating below operational capacity in the morning peak except for sections north of Grove and Frilford which are operating at operational capacity in the northbound direction. In the evening peak the A338 is forecast to be operating below operational capacity except for a southbound section north of Grove.

### **A420**

- 7.5.25. Scenarios 5A, 5B and 5C show that the A420 westbound is forecast to be operating below operational capacity in the morning peak except at Buckland where it operates at or above operational capacity in both directions. In addition, short sections near Cumnor on the eastbound section, the eastbound section near Fyfield and on the northbound section where the A420 meets the A417 near Faringdon, also operate at or above operational capacity. In the evening peak the A420 is forecast to be operating below operational capacity except at Buckland in both directions, the westbound sections near Fyfield and Cumnor are forecast to operate at or above operational capacity.

### **A415**

- 7.5.26. Scenarios 5A and 5B show that in the morning peak the A415 is forecast to be operating at operational capacity between Kingston Bagpuize and Frilford and at capacity on the approach to the A34 in the eastbound direction. The westbound direction is operating below operational capacity in the morning peak. In the evening peak the A415 is forecast to be operating at operational capacity in the eastbound direction and on the westbound section between the A34 and Frilford. In both scenarios the A415 in the westbound direction between Frilford and Marcham is also forecast to be operating at capacity.
- 7.5.27. Scenario 5C shows that the A415 is forecast to be operating below operational capacity in the AM in the westbound direction. In the eastbound direction, sections between Kingston Bagpuize and Frilford and between Marcham and the A34 operate at or above operational capacity. In the evening peak the A415 is forecast to be operating at capacity between Kingston Bagpuize and Frilford on the eastbound section and between the A34 and Frilford in the westbound direction. The A415 in the westbound direction between Frilford and Marcham is also forecast to be operating at capacity during the evening peak.

### **A4130**

- 7.5.28. Scenario 5A shows that the A4130 is forecast to be operating at capacity in the morning peak on the westbound approach to the Avon Way roundabout and eastbound approach to the Avon Way roundabout in the evening peak.
- 7.5.29. Scenario 5B shows that the A4130 is forecast to be operating below operational capacity in the morning and evening peaks, except for the approach links in each direction to the Avon Way

roundabout and the eastbound approach to the Ladygrove junction which are forecast to be at operating capacity.

- 7.5.30. Scenario 5C shows that the A4130 is forecast to be operating at capacity in the morning peak on the westbound approach to the Avon Way roundabout and eastbound approach to the Avon Way roundabout in the evening peak. Both peaks show that the westbound section near Science Bridge to be operating at capacity.

### **A4185**

- 7.5.31. Scenario 5A shows that the A4185 is forecast to be at operational capacity during both peak periods.
- 7.5.32. Scenario 5B shows that the A4185 is forecast to operate below operational capacity, except for traffic travelling southbound, south of the A417/A4185 junction. It is forecast to operate below operational capacity in the evening peak.
- 7.5.33. Scenario 5C shows that in the morning peak, the A4185 is forecast to operate below operational capacity, except for traffic travelling north from Chilton Interchange to Milton which is operating at capacity. It is forecast to operate below operational capacity in the evening peak.

In summary, it can be seen that the main east-west and north-south corridors across the Vale have instances where sections of the routes are forecast to be operating at or above operational capacity. In other places along the corridors, there is little change between the traffic flows at Stage 1 (South East Plan growth) vs. Stage 5b (Local Plan 2031 growth). Oxfordshire County Council will analyse and make recommendations to improve traffic flow and access for all modes along these routes, through a mix of corridor Studies and targeted assessment to understand what improvements might be possible.

## **7.6. Public transport and smarter choices mitigation scenario definition**

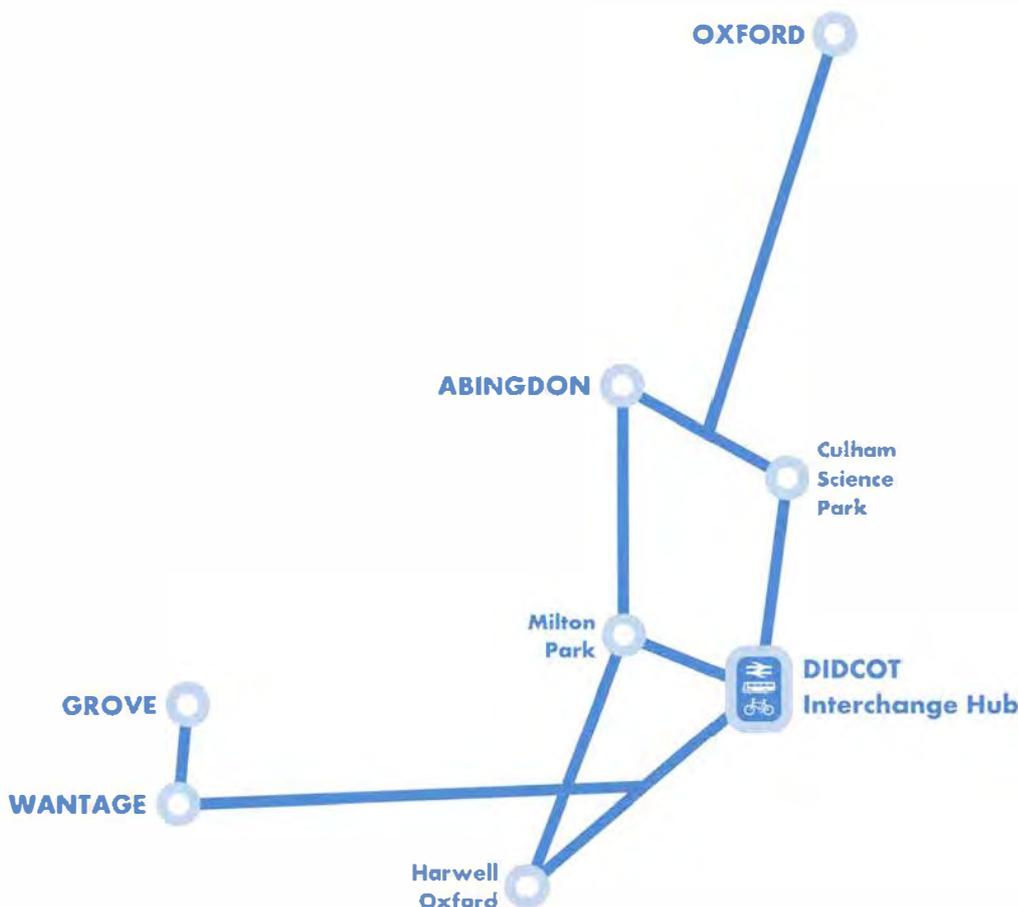
- 7.6.1. In addition to the package of strategic highway schemes tested in the Central Oxfordshire Transport Model, a range of schemes are either being delivered or are programmed for delivery to improve travel by sustainable modes. These align with Local Transport Plan 3 (LTP3) objectives which include reducing congestion; improving accessibility to work, education and services; reducing carbon emissions from transport and developing and increasing the use of public transport, walking and cycling. The primary focus for this is on the Science Vale area, but improvements will also take place across the district:

### **Cycling**

- 7.6.2. To provide an attractive, sustainable and safe alternative to driving within the Science Vale area, a substantial upgrade and expansion of the cycle network is required. The forthcoming Oxfordshire Cycling Strategy (as part of Local Transport Plan 4) will aim to get more people cycling. This will be through a series of measures including route audits, better publicity, better integration with bus and rail and the establishment of 'Cycling Premium Routes'.

- 7.6.3. Sitting under the umbrella of the Oxfordshire Cycling Strategy, a cycling strategy has been created for Science Vale, and includes a list of scheme aspirations to form the Science Vale cycle network. This network is based around strategic corridors linking the main towns, housing developments and Didcot Station to the main employment sites. Schemes will include improvements to existing cycle routes, as well as developing new high quality cycle routes.
- 7.6.4. The first stages of realising this network are already funded and programmed for construction. Schemes which are part of the first stage in delivering a comprehensive cycle network in Science Vale include upgrading the Winnaway route between Harwell Campus and Harwell village, and opening up Backhill Lane tunnel from the A4130 under the railway line into Milton Park, to provide new cycling and pedestrian connectivity to the Enterprise Zone.
- 7.6.5. Local Sustainable Transport Funding (LSTF) of £1 million has been awarded to the County Council for several cycling measures, including National Cycle Network upgrades and maintenance to routes 5 and 544, near to Harwell Oxford and other sections in most need. LSTF funding will also go towards cycle route signage, marketing and a trial bike hire scheme focussed on Didcot, Harwell Oxford and Milton Park, to raise the profile of cycling throughout Science Vale.
- 7.6.6. LSTF funding will also be used to investigate route and scheme feasibility along the following corridors:
- Harwell Oxford / Milton Park to Wantage and Grove
  - Harwell Oxford / Milton Park / Culham Science Centre to Abingdon
  - Harwell Oxford/ Milton Park to Didcot
- 7.6.7. £4.9m of Local Growth Funding to construct cycle route schemes within Science Vale has also been awarded to Oxfordshire, starting in 2015/16. Details of the proposed network are shown in Figure 7.5. These are subject to consultation.

**Figure 7-6 proposed cycle network enhancements**

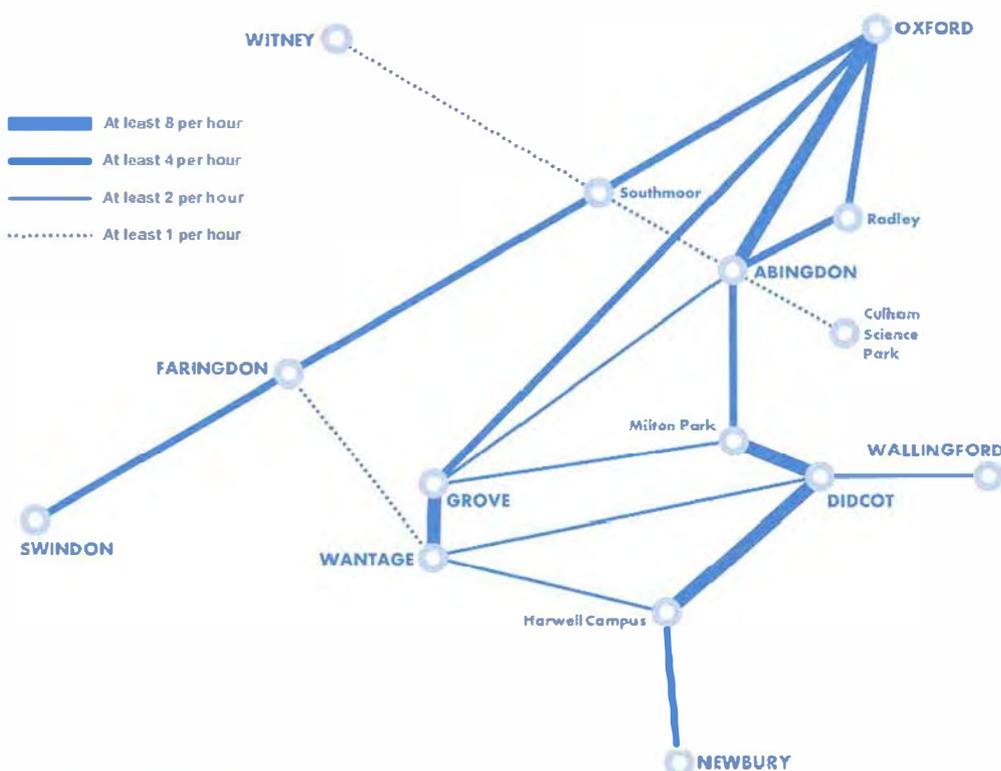


Note: This is OCC's intention, subject to consultation

## Public Transport

- 7.6.8. Oxfordshire County Council is working with public transport operators on a range of schemes across the district. The county council is also developing an Oxfordshire Bus Strategy as part of Local Transport Plan 4 to outline the overall vision for the bus network county-wide. In essence, public transport will be significantly improved to provide high quality, high frequency bus services linking Didcot station with major Science Vale employment sites, as well as connecting to other towns across the district and Oxfordshire, outside of Science Vale.
- 7.6.9. Specific public transport schemes and objectives that are being developed and investigated include:
- The delivery of a new Park & Ride to the north of Abingdon to enable more trips into Oxford to be made by bus and to alleviate congestion on Oxford's approach roads.
  - Promoting an improved and fully integrated public transport system linking Science Vale with innovation hubs and research locations in Oxford.
  - Promoting an improved level of rail service at Didcot, seeking a minimum of four trains per hour to Oxford and Bicester.
  - Developing Didcot Station into a 'state-of-the-art' multi-modal interchange, to meet demand from new development and improved rail services. This includes a multi-storey car park, station access from the north, and a new station building.
  - Safeguarding and protecting the ability to deliver a station at Grove to ensure the future longer term ambition of connecting Wantage and Grove with Didcot, Swindon and beyond can be achieved.
  - Working with Network Rail and other partners to support the delivery of the overhead electrification of the Great Western Mainline.
  - Ensuring provision is made for a high frequency direct bus route linking Didcot to Harwell Oxford Campus, through the Valley Park site, linking to the A4130 at its northern edge and the A417 to the south. This route will include bus priority measures approaching junctions with the A4130, B4493 and A417.
  - Promote a strategic bus route between Grove, Wantage, Milton Park and Didcot.
- 7.6.10. Part of the £1m awarded from the LSTF will also go towards connecting Didcot Station to Harwell Oxford Campus, from two buses to four buses per hour, starting in 2015. Details of the proposed network are shown in Figure 7.6. These are subject to consultation.

**Figure 7-7 Proposed public transport enhancements**



Note: This is OCC's intention, subject to consultation

- 7.6.11. In addition to standalone pedestrian, cycle or public transport schemes, sustainable travel improvements are being included in other schemes. For example as part of improvements along the A417 corridor, Oxfordshire County Council has been working with the Parishes between Wantage and Blewbury along this route to identify ways to improve safety, and address the conflict between the volume of traffic and access to the villages. This study importantly includes measures to improve the environment for pedestrians and cyclists, for example by introducing crossings to access bus stops, providing new pedestrian and cycle facilities along its length between Wantage and Blewbury and providing consistent speed limits.
- 7.6.12. Developers will also be expected to deliver local improvements for sustainable travel, to be identified in Transport Assessments and delivered as direct mitigation.

## 7.7. Summary of remaining issues

### Scenario 5A

- 7.7.1. Along the key corridors the following sections of the highway network are forecast to be at or above operational capacity by 2031 in one or both peak hours:
- 7.7.2. The A34 is forecast to be operating at or above operational capacity between Botley and Milton Interchanges. In addition, the evening peak the section between Chilton and Milton also operates at operational capacity in the northbound direction but with delays of approximately 1 minute. *Scenario 5B and 5C address how this could be mitigated by delivering the new Thames river crossing between north of Didcot and Culham. However, whilst delivery of such measures is feasible in the short to medium term and are achievable within the plan period, the Highways Agency who are responsible for the A34 still need to provide a longer term solution to increase capacity along the route. Oxfordshire County Council will continue to proactively work with the Highways Agency to review options.*
- 7.7.3. In the morning peak the A417 is forecast to be operating at or above operational capacity in the eastbound direction between Wantage and Featherbed Lane. In the evening peak the A417 is operating at or above operation capacity in the westbound direction between Featherbed Lane and Wantage. Delays are forecast to be in the order of ten minutes along this five mile route. *The A417 Corridor Study is currently being progressed in discussion with the Parish Council's along its route. It will investigate these issues and it is expected that the public transport and smarter choices strategy will at least increase the people moving capacity of this corridor.*
- 7.7.4. The A420 is forecast to operate at or above operational capacity in both directions at Buckland and short sections near Cumnor and near Fyfield with small delays between one to two minutes at these congested locations. *The A420 Corridor Strategy is being developed by Oxfordshire County Council as part of Local Transport Plan 4. These issues will be investigated and it is expected that the public transport and smarter choices strategy will at least increase the people moving capacity of this corridor. Direct mitigation by relevant developers should also form part of the mitigation of these problems and those identified as part of the planning application process.*
- 7.7.5. The A415 is forecast to be operating at operational capacity between Kingston Bagpuize and Frilford and at capacity on the approach to the A34 and between Marcham and Frilford in the westbound direction during the evening peak with small delays between one to two minutes at these congested locations. The key issue here is the traffic signals at Frilford. *The transport strategy includes measures to review these signals, which will require further analysis using specific junction modelling software rather than strategy highway assignments, to identify a preferred scheme. Wider-area proposed enhancements to public transport and cycling routes, will help to improve the performance of the A415 corridor.*

- 7.7.6. The A4130 is forecast to be operating at capacity in the morning peak on the westbound approaches to the Avon Way roundabout with small delays between one and three minutes at this location. *It is expected that the public transport and smarter choices strategy will at least increase the people moving capacity of this corridor and direct mitigation by relevant developers should also form part of the mitigation of these problems and those identified as part of the planning application process. Being in the Science Vale area, the A4130 improvements will be informed by more detailed work to investigate opportunities for further highway mitigation as part of the Joint Science Vale Area Action Plan (AAP). This is in addition to significant work being undertaken to enhance public transport, particularly along the 'knowledge spine' between Harwell Campus, Didcot, Oxford and Bicester, with improved bus services, facilities for cycling and upgraded rail services. These measures will also contribute to improving the performance of this route, especially by providing a credible alternative to Vale residents, for making local journeys. For example, a high frequency, high quality bus corridor with appropriate bus priority where required is proposed between Harwell Campus and Didcot Railway Station and Town Centre.*

### **Scenario 5B**

- 7.7.7. Along the key corridors the following sections of the highway network are forecast to be at or above operational capacity by 2031 in one or both peak hours:
- 7.7.8. The A34 performs better with the addition of the new Thames crossing at Culham and a Clifton Hampden Bypass although the sections between Hinksey Hill and Milton Interchanges are still performing at operational capacity. *As under Scenario 5A, Oxfordshire County Council will continue to work with the Highways Agency and other stakeholders on a longer term deliverable solution for the A34. Given the benefits of introducing a new river crossing and bypass as shown in Scenario 5B, feasibility work is now underway to determine a preferred alignment, as well as other factors such as land-take and cost.*
- 7.7.9. The A420 is forecast to operate at or above operational capacity in both directions at Buckland and short sections near Cumnor and near Fyfield with small delays between one to two minutes at these congested locations. *The A420 Corridor Strategy will investigate these issues and it is expected that the public transport and smarter choices strategy will at least increase the people moving capacity of this corridor. Direct mitigation by relevant developers should also form part of the mitigation of these problems and those identified as part of the planning application process.*
- 7.7.10. The A415 is forecast to be operating at operational capacity between Kingston Bagpuize and Frilford and at capacity on the approach to the A34 and between Marcham and Frilford in the westbound direction during the evening peak with small delays between one to three minutes at these congested locations. The key issue here is the traffic signals at Frilford. *As under Scenario 5A, the transport strategy includes measures to review these signals and further would be required using specific junction modelling software rather than strategy highway assignments.*
- 7.7.11. In the morning peak the A417 is forecast to be operating at or above operational capacity in the eastbound direction between Wantage and Featherbed Lane. In the evening peak the A417 is operating at or above operation capacity in the westbound direction between Featherbed Lane and Wantage. Delays are forecast to be in the order of eight minutes along this five mile route. *The A417 Corridor Study will investigate these issues and it is expected that the public transport and smarter choices strategy will at least increase the people moving capacity of this corridor.*
- 7.7.12. Sections of the A338 in the northbound direction near Grove and Frilford reach operational capacity. *The transport strategy includes measures to review these signals and further would be required using specific junction modelling software.*

### **Scenario 5C**

- 7.7.13. The A34 performs better with the additional lane between Milton Interchange and Hinksey Hill, causing the route to operate under operational capacity. However, whilst it solves problems on the A34 it will inevitably result in problems at interchanges and on the local road network. *As under Scenarios 5A and 5B, Oxfordshire County Council will continue to work with the Highways Agency and other stakeholders on a Route Based Strategy. It is anticipated that this work will lead to enhancements to the A34 route within the Vale, along with identification of potential longer-term options to provide a step-change in capacity.*

- 7.7.14. The A420 is forecast to operate at or above operational capacity in both directions at Buckland and short sections near Cumnor and near Fyfield with small delays between one to two minutes at these congested locations. *The A420 Corridor Strategy will investigate these issues and it is expected that the public transport and smarter choices strategy will at least increase the people moving capacity of this corridor. Direct mitigation by relevant developers should also form part of the mitigation of these problems and those identified as part of the planning application process.*
- 7.7.15. The A415 is forecast to be operating at operational capacity between Kingston Bagpuize and Frilford and at capacity on the approach to the A34 and between Marcham and Frilford in the westbound direction during the evening peak with small delays between one to three minutes at these congested locations. The key issue here is the traffic signals at Frilford. *The transport strategy includes measures to review these signals and further would be required using specific junction modelling software rather than strategy highway assignments.*
- 7.7.16. In the morning peak the A417 is forecast to be operating at or above operational capacity in the eastbound direction between Wantage and Featherbed Lane. In the evening peak the A417 is operating at or above operation capacity in the westbound direction between Featherbed Lane and Wantage. Delays are forecast to be in the order of eight minutes along this five mile route. *The A417 Corridor Study will investigate these issues and it is expected that the public transport and smarter choices strategy will at least increase the people moving capacity of this corridor.*
- 7.7.17. In addition to the package of strategic highway schemes listed above a range of schemes are either being delivered or are programmed for delivery to improve travel by sustainable modes. These align with Local Transport Plan 3 (LTP3) objectives which include reducing congestion; improving accessibility to work, education and services; reducing carbon emissions from transport and developing and increasing the use of public transport, walking and cycling. These will be taken forward under the new Local Transport Plan, LTP4.

## 8. Summary

- 8.1.1. The Local Plan 2031 sets out a policy framework for the delivery of sustainable development across the district up to 2031. It sets out the spatial strategy and strategic policies for the district to deliver sustainable development. It identifies the number of new homes and jobs to be provided in the area and makes provision for retail, leisure and commercial development and the infrastructure needed to support them.
- 8.1.2. One of the main purposes of the Evaluation of Transport Impacts (ETI) has been to inform the selection of strategic development sites to be allocated in the Local Plan 2031 and to help identify a package of highway mitigation to ensure the plan contributes towards the delivery of sustainable development. The ETI forms part of the evidence base to inform the Local Plan 2031 alongside other evidence, including: Landscape Capacity Study, Strategic Flood Risk Assessment, Sustainability Appraisal, Green Belt Review, and others.
- 8.1.3. The ETI and Local Plan have been prepared iteratively to inform each stage of the planning process and this is shown in Table 8-1. This has ensured that the Vale of White Horse District Council has a detailed understanding of the impact of their proposals on the highway network at each stage of developing the Local Plan 2031. An understanding of transport impacts has therefore been used, for example, to inform the selection of strategic development sites to be allocated in the Local Plan 2031.

**Table 8-1 ETI and Local Plan Process Map**

ETI	Date	Local Plan
Stage 1	February 2013	Draft Local Plan Consultation (Feb 13)
Stage 2	2013	Assessment of Additional Site Options
Stage 3	February 2014	Housing Delivery Update (Feb 14)
Stage 4	2014	Assessment of Additional Site Options
Stage 5	November 2014	Local Plan - Publication Version (Nov 2014)

- 8.1.4. The process focuses upon the impacts of development scenarios on the highway network. The early stages (Stage 1 and 2) of the ETI were undertaken by the consultants CH2M Hill, using the Central Oxfordshire Transport Model (COTM). The full COTM is multi-modal that enables mode choice and trip frequency choice to be tested, based upon costs of travel, which influences the demand for highway travel. In contrast, the later stages of work were undertaken by the consultants Atkins, using the highway element of COTM only. Checks were made to ensure that the results were consistent across both approaches and similar conclusions would be drawn regardless of the approach adopted.
- 8.1.5. The ETI work has focused upon the highway impacts of the different Local Plan scenarios, although it is recognised that public transport and smarter choices are essential components of a final transport strategy. The ETI has helped identify where more sustainable travel choices need further planning and delivery. This is also reflected in Oxfordshire County Council's Local Transport Plan and the Infrastructure Development Plan which accompanies the VoWH Local Plan.
- 8.1.6. The different stages have been described in the preceding chapters and it is appropriate for this conclusion to focus on the Local Plan - Publication Version (Nov 2014), or ETI Stage 5.
- 8.1.7. The testing of the Stage 5 (S5) scenarios consist of a fixed housing and employment distribution of 20,560 homes and 23,000 jobs in VoWH along with South East Plan levels of development in the other districts in Oxfordshire. A test without additional highway mitigation was undertaken to understand the impact of the development on the highway network. This led to the formulation of three highway mitigation scenarios: one medium scale scenario and two larger scale scenarios.

- 8.1.8. The medium scale schemes aim to address traffic problems on the A417, A420, A415 and A4130 and include:
- Widening the A4130 from Milton Interchange to Science Bridge to accommodate the additional traffic from developments at Great Western Park, Valley Park and Didcot A and to facilitate a public transport corridor east of Science Bridge, into Didcot.
  - South facing slips at Lodge Hill would provide better access for traffic travelling to and from Abingdon whilst relieving Abingdon of some traffic travelling through the town and Marcham Interchange.
  - Improvements to the traffic signal timings at Frilford signals.
  - In addition to the mitigation measures above, Oxfordshire County Council are progressing corridor studies along the A420, A338 and A417. These studies typically have the following objectives:
    - Improve capacity by reducing non-motorised and motorised user conflicts;
    - Improve public transport frequency and reliability along the corridors;
    - Thus enable more people to travel;
    - Address the competing requirements of road users and the adjacent communities; and thus improve safety at accident hot-spots.
- 8.1.9. The larger scale schemes focus on potential approaches to managing traffic between Oxford, Abingdon and Didcot; addressing problems on the A34 in two ways:
- One option considers an improved Thames crossing near Culham, utilising the A415 and A4074 as alternative routes between Didcot, Oxford and Abingdon.
  - The other option considered widening the A34 between Hinksey and Milton.
- 8.1.10. This testing revealed a number of themes common to all scenarios:
- The A420 is forecast to operate at or above operational capacity in both directions at Buckland and short sections near Cumnor and near Fyfield although the delays at these locations are forecast to be small.
  - The A415 is forecast to be operating at operational capacity between Kingston Bagpuize and Frilford and at capacity on the approach to the A34 where delays at these locations are forecast to be small.
  - In the morning peak the A417 is forecast to be operating at or above operational capacity in the eastbound direction between Wantage and Featherbed Lane and the reverse in the evening peak, with delays along this route forecast to be in the order of eight minutes along this five mile route.
  - Sections of the A338 in the northbound direction near Grove and Frilford reach operational capacity.
  - The Avon Way junction on the A4130, near Didcot A reaches capacity.
- 8.1.11. The various corridor schemes that are being developed will need to consider these impacts and direct mitigation by relevant developers should also form part of the mitigation of these problems and those identified as part of the planning application process. Enhanced public transport and smarter choices are also expected to enable more people to travel and whilst this may not mitigate all of these localised congestion hotspots these elements of the transport strategy will improve transport choice for all.
- 8.1.12. The key remaining issue is the A34. Scenario 5A did not include any further mitigation on the A34 and the A34 was forecast to be operating at or above operational capacity between Botley and Milton in both directions in the morning and evening peak. Both of the larger scale highway scenarios improve conditions on the A34. The addition of the new Culham Crossing and a Clifton Hampden Bypass is forecast to result in improvements on the A34 and on the local road network between Didcot and Oxford, although the sections between Hinksey Hill and Milton at still performing at operational capacity.
- 8.1.13. The widening of the A34 between Milton and Hinksey is forecast to result in the A34 performing under operational capacity but has little effect on the local road network. Both options improve VoWH and county highway network performance to a better condition than that forecast to be experienced in the Draft Local Plan Consultation (Feb 13).
- 8.1.14. The scenario of widening the A34 (S5C) has a marginally greater impact in the VoWH, however, these impacts would not be fully realised without junction improvements and a scheme to

alleviate the congestion around the Oxford Western bypass section. Significant improvements to the A34 are, and need to be, assessed as a holistic corridor. The scale of such an intervention is likely to be a long term and complex project. It is for this reason, coupled with the wider local connectivity benefits, that the new Thames crossing at Culham and Clifton Hampden Bypass is considered by OCC to be a more appropriate scheme to form part of this transport strategy.