Cherwell
DISTRICT COUNCIL
NORTH OXFORDSHIRE

Cherwell Local Plan

(Part 1) Partial Review

Transport Topic Paper

January 2019

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Cherwell Local Plan

(Part 1) Partial Review

Oxford's Unmet Housing Need

Transport Topic Paper

January 2019

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Executive Summary

i. This Transport Topic Paper has been produced to assist the Examination of the Submission draft Partial Review of the Cherwell Local Plan: Oxford's Unmet Housing Needs. It explains how Cherwell District Council, in conjunction with Oxfordshire County Council, has approached transport issues in preparing the Partial Review and arrived at, what in the Council's view, is the most sustainable approach in transport terms to accommodating additional growth for Oxford.

ii. The Topic Paper describes how the Plan responds to national policy and guidance in preparing evidence, in assessing development options, and in developing policies which seek to optimise a sustainable transport approach to accommodating development with Cherwell district and achieve a high level of connectivity and accessibility with Oxford. It explains how locations for growth were assessed, how a transport strategy was developed and how mitigations have been identified. It demonstrates how the wider strategic growth and transport context, along with key representations arising from consultation on the Proposed Submission Plan (July 2017), have been considered.

iii. The Topic Paper refers to documents submitted in support of the Partial Review; in particular:

- PR15 - Oxfordshire Growth Board - High Level Transport Assessment of Spatial Options
- PR18 - Connecting Oxfordshire - LTP vol 8 part 1 - Oxford Transport Strategy July 2016
- PR22 - Interim Transport Assessment (October 2016)
- PR23 - Initial Sustainability Appraisal (October 2016)
- PR24 - Statement of Consultation (October 2016)
- PR52 - Transport Assessment (July 2017)
- PR85 - Outline Agreement for Oxfordshire Housing and Growth Deal (November 2017)
- PR74 - Proposed Submission Sustainability Appraisal Report and Non-Technical Summary (June 2017)
- PR82 - Oxfordshire Infrastructure Strategy (November 2017)
- PR90 – Duty to Cooperate Statement (February 2018)
- PR92 - Sustainability Appraisal Addendum + Non-Technical Summary (February 2018)
- PR93 - Statement of Consultation (February 2018)

iv. Section 2 of the Topic Paper summarises the high-level transport assessment of nine areas of search (see core doc. PR47, p.43, Table 5 and p.44). It explains how the Oxfordshire Strategic Transport Model (OSM) has been utilised and how the Partial

Review has been closely aligned with the County Council's Local Transport Plan (including the Oxford Transport Strategy) and fits with national infrastructure plans. Sections 2, 3 and 4 explain how the proposed development sites were appraised from a transport perspective.

v. Section 3 summarises the development of the transport strategy for the Partial Review, the transport rationale underpinning the strategic site allocations, the transport characteristics and challenges of the proposed growth areas, and the relationship to both wider transport policy and the Plan's objectives.

vi. Section 4 discusses the anticipated cumulative transport impacts of additional growth and the proposed mitigation involving:

- key issues highlighted through Stage 1 modelling and public consultation;
- the rationale for strategic and site-specific transport improvements;
- the estimated impact of transport improvements and residual issues considered through Stage 2 modelling.
- Additional Post Submission model testing undertaken to estimate the impacts of closing Sandy Lane to through-vehicle movements.

vii. Section 5 examines infrastructure delivery and funding and the delivery of transport improvement packages at the national, county and local level.

viii. The Topic Paper summarises (sections 2 & 3) the process of analysis presented in the Transport Assessment Report (PR52) and explains the close joint working that has taken place with the County Council throughout the preparation of the Plan (all sections) and the cooperation and discussion that has taken place with Highways England and Network Rail (sections 2, 3 and 4).

ix. The Topic Paper explains (sections 2, 3 and 4) that the Partial Review is sustainability-led, seeking to maximise opportunities for walking, cycling and public transport use for a high proportion of trips to/from new and existing developments.

x. It explains (sections 2, 3 and 4) that there is integration between Cherwell's Submission Plan and the objectives, policies, and actions of the Connecting Oxfordshire Local Transport Plan (2015-2031), particularly its Oxford Transport Strategy.

xi. The Topic Paper explains (sections 4 and 5) that the strategic regional transport considerations have been taken into account in the development of the plan.

xii. The Topic Paper explains (section 5) the local, county and national opportunities for funding transport improvements and the alignment with the Infrastructure Schedules appended to the Submission Plan (Appendix 4).

xiii. The Topic Paper highlights the specific transport challenges that have had to be considered in preparing the plan, including those that are the result of national traffic growth; of local, county and regional development and associated travel patterns; and

those more directly associated with the plan's proposals. These key issues are summarised below:

Issue 1 – Commuter Trip Demands

Commuter trip demands associated with the proposed development sites are likely to load primarily onto the A44/A4144 and A4260/Oxford Rd corridors. The stressed points, where these two important local corridors cross the A34 (Peartree interchange) and A40 (Wolvercote and Cutteslowe roundabouts) strategic roads, are expected to be placed under additional pressure. Consultation feedback from, and subsequent dialogue with, Highways England representatives has emphasised this sensitivity.

The Council's Approach

Planning for development in locations that maximise the opportunities for less car-centric movement patterns will minimise the additional stress on these points. Encouraging mode-shift to walking/cycling/public transport will minimise the increase in car-based trips. Alignment with the County Council's Local Transport Plan and its strategy for Park and Ride and Rapid Transit seeks to optimise a sustainable transport approach. Strategic investment would potentially result from technological improvements (Highways England) and funding from the Oxfordshire Housing and Growth Deal. There is a longer-term opportunity arising from the proposed Oxford-Cambridge Expressway for which Highways England is currently in the process of designing route options for public consultation.

Issue 2 - Increased demand for connectivity between the A44 and A4260 corridors

There is expected to be demand for travel to/from Kidlington's local centre and new schools proposed close to the A44 in support of the planned developments. Langford Lane and, in particular, Sandy Lane are forecast to attract the bulk of this movement during AM and PM peak periods. Projected flows along Sandy Lane could fundamentally change the nature of this road, deterring people from walking and cycling for local trips between Kidlington, Begbroke, Yarnton, Oxford Parkway Station and the new communities created by the proposed growth. A level crossing (over which Network Rail has expressed safety concerns) and a weight-limited canal bridge with one-way signal-controlled traffic management are both situated along Sandy Lane. Both independently, and in combination, they represent significant limitations to this route accommodating projected additional vehicle flows during the AM and PM peak periods (Table 4-1, para's. 4.7-4.13 in this Topic Paper).

The Council's Approach

That Sandy Lane and its level crossing are closed to all vehicular traffic, with a pedestrian and cycle overbridge being installed there to provide a high-quality walking and cycling route between the Begbroke/Yarnton development areas and Kidlington/Gosford/Oxford Parkway Station/Oxford City Centre (via a new Cycle Super Way).

Issue 3 – Delays to Journey Times on the Local Highway Network

Without transport improvements a 5% (OSM Stage 2 modelling) - 7% (OSM Post Submission modelling, incorporating the Sandy Lane closure) increase in total delay is forecast to occur across the local highway network as a result of a 1% increase in total trip distances and 2% increase in total journey times associated with the additional 4,400 homes.

The Council's Approach

Responding to the findings from initial transport modelling tests, a package of transport investments have been developed. The improvements cover strategic walk/cycle route improvements (including the Sandy Lane level crossing closure/overbridge and canal bridge upgrade and Super Cycle Way), Park & Ride enhancements, bus priority measures and bus stop upgrades, highway junction improvements, and new and improved pedestrian crossings. These measures have been estimated to cost between £51.4m - £57.6m by Oxfordshire County Council, with scope for their delivery to be funded through a combination of developer contributions from the growth sites, the Oxfordshire Housing and Growth Deal and other local and national funds. Overall journey time impacts (countywide) are predicted to be minimal. The second stage of strategic modelling work estimated that, with the inclusion of the proposed transport improvements, the maximum additional amount of delay would be +1 minute on journeys from the A44/A4095 roundabout on the A44 corridor under scenarios that include all proposed transport improvements. While the inclusion of the Sandy Lane closure in the Post Submission modelling indicates that this level of delay may be slightly higher, it is not considered to reflect a severe impact given the range of sustainable transport improvements that support the Submission Plan.

Issue 4a – Residual Traffic Flows – Sandy Lane

The proposed closure of Sandy Lane to through-vehicle traffic presents a residual traffic flow consideration. With the inclusion of additional growth, transport improvement packages 1 + 2, and the closure of Sandy Lane to through-traffic, the Post Submission OSM testing forecasts that around 300 vehicle trips in the 2031 AM

and PM peak hours could load onto the surrounding highway network. The Post Submission modelling work, undertaken since the Submission Plan was prepared, indicated that these tidal vehicle flows are expected to re-route onto Frieze Way, Langford Lane and the A4260 north of Langford Lane. This is expected to slightly worsen delays at some already-congested locations on the local road network, whilst also encouraging a degree of peak-spreading and mode-switching to local bus and rail alternatives.

The Council's Approach

Closure of Sandy Lane. Leaving the road open to through-traffic would amplify existing safety concerns in relation to the level crossing and place greater strain on the weight-limited canal bridge. Although the transformative impact of Sandy Lane providing a dedicated cycle link to the proposed Cycle Super Way to Oxford Parkway Station and Oxford City Centre has been challenging to forecast using the Oxfordshire Strategic Model, it is expected to absorb some of the additional vehicle trips whilst also making a positive contribution to local public health and air quality. Further microsimulation modelling, focused on specific junctions and links in the local area, may be appropriate at the Planning Application stage. Coupled with ongoing monitoring of local road traffic conditions, this would help to ascertain specific impacts linked to ongoing development in the area and identify junction-level improvements that will help to maximise mode-shift to public transport and walk/cycle trips, optimise available roadspace, and ease traffic flow.

<u>Issue 4b – Residual Traffic Flows - Peartree and Kidlington/Wolvercote Roundabouts</u>

Peartree Interchange and Kidlington & Wolvercote roundabouts demonstrate capacity issues relative to the demand for vehicle trips in both the AM and PM peak periods, as they do in 2031 without the additional 4,400 homes being proposed. The capacity issues associated with these junctions are related to the wider countywide, regional and national transport context.

The Council's Response

The inability to fully model the impact of the proposed Cycle Super Way on vehicle trips and public transport capacity may mean the additional traffic associated with the Partial Review would be ameliorated by the introduction of the new cycle route along the A4260/Banbury Road. Strategic investment would potentially result from technological improvements (Highways England) and funding from the Oxfordshire Housing and Growth Deal. Longer term there is an opportunity arising from the suggested Oxford-Cambridge Expressway. Continued monitoring of these junctions will be necessary, given the uncertainties above, and accelerating rapid transit proposals to Oxford employment sites could contribute to a longer-term solution to junction capacity.

Issue 4c – Residual Traffic Flows – Langford Lane

Queuing at Langford Lane/A4260 and A4095 junctions with the A44 and A4260 is already a slight issue during peak times, but predicted to worsen as a result of the additional 4,400 homes. Additional queuing in these locations is undesirable, but in practice will also help to stagger the flow of vehicular traffic towards strategically important junctions with the A34 to the south of the A4260 and A44 corridors. The potential closure of Sandy Lane to through-traffic may further extend delays associated with queuing at some of these junctions, as vehicle trips divert north around Kidlington and Gosford.

The Council's Approach

Monitoring of the junctions as the development proposals and accompanying transport improvements come forward, with targeted junction capacity improvements being considered in the event that traffic congestion delays should significantly worsen at these locations.

Issue 5 – Level Crossings

There is a recognised safety issue with level crossings and Network Rail look for opportunities to remove these from their network. There have been fatalities at the crossings in the vicinity. As highlighted previously; closure of the Sandy Lane crossing would offer the opportunity to address residual traffic flows, achieve the green link between Begbroke/Yarnton and Kidlington, and meet the interests of railway safety. Network Rail and Oxfordshire County Council will be engaged in the development brief for site PR8.

The Council's Approach

Closure of the Sandy Lane level crossing, and provision of a dedicated pedestrian and cycle over-bridge, is accepted as an important measure to help meet the sustainable transport objectives of growth along the A44. The Focused Changes and Minor Modifications to the Plan provide for the necessary engagement with Network Rail and the County Council with regard to the level crossings in taking forward the development brief.

Issue 6 - Strategic road network and junctions – M40 Junction 9

M40 Junction 9 is already predicted to be congested in 2031, as a result of existing committed growth, with the junction itself expected to function at between 85%-95% of design capacity and the southbound approach forecast to be beyond 95% of its design capacity during the AM peak. Without any transport improvements the OSM

Stage 2 model testing predicted a small (~5%) increase in delay at this junction during the PM peak. The potential closure of Sandy Lane is not anticipated to exacerbate this.

The Council's Approach

When the packages of transport improvements developed to support the additional growth are considered, the OSM Stage 2 and Post Submission modelling predicts a small reduction (-1%) in delay during the AM peak and no change in the PM peak. Residential development at the additional growth locations being considered is not anticipated to have an appreciable impact on the operation of M40 J9.

The key issues related to the A34, Peartree interchange and A44 corridor are highlighted above.

1. Introduction

1.1 The Cherwell Local Plan Part 1 2011-2031, adopted in July 2015, is undergoing a partial review with the specific focus of meeting that part of Oxford's unmet housing need apportioned to Cherwell through the Oxfordshire Growth Board. The Councils have accepted that Oxford cannot fully meet its own housing needs (See PR05 'Oxfordshire Growth Board Report and Minutes – 20 Nov 2014').

1.2 The basis for apportioning Oxford City's unmet housing need was determined by the work of the Oxfordshire Growth Board, of which Cherwell District Council is a member. On 26th September 2016 the Growth Board agreed an appointment of the unmet housing need for Oxford amounting to a total of 14,850 dwellings, 4,400 of which were for Cherwell to consider through a Partial Review of its adopted Local Plan (See PR27 'Oxfordshire Growth Board - Public Reports Pack 26 Sept 2016 with Addenda and Decision'). The Growth Board's work was supported by a high-level transport assessment of the transport implications (See PR15 Oxfordshire Growth Board - High Level Transport Assessment of Spatial Options) associated with accommodating Oxford's unmet housing need at various possible spatial options around the city. These were identified by each of the county's District Planning Authorities and appraised using a methodology that ITP subsequently modified to appraise areas of search and site options in Cherwell District.

1.3 The **Submission Plan** supported by this document is a partial review of the adopted Local Plan with the specific focus of meeting that part of Oxford's unmet housing need apportioned to Cherwell through the Oxfordshire Growth Board. This **Topic Paper** has a specific focus on **transport matters** associated with the preparation of the Submission Plan. Both documents should be read alongside the adopted Cherwell Local Plan 2015 and its evidence base.

1.4 In March 2018 the Council submitted the Proposed Submission Local Plan (July 2017) with Focused Changes and Minor Modifications (February 2018).

1.5 The Infrastructure Schedule in Appendix 4 of the Proposed Submission Local Plan has been informed by continuing dialogue with infrastructure and service providers (CD PR90 & PR93). The 2017 Proposed Submission consultation allowed for the refinement of infrastructure schemes and identification of costs as submitted in March 2018 under focused change FC98.

1.6 The Council relies on the schedule in the Focused Changes and Minor Modifications subject to acceptance by the Inspector.

Purpose of this Topic Paper

1.7 This Topic Paper brings together the transport evidence which supported the plan preparation to assist the examination of the Submission Plan. It has been prepared to address the main transport issues highlighted through the Local Plan review process. It also responds to stakeholder representations to a statutory public consultation, conducted in July – October 2017, in respect of preferred development locations and transport improvements proposed to support Cherwell's draft Local Plan. The paper summarises the transport evidence supporting the Submission Plan (Transport Assessment Report - evidence document PR52) and provides clarifications to issues highlighted by stakeholders during the plan's Proposed Submission Stage public consultation (July - October 2017), including evidence from further strategic transport modelling work commissioned by Oxfordshire County Council to address specific questions posed through that consultation process.

1.8 Appendix A summarises the forecast transport network impacts of the proposed development allocations identified in the Submission Plan Transport Assessment. Appendix B indicates how National Planning Policy Framework has influenced the transport considerations supporting the Submission Plan. Appendices C and D contain the findings from further transport modelling work undertaken to estimate the potential impact of closing Sandy Lane to vehicular through-traffic.

1.9 Throughout the Local Plan Review process, CDC's officers have worked collaboratively with officers at Oxfordshire County Council (fulfilling its role as Local Highway Authority), and their modelling consultants, with support from ITP. Proactive engagement with Highways England and Network Rail has also been undertaken at key junctures in the plan preparation process. This joint-working has helped to ensure:

- The Local Plan Review is sustainability-led, seeking to maximise opportunities for walking, cycling and public transport use for a high proportion of trips to/from new and existing developments.
- There is integration between Cherwell's Submission Plan and the objectives, policies, and actions of the Connecting Oxfordshire Local Transport Plan (2015-2031), which considers the mobility needs of all Districts across the county and includes the Oxford Transport Strategy.

- Strategic regional transport considerations – notably pertaining to road and rail networks – are duly considered through the development of the plan.
- All known local and national opportunities for funding the transport improvements required to successfully deliver the additional growth in Cherwell are taken into account and documented in the Schedule of Infrastructure that is appended to the Submission Plan (Appendix 4 to the Submission Plan) and recommended focused changes.).

2. How this Local Plan Review responds to national policy and guidance

Transport evidence and Local Plan preparation

2.1 Transport issues are typically one of many considerations that guide strategic development planning. For this partial review of Cherwell's Local Plan, they were considered alongside other key evidence including the Plan's Sustainability Appraisal. The wider evidence base can be found in the Submission Plan's Core Document Library.

2.2 In line with the National Planning Policy Framework, and the Ministry of Housing, Communities and Local Government's (MHCLG) Planning Practice Guidance on *Transport evidence bases in plan making and decision taking*, the potential transport impacts associated with Cherwell District's accommodation of Oxford's Unmet Housing Needs have been considered at each stage of the plan review process. Table 2-1 outlines this, cross-referencing relevant documents in the Submission Plan's underlying evidence base, and explaining the influence of each stage upon the plan-making process.

2.3 By adopting this methodology, Cherwell District and Oxfordshire County Council's officers have sought to cumulatively consider the potential transport impacts associated with accommodating an agreed portion of Oxford's unmet housing need across a range of locations in Cherwell. The process was subsequently used to inform and refine both the preferred development sites, and a package of sustainably-focused transport improvements specifically intended to help accommodate trips that are anticipated to arise from the locations of the 4,400 homes being allocated.

2.4 Appendix B to this Topic Paper provides more detail on how the National Planning Policy Framework influenced the preparation of the Submission Plan and its proposals.

Table 2-1: Transport evidence in this Local Plan Review process

Activity	Influence on plan making	Supporting evidence	Timing
Detailed review of the local context / existing transport issues	Inform clear understanding of key transport issues and opportunities to be addressed through the Plan.	PR52 'Transport Assessment' Sections 2-4	Spring 2016
High-level assessment of nine broad Areas of Search across the District	Identify and score transport strengths and weaknesses of different locations in Cherwell District using a Red/Amber/Green (RAG) matrix.	PR52 'Transport Assessment' Section 5	Summer 2016
Site-level assessment of 44 locations identified through CDC's Call for Sites	Identify and RAG score transport strengths / weaknesses of individual sites within preferred Areas of Search. Analysis updated using stakeholder input.	PR52 'Transport Assessment' Section 6	Autumn 2016 + Early 2017
Iterative transport appraisal using the latest available version of the Oxfordshire Strategic Model (OSM)	Definition and iterative testing of three packages of site options. Initial modelling results informed refinement of site options and sustainably-focused transport improvements. These were cumulatively tested as a preferred development scenario and package of transport measures. Sensitivity tests with/without an A40-A44 link road, and to predict harder-to-model cycling impacts, were also conducted.	PR52 'Transport Assessment' Section 7	Spring / Summer 2017
Account of OSM outputs for key highway links and junctions	Detailed analysis of OSM-predicted local/strategic highway network and rail level-crossing impacts guided by public consultation representations and engagement with Highways England and Network Rail.	This Transport Topic Paper and Appendix A	Autumn 2017 / Early 2018
Further OSM test forecasting the impacts of closing Sandy Lane to through-traffic	Documented the estimated strategic highway network impacts of closing Sandy Lane to motorised through-traffic in response to public consultation representations.	This Topic Paper and Appendix C & D	Autumn 2018 / Early 2019

High-level assessment of nine areas of search

2.5 By applying a similar Red/Amber/Green appraisal matrix to that used previously by the Oxfordshire Growth Board (see Section 5 of PR52 'Transport Assessment' for details), ITP assisted Cherwell District and Oxfordshire County Council's initial assessment of which areas of the District could most sustainably (in transport terms) accommodate a share of Oxford's unmet housing need. A total of eight metrics covered indicators that explored existing commuting patterns and physical proximity to existing sustainable transport routes/services/rail stations, job accessibility by walk + public transport and by car, existing levels of traffic congestion, and proximity to future transport investments and those being initiated to support strategic growth.

2.6 The findings suggested that, in transport terms, the areas of search 'A' and 'B' - labelled respectively as 'Kidlington and Surrounding Area' (comprising Cherwell's southern boundary with Oxford, Kidlington, Begbroke and Yarnton) and 'North and East of Kidlington' (comprising Woodstock, Islip, Shipton-on-Cherwell, Hampton Gay and Islip) scored particularly well in terms of their proximity to sustainable transport services and public transport accessibility to Oxford jobs. The findings from this interim transport appraisal were considered by Cherwell District Council Officers alongside those from a separate Sustainability Appraisal (see PR24 'Statement of Consultation, October 2016'). They concurred that areas A (Kidlington and Surrounding Area) and B (North and East of Kidlington) represent the locations where Cherwell District could most sustainably accommodate Oxford's unmet housing need.

Using the Oxfordshire Strategic Transport Model (OSM)

2.7 Atkins maintains the OSM on behalf of Oxfordshire County Council. The model is validated to a base year of 2013 using existing highway and public transport flow data and has been updated through the plan preparation process to incorporate land-use scenarios from neighbouring Districts.

2.8 Further detail on the model's construction, and the data which underpin it, can be found in Appendix 7 to PR 52 'Transport Assessment' (Section 3). In short, the model contained a number of core assumptions about committed strategic development growth in Cherwell and surrounding districts, as well as transport improvements which are already proposed to accommodate this growth, beyond the 2013 base year.

Stage 1 – Testing packages of site options where the growth could be allocated

2.9 An initial round of model testing iteratively considered the forecast transport network impacts associated with different 'packages' of possible site options in which Cherwell could accommodate Oxford's Unmet Housing Need. Each package was made up of groups of sites that scored strongly through the site-level RAG assessment summarised in Table 2-1 (and in detail in Section 6 of PR52 'Transport Assessment'). All these sites were located in the two Areas of Search ('A' and 'B') that are closest to Cherwell District's administrative boundary with Oxford City, which focus on Kidlington and its surrounding areas.

2.10 In view of the large number of site options (44) in these two Areas of Search, it was not considered proportionate to model every possible combination. As explained in Section 7 of PR52 'Transport Assessment', a total of 17 site options were short-listed and refined into three 'development scenarios' which each could accommodate 4,400 homes. The rationale for the selection of these options is discussed in Section 3 of this topic paper, and explanation of CDC's reasoning for sites that were excluded in the development scenario packages can be found in Appendix 4 of PR52 'Transport Assessment'.

2.11 Three of the 44 site options (Yarnton Nurseries, Begbroke Gap and Frieze Farm (site 39)) came later to form part of larger site options Begbroke Science Park (Site 20) and Frieze Farm (Site 39A).

2.12 At stage 1, development scenarios (A1-A3) were modelled as part of an iterative process where the selection of options could be revisited and refined following consultation responses and other evidence informing the Plan's preparation. The aim of the modelling at this stage was to understand how different clusters of site options were projected to impact on the highway and public transport networks.

2.13 Using the OSM, it was possible to benchmark each of the three development scenarios against one another without the inclusion of any additional transport improvements. This provided a comparative insight into the extent to which different allocations of Cherwell's portion of Oxford's Unmet Housing Need might impact upon local transport networks. A preferred development scenario, made up of seven site options spread across three growth areas (North Oxford, Kidlington and the A44 Corridor – see Table 3-1 and Figure 3-2 for details), emerged as the optimal combination of sites when all

planning considerations were taking into account. As such, it formed the basis for all subsequent OSM model tests (as explained in paragraphs 7.23-7.27 of PR52 'Transport Assessment').

Stage 2 – Testing anticipated transport impacts of the preferred development scenario

2.14 Stage 2 built upon the initial round of development scenario model testing (Stage 1), considered the findings of the County Council's A44/A4260 Corridor Study, and took into account discussions with Highways England and Oxfordshire County Council. The 44 site options in Areas of Search A and B were revisited through work led by Cherwell officers. This drew on findings from evidence including sustainability, landscape, habitats and transport, as well as consultation representations (refer to rejected sites in Appendix 4 to PR52 Transport Assessment). Their work resulted in a preferred development scenario (A4), which included three further site options: Yarnton Nurseries and Begbroke West Gap as part of revised site PR20 and Land at Stratfield Farm (site PR49). Figure 3-2 of this Topic Paper shows the composition of site options in the preferred development scenario (A4).

2.15 The OSM seeks to dynamically predict the demand for trips associated with new residential and commercial development on motorised vehicular and public transport networks across Oxfordshire's highway network. Its strategic nature means the model is best-suited to determining what could happen in respect of public transport patronage and average road traffic speeds/delay along principal routes and at key junctions. Despite its sophistication, and in common to all transport models, the outputs from OSM are only ever indicative:

- They are intended to give an idea of where the impacts of changes in journey choice are most likely to be felt.
- The model assumes that drivers have perfect knowledge of the network and will always choose the quickest route available.
- It cannot account for the impact of changes to transport network features that are not capacity constrained. In the context of the Local Plan review, this included the expansion of Water Eaton Park & Ride and bus priority measures on the A4165, A4260 and A44 corridors.
- OSM is a strategic model designed to assess the county-wide impact of changes to the transport network and demand for travel. The model applies trip rate estimates based on an average derived from outlying market towns and villages

(labelled 'Rest of Oxon') for the development areas that make up the preferred development scenario. In practice we anticipate the new developments will adopt similar travel patterns to neighbouring settlements like Kidlington (which are generally less car-dominated due to the locations' proximity to Oxford), with the proposed sustainable transport improvements offering scope to positively alter existing trip rates and travel mode choices.

- It also does not account for walking or cycling trips (non-motorised modes of travel), which is significant given the specific focus of the transport investment packages on encouraging more widespread uptake of these active and sustainable travel modes. National research has shown that walking and cycling levels can be positively influenced through enhanced infrastructure provision and accompanying travel behaviour change interventions. Oxford has one of the highest mode shares for walking and cycling when compared to other local authorities (25% walk/25% cycle/20% bus). This cycling culture, supported by planned transport network improvements, could be strengthened and extended to key corridors around Oxford.

2.16 To overcome these known issues, a number of model scenarios were developed to test a range of possible transport outcomes associated with different levels of investment. The transport improvement scenarios tested, and underlying calculations related to walking and cycling uptake levels, are documented in full in Appendices 5, 7 and 8 to PR52 'Transport Assessment'. The scenarios were tested in relation to two packages of transport improvements (the composition and rationale for which are discussed in section 4 of this Paper, see Table 4-2, Figure 4-2 and Figure 4-3), and comprised:

- Scenario 1: Preferred Development Scenario with no additional transport improvements.
- Scenario 2: Preferred Development Scenario with transport investment package 1.
- Scenario 3: Preferred Development Scenario with transport investment package 1 & 2.
- Scenario 4: Preferred Development Scenario with transport investment package 1 & 2 and the estimated trip impact of the A4260 Cycle Super Way (a sensitivity test).
- Scenario 5: Preferred Development Scenario with transport improvement package 1 & 2, but without the A40-A44 link road (a sensitivity test).

2.17 Each transport improvement scenario was tested in relation to the preferred development scenario that was iteratively defined through the OSM Stage 1 model

testing. The model outputs resulting from this process informed much of the evidence discussed in the sections 3 and 4 of this Topic Paper. Reflecting the sustainable-transport focus of the draft Plan, the OSM findings have deliberately not been used as the basis to 'predict and provide' a level of highway capacity that may be required to accommodate the preferred development scenario. Instead they have helped to shape the vision for a more desirable pattern of land-use and sustainable transport connectivity that can help to minimise private car use; delivering wider environmental, air quality and public health benefits for people living, working and studying in North Oxford and South Cherwell.

Further OSM test of the proposed Sandy Lane closure to through-traffic in relation to the preferred development scenario (Aug-Dec 2018)

2.18 This OSM further tests the impact that the proposed closure of Sandy Lane could have on local transport networks in response to representations received through the statutory consultation process and on-going engagement between CDC, Oxfordshire County Council, and Network Rail in relation to the latter's ongoing risk and performance review of railway level crossings in the North Oxford area.

2.19 The Post Submission OSM test involved a further, comparative model test that sought to provide clarification, based on OSM outputs, of the potential impact of closing Sandy Lane to through vehicular traffic. To complete this work, Atkins' modelling team interrogated the Stage 2 model outputs and made the revisions documented in section 2 of Appendix C to this topic paper, along with confirmation of improved Base Year model validation against observed traffic counts (Section 3). Following this, the model was re-run for both the Base and Future Years of Scenario 3 (described in paragraph 2.16 bullet points). The results from this work are discussed in section 4 of this Topic Paper.

Aligning with evolving Local Transport Plan and national infrastructure plans

2.20 This step-change in approach to using the OSM to define and test a package of predominantly walk, cycle and public transport-oriented improvements is wholly consistent with that called for in the Connecting Oxfordshire Local Transport Plan and its Oxford Transport and Active & Healthy Travel Strategies. Both strategies indicate that perpetuating relatively car-based patterns of commuting into Oxford City is

unsustainable. They also suggest that a continuation of existing travel behaviour through population and job growth would threaten to overburden the transport network to an extent that compromises the city's character and impinges on the quality of life of people who live and work there.

2.21 In this context, improving the quality of local networks that support mode-shift from car travel in favour of widespread uptake of zero-emission walking and cycling options is particularly important. It is relevant since one of Cherwell's four Air Quality Management Areas (see Figure 2-13 in PR52 'Transport Assessment') covers five residential properties on Bicester Road in Kidlington, to the north of the Water Eaton Lane signalised junction. Promoting cycling and walking as a means of every-day travel is also widely evidenced to be one of the most effective ways of increasing physical activity and improving public health amongst the population (Cycling England, 2007). Cycling also delivers positive stress management and wellbeing experiences for commuters, who report improved concentration levels compared to those travelling to work by car (Mitton, Panter and Ogilvie, 2016).

2.22 Both the adopted Cherwell Local Plan and the Local Transport Plan's Oxford Transport Strategy (which will also inform Oxford City's emerging Local Plan) already place heavy emphasis on improving public transport services and capacity, and active travel networks, in the local area. Key proposals, shown in Figure 2-1, include:

- The delivery of two rapid transit services, initially expected to be bus-based, to connect these Park & Ride sites and adjoining employment growth sites with Oxford's residential and employment areas in the city centre and to the east of the urban area.
- New Park & Ride sites at Eynsham (A44) and London-Oxford Airport (A44/A4095 junction), coupled with improvements to the Water Eaton Park & Ride facility.
- Introducing a bus-link between Kidlington and the recently-opened Oxford Parkway station.
- The delivery of Cycle Super Ways (the highest quality cycle routes envisaged for Oxford; see page 22 of PR18 'Oxford Transport Strategy') to link Oxford Parkway, the Northern Gateway employment site and Oxford city centre.
- Cycle Premium Routes to link Kidlington to Oxford City Centre, via Summertown and Park Town (along the Banbury Road (A4165)).

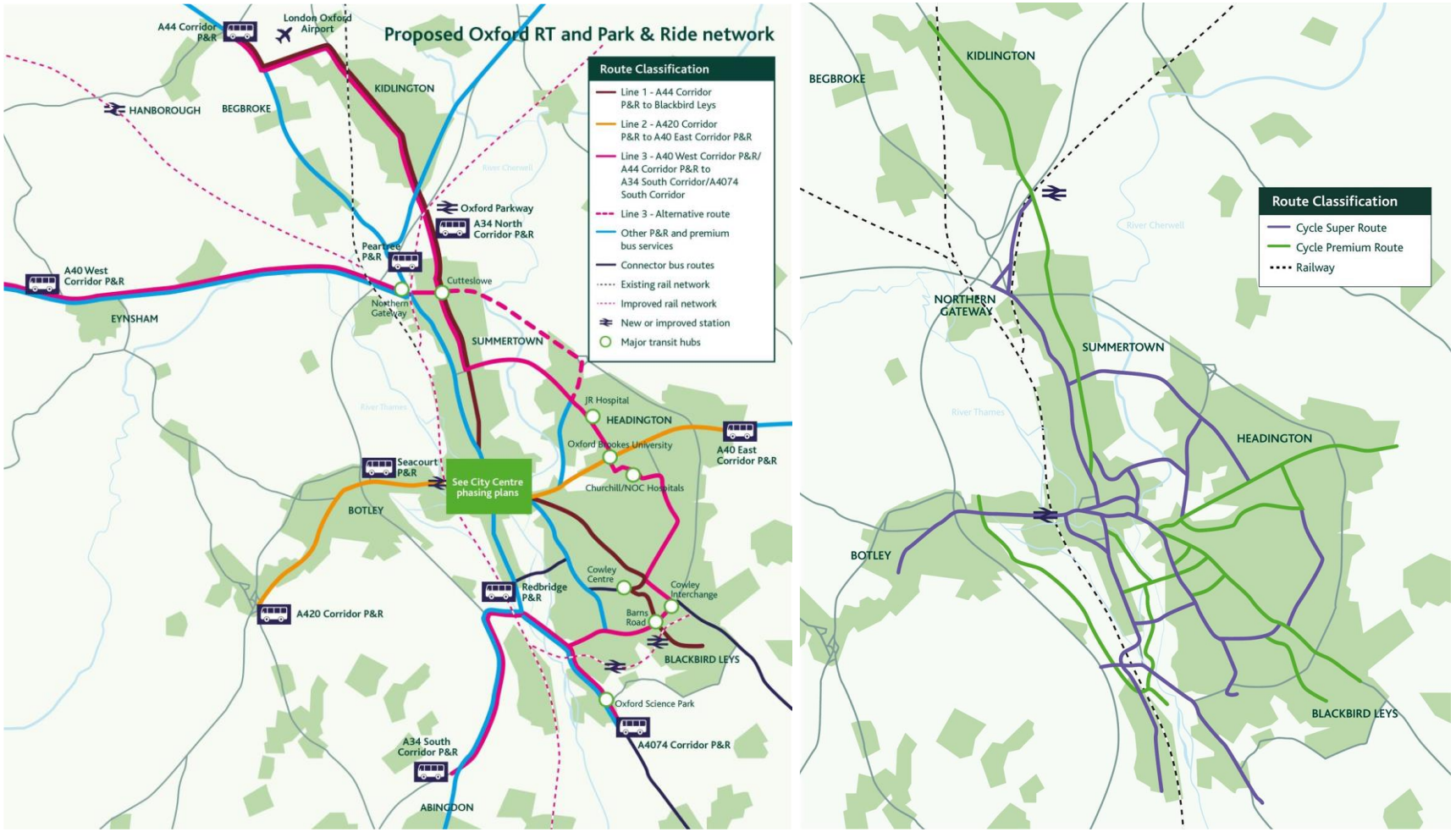
2.23 These policies and investment proposals provided the framework within which packages of additional transport improvements (shown in Table 4-2, Figure 4-2 and Figure 4-3, and discussed in more detail in section 4 of this Topic Paper) were

developed for testing using the OSM. The specific intention of this process was to identify a sustainable location for the supplementary growth in Cherwell to address Oxford's unmet housing need, while seeking to maximise opportunities for sustainable travel. The process builds on the County's existing transport strategy and increases funding possibilities to help secure LTP objectives, while facilitating delivery of the emerging plan as well as existing commitments such as Northern Gateway. As such the process of developing the Submission Plan's accompanying transport improvements was tailored to the nature of the preferred development scenario, and informed by Cherwell District Council, Oxfordshire County Council, and ITP's joint understanding of:

- Residual transport network performance issues affecting South Cherwell and North Oxford (Section 4 of PR52 'Transport Assessment').
- The function of key transport corridors that link south Cherwell with Oxford, and their placemaking implications (Table 7-6 in PR52 'Transport Assessment').

2.24 This approach has helped to ensure the proposed transport improvements are closely aligned to strategic transport investment priorities defined in the Local Transport Plan. The Oxfordshire Housing and Growth Deal (evidence document PR85 & PR88) is expected to part-fund some of these improvements. The result is a sustainable transport-led plan, providing for 4,400 homes to meet Oxford's unmet needs in close proximity to Oxford along key corridors into the city centre.

Figure 2-1: Proposed future bus and rapid transit (left) and cycle (right) routes in Oxford



National infrastructure plans and proposals

2.25 In addition to locally identified transport infrastructure needs, the ongoing definition and delivery of nationally significant investments was also considered. By liaising with Highways England and Network Rail through the Plan making process, Oxfordshire County Council and Cherwell District Council's officers sought to ensure that transport improvements proposed to support the preferred development scenario are cognisant of national transport infrastructure proposals. The outcomes of this ongoing dialogue, and implications considered through the process are summarised in Table 2-2.

Table 2-2: National infrastructure considerations

Network	Investment	Implications
Rail	Signalling upgrades to Banbury – Oxford mainline (Delivered)	The rail capacity improvements facilitated by these recently-delivered improvement are currently limited due to three level crossings on the Banbury-Oxford mainline (at Yarnton Lane, Sandy Lane, and Roundham) which provide a mix of vehicular and pedestrian/cycle access across the railway line.
	Network Rail level crossing closure programme (Ongoing)	The three level crossings on the Banbury-Oxford mainline are part of Network Rail's long-term aspiration to close level crossings, where possible, to maximise safety and operational capacity across the GB railway network.
	East-West Rail Phase 2 (Ongoing)	Phase 1 has already delivered direct rail services between Oxford, Oxford Parkway and Bicester Village stations to London Marylebone. Phase 2 will extend these improvements to Cambridge, via Milton Keynes; further increasing the capacity and frequency of rail services between the local stations mentioned above.
Road	M40 Junction 9 and 10 pinch point improvements (Delivered)	Already delivered and the additional capacity is forecast by the OSM to be largely absorbed by 2031, as a result of already-allocated strategic growth in Cherwell and neighbouring planning authorities.

Network	Investment	Implications
	Ox-Cam Expressway and A34 capacity considerations (Ongoing)	Significant additional highway capacity could be added between Oxford, Milton Keynes and Cambridge as a result of the Oxford to Cambridge Expressway, which is being explored jointly by Highways England and the National Infrastructure Commission. Its funded inclusion in the Road Investment Strategy post 2020 (RIS 2) introduces the likelihood that this new road could help to alleviate long-term road traffic congestion and resilience issues that are focused on the A34 and its junctions with the A40-A44 around North Oxford and South Cherwell.

2.26 These nationally significant transport infrastructure considerations are factors that have influenced, and could be influenced by, the preferred development scenario for Cherwell's accommodation of its agreed portion of Oxford's unmet housing needs. Notwithstanding this, any de-congestion effects (forecasts of which are yet to be published) associated with major road schemes like the East-West Expressway are unlikely to be realised until after its projected delivery in 2030. Post-opening evidence from similar road schemes delivered elsewhere, would suggest this infrastructure is likely to both induce and unlock suppressed demand for further car trips (See page 81 of the National Infrastructure Commission's Consultation Paper on 'Congestion, Capacity, Carbon').

2.27 It is in this context that these major national infrastructure schemes have informed the definition of the package of transport improvements explained in subsequent sections this Topic Paper.

3. Developing the transport strategy for the Local Plan Review

3.1 Following the methodology outlined in the previous section, ITP's analysis of the underlying travel patterns and transport network capacity across North Oxford and South Cherwell guided the development of the transport strategy for the Local Plan Review. This section sets the scene by summarising the key issues identified through this work. It also identifies the characteristics and challenges associated with the preferred package of sites for accommodating Cherwell's agreed portion of Oxford's Unmet Housing Need (4,400 homes).

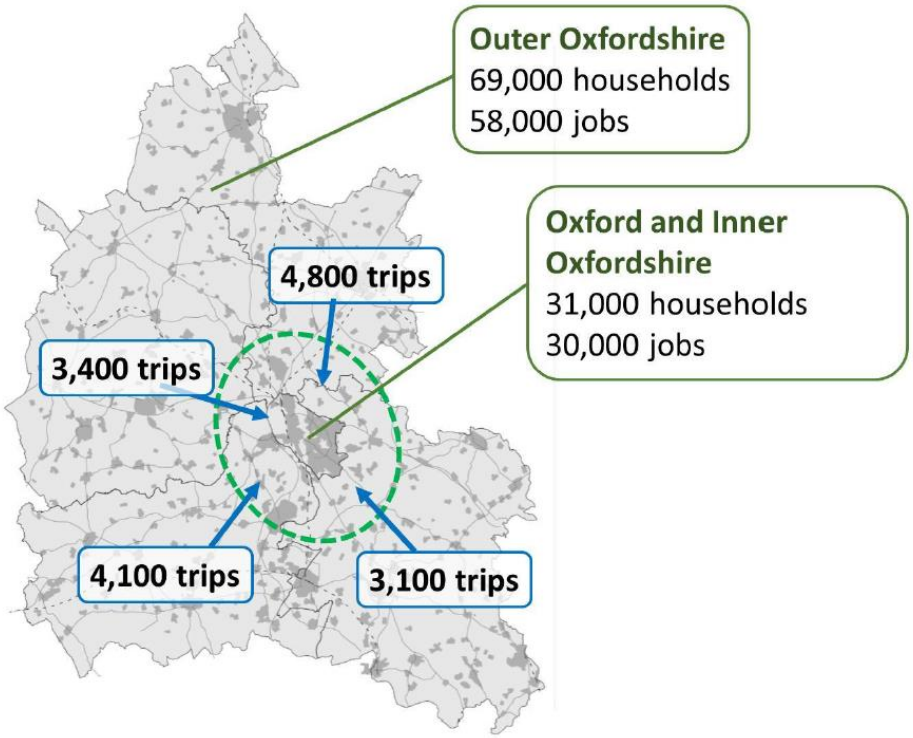
Transport rationale underpinning the strategic growth site allocations

3.2 PR04 'The Strategic Housing Market Assessment' (SHMA) predicted a requirement for 100,000 new homes in Oxfordshire in the period 2011 to 2031 (Figure 3-1). These are needed to support economic growth and rising demand for more affordable housing within the Oxford Travel-To-Work area. Sections 3 and 4 of PR52 'Transport Assessment' note that, at the time that the TA was produced, around 30,000 of these homes had already been committed through existing Local Plan/Core Strategy allocations to strategic development sites in Oxford (up to 9,200 homes by 2026) and Cherwell (almost 23,000 homes by 2031). The additional 4,400 homes being considered for allocation in Cherwell through the current Local Plan Review respond to the predicted requirement in the SHMA. Collectively, the suite of Plans being produced in Oxfordshire (including the adopted Vale of White Horse (Part 1) and West Oxfordshire Local Plans) seeks to deliver the 100,000 homes identified in the SHMA as required under the terms of the Oxfordshire Housing and Growth Deal signed by the Secretary of State for Housing, Communities and Local Government on 15 March 2018.

3.3 The 30,000 homes committed through existing Local Plan/Core Strategy allocations was anticipated to result in over 15,000 additional commuter trips (i.e. home-work journeys) into Oxford from surrounding Districts, of which 4,800 trips are expected to originate from Cherwell and focus on the A34 (which already carries an average of 70,000 vehicle trips per day). PR18 'Oxford Transport Strategy' indicates that a 10% decrease in the car driver mode share is needed to prevent traffic levels rising. The level of extra travel demand, coupled with the tendency for these trips to be more car-

based than those within the Oxford urban area, highlights the importance of planning for more mixed-use developments in locations where opportunities for less car-centric movement patterns can be well supported.

Figure 3-1: Commuter travel impacts of projected employment and housing growth to 2031



Source: Oxfordshire County Council, LTP Volume 1, pg.32

Key mobility considerations

3.4 The considerations listed below were highlighted through ITP's initial desk-review of evidence underpinning Cherwell's adopted Local Plan and the Connecting Oxfordshire Local Transport Plan. These informed the rationale for Cherwell's proposed spatial allocations for accommodating Oxford's Unmet Housing Need and the development of accompanying transport improvements:

- **Commuter flows** are likely to focus on Oxford, given the additional homes in Cherwell to address Oxford's unmet housing need are intended to serve the city's growing economy.
- **Proximity and accessibility to Oxford** is critical to achieving the National Planning Policy Framework's objectives related to maximising scope for use of sustainable modes of travel.

- **Dedicated walk/cycle infrastructure** will be required to link new and existing homes in South Cherwell with Oxford jobs given the convergence of busy A-roads around Oxford and Cherwell, and its distance from Oxford City Centre (6km) which is slightly further than the national average cycle trip length (4.8km).
- **Higher levels of priority for bus services** are needed, particularly on arterial routes into Oxford and to employment locations in East Oxford, to ensure viable public transport alternatives are not critically inhibited by existing levels of traffic congestion.
- **Passenger demand and financial support for proposed rapid transit links** could be facilitated by intensified housing development around the Cherwell-Oxford administrative boundary; helping deliver the step-change in sustainable transport investment to better coordinated employment and housing growth locations across the county.
- **Limiting further road traffic growth around North Oxford** – particularly on the A34/A40/A4260/A44/Wolvercote and Cutteslowe Roundabouts/M40 Junction 9 – is critical to accommodating additional development in this area. Building more road capacity is not a sustainable long-term solution, whereas encouraging mode-shift to walking/cycling/public transport should release capacity on existing roads to help accommodate further growth.
- **Replicating Oxford City travel to work mode share (25% walk, 25% cycle, 20% bus)** should therefore be considered as a long-term aspiration for supporting additional growth around the Oxford-Cherwell boundary.
- **More widespread uptake of Ultra Low Emission Vehicles**, coupled with the more sustainable movement patterns described above, will also contribute significantly to improving local air quality and public health.

3.5 As described briefly in Section 2 of this Topic Paper, and in greater detail in Section 5 of PR52 'Transport Assessment', these insights informed a transport-led RAG Assessment of nine Areas of Search across Cherwell District. The findings clearly indicated that Areas of Search 'A' and 'B' - labelled respectively as 'Kidlington and Surrounding Area' (comprising Cherwell's southern boundary with Oxford, Kidlington, Begbroke and Yarnton) and 'North and East of Kidlington' (comprising Woodstock, Islip, Shipton-on-Cherwell, Hampton Gay and Islip) – are the optimal locations, from a sustainable transport connectivity perspective, in which to seek to accommodate Oxford's Unmet Housing Need. Sites in these locations had previously emerged from both the Initial Sustainability Appraisal (PR23 'Initial Sustainability Appraisal') and Initial

Transport Assessment (PR22 'Initial Transport Assessment') as those which were most favourable to accommodating Oxford's Unmet Housing Need, on account of:

- Their proximity to existing premium bus and rail routes that served major employment areas in Oxford City.
- All being within a 45-minute walk + public transport journey of at least 55,000 jobs based in Oxford during the AM Peak.
- Their proximity to proposed rapid transit lines (1 & 3) defined in the Local Transport Plan and improving East-West rail connections via Oxford Parkway station (see section 2).
- Their potential to deliver transport infrastructure investment focused on Kidlington and North Oxford to promote widespread uptake in alternatives to private car use for both new and existing residents.

3.6 Other locations considered through this process are expected to result in more car-based developments where higher levels of investment in public transport measures are required to achieve similarly sustainable patterns of movement and limited impacts on strategic local and national road networks.

Influence of transport considerations on the selection of preferred development sites

3.7 Using the methodology outlined in Section 2 of this Paper (Table 2-1), and detailed fully in Sections 6 and 7 of PR52 'Transport Assessment', a combination of site-specific RAG assessment and OSM model tests (Stage 1) were used to compare the potential sites in which Cherwell could accommodate its apportionment of Oxford's Unmet Housing Need. Through this process, and in combination with wider Sustainability Appraisal inputs and other planning considerations, we compared the transport impacts of different 'development scenarios' each containing different permutations of 17 site options. The model outputs showed these scenarios performed reasonably similarly, but supplemented the desk-review insights listed earlier in this section by quantifying:

- The critical need to minimise the impact of growth in this area on already congested road networks that are sensitive to disruption (notably the A34, A40, A44, A4260, A4095, Junction 9 of the M40, Peartree Interchange, and Wolvercote & Cutteslowe roundabouts).
- The less-effective ability of large sites considered at Islip to facilitate travel demand to Oxford employment locations. These allied with concerns expressed

by Highways England in relation to the capacity and design of the A34 junction that serves these site options.

- A significant projected increase in road vehicle traffic along Sandy Lane (between Kidlington and Yarnton) which contains a level crossing and a weight-limited canal bridge. Left unchecked these additional traffic flows would be expected to alter the character of this semi-rural road and undesirably compromise safety at the level crossing.
- A clear need for growth to support the delivery of infrastructure that allows for improved non-motorised (walk/cycle) and public transport (bus/rapid transit) travel options, safety and journey times – both for new and existing residents in the area.

3.8 Using these insights, a refined development scenario (Scenario A4) was subsequently defined and tested using OSM prior to the formulation of any transport improvements. In view of the findings from the initial stage of model testing and the need to meet the Plan's vision and objectives, CDC's officers sought to focus Oxford-facing residential development on locations with greatest potential for widespread uptake of non-polluting walk and cycle modes that would link existing settlements with:

- Nearby employment sites at Langford Lane/Oxford Airport.
- The proposed Northern Gateway mixed-use development area.
- Oxford City Centre and, to a lesser extent (due to current lower levels of direct public transport accessibility), the Eastern Arc.

3.9 Table 3-1 and Figure 3-2 show the site options and their locations, and estimated numbers of dwellings that could be delivered at each one.

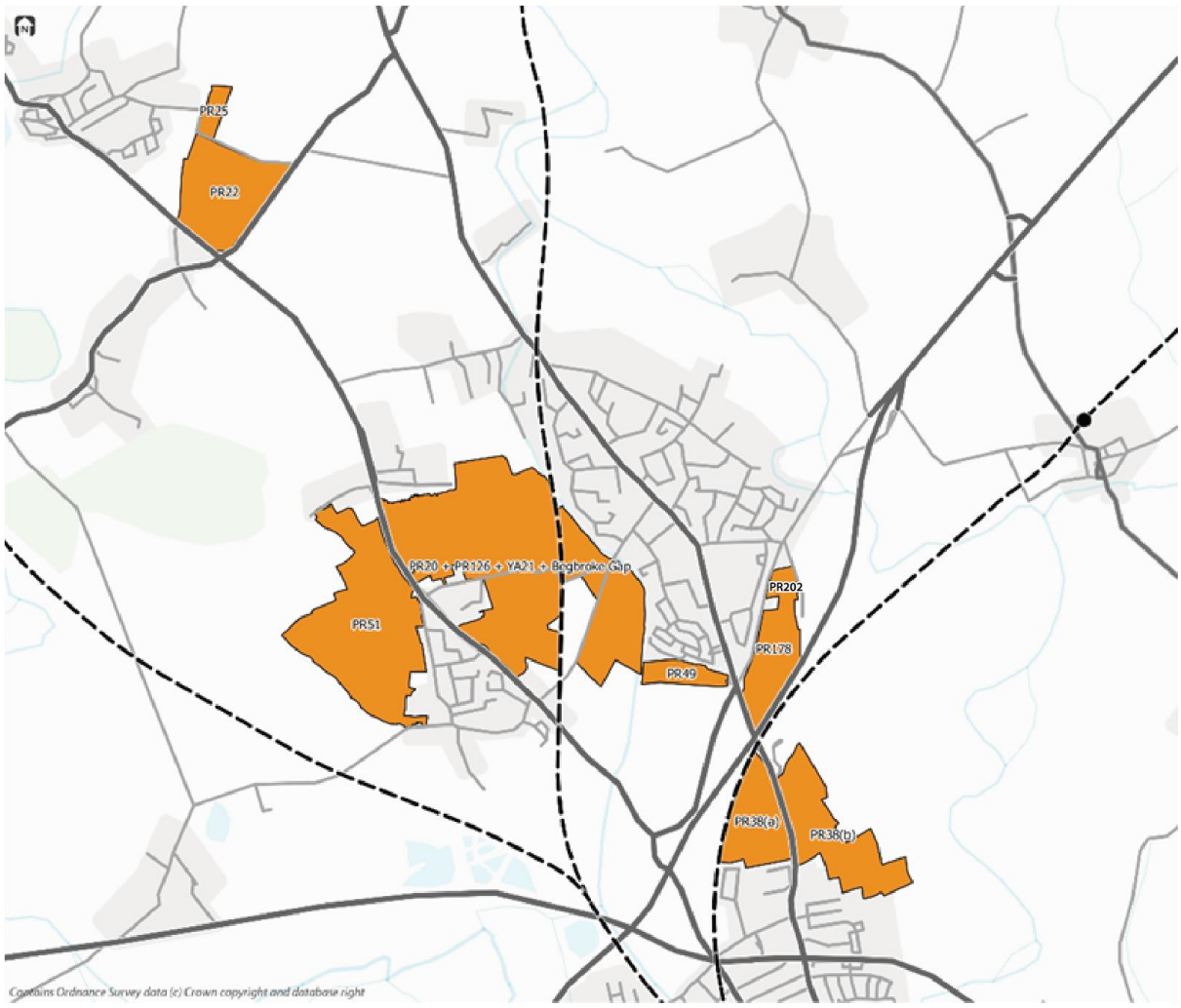
Table 3-1: Composition of site options in preferred development scenario

Site Ref	Site name	Estimated dwellings	Growth Area
PR22, PR25 (Policy PR10)	Land South East of Woodstock	410*	A44 corridor
PR20, PR126, YA21, Begbroke Gap (Policy PR8)	Land East of the A44	1,950*	
PR51 (Policy PR9)	Land West of Yarnton	530	
PR49 (Policy PR7b)	Land at Stratfield Farm	100	Kidlington
PR178 (Policy PR7a)	Land South East of Kidlington	230	
PR38 (a) (Policy PR6a)	Land East of Oxford Road	530	North Oxford
PR38 (b), includes PR123 (Policy PR6b)	Land West of Oxford Road	650	
	Total dwellings	4,400	All

Site reference numbers reflect position at this stage of evidence preparation.
Policy numbers in brackets are added for ease of referencing.
*Dwelling numbers reflect the position at this stage of evidence preparation.

3.10 After all of the transport modelling work was completed, some minor changes to the estimated numbers of dwellings at PR22/PR25 (+90 dwellings, to 500) and PR51 (-90 dwellings, to 440) were made. These followed representations regarding the amount of developable area in each site, and associated heritage and landscape considerations. The model tests were not repeated, given the total number of dwellings allocated along the A44 corridor remains unchanged, and such relatively small changes are not expected to have a material impact on the strategic transport model outputs.

Figure 3-2: Composition of site options in preferred development scenario



Transport characteristics and challenges of the proposed growth areas

3.11 Table 3-2 summarises the key characteristics, opportunities and constraints for each of the three growth areas which will be established by the preferred development sites. The specific issues for each one clearly reflect those identified for the wider area (in Section 3 of this paper), and are drawn primarily from evidence presented in Section 6 of PR52 'Transport Assessment' and the detailed findings contained in Appendix 2 to that document.

Table 3-2: Transport characteristics, opportunities and constraints

Metrics	North Oxford (1,180 dwellings)	Kidlington (330 dwellings)	A44 Corridor (2,890 dwellings)
Relationship to Oxford / West Oxon / wider area	Next to current Oxford urban fringe South of the A34, but north of A40 Oxford-facing locations	Next to Kidlington urban area North of the A34 Oxford-facing locations	Next to smaller settlements of Yarnton, Begbroke and Woodstock along the A44 Less-urbanised Oxford-facing locations
Relationship to local highway network	Tidal traffic flow in/out of Oxford from Kidlington along Oxford Rd Contributes to peak hour congestion at Kidlington and Cutteslowe roundabouts	Tidal traffic flow in/out of Oxford from Kidlington/Gosford (and A34) via Kidlington roundabout/A4260 Contributes to peak hour congestion at Cutteslowe and Peartree roundabouts	Tidal traffic flow in/out of Oxford, and onto A34, along the A44 from Woodstock and surrounding villages Contributes to peak hour congestion at Peartree and Wolvercote roundabouts
Relationship to strategic roads (A34 and M40)	Close to A34, but less likely to be used for commuter trips into Oxford Distant from M40 J9	Close to A34, with some scope for use to access South Oxford Bicester Rd links A34 (north) & M40	Close to A34, with some scope for use to access South Oxford Potential for westbound travel on A40
Key commuter travel modes (2011 Census)	46% by private car 22% by public transport 22% by walk/cycle	61% by private car 20% by public transport 13% by walk/cycle	59% - 73% by private car 11% - 20% by public transport 7% - 16% by walk/cycle

Metrics	North Oxford (1,180 dwellings)	Kidlington (330 dwellings)	A44 Corridor (2,890 dwellings)
Public transport connectivity	Within 500m of premium bus services between Oxford, Water Eaton P&R. Kidlington and Bicester Short walk/cycle to Oxford Parkway	Within 500m of premium bus services between Oxford, Water Eaton P&R, Kidlington and Bicester. Short walk/cycle to Oxford Parkway	Within 500m of direct premium bus services between Banbury, Woodstock and Oxford.
Walk/cycle infrastructure	On-road cycle lanes along A4165 / Oxford Rd to Oxford and Kidlington	Off-road cycle lanes along A4165 towards Oxford (NCN 51)	Off-road cycle lanes (NCN 5) along part of A44 from Woodstock to north Oxford
Key transport opportunities and constraints	Direct walk/cycle access into Northern Gateway employment site Within 5km of Oxford city centre Good existing bus and rail links Scope for growth to enhance a key north-south movement corridor Key role of A34/A40 for some car trips (e.g. S. & E. Oxford) Close to roads covered by Oxford's Air Quality Management Area (City wide AQMA)	On route of rapid transit lines 1 & 3 Scope to improve Oxford cycle route Contain convenience trips to Kidlington Scope for growth to enhance a key north-south movement corridor Kidlington roundabout (capacity) Close to roads covered by a Cherwell Air Quality Management Area	Possible new rail station halt Enhanced bus services along the A44 Park & Ride at Oxford Airport Sandy Lane walk/cycle route to Kidlington Potential for increased use of level crossings over Banbury-Oxford railway line Less well connected to S. & E. Oxford

Relationship to transport policy and objectives set out in the Submission Plan

3.12 The transport-related characteristics and challenges for the three preferred growth areas, as well as the site-specific opportunities and constraints that exist for each one, have guided development of the proposed package of transport improvements (summarised in Table 4-2, Figure 4-2 and Figure 4-3). They also directly informed the Local Plan Review's vision and objectives for how the District Council is seeking to help accommodate Oxford's unmet housing need within Cherwell. The most relevant of these (as enshrined in the Local Plan Partial Review (Oxford's Unmet Housing Need) Submission Plan) are as follows:

- The **vision statement** seeking to:
  - Ensure people have convenient, affordable, and sustainable travel opportunities to Oxford's places of work, study and recreation, and to its services and facilities.
  - Deliver development that is well connected to Oxford, supported by necessary infrastructure, and contributes positively to improving public health and well-being.
- Specific **strategic objectives** that supplement those already included in the existing adopted Cherwell Local Plan (2015), which relate to:
  - Partnership working to meet needs and required infrastructure by 2031 (objective SO16).
  - Providing development so that it complements the County Council's Local Transport Plan (including the Oxford Transport Strategy) and facilitates demonstrable and deliverable improvements to the availability of sustainable transport for access to Oxford (objectives SO19).

3.13 By expressly including these strategic objectives within the Plan, Cherwell District Council has made plain its intention to deliver homes that will enable people to live within the District in locations well connected to the Oxford urban area. As well as maximising the opportunities for active and healthy travel described earlier in this Paper, it strengthens the case for the transformative investments in sustainable transport infrastructure (as called for in the Connecting Oxfordshire Local Transport Plan) around the North Oxford/South Cherwell boundary. It also ensures any new housing can build upon Cherwell's strongest geographic, economic, and social relationships with Oxford – while helping to strengthen Kidlington as an important

urban centre (Policy Kidlington 2 of the adopted Local Plan, Kidlington Framework Masterplan, and Submission Plan Policy PR4b).

3.14 The Submission Plan emphasises the important role played by several local employment sites. These include existing locations within Cherwell (Oxford Parkway Railway Station, Oxford University's Begbroke Science Park, London-Oxford Airport, Langford Lane commercial area in Kidlington) and the Oxford Northern Gateway site on the border of Cherwell and Oxford, which will be a key driver of employment growth. By delivering sustainable connectivity between the preferred housing growth areas and these locations, there is genuine scope to achieve a more mixed pattern of land-use that supports lower levels of car use for commuting and higher levels of activity and health among the local population. The planned local provision - through the new housing development - of schools (a primary school in North Oxford and a primary school and Secondary School on land East of the A44), new local centre facilities (in North Oxford and East of the A44), formal sports/play areas, and nature reserves; is expected to further support and enhance the potential for widespread uptake in walking and cycling for local trips.

4. Anticipated cumulative transport impacts of additional growth and proposed mitigation

4.1 The methodology outlined in section 2 of this Topic Paper, coupled with the insights summarised in section 3, was used to estimate the cumulative transport impacts on local highway and public transport networks. Working closely with Oxfordshire County Council's officers, we used the OSM to test the performance of different packages of transport improvements so as to further estimate their effectiveness in respect of mitigating undesirable network impacts. In particular, we sought to iteratively define a package of transport investments that would:

- Limit significant increases in traffic delay during AM and PM peak hours, particularly in locations where the transport model already predicts the highway network will operate close to its design capacity in 2031 as a result of forecast future trip growth.
- Limit significant increases in vehicle flows during AM and PM peak hours, particularly in locations where traffic flows are currently low and significant increases would alter the function or nature of such roads.
- Maximise scope for walking, cycling and public transport use from both new and existing residential areas in the locations around the new growth areas.

4.2 This section of the Topic Paper summarises the key findings from this process and explains the rationale behind the transport improvement packages it tested. Residual transport issues are highlighted for consideration in respect of wider infrastructure investment practices that fall beyond the scope of Cherwell's Local Plan Review.

Key issues highlighted through Stage 1 modelling and public consultation

4.3 The initial round of model testing, through which preferred development locations were identified, emphasised the vulnerability of both local and strategic highway networks in the vicinity of the North Oxford/South Cherwell area. It revealed that, without accompanying transport improvements, the predicted 1% increase in the additional total AM peak hour vehicle distance travelled in 2031 (resulting from the additional growth considered through this Local Plan Review) is forecast to result in a 5% average increase in traffic delay and cause average road speeds to fall by 2%.

These forecast delay increases were predicted to focus on a few key road corridors, some of which also currently accommodate premium bus routes.

4.4 The key impacts, and their relevance to the nature of each corridor were used to inform the rationale for strategic transport improvements (discussed further in section 4). The forecast changes in delay along a number of road corridors (expressed as percentage increases or decreases relative to what is expected to happen as a result of committed growth across the county to 2031) are summarised in Table 4-1, with more detail available in Section 7 of PR52 'Transport Assessment' and the detailed findings contained in Appendix 7 to that document. It is important to remember that the estimated 'impact of development' in respect of the individual corridors reflects an accumulation of already committed growth plus the 4,400 homes associated with Cherwell's apportionment of Oxford's unmet housing need. A map showing the locations of local road corridors and junctions in the context of the area can be found in Figure 4-1.

4.5 Through this process, it was recognised that commuter trip demands associated with the allocation of 4,400 homes to preferred development sites are likely to load primarily onto the A44/A4144 and A4260/Oxford Rd corridors. Without proportionate transport improvements that seek to address this issue (i.e. predominantly car-based travel patterns associated with existing trips and all committed growth across the county) rather than the implications (i.e. highway network capacity), the points where these two important local corridors cross the A34 (Peartree interchange) and A40 (Wolvercote and Cutteslowe roundabouts) strategic roads are expected to be placed under additional pressure due to existing travel demand. Consultation feedback from, and subsequent dialogue with Highways England, emphasised this sensitivity, which is covered in more detail later in this section.

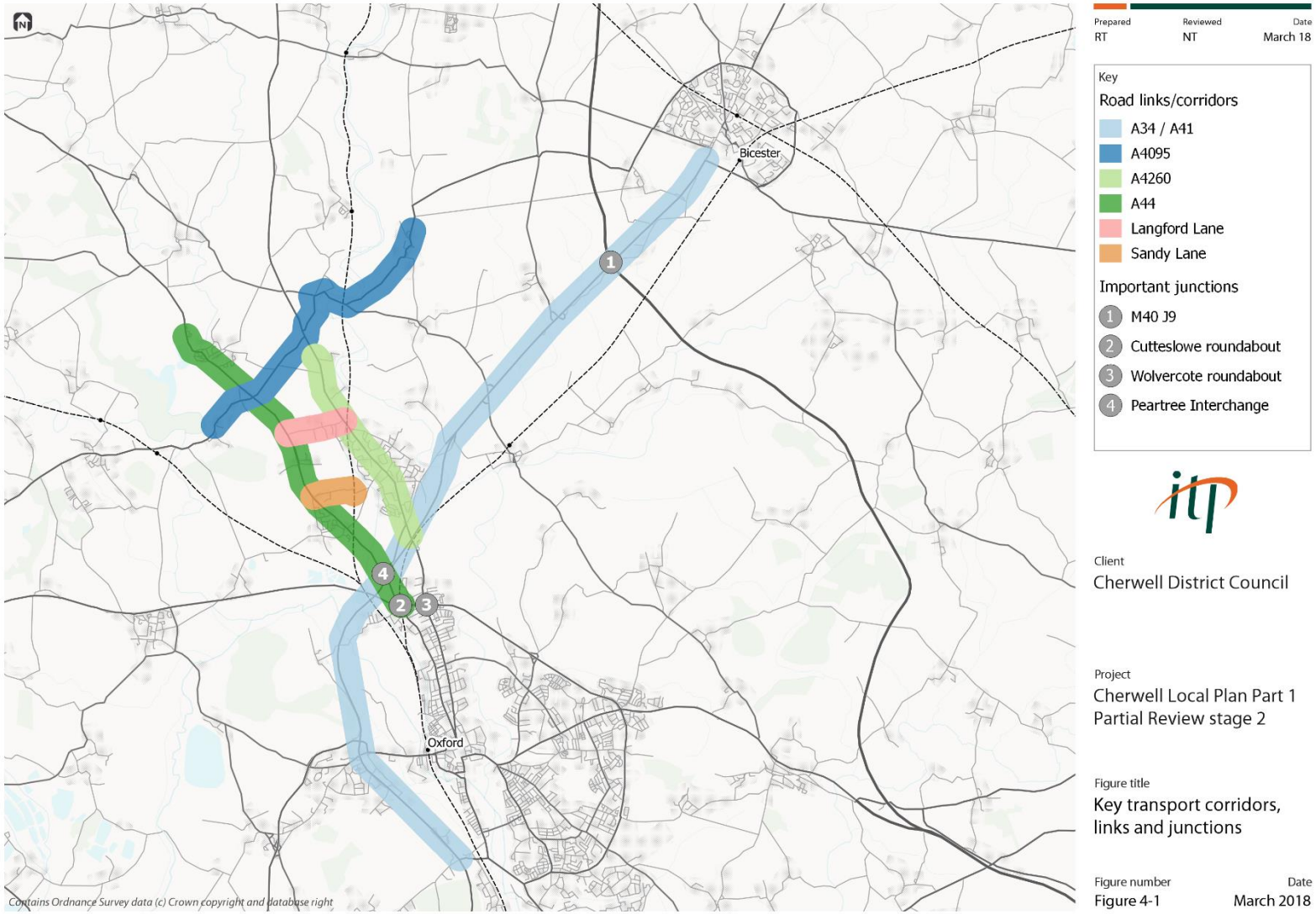
4.6 It is pertinent to note that the motorised mode shares that underpin the trip rates behind these estimates, and applied in OSM, are reasonably conservative. They assume the new homes allocated across all three growth areas will adopt a 'Rest of Oxon' set of residential trip rates. In practice, the complementary sustainable transport improvements and new employment sites to be delivered around the north of Oxford and close to the airport should mean that new homes in North Oxford, Kidlington, and close to Begbroke and Yarnton are expected to adopt more sustainable patterns of movement - similar to those observed in Kidlington currently (where 33% of commuters walk, cycle or use public transport to get to work, according to the 2011 Census). As such the delay forecasts presented in Table 4-1 are expected to reflect a 'worst case' assessment of future road traffic impacts.

Table 4-1: Local transport links/corridors and unmitigated road traffic impacts (from Stage 1 OSM tests)

Corridor	Corridor function and placemaking implications	OSM forecast delay impacts	
		AM peak	PM peak
A34/A41 Bicester to Oxford	Strategic regional/national route from M40 to south coast Also important for access to South Oxford employment sites Impact of development on individual junctions is critical Junctions closest to development locations most vulnerable	+ 1%	+ 2%
A44 Woodstock to Oxford	Strategic route with higher traffic speeds and flows Inconsistent off-road cycle lanes could be enhanced Lack of bus priority/crossing facilities to south of corridor Potential for direct pedestrian/cycle access into Northern Gateway Lower speed limit and pedestrian crossings will reduce segregation Scope to safeguard land to facilitate aspiration for a station halt near to the corridor	+ 18%	+ 7%
A4095 Kirtlington to Bladon	Key 'north of settlement' route Can absorb East-West traffic to de-congest new communities	+ 24%	+ 2%
A4260 Shipton to Oxford	Heavy traffic flows but lower speeds than A44 Improved pedestrian/cycle crossings would enhance the local centre A high-quality cycle route could use existing A34 over bridge Rapid transit may provide impetus for roadspace reallocation Designate as PT + cycle corridor into Oxford (via Water Eaton)	+ 16%	- 3%

Corridor	Corridor function and placemaking implications	OSM forecast delay impacts	
		AM peak	PM peak
M40 Junction 9	Major interchange between A34 and motorway network Low anticipated impact owing to Oxford focus for growth	- 1%	+ 5%
Langford Lane (Kidlington)	Key 'north of settlement' route Can absorb East/West traffic to de-congest new communities Also important East/West rapid transit and walk/cycle route	+ 17%	- 29%
Sandy Lane (Kidlington)	Key 'desire line' between A44 corridor and Kidlington Risk additional vehicle trips turn the road into a rat-run This would make it less appealing for walking Automated level crossing with poor sight lines is a constraint which (in combination with Yarnton Lane and Roundham level crossings) also limits full utilisation of recent rail signalling upgrades to increase rail service frequency. Weight-limited single lane canal bridge also a constraint Upgrading these crossings is both challenging and expensive Scope to install a pedestrian/cycle bridge and close level crossing Scope to provide access onto canal towpath for recreation	+ 50%	+33%

Figure 4-1: Local transport links/corridors and junctions



4.7 Table 4-1 indicates that development along the A44 corridor, around Yarnton and Begbroke, is likely to increase existing demand for connectivity between the A44 and A4260 corridors to/from Kidlington's local centre and new schools proposed close to the A44. Based on development site locations and likely desire lines, we anticipate that Langford Lane and Sandy Lane will be the most popular points for crossing between the two corridors.

4.8 In particular, the OSM predicted that Sandy Lane may attract the bulk of this movement during AM and PM peak periods. Aside from fundamentally changing the nature of this road, the significant increases in forecast vehicular traffic would be expected to deter people from walking and cycling for local trips between Kidlington, Begbroke, Yarnton, Oxford Parkway Station and the new communities created by the proposed growth. Specific feedback received from Network Rail highlighted their concerns over level crossing safety at Sandy Lane, Yarnton Lane and Roundham. Of the three, Sandy Lane's scope for significantly increased vehicle flows, coupled with the poor visibility on approach to the crossing from the West, is expected to compromise safety at this level crossing. Network Rail also highlighted that the level crossing's poor risk score currently prevents an increase in rail network capacity, which is possible due to recent re-signalling work along the line, from being realised.

4.9 Further Post Submission modelling work (discussed later in this section), indicated that Sandy Lane was encoded in the OSM in a way that made it more attractive to absorbing vehicle trips than is realistic (owing to the constraints of a level crossing and signal-controlled canal bridge). As such, the forecast delay impacts shown in Table 4-1 may over-estimate the impact of proposed development on Sandy Lane, and underestimate impacts on Langford Lane and the A44/A4260.

4.10 Notwithstanding this, Sandy Lane's promotion as the primary access over the railway line via a high-quality walking and cycling route is an important measure to deliver a more direct connection between Yarnton, Begbroke, Kidlington and Oxford Parkway Station through the southern portion of PR8 (Land East of Begbroke), while addressing Network Rail's safety concerns about the level crossing and its knock-on impact on network capacity.

4.11 Section 1 of the PR52 'Transport Assessment' (paragraphs 1.6 to 1.8) summarises the main feedback received on the PR22 Interim Transport Assessment during the Plan's Options Consultation (November 2016 -January 2017). As a result of this consultation,

the transport evidence was updated in relation to changes to bus services and road safety data.

4.12 Transport-related representations received at the Proposed Submission stage (July 2017-October 2017) covered a mix of site-specific and strategic access concerns, including:

- Requests for amendments to draft development briefs and dedicated policies so that they better reflect county-wide transport policies and practices, as well as specific access requirements for some sites. These were subsequently accommodated in the Submission Plan.
- Requests for greater detail on strategic highway network junction impacts and residual issues (included in Appendix A, and summarised in this section).
- Requests for supplementary model tests to consider further cumulative impacts with neighbouring planning authorities' growth allocations (including Oxford's unmet housing need). These were not pursued at this stage, since the modelling work used the latest housing and employment land commitments provided by all neighbouring District Planning Authorities that were available at the time of Local Plan preparation. Further transport model testing is being coordinated by Oxfordshire County Council, through its ongoing work to integrate the transport implications and Infrastructure Delivery Plans of each District Council's evolving Local Plans to ensure they align with the evolving Oxfordshire Infrastructure Strategy their monitoring of the County's Local Transport Plan, and delivery of transport improvements and new homes as part of the County's Housing Growth Deal with Central Government.
- Requests for clarity over the nature of bus priority proposals on the A44 and A4260 corridors to help ensure their congestion-beating potential is maximised.
- Calls for single-payment bus + Park & Ride fare options to maximise desirability and affordability of this option, which were forwarded to Oxfordshire County Council to consider in its role as the local transport authority.
- Operational questions related to the diversion of bus services into new developments and the setting of appropriate trigger points for this to happen.
- Concerns over the potential severance effect of closing Sandy Lane to through vehicular traffic. This was reconsidered through the Post Submission OSM tests, which are reported in Appendices 3 and 4 and summarised later in this section. The severance impact is considered secondary to maximising safety at the level crossing and encouraging more widespread uptake of walking and cycling trips.

- Concerns expressed over the level of detail yielded by strategic transport modelling activities undertaken by Oxfordshire County Council on behalf of Cherwell District. These included observations and separate analyses of cumulative vehicle trip totals on key corridors, questioning of potential for new trips to be made by walking/cycling/public transport modes, commentary on the strategic importance of retaining Sandy Lane as a vehicular link between the A44 and A4260 (and the validity of model tests that retain this link), and the potential future impact (among both new and existing residents along key transport corridors) of high-quality segregated cycle route provision and bus priority measures proposed to support the additional growth. These concerns have been carefully considered and are addressed, where relevant, through the explanation of findings and analytical approaches adopted which are set out in this Topic Paper, as well as through documentation of the Post Submission OSM testing (Appendices C and D). We remain satisfied that the methodology used to determine sustainable transport locations for accommodating Oxford's unmet housing need is both proportionate to this Local Plan Review, and sufficiently robust to meet the technical requirements of the MHCLG guidance on *Transport evidence bases in plan making and decision taking.*

- Questions over the funding and delivery of infrastructure which are covered in the Submission Plan Appendix 4 – Schedule of Infrastructure and recommended Focused Changes.

- Questions over the availability of time for the Transport Assessment to inform the Sustainability Appraisal. The Transport Assessment and the Sustainability Appraisal were undertaken in parallel looking at areas of search and then specific sites with the metrics from the Transport Assessment feeding directly into the Sustainability Appraisal. Transport, Sustainability and other plan evidence guided the selection of sites which could accommodate development followed by testing using the Oxfordshire Strategic Model (OSM) which through an iterative process guided the development of transport improvement packages.

4.13 These issues are duly acknowledged and have been taken into account through subsequent transport strategy development, model testing and plan preparation processes. In addition to the consideration of representations, the Submission Plan was informed by close collaboration with Oxfordshire County Council and meetings with Highways England and Network Rail addressing transport matters. The Submission Plan's Statement of Consultation provides details of the plan's consultations and a summary of issues raised. This document and all the

representations received during the plan's consultation stages are available on the Council's website (Local Plan Partial Review Evidence Base).

Rationale for strategic and site-specific transport improvements

4.14 Two packages of strategic transport improvements were developed on the basis of the observations summarised in Table 3-2, the data obtained from the model tests, and public consultation representations. The measures proposed are in addition to those already included in the Infrastructure Delivery Plan for Cherwell's Adopted Local Plan and their locations are shown in Figure 4-2 and Figure 4-3, and the ID numbers shown correspond with those documented in Table 4-2. They typically fit into one of the five categories defined in Table 4-1 and seek to:

- Reduce bus service journey times and improve service reliability to improve their attractiveness relative to private car use; thereby maximising the peak hour trip carrying capacity along the A44 and A4260 corridors.
- Deliver new bus services and Park & Ride facilities that further support enhanced bus-based public transport options for new and existing communities in Kidlington, Yarnton, Begbroke and North Oxford.
- Reduce speed limits along key corridors, coupled with public realm improvements that enhance the quality of place in Kidlington and Begbroke/Yarnton and improve the safety of road conditions for pedestrians and cyclists.
- Targeted junction capacity improvements that will deliver improvements for all vehicular traffic and help to reduce journey times.
- Deliver significant, high-quality walking and cycling network improvements that ensure fast, safe, direct and (where possible) segregated routes are possible between new and existing residential areas and key employment locations.

4.15 Together, these proposed strategic transport improvements are expected to enhance the quality, convenience, and viability of sustainable alternatives to car-based travel. Reflecting the sustainably-led focus of the Local Plan Review, they represent a deliberately different course of action that seeks to avoid adding further capacity to parts of an already congested highway network.

Table 4-2: Categorisation of proposed transport improvements

Rationale	ID	Package	Proposed transport improvements
Strategic bus priority measures intended to reduce bus journey times relative to private car travel options	1	1 & 2	A44 S/bound: Bus lane from a new southern access to East Yarnton (Begbroke) to Loop Farm Roundabout
	5	2 only	A44 to Langford Lane: Bus-only left turn filter
	6	2 only	A44 S/bound: Bus lane from Langford Lane to Spring Hill junction.
	7	2 only	Woodstock Rd N/bound: Extend bus lane to Bainton Rd (currently stops at Moreton Rd)
	9	1 & 2	A4165: Improved bus lane provision from Kidlington roundabout to past the new housing site
	10	2 only	A4260 S/bound: Bus lane from The Moors to Benmead Road
	11	2 only	A4260 S/bound: Bus lane Bicester Rd/A4260 to Kidlington r/bout
	12	2 only	Banbury Rd N/bound: Bus lane, Summerhill Rd to Davenant Rd
	13	2 only	Banbury Rd S/bound: Bus lane, Rawlinson Rd to St Margaret's Rd
	22	2 only	Langford Lane/A4260 junction improvement + some bus lanes
	23	2 only	A44 N/bound: Bus lane between Langford Lane and Bladon Roundabout. Southbound bus lane from approximately 200m south of Bladon roundabout to Langford Lane
Bus service improvements delivered in partnership with local bus operators	2	1 & 2	At least 4 buses per hour new service between Oxford and Begbroke routed through East Yarnton development site
	8	1 & 2	New Park & Ride at London Oxford Airport to facilitate new services and intercept Oxford-bound traffic
	14	1 & 2	Expansion of Water Eaton Park & Ride to increase scope for interception of Oxford-bound traffic
	2	1 & 2	At least 4 buses per hour new service between Oxford and Begbroke routed through East Yarnton development site
Speed limit reduction and	3	1 & 2	40mph on A44 from Sandy Lane junction to Cassington Road junction

Rationale	ID	Package	Proposed transport improvements
public realm changes to enhance place quality	19	2 only	20mph zone and public realm improvements in the centre of Kidlington on A4260 between Lyne Road and Sterling Approach
Targeted junction capacity / optimisation improvements	4	2 only	Left turn bypass lane from A4095 Upper Campsfield Road to A44
	15	2 only	Signalising A4095 Upper Campsfield Road/A4260 junction
	20	2 only	A4260/Bicester Road Signalised junction – RT detection
	21	2 only	A4260/Lyne Road Signalised junction - RT detection
Strategic walk and cycle network improvements	16	1 & 2	Sandy Lane: close level crossing and provide a ped+cycle only bridge over the railway line
	17	1 & 2	Cycle Super Way from centre of Oxford to A34 (per the LTP4)
	18	2 only	Cycle Super Way from A34 to northern tip of Kidlington (exceeding LTP4 proposal for a Premium Route along the A4260)

Figure 4-2: Transport Mitigation Measures – Package 1

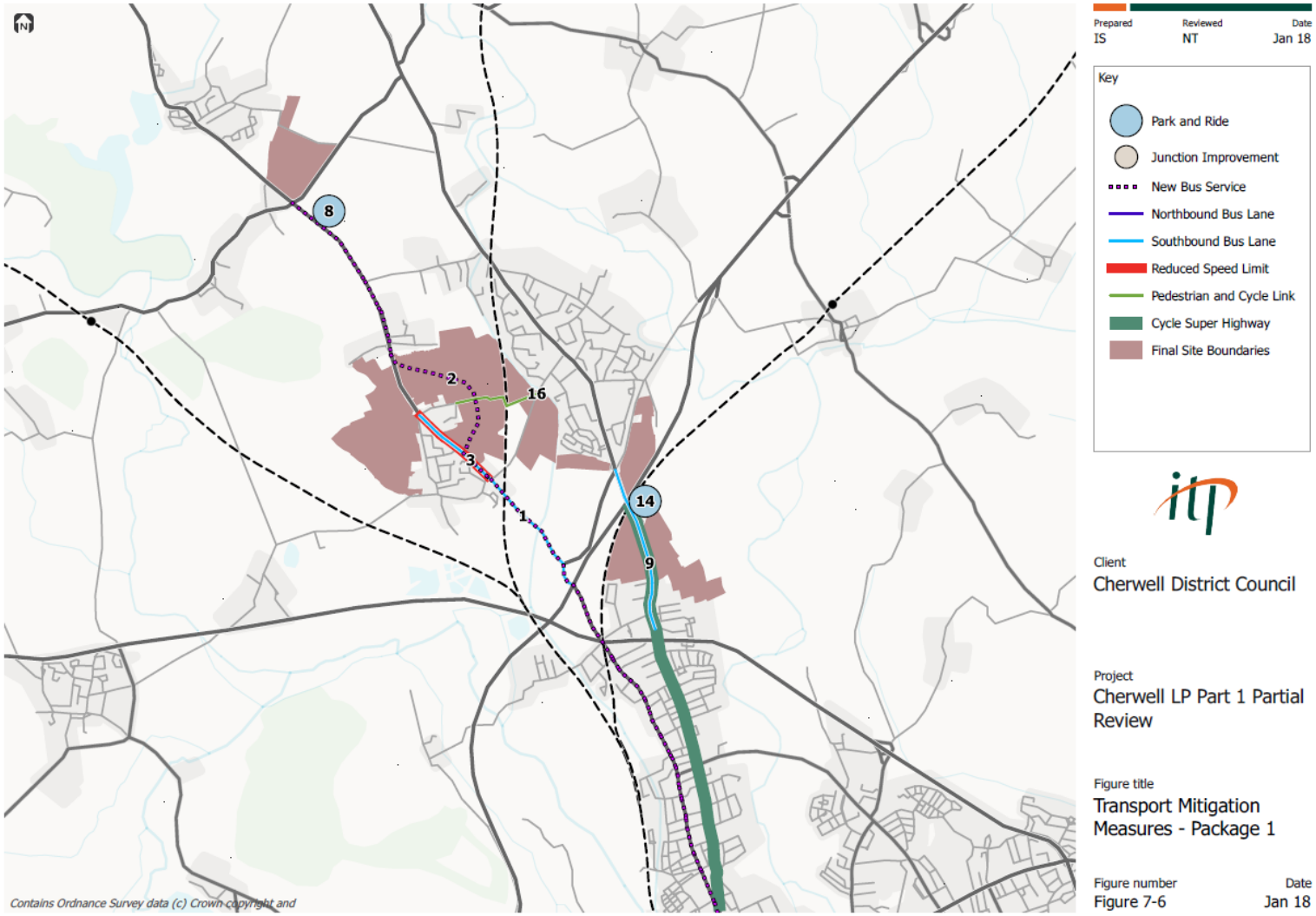
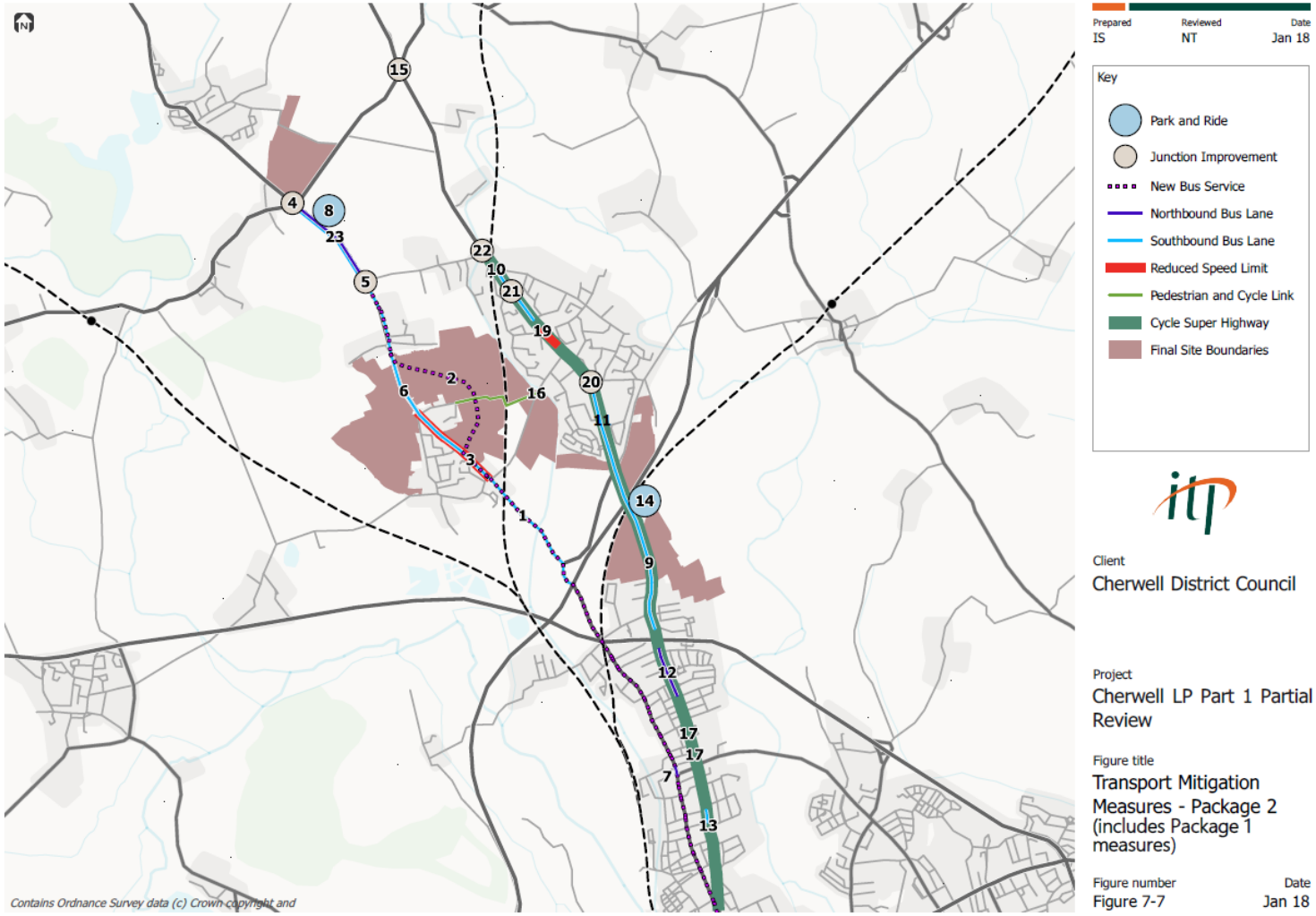


Figure 4-3: Transport Mitigation Measures – Package 2 (which includes all Package 1 measures)



4.16 The two strategic transport improvement packages were defined to facilitate the modelling of a 'lower' and 'higher' cost set of interventions, as a form of sensitivity test over the level of investment that may be required. The transport improvement packages defined above represent an evolution of proposals set out in PR 18 'Connecting Oxfordshire – LTP vol 8 part 1 – Oxford transport strategy July 2016'. The infrastructure schedule focused on the A44 and A4260 highway corridors and was tested using the OSM. For the purposes of modelling the cycle 'Super Way' proposals were focused along a single corridor (Banbury Road and the A4260), whcih was considered to deliver maximum benefit for the new growth areas being considered in the Local Plan Review, as well as existing residents in Kidlington and Summertown. Since that initial piece of work, similar levels of impact in terms of encouraging more widespread uptake in cycling, are being sought along the A44/A4144 corridor, which also directly serves the proposed Oxford Northern Gateway.

4.17 We recognise that the Oxford Transport Strategy will continue to be updated following, and in part influenced by, this work. As such the Infrastructure Schedule proposals may need to be subject to further refinement and sensitivity testing to ensure the provision of transport infrastructure for south Cherwell is balanced with the needs of growth in neighbouring Districts.

Proposed site-specific transport requirements

4.18 In addition to the strategic (off-site) transport improvements summarised above, a set of localised (on-site) measures have been recommended for inclusion in a set of development briefs for each new growth area's masterplan. These are documented in Table 8-1 in PR 52 'Transport Assessment' and have not been replicated here on the basis their impact has not been modelled using the OSM.

4.19 By including these proposals for each of the preferred development sites, Cherwell District Council Officers can seek to positively influence the quality of placemaking outcomes and ensure holistic integration with on-site and off-site provision for walking, cycling and public transport options. In this context, key measures site-specific include:

- Allocating space for high-quality, direct, and safe walking and cycling routes through larger growth areas.
- Allocated space for a vehicular spine route through the A44 corridor growth area that is suitable for bus services, with local stops provided.

- Providing direct connections between strategic local area walk/cycle routes and those within the growth areas.
- The creation of appropriate vehicular accesses into/out of development sites.

4.20 These will be developed further through development briefs, and tested through statutory planning application and site-specific transport assessment process.

Estimated impact of transport improvements (Stage 2 OSM modelling)

4.21 The approach and findings from the transport model testing of the packages of transport improvements (summarised in section 4 of this paper) are fully described in paragraphs 7.35 to 7.62 of PR 52 'Transport Assessment', with the detailed OSM outputs available in Appendix 7 and 8 to that assessment report. This represented Stage 2 of the OSM testing work commissioned by Oxfordshire County Council, and the anticipated impacts on key local and strategic highway network links and junctions are documented in Appendix A. The depth of detail from these reports is not replicated here. Instead the focus is on forecast impacts and residual issues.

The network-wide view and sensitivity tests

4.22 Comparing the 'Do Minimum' forecast of what the OSM predicts will happen during AM and PM peaks in 2031 without the additional growth and associated transport improvements, with the impacts it forecasts when the growth and different packages of transport improvements are included reveals:

- That significant pressure already exists at key junctions and links on both local and national strategic highway networks.
    - This is focused on the A34 junctions, M40 Junction 9, Wolvercote and Cutteslowe, and the north-south approaches to Oxford along the A44 and A4260 corridors.

- A 5% increase in network-wide delay is forecast to result from the additional growth (without any transport improvements), as a consequence of a 1% increase in the total distance of trips during the AM peak and a 2% increase in total journey times.
    - PM peak impacts are significantly less pronounced.

- OSM Scenario 3 (which includes both packages of transport improvements) and Scenario 4 (both packages of transport improvements, plus a best estimate of the impact associated with the delivery of a Cycle Super Way to Kidlington, are predicted to perform better than the scenario which only includes transport improvement package 1 (Scenario 2).
    - When transport packages 1 and 2 are considered (Scenario 3) the 1% increase in total trip distances during the AM peak results in a slightly more acceptable 4% increase in total delay.
    - This suggests that the higher level of transport infrastructure investment proposed through the combination of transport improvement packages 1 and 2 will be required if sustainable transport aspirations associated with Cherwell's accommodation of Oxford's unmet housing need are to be fully realised.
    - Consequently, Scenario 2 was not considered to provide a realistic package of transport investment and Scenario 3 was selected as the basis for subsequent analyses and reporting.

- OSM Scenario 4, which attempts to estimate the behavioural impact of the Cycle Super Way between Kidlington and Oxford, appears to have a marginally more positive impact relative to Scenario 3 (on which it is based).
    - Its relatively modest performance in the OSM is related to the considerable challenge associated with incorporating anticipated walk and cycle behavioural impacts in a strategic model that is designed to forecast future changes in private car and public transport trips.
    - A best attempt was made to estimate these impacts and feed them into the modelling process.
    - Evidence from other locations where high-quality cycling infrastructure has been implemented suggests the average change in cycling activity levels is around +45%, with some of this increase derived from changes in behaviour by people who usually drive or use public transport – unlocking road capacity for other users (See PR52 'Transport Assessment' Appendix 8 and Sustrans' evidence from its Linking Communities programme).
    - That level of behaviour change is along the lines of that we would expect the proposed Oxford – Kidlington Cycle Super Way to deliver. This level of uptake in walking and cycling is expected to be focused on currently very busy

sections of road network (evidenced in Table 4-4), which has potential to free-up capacity for vehicle movements on the surrounding network.

- Significant increases in walking and cycling behaviours would also be expected to yield considerable public health and air quality benefits. Incorporating cycling or walking into people's daily routines is recognised as one of the most effective ways to increase physical activity[1]. Journeys on foot or by bike deliver positive stress management and wellbeing experiences for commuters, who report improved concentration levels compared to those travelling to work by car[2]. These aspirations are entirely consistent with those set out in the Connecting Oxfordshire (Vol 4) Cycling Strategy.

- OSM Scenario 5, which removed the A40-A44 link road, included in the 'Do Minimum' package of transport measures to provide a sensitivity test of its impact, performs the best of all scenarios at a network-wide level.
  - Removing the A40-A44 link road limited the overall level of additional road network delay associated with Cherwell's accommodation of Oxford's unmet housing need to +1% above the level predicted to occur in 2031 without this additional growth.
  - This suggests the A40-A44 link road does not aid Cherwell's proposed accommodation of Oxford's unmet housing need, and is not therefore required to deliver the three new growth areas covered in this Topic Paper.

- These OSM Stage 2 model tests forecast that the delay impacts on common journey times for Cherwell to Oxford commuter journeys (shown in **Error! Reference source not found.**) – which include trips through junctions that are already congested in peak periods (Peartree interchange, Wolvercote and Cutteslowe roundabouts) – are predicted to be small.

[1] Valuing the benefits of cycling, SQW May 2007
[2] Longitudinal associations of active commuting with wellbeing and sickness absence, Preventive Medicine 2016

Table 4-3: Projected journey time analysis using consistently-routed trips (OSM Stage 2)

Origin	Destination	Journey times (minutes)		Journey time difference (minutes) compared with 'do minimum' scenario				
		Base Year (2013)	Do Minimum (2031)	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
A44/A4095 roundabout on the Woodstock corridor, at the eastern tip of Oxford Airport	St Aldate's / High Street junction in Oxford City Centre	17	19	+1	+1	0	0	0
	Churchill Hospital	24	26	+1	+1	+1	+1	+1
	B480/A4142 junction in Cowley	24	24	+2	+1	+1	+1	+1
Jordan Hill Business Park on Oxford Rd/Banbury Rd north of Kidlington	St Aldate's / High Street junction in Oxford City Centre	10	9	0	0	0	0	0
	Churchill Hospital	12	11	0	0	0	0	0
	B480/A4142 junction in Cowley	13	13	0	0	0	0	0
B4027/Middle Street junction in the centre of Islip	St Aldate's / High Street junction in Oxford City Centre	19	18	0	+1	0	0	0
	Churchill Hospital	15	16	0	0	0	0	0
	B480/A4142 junction in Cowley	16	18	0	0	0	0	0

- This highlights that additional traffic congestion forecast to occur in 2031 without the additional development ('Do Minimum' scenario) is expected to create most additional traffic delay.
- The marginal impact of Cherwell's additional growth (relative to the 'Do Minimum' scenario, in which no additional growth in Cherwell is included) on predicted journey-time delays is between 0 and +1 minutes along strategic road corridors and through key junctions, particularly in Scenarios 3, 4, and 5.
- **Error! Reference source not found.** shows that the largest increases in journey times are predicted to occur as a result of already committed growth across the whole county during the Local Plan period (the difference in each row between the 2013 Base Year and 2031 'Do Minimum' columns), rather than as a result of the additional growth and transport investment packages being considered in Cherwell District (for which the differences from 'Do Minimum' scenario estimates are shown for each OSM scenario in the right-hand columns).

4.23 Taken together these estimates lend further weight to the network-wide findings from OSM Stage 2 modelling, which found that Scenarios 3, 4, 5 (which all include both packages of strategic transport improvements) perform better than those in which fewer sustainable transport measures are included. The detail of these journey time comparisons can be found in paragraphs 7.57 to 7.63 in PR52 'Transport Assessment'.

Key local road corridors and junctions

4.24 Appendix A explores the detail of the OSM Stage 2 modelling results for major local highway network junctions and links managed and maintained by Oxfordshire County Council. Key impacts and residual issues associated with each of these are summarised in Table 4-4, which omits OSM Scenario 2 on the basis that Scenario 3 (which includes both packages of proposed transport improvements) and the other scenarios based upon it (scenarios 4 and 5) were predicted to be more effective.

Table 4-4: Peak hour impacts and residual issues of additional growth + transport improvements (OSM Stage 2)

Link/junction	Current function	Predicted impact of already committed growth (Do Minimum)	Impact of additional growth (Scenario 1 vs. Do Min)	Effectiveness of transport improvements (Scenario 3/4/5 vs. Do Min)	Residual issues
Sandy Lane Kidlington	Local road (~100 trips/hr)	Some additional traffic, but forecast to operate well below design capacity	+350 AM and +650 PM additional vehicle trips	+240 AM to +360 PM change in vehicle trips	Level crossing and canal bridge safety concerns. Change in nature of this semi-rural local road
A44 Woodstock to Peartree interchange	Strategic link road	Operates at/over-capacity in sections from Begbroke to Peartree interchange	+180 AM and +300 PM additional vehicle trips +18% (AM) and +7% (PM) increase in delays	+248 AM and +600 PM additional vehicle trips +22% (AM) and +5% (PM) increase in delays Cycle Super Way could free-up a further 70 bus seats per peak hour	Loop Farm to Peartree Interchange forecast to remain over 95% of design capacity, but Cycle Super Way could help to address this.
A4260 Shipton to Kidlington roundabout	Local road in Kidlington and alternative link to A34/M40	Operating below 85% of design capacity, but some delay in both AM and PM peak periods	+103 AM to +84 PM additional vehicle trips +16% (AM) and -3% (PM) change in delays	+41 AM to +173 PM additional vehicle trips +4% (AM) and 9% (PM) change in delays Cycle Super Way could free-up a further 50 bus seats per peak hour	Kidlington roundabout and A4260 / Langford Lane junction heading northbound in the PM peak

Link/junction	Current function	Predicted impact of already committed growth (Do Minimum)	Impact of additional growth (Scenario 1 vs. Do Min)	Effectiveness of transport improvements (Scenario 3/4/5 vs. Do Min)	Residual issues
Langford Lane	Access road to London Oxford Airport, strategic A44 – A4260 link	Operating below 85% of design capacity	Marginal increase in AM trips (from A4260) with small increase in delays Reduced PM peak delays	-145 AM and +50 PM change in vehicle trips	Queuing at the Langford Lane / A4260 junction
A4095 Kirtlington to Bladon	Rural road that connects A44 and A4260 corridors	Operating below capacity, but delays linked to queuing at A44 and A4260 junctions	+50 AM to +177 PM additional vehicle trips +24% (AM) and +2% (PM) change in delays	+370 AM to +250 PM additional vehicle trips +20% (AM) to +32% (PM) change in delays	Road remains under 85% of design capacity, except for queuing at A44 and A4260 junctions
Cutteslowe and Wolvercote roundabouts	Key roundabouts on Oxford arterial routes	Cutteslowe forecast to be below 85% of design capacity, but Wolvercote is congested in both AM and PM peaks	Small increase in tidal AM/PM vehicle trips, but Wolvercote exceeds 95% of its design capacity	Wolvercote still over 95% of capacity. Cycle Super Way could free-up a further 105 bus seats and yield 85 fewer car trips per peak hour	Wolvercote continuing to exceed 95% of design capacity in AM and PM, but Cycle Super Way may help to mitigate this.

Residual transport network issues identified through Stage 2 OSM modelling

4.25 It is important to remember that the model's outputs are indicative and simply provide a basis for comparing different possible outcomes. Residual issues, which the OSM Stage 2 model tests suggest will not be mitigated by the packages of transport improvements, are discussed below:

- **Sandy Lane** can absorb the increases in vehicular traffic forecast by the model, but existing traffic levels are already present safety concerns due to the level crossing over the Banbury–Oxford railway line (with poor sight lines on approach from the west) and the weight-restricted canal bridge with signalised one-way control (which can cause traffic to queue back towards the level crossing).
  - Based on these identified issues, and given that implemented rail signalling/capacity improvements on the Banbury-Oxford line cannot currently be exploited due to level crossing safety concerns, it is recommended that the level crossing is closed to all vehicular traffic.
  - Bridging over both the railway line and canal for vehicles is anticipated to be both costly and challenging from an engineering perspective, and sub-optimal for existing residents living close to Yarnton Road.
  - Since the route is on a key desire line from the A44 corridor to Kidlington and the Parkway Station, and the proposed A4260 cycle route into Oxford, we advocate that a ped/cycle overbridge is provided in place of the level crossing to maximise opportunities for active and sustainable travel.
  - Engagement with Oxfordshire County Council and Network Rail confirmed the desirability of closing Sandy Lane for motorised through traffic on account of Sandy Lane's limitations, rail safety concerns and operational needs.
- **Peartree Interchange and Kidlington & Wolvercote roundabouts** demonstrate capacity issues relative to the demand for vehicle trips in both the AM and PM peak periods, as they do in 2031 without the additional growth being allocated in South Cherwell.
  - The inability to fully model the impact of the proposed Cycle Super Way on vehicle trips and public transport capacity means that the model is believed to under-estimate the extent to which these long-term congestion issues are ameliorated as a result of the proposed improved cycle route into Oxford.

- Longer-term, the Oxford-Cambridge Expressway may alleviate some congestion at these junctions, albeit any post-implementation gains are likely to be short-term (see Duranton and Turner, 2011 and Highways England, 2016 for examples).
- Nearer-term, Growth Deal-funded proposals being developed and designed at the time of writing, which focus on improving the approaches to Frieze Farm roundabout and Peartree interchange for local bus services, those walking, and cyclists, are expected to add capacity for people movements through these junctions.
- Continued monitoring of these junctions, given the uncertainties above, and accelerating rapid transit proposals to Oxford employment sites could be considered a longer-term alternative to continually expanding junction capacity.

- **Queuing at Langford Lane/A4260 and A4095 junctions with the A44 and A4260** is already a slight issue during peak times, but predicted to worsen as a result of Cherwell accommodating a portion of Oxford's unmet housing need.
  - Additional queuing in these locations is undesirable, but in practice will also help to stagger the flow of vehicular traffic towards strategically important junctions with the A34 to the south of the A4260 and A44 corridors.
  - The potential closure of Sandy Lane to through-traffic may further extend delays associated with queuing at some of these junctions, as vehicle trips divert north around Kidlington and Gosford. This has been explored separately through the Post Submission OSM modelling described later in this section.
  - As such we recommend monitoring of the junctions as the development proposals come forward, with targeted junction capacity improvements being considered in the event traffic congestion delays should significantly worsen at these locations.

4.26 Aside from the Sandy Lane level crossing and pedestrian/cycle bridge, we consider the other residual issues discussed above to be beyond the scope of this Local Plan Review.

Level crossings

4.27 In addition to the Sandy Lane level crossing discussed above, the impact of additional growth on the level crossings at Roundham (North Kidlington) and Yarnton Lane (to

the south of the A44 corridor) have also been identified as considerations by Network Rail and Oxfordshire County Council. Taken together, the safety risk assessment covering all three level crossings currently prevents the realisation of rail service frequency improvements that could be delivered by already-implemented signalling upgrades on the Banbury – Oxford mainline railway.

4.28 Appendix A documents the current level of usage at these crossings (where known) and the issues associated with their potential closure. While the closure of the Sandy Lane level crossing, and provision of a dedicated pedestrian and cycle over-bridge, is accepted as an important measure to help deliver additional growth along the A44 corridor; there is less of a case for closing the other two crossings.

4.29 Discussions with Oxfordshire County Council and Network Rail concluded that:

- **Roundham level crossing** could be maintained in its current form, with Network Rail and Oxfordshire County Council engaged in the development brief for site PR8 (which covers the development area between the A44 and railway line).
- **Yarnton Lane level crossing** can also be maintained in its current form; with Network Rail and Oxfordshire County Council engaged in the development brief for site PR8 (covering the development area between the A44 and railway line).
- **Sandy Lane** is to be promoted (e.g. through local walk/cycle route signage) as the primary access over the railway line. This could be achieved though the provision of a high-quality walking and cycling route through the southern portion of the PR8 development site that more-directly connects the existing Yarnton village settlement with Sandy Lane and the ped/cycle overbridge across the railway line.

Strategic Road Network links and junctions

4.30 Appendix A provides detail on the impact forecast by the OSM in respect of M40 Junction 9 and the A34 north of Oxford. This expands on previous corridor-based analysis which can be found in paragraphs 7.46-7.54 in PR52 'Transport Assessment', as well as Appendix 7 to that report. Full details are not replicated here; instead the key anticipated impacts, residual issues and suggested actions have been summarised.

- **M40 Junction 9** is already predicted to be congested in 2031, as a result of existing committed growth, with the junction itself expected to function at between 85%-95% of design capacity and the southbound approach forecast to be beyond 95% of its design capacity during the AM peak. Without any transport improvements the OSM Stage 2 modelling predicts a small (~5%) increase in delay at this junction during the PM peak. When both packages of transport

improvements developed to support the additional growth are considered, the OSM predicts a small reduction (-1%) in delay during the AM peak and no change in the PM peak.

  - Residential development at the additional growth locations being considered is not anticipated to have an appreciable impact on the operation of M40 J9, yet the junction will continue to operate at/beyond its design capacity in AM and PM peaks.
  - As such we consider additional investment in junction capacity at this location to be a wider strategic issue, required to support the region's growth.

- **A34/A41 links and junctions** are already predicted to be congested in 2031, as a result of existing committed growth. The junctions closest to Kidlington and North Oxford are forecast to operate at 85%-95%, or beyond 95% of their design capacity during both AM and PM peaks. This trend is tidal, with most impacts focused on southbound (towards Oxford from the M40) movement along the corridor in the AM peak and northbound (away from Oxford) in the PM peak. Without mitigation, the additional growth is forecast to result in a 2% increase in AM peak delays and a 5% increase in PM peak delays. With mitigation, this is limited to no change from what would happen in 2031 peak without the additional growth, and a 1% reduction in delay during the PM peak.
  - The additional development around north Oxford, east of Kidlington, and along the A44 corridor appears to be mitigated by the package of complementary transport improvements proposed to accompany this growth; while also improving public transport and cycling options for new and existing residents and employees travelling around these areas.
  - As noted earlier in this section, the strategic nature of the Peartree interchange, and the fact it is already forecast to operate over its design capacity in 2031, suggests a more significant package of improvements may be required here.
  - Any such improvements are considered as beyond the scope of this Local Plan Review, given they are required to address wider growth commitments, and the impact of the additional growth being appraised is effectively mitigated.
  - Since the publication of the Submission Plan by CDC, Oxfordshire County Council officers have been considering various design options for adding capacity and improving priority at Peartree interchange. This work is ongoing, and likely to draw on funding from the County's Housing and Growth Deal signed and approved with Government in February 2018.

- Monitoring the impact of nearer-term proposals to improve the Peartree interchange (announced in 2014) and Highways England's work to forecast the impact of the Oxford – Cambridge Expressway (announced in 2017), will also help to inform the extent of any further improvements.

- **The proposed A40-A44 link road** was also discussed earlier in this section, in relation to the network-wide view. It forms part of existing transport proposals intended to support existing committed strategic growth. An OSM Stage 2 sensitivity test (Appendix A) forecast that the link road has a negligible impact on overall delay across the north Oxford highway network, with some links yielding improvements and others forecast to result in slightly longer delays. At a network-wide level, the removal of the A40-A44 link road from proposed improvements is forecast to reduce the average level of delay on the highway network by a greater degree than other mitigation packages.

  - The link road may deliver strategic benefit in relation to growth allocations being considered in West Oxfordshire (along the A40 corridor), but does not benefit the highway network in the south of the Cherwell District.

  - With the proposed package of transport improvements and spatial allocation of growth around North Oxford, Kidlington and Begbroke, the A40-A44 link road is not considered a critical requirement for the Submission Plan's growth.

Forecast impact of closing Sandy Lane to through-traffic (Post Submission OSM modelling)

4.31 The Stage 1 and 2 OSM modelling tests assumed that Sandy Lane would remain open to through-traffic. However, given it currently carries a relatively low number of vehicle trips (~100) during peak hours, and there are clear constraints to through-vehicle movement (a railway level crossing and a narrow, weight-limited, signal-controlled canal bridge that only affords alternate one-way traffic movements), the route was identified as one that could be closed to through-vehicle movements. Doing so would also address Network Rail's existing safety concerns regarding the Sandy Lane level crossing, while creating scope to establish a dedicated walking and cycling route between Yarnton, Begbroke, Kidlington and Water Eaton Park & Ride/Oxford Parkway rail station.

4.32 Further OSM testing was commissioned by Oxfordshire County Council, following the publication of the Submission Plan, to explore the specific impacts of such a closure. This work responded to questions posed through the Statutory Consultation process

and focused on estimating the impact that closing Sandy Lane to through-traffic might have on the wider transport network.

Impact of reclassifying Sandy Lane in the OSM

4.33 The adopted approach is outlined in paragraphs 2.18 to 2.19 in this Topic Paper and, in greater detail, in Appendix C. The process of reclassifying Sandy Lane in the transport model impacted on its estimates of wider transport network performance in both Base and Future Year OSM Post Submission scenarios.

4.34 Aside from the improved validation performance of the model relative to recent (2018) traffic counts, the following impacts were reported for the 2031 Future Year in relation to the Stage 2 OSM testing:

- Total traffic flows along Sandy Lane reduced significantly, more closely reflecting realistically expected values for 2031 (258 vehicles in the AM peak and 316 vehicles in the PM peak). These flow estimates still underplay the impact the level crossing on Sandy Lane can have on through-traffic, which it is challenging to model. As such these values are still considered to be over-estimates of likely demand for using the Sandy Lane link.
- Reclassifying Sandy Lane in the model meant that higher vehicle trip flows are predicted along the A4260 (Frieze Way) northbound, the A44, and Langford Lane. These higher flows (relative to the OSM Stage 2 model) are considered to more realistically reflect the patterns of current traffic flow in the local area, and are unsurprising given that less theoretical highway capacity (reflecting the lower desirability of Sandy Lane as vehicular route) now exists in the model for east-west movements between the A44 and A4260 corridors.
- Bus loadings are forecast to be broadly the same in the Post Submission OSM as they were in Stage 2. As discussed earlier in this Topic Paper, these are based on conservative mode shares for motorised trips in respect of the new development areas (and thereby represent a 'worst case' estimation of future impacts on the local highway network). Figure 5-10 in Appendix C illustrates this visually, with the higher proportions of private car mode share allocated to the growth locations being apparent in the pie charts related to their model zones (9273, 8535, 9271 and 9272), when compared with those in Kidlington locations (model zones 9283, 9278, 9279, 9277 and 9274).

4.35 As a result of these changes, the findings presented below are not directly comparable with those from Stage 1 and 2, but their relative impacts can be contrasted.

Forecast network impacts of closing Sandy Lane to through-traffic in 2031

Network-wide analysis

4.36 Tables 1 and 2 in Appendix D compare the OSM Post Submission model test results for Scenario 3 (which includes all allocated growth, including the additional 4,400 homes allocated through the Submission Plan, and both of the transport improvement packages defined in Table 4-2, and illustrated in Figure 4-2 and Figure 4-3) with the same Scenario, plus the proposed closure of Sandy Lane to through-traffic. The model predicts the closure of Sandy Lane will have a negligible impact on total demand for travel across different times of day and travel modes:

- It forecasts slightly fewer AM (-13) and PM (-166) peak period car trips, some of which are predicted to spread into the inter-peak period (+140).
- It also forecasts a reduction in Park & Ride trips across all time periods. This reflects the OSM Stage 2 model's estimate that Sandy Lane would carry a large volume of vehicle trips to/from Water Eaton Park & Ride.
- The model predicts slightly higher numbers of bus (+54) and rail trips (+30) over the course of the 12-hour daytime period (7am – 7pm). This forecast reflects some trips switching to sustainable travel modes, owing to the reduced potential for east-west vehicle trips via Sandy Lane.

4.37 Taken together, these findings suggest that – at a network-wide level – the closure of Sandy Lane does not significantly alter the number of trips accommodated on the network within the Post Submission model.

Key local road corridors and junctions

4.38 Section 3 of the OSM Post Submission modelling note found in Appendix D to this Topic Paper, and the tables set out in its Appendices A, C, and D summarise the forecast impact of closing Sandy Lane to through-traffic on 18 key highway links (illustrated in Figure A1) around the growth areas being considered in the Submission Plan. They show the forecast traffic flows (measured in 'passenger car units per hour'), average speeds, and the ratio between available highway capacity and the anticipated traffic flows (Volume:Capacity Ratio, or VCR) along key local road corridors:

- Tables A1 to A3 in the Post Submission modelling note, found in Appendix D to this Topic Paper, make a comparison between what the model predicts will happen if Sandy Lane remains open (Scenario 3) or is closed (Sandy Lane Closure) in the 2031 Future Year with all allocated growth and proposed transport

improvements - including the 4,400 homes considered in the Submission Plan. These directly comparable results are calculated within the Post Submission model, with both scenarios utilising the refinements made to the model (which include the reclassification of Sandy Lane, as described earlier in this section).

- Tables C1 to C3 in this note make the same comparison (Sandy Lane open vs Sandy Lane closed), but contrast the OSM Stage 2 model results for the Scenario 3 test with the Post Submission model run in which Sandy Lane is closed. This is not a like-for-like comparison, because the Stage 2 OSM contains a less-realistic representation of Sandy Lane than that incorporated in the Post Submission iteration.

4.39 Looking across both sets of comparisons, it is clear that the main changes are anticipated during the AM and PM peak periods. With Sandy Lane left open to through-traffic, both the Stage 2 and Post Submission OSM model predict increased vehicle flows will be attracted to it during these peak periods (albeit at different levels) for trips routing between the A44 and A4260 highway corridors. Contrasting the various model forecasts, described above, for the AM and PM peak periods indicates that:

- Woodstock A4095 (Link 2), Langford Lane (Link 4) and the A4260 north of Langford Lane (Link 5) are predicted to carry the bulk of displaced vehicle trips from Sandy Lane when it is closed to through-traffic. This suggests the model assumes vehicle trips routing east-west will predominantly be displaced to highway links to the north of Kidlington, Begbroke and Yarnton.
- These flows appear tidal in nature, with projected changes in link flows typically greatest towards Oxford in the AM peak and away from Oxford in the PM peak.
- In Volume:Capacity Ratio terms, the proposed closure of Sandy Lane to through-traffic is forecast to result in the southbound lane of the Woodstock A4095 (Link 2) and the southbound lane(s) of the A44 South of Yarnton (Link 13) becoming more congested in the AM peak:
  - All of these routes are already forecast to have Volume:Capacity Ratios over the 90% threshold typically used to define capacity deficiency on highways.
  - Other routes, such as the A4260 (Link 14) and Langford Lane (Link 4) are forecast to carry more vehicle traffic, but not to exceed the 90% Volume:Capacity threshold.
  - The A34 Western Bypass and A40 are forecast to continue operating over the 90% Volume:Capacity ratio threshold, but do not experience marked changes in traffic volumes.

- During the PM peak the southbound lane of the Woodstock A4095 (Link 2), westbound direction of Langford Lane (Link 4), A40 westbound (Link 12) and northbound lane(s) of the A44 South of Yarnton (Link 13) are predicted to become more congested as a result of the proposed Sandy Lane closure:
  - With the exception of the Woodstock A4095, all of these routes are already forecast to have Volume:Capacity Ratios over the 90% threshold typically used to define capacity deficiency on highways, so PM peak delays anticipated on these links could increase slightly.
  - As in the AM peak, nearby links (notably those along the A4260) are predicted to carry higher traffic volumes without exceeding the 90% Volume:Capacity ratio threshold.
  - The A34 Western Bypass is forecast to continue operating over the 90% Volume:Capacity ratio threshold, but does not experience marked changes in traffic volumes.

4.40 Appendix D within Appendix D to this Topic Paper contains the demand model statistics derived from Post Submission model tests, and presents a comparison with the Sandy Lane link closed to through traffic in the 2031 Future Year. The data tables indicate that:

- Highway and public transport networks covered by the OSM are forecast to carry marginally more person trips under the future growth scenario in which Sandy Lane is closed and all transport improvements proposed in Table 4-2 are delivered.
- In doing so, total delay on highway networks in the Cherwell District is forecast to be marginally higher, at +7% above the 'no-growth' Do Minimum scenario in the AM peak and +6% in the PM peak, compared to +5% in both periods without Sandy Lane being closed to through traffic and the transport improvements delivered.
- In line with the Volume:Capacity Ratio numbers, the model predicts that highway network delays will particularly focus on the A44 Woodstock – Oxford, A4095 Kirtlington – Bladon, and Langford Lane corridors in the 2031 future year.

Summary of impacts

4.41 Taken together, these findings reflect those presented in respect of the OSM Stage 2 modelling results. They suggest the proposed allocation of 4,400 homes, coupled with the closure of Sandy Lane to through-traffic, could increase pressure on already congested road links and junctions to the south of Yarnton on the A44, around

Langford Lane, and on the A40 in the vicinity of Wolvercote and Cutteslowe roundabouts. However, as with the Stage 2 OSM outputs, when considering the Post Submission modelling results it is important to recognise that:

- Conservative mode shares are assumed for motorised trips in all iterations of the model, which assume adoption of existing travel patterns by new inhabitants of the 4,400 homes allocated in the Submission Plan. In practice we anticipate the range of sustainable transport improvements to be delivered in support of this growth, coupled with existing peak hour levels of road traffic congestion in the local area, will encourage shifts in travel behaviour such that new residents adopt similar (more walk/cycle/public transport oriented) trip patterns to those already exhibited in Kidlington.
- Generalised costs within the model do not include the cost of parking at destinations, which can be significant in central Oxford and act as a deterrent to car-based trips.
- Modelling the behavioural impacts of the proposed, high-quality Cycle Super Way linking the Submission Plan growth areas and Oxford was not attempted in the Post Submission testing due to time constraints. Similar tests undertaken in respect of Stage 2 were found to free-up public transport capacity and encourage some mode shift away from private car use. The delivery of such a link offers considerable potential for more widespread uptake of cycling for trips north of the A34, with the aim being to propagate cycle trip mode-shares similar to those already achieved with limited dedicated cycling infrastructure in nearby Summertown (~20%) and Sunnymead (~15%) (both in Oxford)_ for all journeys to work.
- The journey time savings (relative to private car trips) attributable to extended bus lanes contained in the packages of transport improvements developed to accompany the proposed growth allocations, and which focus on the A44 and A4260 corridors, are predicted to be considerable. Section 5 of Appendix D to this Topic Paper notes the OSM estimates they will be between 4-7 minutes in the AM peak and 2-4 minutes in the PM peak. Such time savings are expected to further enhance the attractiveness of local public transport options relative to private vehicle travel for trips to central Oxford destinations.

4.42 Set in this context, we recommend the impacts of allocated growth sites and accompanying transport network improvements should be monitored on an ongoing basis. Such data can be used to check the accuracy of transport model forecasts

documented in the Local Plan Review evidence base, and inform the iterative design and delivery of highway, public transport and walk/cycle network improvements.

5. Infrastructure delivery and funding

National/county/local infrastructure

5.1 A range of funding sources are already being pursued by Oxfordshire County Council in its role as the local highway and transportation authority. The information in this section has been provided by the relevant County Council locality teams, and offers insight into the sources of funding that could be directed to help implement or augment the package of transport improvements discussed in section 4 of this Topic Paper.

North Oxford junctions

5.2 Over recent years there has been a package of transport improvements across the North Oxford area, specifically at Cutteslowe and Wolvercote Roundabouts. Works which were completed in 2016 included the upgrade of both roundabouts, including full signalisation and adding safer pedestrian and cycle crossings. The county council has also identified a new strategic link road to the west of the A34 to connect the A40 and A44. Planning and transport modelling work on the project has been extended in order to take account of Local Plan work currently being undertaken by West Oxfordshire District Council and Cherwell District Council. This additional planning assessment work has extended the timetable of the project by several months. Further design work will be undertaken following completion of this assessment.

5.3 As noted in paragraph 4.17 of this Topic Paper, the A40-A44 link road does not aid Cherwell's proposed accommodation of Oxford's unmet housing need, and is not therefore required to deliver the three new growth areas in the Submission Plan.

East-West Rail

5.4 Phase 1 of the project, which introduced new services between Oxford, Bicester and London Marylebone, was fully operational from December 2016, with Oxford Parkway Station itself open from 2015. Phase 2 of the Western Section covers the route from Bicester Village to Bedford (due to open in 2022), and Milton Keynes to Aylesbury (due to open in 2024).

Highways England's A34 Technological Improvements

5.5 Highways England has committed to investing in a number of technology enhancements along the A34. This includes the introduction of vehicle detection loops, CCTV cameras and driver information systems on the A34 between the M4 and the M40, with proposals aimed at easing congestion, improving safety and incident management. Works are planned to start in 2019/2020, with traffic survey work having commenced at the time of writing. For further information see: A34 Technology enhancements.

Highways England's Oxford to Cambridge Expressway

5.6 Highways England has carried out a number of technical studies. with the Oxford to Cambridge Expressway Strategic Study Stage 3 Report published in November 2016 (See evidence document PR38) since superseded by its Corridor Assessment Report (published in September 2018). This latest report concluded that Corridor B – which broadly follows the alignment of the proposed East-West rail link – would deliver better benefits for the region than alternative options. Two viable route options are currently being scoped by Highways England, both of which would have major consequences for the A34 through Oxford. These are:

- Corridor B1 – a central corridor broadly aligned with the proposed East-West Rail route from Abingdon to south Milton Keynes via Winslow. This option passes to the west of Oxford.
- Corridor B3 – a central corridor broadly aligned with the proposed East-West Rail route from Abingdon to south Milton Keynes via Winslow. This option passes to the south east of Oxford.

5.7 Subject to the development of these two preferred route options, the public consultation is expected to commence in Autumn 2019 followed by the announcement of a preferred route announcement in 2020. Assuming these timescales are met, construction could start in 2025, with the new link open to the public in 2030 - within the Cherwell Local Plan delivery timeframe.

5.8 Further detail can be found on the Highways England website.

Northern Gateway

5.9 An Area Action Plan (AAP) for a large-scale employment site at Northern Gateway was adopted in July 2015. The development, which comprises a 90,000sqm commercial/innovation quarter, 480 homes and 180 hotel bed spaces, will require new and improved vehicle, bus, pedestrian and cycle access - including along the A40 and A44.

5.10 Since the AAP was adopted, £5.9 million has been secured through the Local Growth Fund (central government via the LEP) to go towards funding highway works associated with the development including on the A40. More recently, a further £10 million has been secured for infrastructure primarily linked to utility reinforcements, surface and foul water, via the Housing Infrastructure (Marginal Viability) Fund. St John's College, the land owners, submitted a planning application in August 2018, and continue to work with both the City and County Councils on final details and ahead of plans being formally considered by Oxford City Council as planning authority.

Oxford Demand Management

5.11 In November 2016, Oxfordshire County Council's Cabinet approved funding to develop an outline business case to explore whether demand management options put forward in the Oxford Transport Strategy - a congestion charge, workplace parking levy and access measures - could be appropriate for Oxford.

5.12 Since then a programme of technical work has been underway including highway modelling and research to help develop initial proposals and support ongoing discussions. In September 2017, 1,500 businesses were contacted to ask them to participate in some research, see: http://news.oxfordshire.gov.uk/oxfordgearchange/. More recently the County Council and Oxford City Council have set up a joint project steering group to consider demand management in Oxford with public consultation expected to take place later in 2019 following completion of further technical work.

Oxford Zero Emission Zone

5.13 At the time of preparing this Topic Paper (January 2019) the latest briefing note announced the Councils' intention to launch a further public consultation on an updated ZEZ proposal for Oxford City Centre, which they will be discussing with business and other stakeholders in early 2019. The vision and illustrative phasing suggest the Zero Emission Zone will come into effect in 2020 and be scaled-up over time to cover a gradually larger area of the city. The ZEZ has potential to significantly

alter the travel mode choices and trip destinations of people who live in the growth areas considered in the Submission Plan.

A40 Corridor

5.14 Congestion on the A40 and its junctions causes daily problems for road users and has been described by business leaders as one of the biggest barriers to economic growth and prosperity. Local Growth Funding has been provisionally allocated by the Department for Transport to significantly improve the reliability, frequency and variety of destinations in Oxford served by public transport. Oxfordshire County Council plans to use this to:

- Provide a congestion free route for public transport on the A40 eastbound approach to Oxford.
- Encourage people from using cars to public transport.
- Improve journey times and making them more reliable for public transport along the A40.

5.15 The scheme for a Park and Ride (which will accommodate up to 1,000 cars to the north of the A40), located to the west of the A40/Cuckoo Lane junction at Eynsham, is undergoing detailed design in 2019. It will be supported by an eastbound bus lane between Eynsham Park and Ride and the Duke's Cut canal bridge near Wolvercote. Sections of westbound bus priority on the approaches to Cassington traffic signals and Eynsham roundabout will also be provided, along with a two-way shared walking and cycle path located on the northern verge. These works are subject to approval of a major scheme business case (due i 2019), with construction works scheduled for mid-2019 until winter-2020.

5.16 In March 2018 Oxfordshire County Council were invited to produce a business case to secure Housing Infrastructure Fund (HIF) bid to complement the A40 LGF scheme and deliver the remaining elements of the A40 strategy. These comprise: westbound bus lanes from Wolvercote to Eynsham Park and Ride; completing the eastbound bus lane along the Duke's Cut bridges; extending the A40 dual carriageway from Witney to Eynsham Park and Ride; provide cycle links from the A40 to National Cycle Network route 5 and from Eynsham to link with the Oxford cycle network.

5.17 In January 2017 government endorsed the Oxfordshire Cotswold Garden Village as one of 14 garden villages nationwide. The strategic location for growth is located to the

north of the A40 at Eynsham. The garden village is the preferred option for West Oxfordshire District Council to meet Oxford's unmet housing needs. Planning for the site of 2,200 dwellings and 40ha employment land will come forward through the West Oxfordshire Local Plan process, with additional support provided by government in the early development and planning stages.

Oxfordshire Housing and Growth Deal

5.18 The Oxfordshire Housing and Growth Deal was signed by the Secretary of State for Housing, Communities and Local Government on 15 March 2018. The agreement will provide £150m for transport and supporting infrastructure, £60m for additional affordable housing, and £5m capacity funding to support planned housing development in Oxfordshire over the next 5 years.

LP1 PR Infrastructure Funding Delivery

5.19 Paragraphs 5.1 to 5.18 detail effective cooperation and engagement at county and national level to secure strategic infrastructure to 2031. Joint working to deliver transport infrastructure in the North Oxford/South Cherwell has resulted in funding and delivery of schemes such as improvements to Cutteslowe and Wolvercote roundabouts in 2016 secured through the 2014 City Deal, Housing Infrastructure Funding to support the Northern Gateway Area Action Plan and the A40 Strategy as well as technology improvements to the A34 as part of Highways England/DfT through Road Investment Strategy 1 (RIS1).

5.20 The Oxfordshire Housing and Growth Deal signed by the Secretary of State for MHCLG in March 2018, secures a 5-year (2018-2023) funding package of £150m to deliver strategic transport and associated infrastructure to unlock committed and emerging housing growth in Oxfordshire. The Deal's delivery plan includes the transport schemes for the North Oxford/South Cherwell Area. The Oxfordshire Growth Board agreed the schemes that could be developed during Year 1 of the deal (2018-19), with capital funding allocated to the delivery of the emerging schemes. This saw the allocation of the following towards the A44 / A4260 corridor package:

- 2018-19 - £1.5m of revenue funding for optioneering / feasibility design work on key sections of both corridors.
- 2019-21 - £5m of capital funding to deliver a prioritised element of the package.

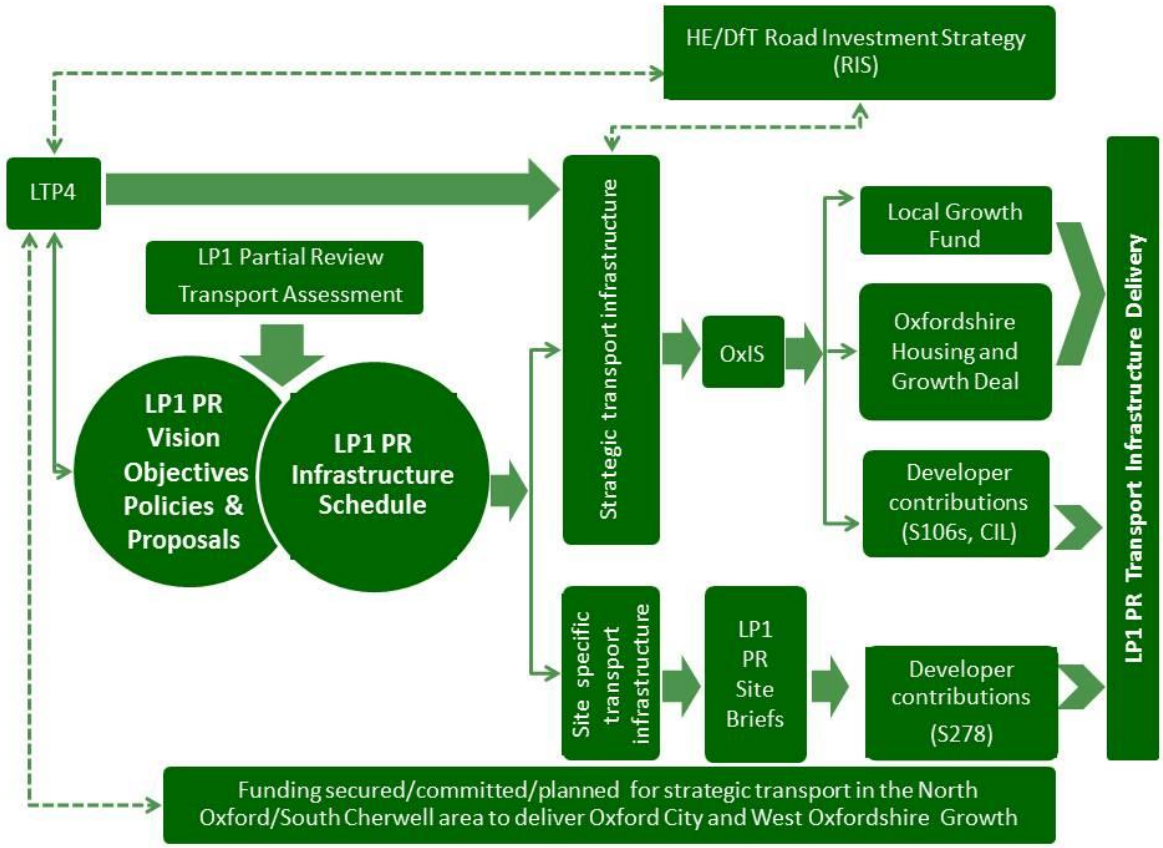
5.21 The Oxfordshire Growth Board has now agreed the Years 2-5 programme, which includes a further allocation of funding for the strategy:

- £20.1m for sustainable connections (bus and cycle) along the A44 corridor between Langford Lane and Peartree Roundabout
- £9.1m for improvements to the Woodstock Road Corridor (bus lanes and cycle improvements)
- £9.7m for improvements to the Banbury Road Corridor (bus lanes and cycle lanes).

5.22 During the lifetime of the Submission Plan, a number of new technologies are also expected to become mainstream. Oxfordshire County Council has been proactive in working with other partners to trial and demonstrate such opportunities, and has to date secured c.£30-£40 million in funding and R&D investment from Innovate UK. Projects range from introducing fully electric double-decker buses in Oxford (DfT Clean Bus Technology Fund) to trialling the use of fully connected and autonomous vehicles (CAV) on public roads in Oxfordshire (Innovate UK Fund). More information on the work on transport and technology in Oxfordshire, which is directly aligned with Oxford's Smart City strategy, can be found on the Smart Oxford website.

5.23 The Submission Plan sits within the wider cross-boundary context of the North Oxford/South Cherwell area, Oxfordshire and the Oxford to Cambridge Corridor. The Submission Plan's strategic transport schemes and those in the adopted Local Plan's IDP are collated in the Oxfordshire Infrastructure Strategy (OxIS) November 2017. This provides up to date and coordinated county wide and district evidence to inform and influence local, county and national infrastructure investment programs including an emerging Oxfordshire Housing and Growth Deal, Local Growth funding bids, Housing Infrastructure Fund bids and Highways England/ Department for Transport Road Investment Strategies (see Figure 5-1).

Figure 5-1: LP1 PR transport infrastructure delivery



5.24 Funding for the transport schemes will come from a range of sources:

- Site specific impacts identified through the transport assessment of development proposals: section 278 agreements.
- Strategic infrastructure: Local Growth Fund bids, Oxfordshire Housing and Growth Deal and other Government infrastructure investment opportunities including Transport Investment Strategy and funding for the Major Road Network, National Productivity Investment Fund and transport-related Innovate UK funding.
- Strategic infrastructure: schemes identified through the transport assessment of development proposals which require funding from more than one developer and enable forward funding or provide gap funding through Section 106 agreements or CIL once in place.

Delivery of transport improvement packages

5.25 The Submission Plan is supported by an Infrastructure Schedule (see Appendix 4 to the Submission Plan document), which identifies transport schemes to support the

Submission Plan's proposals. As the Submission Plan progresses to adoption, infrastructure monitoring and delivery will form part of the Council's yearly IDP updates.

5.26 In March 2018 the Council submitted the Proposed Submission Local Plan (July 2017) with Focused Changes and Minor Modifications (February 2018). The Council relies on the schedule in the Focused Changes and Minor Modifications subject to acceptance by the Inspector.

5.27 Oxfordshire County Council and Cherwell District Council (with advice from ITP) have identified the transport schemes for potential future delivery to support growth. These cover a combination of strategic objectives and those required to facilitate the delivery of the Submission Plan development sites - for which Section 106 agreements (or Community Infrastructure Levy (CIL) funding, once in place) will be sought through negotiations with developers. These negotiations will take place during the preparation of detailed site planning briefs and following the Transport Assessment process as proposals progress to planning application stage, drafting S106 agreements and planning consents.

5.28 A number of schemes in the schedule will be defined further and costed through the preparation of site-specific Transport Assessments in support of development proposals. These will consider site-specific transport mitigation with the benefit of detailed proposals and design considerations and such schemes will be delivered through developer contributions (Section 278). Submission Plan schemes, such as the provision and expansion of Park and Rides and bus infrastructure improvements, form part of a cross-boundary, corridor-led approach to infrastructure delivery supporting Cherwell, Oxford City and West Oxfordshire's committed and emerging growth. LP1 PR strategic infrastructure is expected to be delivered as shown in Table 5-1.

Table 5-1: LP1 PR Transport measures, estimated costs and delivery mechanisms (based on LP1 PR Infrastructure Schedule and further information from OCC)

LP 1 PR Strategic Infrastructure	Estimated known costs	Phasing	Funding	Delivery
Expansion of Water Eaton P&R Phase 1	c.£7m	2021-2026	Oxfordshire Housing and Growth Deal (£150m for 2018-2023) Local Growth Fund bids Developer contributions (S106s or CIL when in place) Network Rail potential level	**Near term** OCC P&R study finalised with options recommended. OCC A44-A4260 study finalised with schemes recommended. **2018-2021** Y1 of Growth Deal infrastructure agreed (March 2018) Y2-5 of Growth Deal infrastructure agreed (November 2018). Growth Deal funding commits to:
P&R at London Oxford Airport Phase 1	c.£4m	2021-2026		
Bus Lane and bus stop improvements along the A4260/A4165	c.£4.5m	2018-2026		
Signalised junctions along the A4260/A4165 corridor to improve bus movements	c.£0.89m	2018-2026		
Bus Lane improvements along the A44/A4144	c.£5.52m	2018-2026		

Junction improvements facilitating cross-corridor bus movements (A44 to/from A4260)	c.£3.15m	2018-2026	crossings funding Innovate UK funding bids	c. £45.4m funding agreed to deliver A40-A4260 transport improvements **2019-2021** Feasibility work for A44/A4260 schemes expected completion in March 2019 Negotiate developer contributions through the site briefs and as part of TA and planning application process. LP1 PR Infrastructure schedule schemes into CDC's IDP from plan's adoption. **2021-2026** Delivering 1,810 new dwellings and their site-specific transport infrastructure. Delivery of Oxfordshire Housing and Growth Deal Schemes by 2023 Delivering all LP1 PR identified strategic transport infrastructure having regard to expected residential completions trigger points. **2026-2031** Delivering 2,590 new dwellings and their site-specific transport infrastructure.

LP 1 PR Strategic Infrastructure	Estimated known costs	Phasing	Funding	Delivery
Cycle Super Way along the A4260/A4165 to Oxford Parkway	c.£2.1m-5.25m	2018-2026		
Cycle and pedestrian improvements along the A44 (between Bladon Roundabout and Pear Tree Roundabout)	c.£8.23m	2018-2026		
Cycle and pedestrian improvements along Langford Lane	c.£0.77m	2018-2026		
Total (known costs)	**c.£36.2-£40m**	**2018-2026**		

5.29 The National Planning Policy Framework paragraph 177 expects local planning authorities to plan for infrastructure and development policies at the same time and to understand district-wide development costs. It also highlights the importance of ensuring 'there is a reasonable prospect that planned infrastructure is deliverable in a timely fashion'.

5.30 The Submission Plan and recommended Focused Changes is accompanied by an Infrastructure Schedule (Appendix 4 to the Submission Plan) with specific transport schemes and their known costs. The necessary private and public funding mechanisms have been identified to help deliver the Plan from 2021 and there is a strong public funding commitment from the District Council, its partners and Central Government through the Oxfordshire Growth Board and the Oxfordshire Growth Deal to ensure infrastructure is delivered (as outlined in Table 5-1 and paragraphs 5.1 to 5.18).

5.31 The Submission Plan has been informed by a Viability Assessment (evidence document PR49), confirming the Plan's proposals at this strategic level can be delivered. The Viability Assessment included costs, such as developer contributions expected from new development, in addition to costs for the provision of local site infrastructure, major site infrastructure, abnormal costs, and improvements to compensatory land. The Viability Assessment results indicate site specific infrastructure can be supported by the development proposed in the Submission Plan.

5.32 Planning for infrastructure is an iterative process and Cherwell District Council will continue to work closely with the County Council, and relevant infrastructure providers, to understand the benefits and impacts of the transport schemes identified during plan preparation. These will be refined as the plan progresses to adoption and development briefs are prepared to provide more detailed information on how and when they can be brought forward.

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Appendix A

Local and strategic roads analysis

Transport Topic Paper: Evidence for Cherwell Local Plan (Part 1) Partial Review

Title	Local and strategic roads analysis
Date	28/02/2018
Author(s)	Neil Taylor, Emma Taylor, Rachel Tate
Project Code	2336
Version	1

1. Introduction

1.1 This technical note supports the Transport Topic Paper and explores the detail of strategic model findings for major local highway network junctions and links managed and maintained by Oxfordshire County Council.

1.2 This note is structured as follows:

- Potential impact on local road network:
  - A: Sandy Lane, Kidlington
  - B: A44 (between Woodstock and Pear Tree interchange)
  - C: A4260 (between Shipton and Oxford) / Kidlington Roundabout
  - D: Langford Lane
  - E: A4095 (between Kirtlington and Bladon)
  - F: Cutteslowe and Wolvercote roundabouts
- Potential impact on level crossings
- Potential impact on strategic road network
  - G: M40, Junction 9
  - H: A34/A41 (between Bicester and Oxford)
  - I: A34 Junctions north of Oxford
- Forecast impact of the A40/A44 link road from a Cherwell additional growth perspective

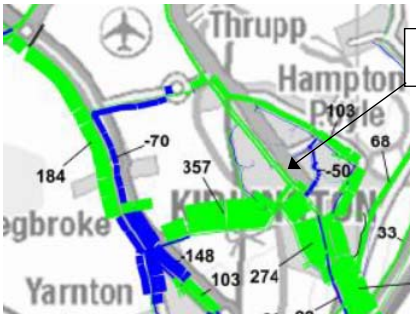
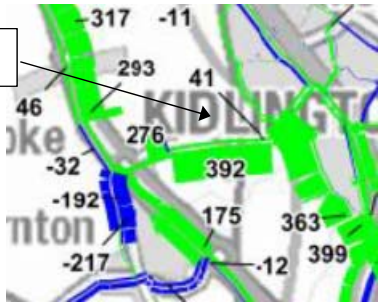
2. Potential impact on local road network

A: Sandy Lane, Kidlington

2.1 Sandy Lane currently functions as a local road. It is forecast to experience additional traffic delay in 2031 as a result of already committed spatial growth. In a 'Do Minimum' scenario (which projects future traffic levels associated with already committed development across Oxfordshire to 2031), delays of 2 Passenger Car Units Per Hour (PCUH) are forecast in the AM peak and 3 PCUH in the PM peak. As such, Sandy Lane is forecast to function below its operational design capacity in both the AM and PM peak hours.

Potential impact of development

2.2 When the additional dwellings to accommodate Oxford's unmet housing need are considered without any associated transport improvements, the strategic transport model estimates a small increase in travel delay (+1 PCUH) and journey time (+ 16 PCUH). Traffic flow estimates along Sandy Lane (Figures 1 and 2) supfreflect this, with a forecast increase of 350-650 vehicles (shown by the green flows) during the AM and PM perk periods respectively, arising from greater demand for trips between Kidlington, Begbroke and Yarnton.

	
Development Package A4 – Do minimum flow difference AM Peak (Figure 1)	Development Package A4 – Do minimum flow difference PM peak (Figure 2)

2.3 This estimated increase in traffic flow may fundamentally change the road's nature during peak hours. Traffic counts and speed surveys were undertaken on Sandy Lane in February 2014. These recorded a two-way flow of 107 vehicles in the AM peak and 83 vehicles in the PM peak (5-day average). With additional development an estimated 350-650 additional vehicle trips are expected per hour on Sandy Lane. This equates to a 300%-780% increase in traffic compared to the 2014 observed flows.

2.4 The increased traffic may discourage people from walking and cycling for local trips to/from the new development areas, and could increase scope for queuing and conflict at the Sandy Lane level crossing.

Options considered to address potential impact and issues raised through plan preparation

2.5 The option to sever Sandy Lane as a vehicular through-route to allow access to development sites and existing properties, and convert it into a pedestrian and cycle only route across the railway, was tested in an earlier version of the model. However, because the model is designed to forecast strategic traffic and public transport flows, the results did not account for potential switching to walking and cycling for local trips.

2.6 Sandy Lane was therefore left open to vehicles in subsequent modelling, but with the recognition that its long-term closure to through-traffic may be desirable so as to prevent rat-running and mitigate level-crossing conflicts. An alternative may be to retain Sandy Lane as a vehicular link, but with Green Lane (Yarnton Lane) developed as a pedestrian/cycle link. This option is likely to provide sustainable travel benefit to fewer people – primarily occupants of new dwellings in the southern-most portion of the 'Land to the East of the A44' site option and existing Yarnton residents.

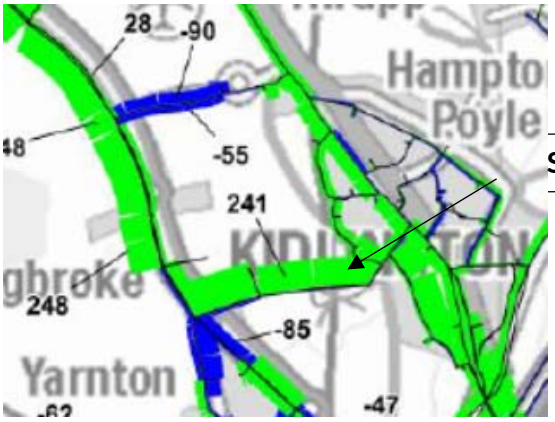
2.7 To lock-in traffic reduction benefits, this approach was complemented by a number of local highway and public transport improvements that include:

- Southbound bus lane on the A44 from East Yarnton/Begbroke to Loop Farm roundabout with a new bus service into the development areas.
- A new Park & Ride at London Oxford Airport to intercept Oxford-bound traffic.
- 40mph speed limit introduced along A44 from Sandy Lane to Cassington Road junctions.
- Super Cycleway linking Oxford City Centre, Northern Gateway and Kidlington, Begbroke and Yarnton.

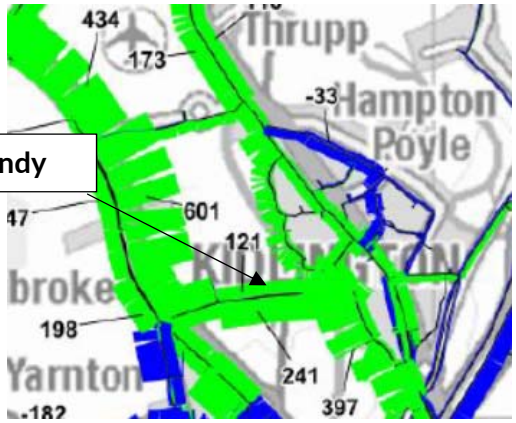
Forecast impact of mitigation

2.8 The transport model forecast that the proposed public transport and targeted highway improvements described above will help to limit the increase in vehicle movements along Sandy Lane during the AM and PM Peak periods to between 240-360 additional vehicles respectively. In the PM peak the model estimates significantly increased southbound vehicle flows on the A44 through Yarnton and Begbroke (+600 vehicles, compared to +300 without the package of transport improvements). This partly relates

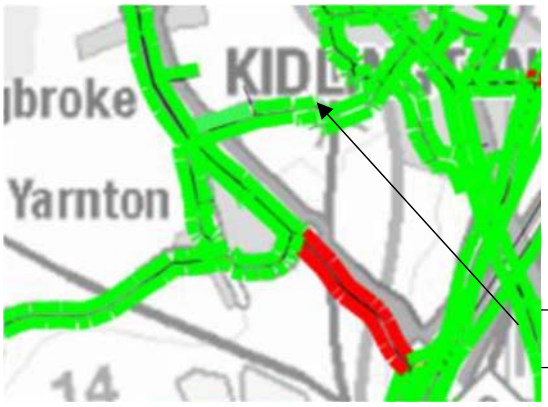
to the reduced speed limit on the A44, which increases the effective carrying capacity of the road, but is also reflected by increased delays along Sandy Lane (+1 PCUH in the AM and +11 in the PM Peak respectively) associated with a forecast higher ratio of traffic volumes to available capacity – notably in the evening peak (Figure 6). Finally, it reflects a concerted effort to focus vehicular traffic flows on the A44 corridor, so as to free-up capacity on the A4260/A4095 junction and through the Kidlington local centre.



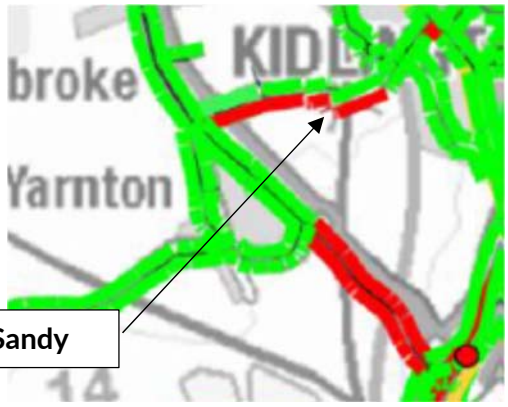
Transport Improvement Package 2 – Do minimum Flow Difference AM Peak (Figure 3)



Transport Improvement Package 2 – Do minimum Flow Difference PM Peak (Figure 4)



Transport Improvement Package 2 – Volume Capacity Ratio AM Peak (Figure 5)



Transport Improvement Package 2 – Volume Capacity Ratio PM Peak (Figure 6)

Residual issues for further consideration

2.9 A combination of site-specific investments (e.g. greenway routes through masterplanned development areas, connected to the wider cycle network, and bus route/stop provision) coupled with smarter travel interventions (e.g. targeted information and incentives for site occupiers) could help to promote more sustainable

travel behaviours as new developments are occupied. Effective promotion of active and sustainable travel modes, coupled with infrastructure and service improvements, is empirically proven to reduce single occupancy car use by targeted intervention groups.

2.10 There is a need for the highways authority to strike a balance between severing Sandy Lane as a vehicular through-route, to create new developments designed to encourage the highest levels of active travel, and recognising local residents' concerns about vehicular severance. There are also both capacity and road safety issues associated with leaving Sandy Lane open for vehicular movement. In respect of the level crossing on Sandy Lane (and others nearby), Network Rail's representation highlighted:

- Its view that development resulting in a material increase, or significant change in the character of traffic using the crossings should be refused unless it can be demonstrated that safety will not be compromised, or that any safety issues can be mitigated.
- This applies to the level crossing at Sandy Lane, as well as those at Roundham and Yarnton.
- Given the additional dwellings will result in additional vehicular movements along Sandy Lane (as illustrated in Figure 3 and Figure 4), Network Rail's preference would be for this route to close to through-traffic, or for an overbridge to be provided.
- Oxfordshire County Council's (OCC) representation advocated a similar approach, and stated a preference for the level crossing to be closed to through-traffic prior to the commencement of any development to the east of the A44. Follow-up dialogue also noted that the level crossings are preventing the full benefits of recent railway line re-signalling from being realised. OCC also observed that introducing any new rail station at Begbroke would likely require the closure of the level crossings.

2.11 Finally, the cost of upgrading the existing canal bridge, and replacing the level crossing with a road overbridge capable of carrying vehicular traffic are likely to be very high compared to the cost of a pedestrian/cycle bridge over the railway line. Were an improved road bridge delivered over the railway line and canal, then the increased attractiveness of the Sandy Lane link to through-traffic is expected to result in additional vehicle movements on the A44 corridor. This would likely worsen the likely environment for existing residents of Sandy Lane, and establish considerably less favourable conditions for walking and cycling trips between new development locations and the Kidlington local centre.

2.12 Based on the above the preferred option would be to close Sandy Lane to vehicular through-traffic (access for Network Rail would be maintained) with an over-bridge installed for pedestrians and cyclists.

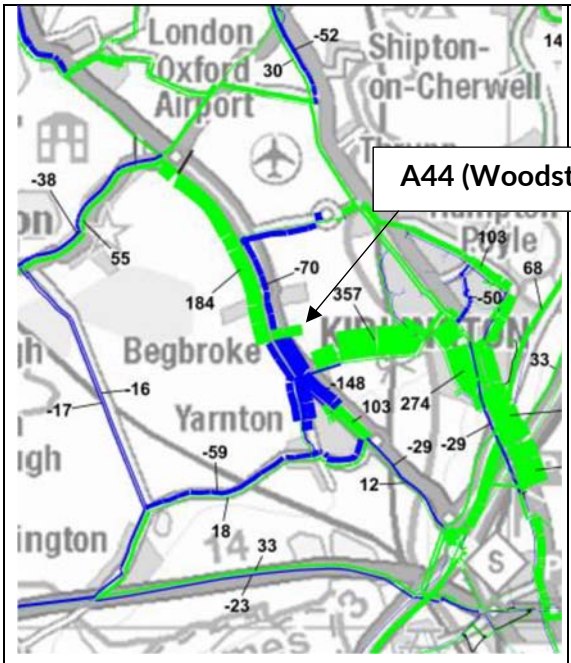
B: A44 (between Woodstock and Pear Tree interchange)

2.13 The A44 is currently a strategic route linking north Oxford with Woodstock, the Cotswolds, Evesham and Worcester. In the Do Minimum Scenario the strategic transport model project delays on this section of the A44 of up to 189 PCUH in the AM peak, increasing 316 PCUH in the PM peak. Between Begbroke and Pear Tree Interchange there are sections of the A44 which are forecast to operate over capacity (volume:capacity ratio of 85-95% or >95%), and traffic congestion is expected to be particularly severe northbound and southbound between Pear Tree Interchange and Cassington Road.

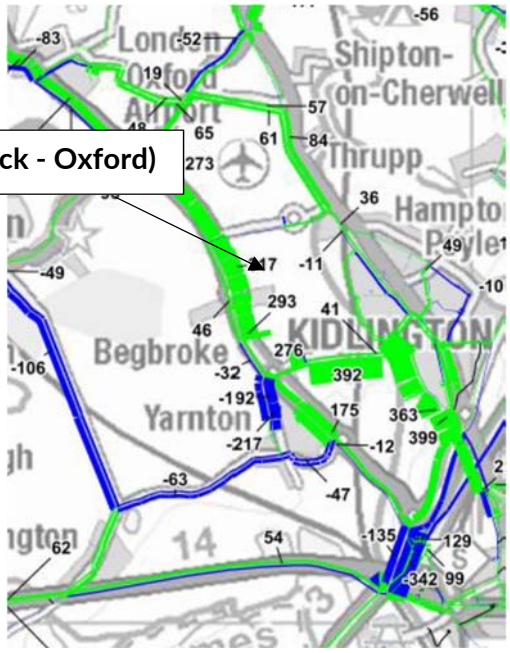
Potential impact of development

2.14 The A44 is located in close proximity to many of the dwellings allocated in the additional development sites proposed to accommodate Oxford's unmet housing need. Without any additional transport improvements, the strategic transport model forecasts an increase in travel delay of +34 PCUH in the AM peak (+18%) and +22 in the PM peak (+7%).

2.15 Figure 7 shows that, during the AM peak, the strategic transport model predicts that increased vehicle trips will be focused on the northbound section of the A44, heading from proposed residential areas towards the airport business park (+184 vehicle movements). Reduced flows (-148 vehicle movements) are predicted around Begbroke and Yarnton in a southbound direction, while increased flows (+103 vehicle movements) are forecast in a northbound direction. Figure 8 shows that in the PM peak the model predicts a broadly inverse pattern, with increases in vehicle trips focused on southbound movement from London Oxford Airport to the proposed additional development locations (+300 vehicle movements) and northbound from Loop Farm roundabout towards Yarnton (+175 vehicle movements). Some small reductions (-38 vehicles) are predicted along the northbound section of the A44 around Woodstock, while significant reductions (-135 vehicle movements) are projected around on the A44 link between Loop Farm and Pear Tree interchange.



Development Package A4 – Do minimum flow difference AM Peak (Figure 7)



Development Package A4 – Do minimum flow difference PM peak (Figure 8)

Options considered to address potential impact and issues raised through plan preparation

2.16 To help accommodate the projected transport impacts of proposed additional development allocations along the A44 corridor, the following additional improvements were included within a package of strategic transport network and service improvements:

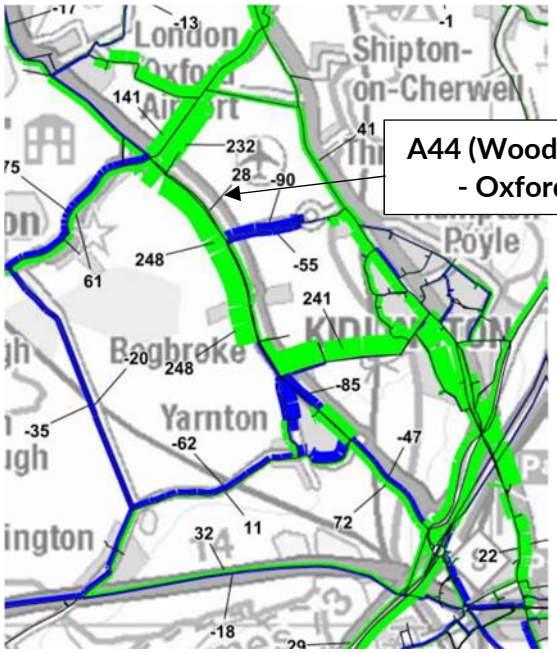
- Southbound bus lane on the A44 from East Yarnton/Begbroke to Loop Farm roundabout with a new bus service into the development areas.
- Northbound and southbound bus lanes on the A44 between Langford Lane and the Bladon roundabout.
- A new Park & Ride at London Oxford Airport to intercept Oxford-bound traffic.
- 40mph speed limit introduced along A44 from Sandy Lane to Cassington Road junctions.
- Super Cycleway linking Oxford City Centre, Northern Gateway and Kidlington, Begbroke and Yarnton.

Forecast impact of mitigation

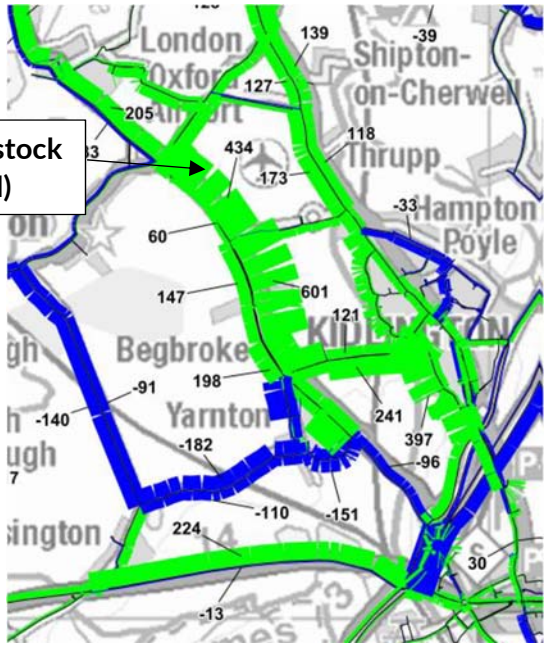
2.17 The strategic transport model predicts these additional transport improvements will reduce the impact of additional development proposed to accommodate Oxford's unmet housing need during the PM peak. They limit any increase in delay associated with travel demand to +5%, compared with +7% without the improvements. The opposite trend is predicted in the AM peak, where the additional transport movements are forecast to result in a 22% increase in delay, compared to an 18% increase without them.

2.18 In the AM peak the model predicts there will be 248 additional vehicle movements on northbound sections of the A44 through Begbroke, but small reductions (-47) in southbound sections towards Pear Tree Interchange (Figure 9). In the PM peak (Figure 10) the model forecasts an opposite trend, with significantly increased vehicle movements of up to +600 vehicles on the A44 southbound, with some smaller reductions in northbound flows on the A44 around Woodstock (-33) and south of Cassington Road (-96). This pattern of traffic flow appears consistent with employment trips focused between employment locations at London Oxford Airport business parks and new homes in additional development locations at Begbroke and Yarnton.

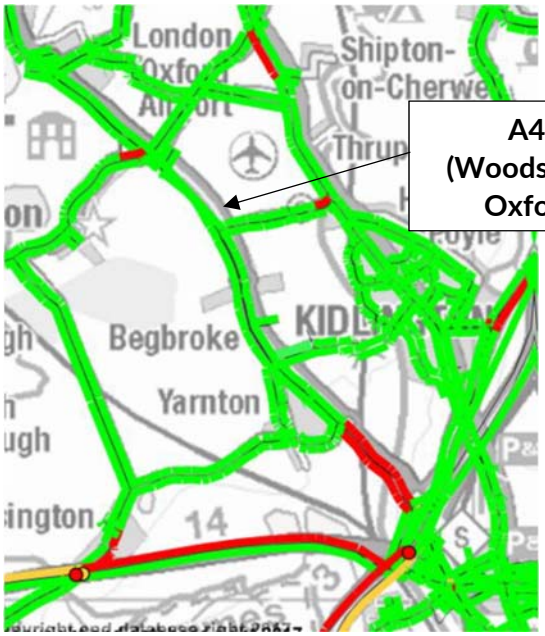
2.19 The volume:capacity ratio forecasts from the strategic transport model (Figure 11 and Figure 12) indicate that, in the both AM and PM peak periods, the A44 corridor is predicted to operate below 85% of its capacity along the majority of its length when the additional transport improvements are included – suggesting the additional vehicle flows can largely be accommodated. This is an improvement compared to the volume:capacity ratio forecasts for the corridor in a scenario without the additional transport services/infrastructure, where small stretches of the A44 in Begbroke (southbound) and Yarnton (northbound) were forecast to be close to/exceed 95% of their design capacity.



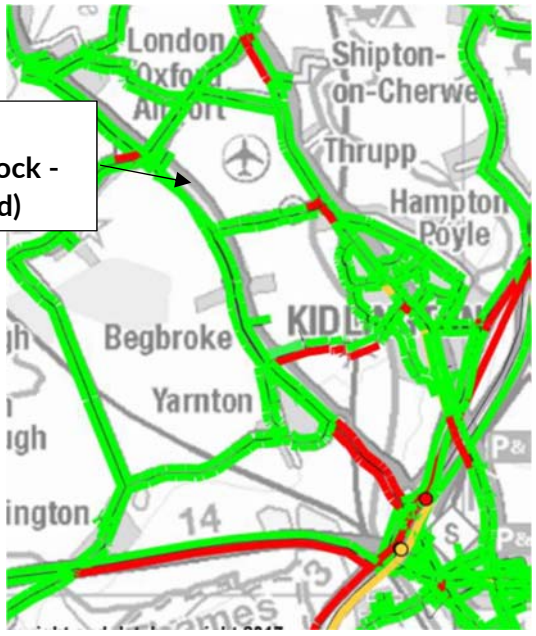
Transport Improvement Package 2 – Do minimum Flow Difference AM Peak (Figure 9)



Transport Improvement Package 2 – Do minimum Flow Difference PM Peak (Figure 10)



Transport Improvement Package 2 – Volume Capacity Ratio AM Peak (Figure 11)



Transport Improvement Package 2 – Volume Capacity Ratio PM Peak (Figure 12)

2.20 The impact of the additional inclusion of the Super Cycleway from Kidlington to Oxford City Centre cannot be dynamically modelled using the Oxfordshire Strategic Transport

Model, given its deliberate focus on traffic and public transport flows. Estimates calculated outside the model suggest that more widespread uptake of cycling trips, triggered by the provision of safe cycle infrastructure, could create between 30 (8am-9am) and 70 (5pm-6pm) passenger's worth of capacity on bus services along the A4260 / Oxford Road route. Across each of the 3-hour AM and PM peak periods this could free-up between 90-210 passenger's worth of capacity on local and inter-urban bus services, while helping to reduce local vehicle traffic congestion. These estimates were based on national best practice evidence of impact from similar schemes delivered elsewhere in England.

Residual issues for further consideration

2.21 The main residual issue highlighted for further consideration by the volume:capacity ratio forecast figures is the southernmost stretch of the A44, between Loop Farm roundabout and Pear Tree Interchange. This is forecast to be operating over 95% of its design capacity in both directions during the AM and PM peak periods in 2031. While this section of the A44 remains over 95% of its design capacity with the introduction of additional transport improvements, they are predicted to yield benefit to the functioning of Pear Tree Interchange during both AM and PM peak periods.

2.22 The strategic nature of the Pear Tree interchange, and the fact it is projected to operate over its design capacity in 2031 with or without transport improvements, suggests that a more significant package of improvements may be required here. Monitoring the impact of nearer-term proposals to improve the Pear Tree interchange (announced in 2014) and the potential impact of the Oxford – Cambridge Expressway (announced in 2017), could help to inform the extent of further improvements.

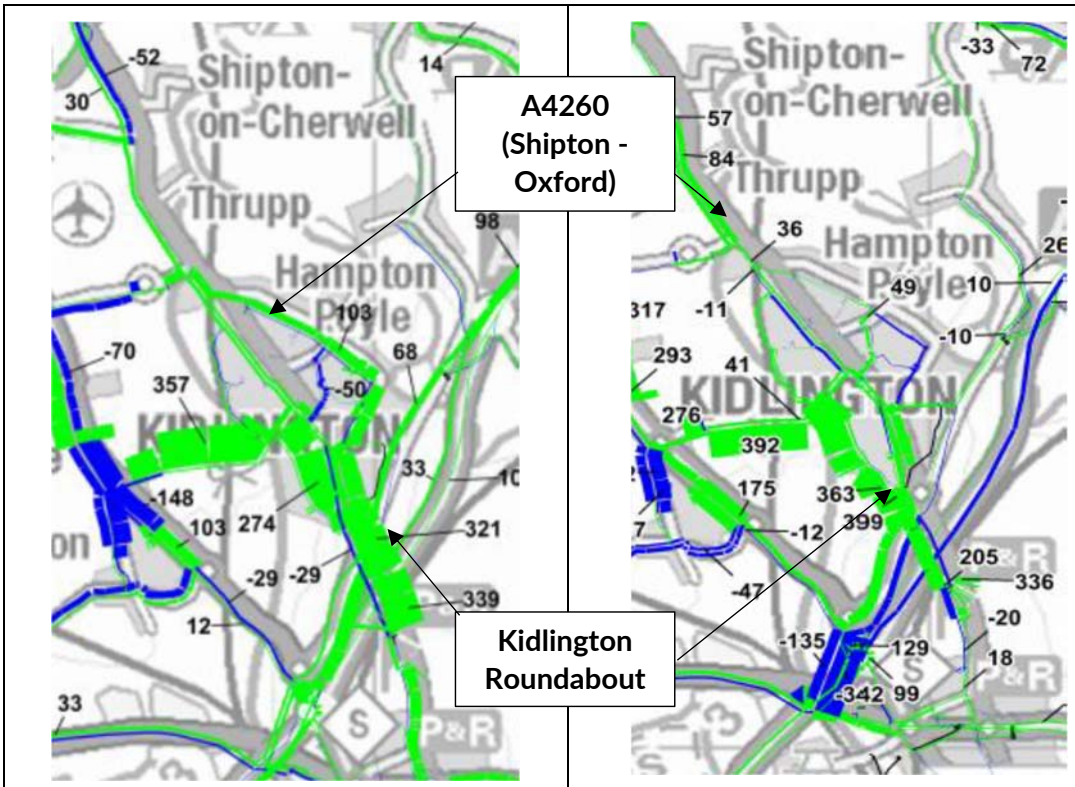
C: A4260 (between Shipton and Oxford) / Kidlington Roundabout

2.23 The A4260 currently serves a dual function as an important local road that links Kidlington centre with Shipton and Oxford, as well as a strategic alternative route to the A34/M40 between Oxford and Banbury. In the Do Minimum modelling scenario for 2031, the A4260 is forecast to operate below 85% of its design capacity during both the AM peak and PM peak periods, with no issues expected on the approach to Kidlington Roundabout. Some delay is forecast along the corridor, to the extent of 70 Passenger Car Units Per Hour in the AM peak and 115 PCUH in the PM peak.

Potential impact of development

2.24 During the AM peak the strategic transport model estimates that proposed additional development to the west and south of the corridor will result in increased delay (+11 PCUH, a 16% increase on projected 2031 trips without the development) between Oxford and Shipton along the A4260. In the PM peak the forecast is more mixed, with a small decrease in delay (-3%) predicted overall along the corridor, with a northbound increase of around 84 vehicle movements close to London Oxford Airport and adjacent business parks.

2.25 Figure 13 and Figure 14 show that the strategic transport model predicts additional development in the area will have a relatively minor impact on the A4260, but increased vehicle movements are forecasted at Kidlington Roundabout. Additional movements are also evident on minor roads in Kidlington (Morton Avenue, Almond Avenue, Hazel Crescent, Oxford Road) parallel to the A4260.



Development Package A4 – Do minimum flow difference AM Peak (Figure 13)	Development Package A4 – Do minimum flow difference PM peak (Figure 14)

Options considered to address potential impact and main issues raised through plan preparation

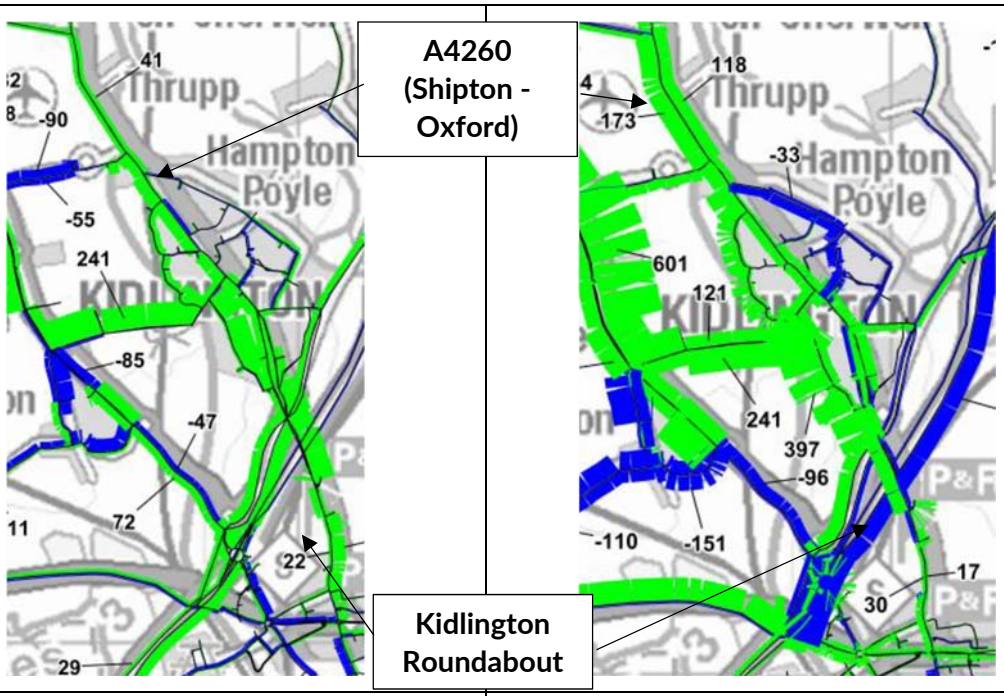
2.26 As well as the transport improvements set out previously in relation to the A44 corridor, the following additional measures were proposed to help accommodate projected transport impacts of the development allocations along the A4260 corridor:

- Southbound bus lanes from The Moors/A4260 junction to Kidlington Roundabout.
- Signalising A4095 Upper Campsfield Road/A4260 junction.
- Expansion of Water Eaton Park & Ride.
- Introducing a 20mph zone and public realm improvements in the centre of Kidlington on A4260 between Lyne Road and Sterling Approach.
- Signalising A4260 junctions with Bicester Road and Lyne Road and including real-time detection of traffic flows.
- Improvements to the Langford Lane/A4260 junction, with bus lanes on some approaches.

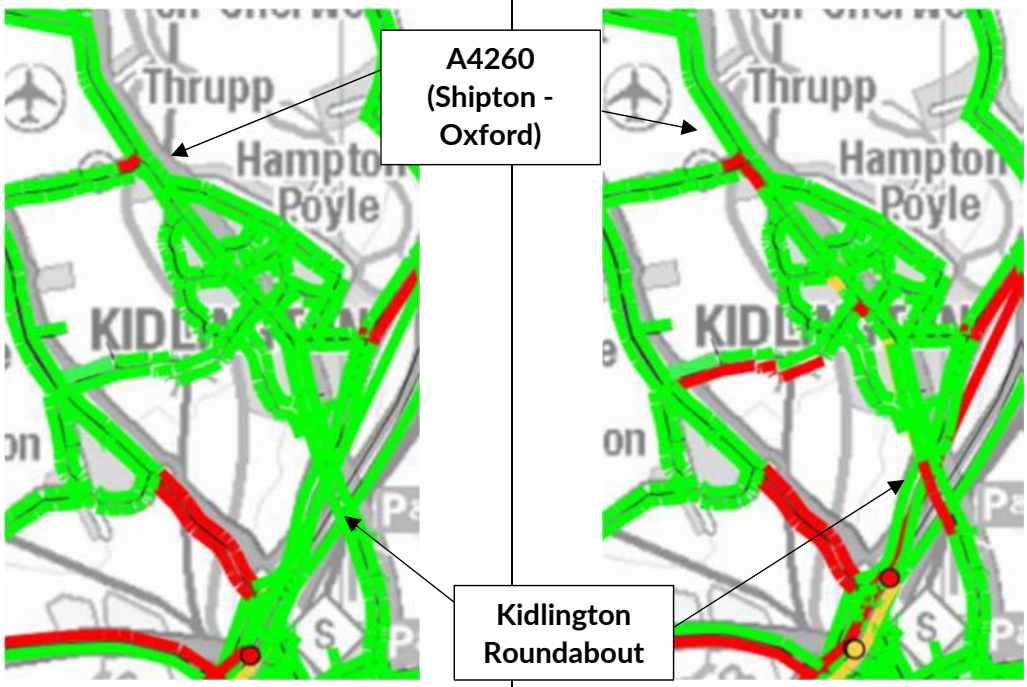
Forecast impact of mitigation

2.27 The strategic transport model predicts these additional transport improvements will significantly improve the A4260's performance in the 2031 AM peak period. They are estimated to limit forecast increases in traffic delay to +4%, which compares favourably to the +16% projected without the improvements. But in the PM peak the strategic transport model predicts a 9% increase in delays, which does not compare as favourably to the -3% reduction in delays predicted without the transport improvements.

2.28 Figure 15 and Figure 16 present this data visually, and reveal that the greatest predicted increase in vehicle movements during both AM and PM peak periods is focused on the Kidlington Roundabout. The predominant flows are anticipated to be southbound in the AM peak and, more significantly, northbound in the PM peak. Figure 17 and 18 reveal the strategic traffic model predicts that these additional vehicle flows can largely be accommodated with the additional transport improvements. They show the Kidlington roundabout operating within 85% of its design capacity in both the AM and PM peaks, but an increase in the volume:capacity ratio (from 85-95% to over 95% of its design capacity) on the northbound section of the A4260 approaching Kidlington Roundabout during the PM peak.



Transport Improvement Package 2 – Do minimum Flow Difference AM Peak (Figure 15)	Transport Improvement Package 2 – Do minimum Flow Difference PM Peak (Figure 16)



Transport Improvement Package 2 – Volume Capacity Ratio AM Peak (Figure 17)	Transport Improvement Package 2 – Volume Capacity Ratio PM Peak (Figure 18)

2.29 The impact of the Super Cycleway from Kidlington to Oxford City Centre cannot be dynamically modelled using the Oxfordshire Strategic Transport Model, given its deliberate focus on traffic and public transport flows. Estimates calculated outside the model suggest that more widespread uptake of cycling trips, triggered by the provision of safe cycle infrastructure, could create between 50 (8am-9am) and 30 (5pm-6pm) passenger's worth of capacity on bus services along the A4260 / Oxford Road route. Across each of the 3-hour AM and PM peak periods this could free-up between 90-150 passenger's worth of capacity on local and inter-urban bus services, while helping to reduce local vehicle traffic congestion. These estimates were based on national best practice evidence of impact from similar schemes delivered elsewhere in England.

Residual issues for further consideration

2.30 The evidence from the strategic transport model highlights the potential for PM peak period traffic congestion on the northbound A4260, immediately to the south of Kidlington roundabout (which worsens slightly as a result of additional development and transport improvements), and at the A4260/Langford Lane junction to the north of Kidlington. Subject to the actual observed impact of proposed additional housing growth (as it is delivered), these residual issues may warrant further mitigation through further cycling/public transport priority enhancements and/or targeted highway capacity improvements.

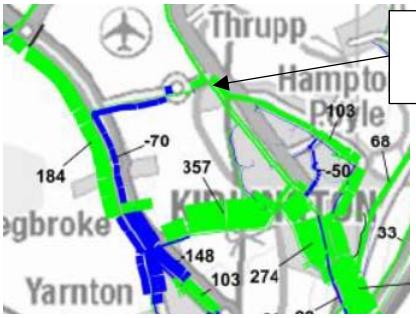
D: Langford Lane

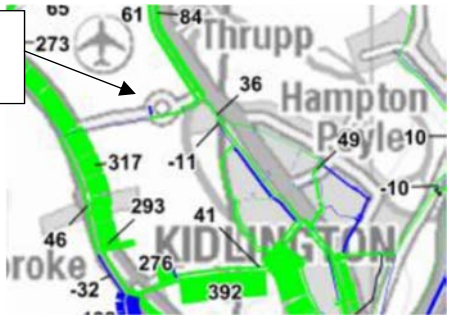
2.31 Langford Lane currently serves as an access road to London Oxford Airport, and adjacent business parks, as well as providing a strategic east-west link between the A44 and A4260 arterial corridors. In the Do Minimum scenario the OSM estimates minimal delays on Langford Lane and the link is forecast to operate below 85% of its design capacity in both AM and PM peak hours.

Potential impact of development

2.32 Langford Lane currently serves as an access road to London Oxford Airport, and adjacent business parks, as well as providing a strategic east-west link between the A44 and A4260 arterial corridors. The strategic transport model predicts the absolute impact of additional development on Langford Lane will be a small increase in travel delay (+1 PCUH) and a small decrease in journey time (- 1 PCUH) during the AM peak. During the PM peak the model predicts a 29% reduction in delay along Langford Lane, but the transport modelling team which generated these forecasts suggests the 'Do Minimum' level of delay is likely to be over-estimated. These anticipated changes

resulting from additional development around Kidlington, Yarnton and Begbroke are shown in Figure 19 and Figure 20.





Development Package A4 – Do minimum flow difference AM Peak (Figure 19)	Development Package A4 – Do minimum flow difference PM peak (Figure 20)

Options considered to address potential impact and main issues raised through plan preparation

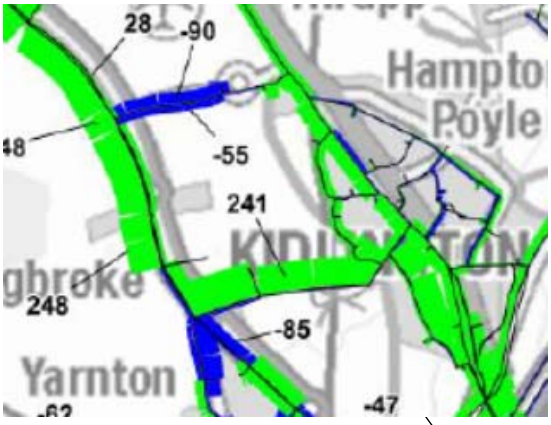
2.33 A number of the transport improvements described in relation to the adjacent A44 and A4260 corridors are also intended to help mitigate the impacts of development along Langford Lane. Specifically, these include the improvements to the Langford Lane/A4260 junction (including bus lanes on some approaches), the new Park & Ride at London Oxford Airport, and a bus-only left turn filter from the A44 onto Langford Lane. These are complemented by bus lanes and signal priority along the A4260 and A44 corridors towards Oxford.

Forecast impact of mitigation

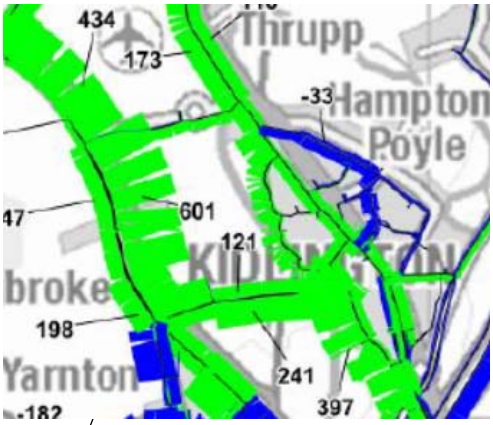
2.34 The strategic transport model forecasts that the additional transport improvements will result in 145 fewer AM peak vehicle movements on Langford Lane which, Figure 21 indicates could be trips intercepted by the new Park & Ride site. This has no overall impact on the small increase in delay (+1 PCUH) predicted without the improvements. Figure 22 reveals there may be a small increase in PM peak vehicle movements heading west along Langford Lane – from the A4260 corridor to the A44. This is consistent with evening commuter trips heading back towards the proposed new development locations around Begbroke and Yarnton.

2.35 Figure 23 and Figure 24 show that the strategic transport model predicts Langford Lane will continue to operate below 85% of its design capacity during both the AM peak and PM peak periods. In both periods some queue-related congestion is

predicted at Langford Lane's junction with the A4260, pushing the anticipated volume:capacity ratio over 95% of the road's design capacity.

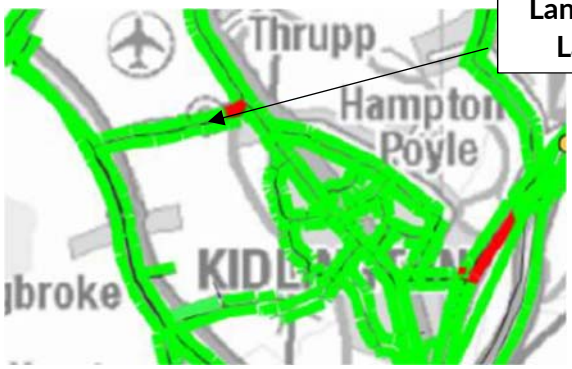


Transport Improvement Package 2 – Do minimum Flow Difference AM Peak (Figure 21)

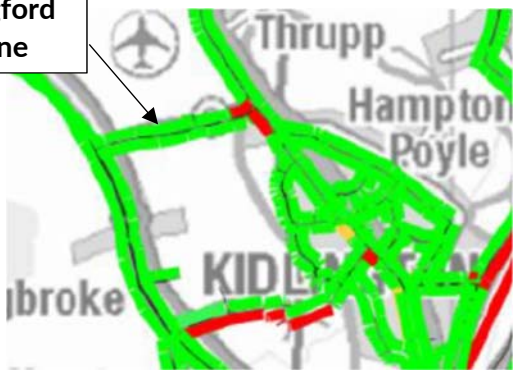


Transport Improvement Package 2 – Do minimum Flow Difference PM Peak (Figure 22)

Langford Lane



Transport Improvement Package 2 – Volume Capacity Ratio AM Peak (Figure 23)



Transport Improvement Package 2 – Volume Capacity Ratio PM Peak (Figure 24)

Residual issues for further consideration

2.36 The key residual issue highlighted in relation to Langford Lane's future operation is the queuing at its junction with the A4260. The actual uptake of the new Park & Ride services to London Oxford Airport could significantly impact on anticipated vehicle movements along Langford Lane, affecting its junctions with both the A4260 and A44. Subject to the actual observed impact of proposed additional housing growth (as it is delivered), these residual issues may warrant further mitigation through targeted junction and traffic signal improvements.

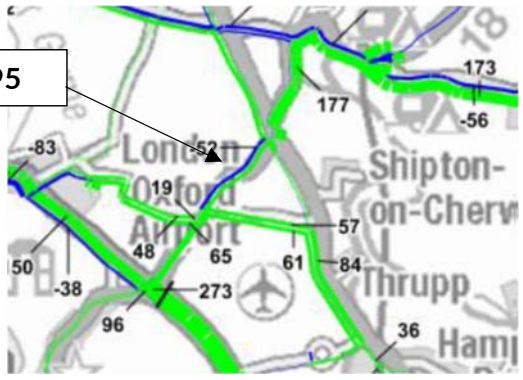
E: A4095 (between Kirtlington and Bladon)

2.37 The A4095's current function is primarily as a rural road that connects Witney, Bladon, south Woodstock, Enslow, Kirtlington and Bicester. In the context of Kidlington, Begbroke and Yarnton; the A4095 acts as a further link between the A44 and A4260 corridors to the north of London Oxford Airport. In the AM peak, the Do Minimum scenario forecasts capacity issues northbound on the approach to the junction with the A4260 and southbound on the approach to the A44/A4095 junction. This link performs better in the PM peak. Delays of 46-56 PCUH are forecast to occur in 2031 peak periods before any additional development or transport improvements are considered.

Potential impact of development

2.38 The strategic model predicts that the additional development to the south of the A4095 will increase delay between Kirtlington and Bladon by +11 PCUH (a 24% increase) in the AM peak. Figure 25 shows this increase in delay correlates with an increase in north-eastbound vehicle flows, towards Kirtlington. In the PM peak, the forecast increase in delay is much smaller (+1 PCUH, a 2% increase) and relates particularly to around 175 additional south-westbound vehicle movements between Enslow and the A4260.

Development Package A4 – Do minimum flow difference AM Peak (Figure 25)



Development Package A4 – Do minimum flow difference PM peak (Figure 26)

Options considered to address potential impact and main issues raised through plan preparation

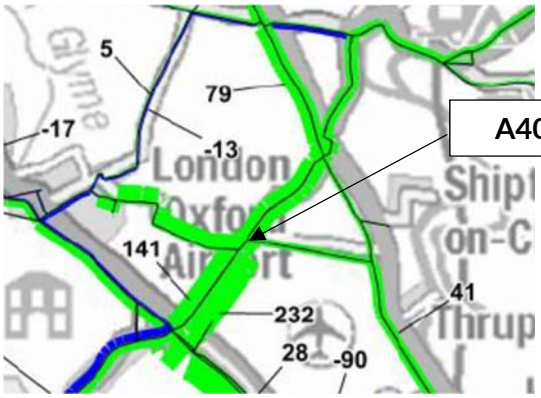
2.39 The following additional transport improvements have been proposed to help mitigate the AM and PM peak delay impacts associated with the additional development proposed around Kidlington, Yarnton and Begbroke:

- Left turn bypass lane from the A4095 Upper Campsfield Road to A44 southbound.
- Signalising the A4095 Upper Campsfield Road/A4260 junction.

Forecast impact of mitigation

2.40 The strategic transport model predicts these additional transport improvements will limit the increase in AM peak delays associated with the proposed additional development to +9 PCUH (+20%), which is slightly lower than is projected without the improvements. However, in the PM peak the additional transport improvements are predicted to result in an increase in delay of +18 PCUH (+32%). This is reflected in Figure 27 and Figure 28, which highlight how around 370 additional vehicle movements are forecast along the A4095 to the north of the airport in the AM peak. They also show that around 250 additional vehicle movements are projected in the PM peak, predominantly moving in a southwest-bound direction.

2.41 Despite these estimated increases in vehicle flows, the A4095 is predicted to continue operating below 85% of its design capacity in most locations (Figure 29 and Figure 30). The links where volume:capacity ratio is predicted to exceed 95% of the road's design capacity are: the northwest-bound approach to the A4095's junction with the A44; the A4260's northbound approach to the A4095; and the A4095's southbound approach to the B4027 intersection in Enslow.

	
Transport Improvement Package 2 – Do minimum Flow Difference AM Peak (Figure 27)	Transport Improvement Package 2 – Do minimum Flow Difference PM Peak (Figure 28)
	
Transport Improvement Package 2 – Volume Capacity Ratio AM Peak (Figure 29)	Transport Improvement Package 2 – Volume Capacity Ratio PM Peak (Figure 30)

Residual issues for further consideration

2.42 The sections of the A4095 that are anticipated to operate beyond capacity after additional transport improvements have been implemented relate primarily to queuing at specific intersections along the A4095 (with the A44, A4260, and B4027) during AM and PM peak times. Subject to the actual observed impact of proposed additional housing growth (as it is delivered), these residual issues may warrant further mitigation through further public transport priority and/or targeted junction capacity and traffic signal improvements in these locations.

F: Cutteslowe and Wolvercote roundabouts

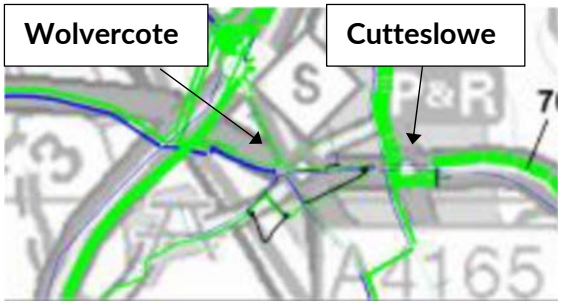
2.43 Cutteslowe and Wolvercote roundabouts currently serve as major local interchanges between the A40 and Banbury Road (which becomes the A4260 as it runs through

Kidlington) and the A40 and A4144/A44 respectively. Their proximity to the Pear Tree interchange means their function and performance are closely linked to that of the A34. In the Do Minimum scenario for 2031, Cutteslowe roundabout and all approaches appear to be operating below 85% of their design capacity, but some capacity issues are predicted at Wolvercote roundabout.

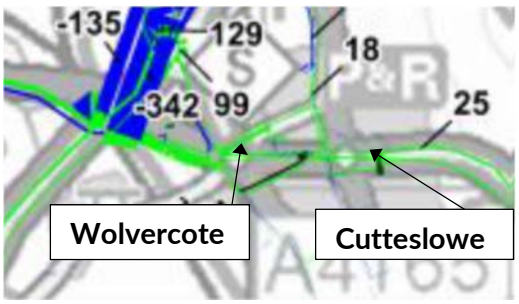
Potential impact of development

2.44 Figure 31 shows that, in the AM peak period, the strategic transport model predicts both Wolvercote and Cutteslowe roundabouts will experience small increases in vehicle flows resulting from the proposed additional development. This is most notable on the southbound section of the Banbury Road from Kidlington, and on the eastbound section of the A40, towards Headington. In the PM peak the impact is focused on the west-bound section of the A40, heading from Wolvercote roundabout towards the Pear Tree interchange.

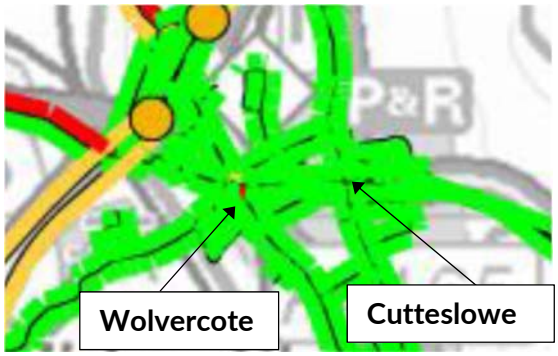
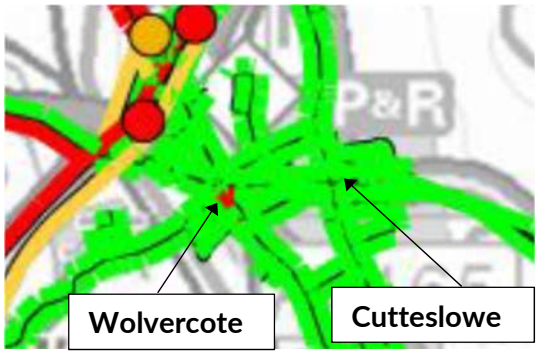
2.45 Figure 33 and Figure 34 visualise the impacts of the additional development on the volume:capacity ratio at both junctions, as forecast by the OSM. While Cutteslowe and all approaches appear to be operating below 85% of their design capacity, Wolvercote roundabout is predicted to operate over 95% of its design capacity in both the AM and PM peak periods.



Development Package A4 – Do minimum flow difference AM Peak (Figure 31)



Development Package A4 – Do minimum flow difference PM peak (Figure 32)

	
Development Package A4 morning peak hour volume to capacity forecast (Figure 33)	Development Package A4 evening peak hour volume to capacity forecast (Figure 34)

Options considered to address potential impact and main issues raised through plan preparation

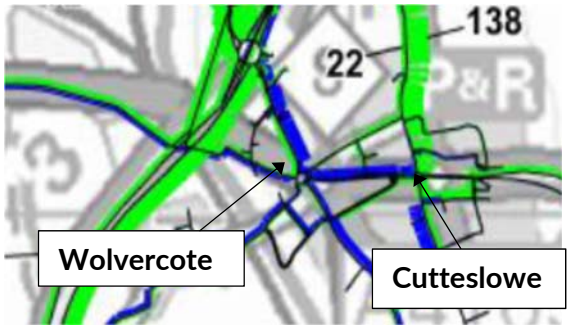
2.46 While none of the proposed transport improvements associated with the potential additional development are directly focused on Cutteslowe and Wolvercote, a number of those described in relation to other locations are expected to alleviate existing and future pressure at these two roundabouts:

- Arterial bus lanes and associated priority enhancements on both the A44 and A4260 are intended to reduce public transport journey times and improve the attractiveness of bus services for people travelling into Oxford.
- Coupled to this, the Super Cycleway linking Kidlington and new development sites with Oxford city centre offers significant mode-shift potential for existing and future car drivers/public transport passengers.
- Reduced speed limits along the southern sections of both the A44 and A4260 may extend journey times, but also to increase the effective flow-capacity of both roads.

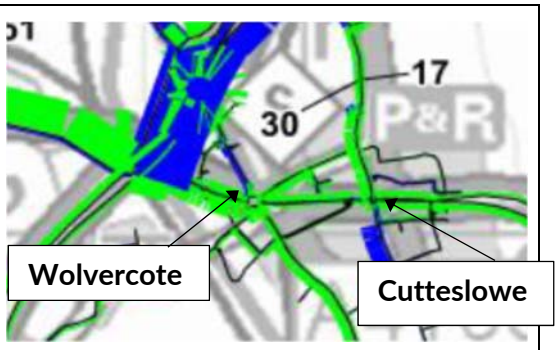
Forecast impact of mitigation

2.47 The strategic transport model forecasts that additional transport improvements to the north of these two roundabouts are anticipated to result in a reduced flow (shown in blue) on the southbound approach to Wolvercote, and on the northbound approach to Cutteslowe in both the AM and PM peak periods (Figure 35 and 36). It also predicts an AM peak increase of around 160 trips along the Banbury Road (to the north of Cutteslowe) and westbound on the A40 (the link from Cutteslowe to Pear Tree interchange). Figure 37 and Figure 38 indicate that the strategic transport model

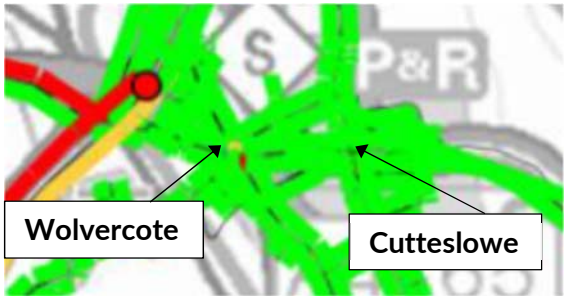
forecasts the Wolvercote roundabout will continue to operate over 95% of its design capacity in both the AM and PM peak periods, while Cutteslowe roundabout will continue to operate within its design capacity during these periods.



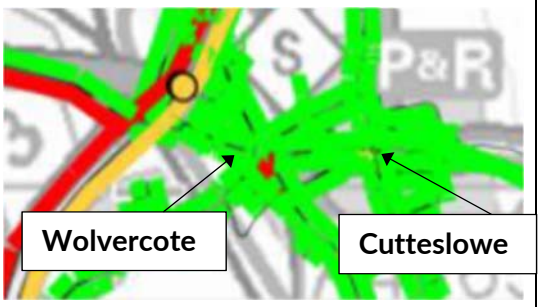
Transport Improvement Package 2 – Do minimum Flow Difference AM Peak (Figure 35)



Transport Improvement Package 2 – Do minimum Flow Difference PM Peak (Figure 36)



Transport Improvement Package 2 – Volume Capacity Ratio AM Peak (Figure 37)

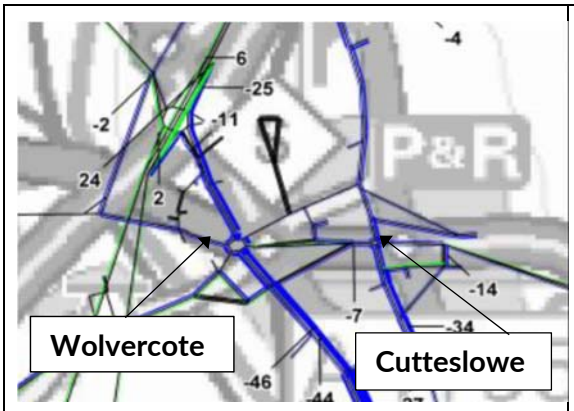


Transport Improvement Package 2 – Volume Capacity Ratio PM Peak (Figure 38)

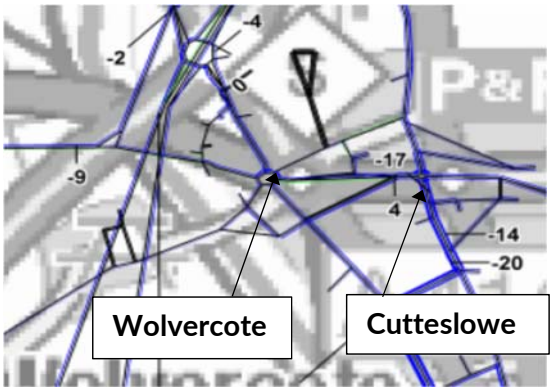
2.48 These projections do not take account of the potential impact of the proposed Super Cycleway, the effect of which on local trip patterns could not be dynamically estimated using the strategic transport model. Separate modelling (Figure 39 and 40), revealed this cycle route could potentially reduce the number of AM peak vehicle trips through Cutteslowe (-35 trips per hour) and Wolvercote (-50 trips per hour) roundabouts. Across the 3-hour peak AM peak period this equates to approximately -255 vehicle trips passing through the two roundabouts.

2.49 Figure 41 and Figure 42 show the strategic model forecast that, in addition to its impact on vehicle movements, the Super Cycleway could result in -35 fewer bus passenger trips south of the Wolvercote roundabout and around -70 bus passenger trips through the Cutteslowe roundabout between 8am and 9am. Across the 3-hour AM peak period this equates to a further 315 fewer bus passenger trips through both

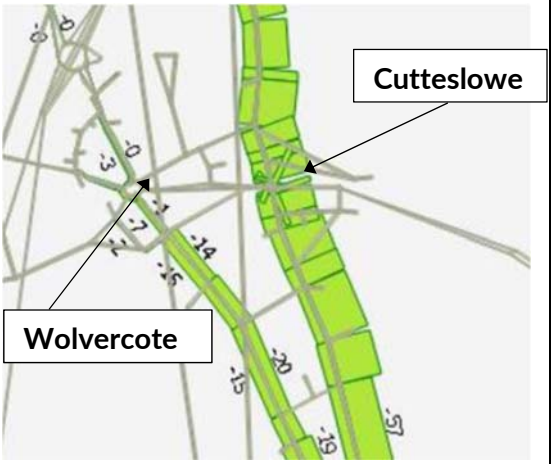
roundabouts – indicating that significant bus capacity could be freed-up through mode shift to cycling. The tidal nature of flows through the two roundabouts mirrors those for vehicle trips – towards Oxford city centre in the AM peak and outbound in the PM.



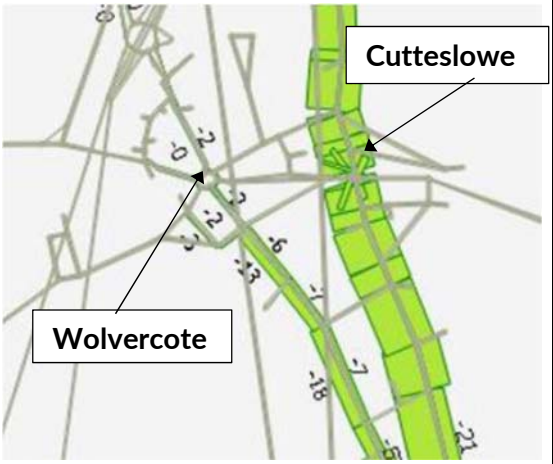
Super Cycleway – projected impact on vehicle flows AM peak (Figure 39)



Super Cycleway – projected impact on vehicle flows PM peak (Figure 40)



Super Cycleway – projected impact on bus patronage AM peak (Figure 41)



Super Cycleway – projected impact on bus patronage PM Peak (Figure 42)

Residual issues for further consideration

2.50 The model's design focus on estimating motorised trip changes across the highway network makes it difficult to accurately estimate mode shift as a result of cycling interventions, and therefore any residual issues at Wolvercote and Cutteslowe. Modelling solely motorised movements indicates the Wolvercote roundabout may require additional capacity improvement to support the additional development. However, including the Super Cycleway's roughly estimated impact reveals that

significant numbers (~570 per AM peak period) of new and existing trips could be made by people switching to cycling from private car and public transport travel modes.

2.51 On this basis we anticipate that residual traffic congestion issues associated with the additional growth being considered are likely to be small, and note that transformative (i.e. segregated) cycling interventions could actually unlock capacity for vehicle traffic moving through these roundabouts at peak times. Given the uncertainty outlined above, we strongly recommend that these roundabouts, and the impacts of proposed transport improvements, are carefully monitored as additional growth is delivered.

3. Potential impact on level crossings

3.1 The sites identified to accommodate the 4,400 additional homes are located in close proximity to three level crossings:

- Sandy Lane - the impact on this crossing has been discussed above
- Yarnton Lane (Green Lane)
- Roundham

3.2 Roundham Level Crossing is located to the north of the additional housing sites, adjacent to the Oxford canal. This is a private user-worked crossing with infrequent vehicular use. It offers non-motorised users access onto the Oxford canal towpath. Network Rail has provided survey data for June 2014 which shows that the crossing is used by 195 pedestrians per day and 44 cyclists (7-day averages). The additional dwellings may result in additional recreational use of the crossing but replacing the level crossing with an over-bridge is not deemed feasible due to a number of physical constraints. Therefore, at this stage it expected that the crossing will be retained in its current form, but Network Rail will be engaged as part of the preparation of the development brief for PR8.

3.3 Yarnton Lane (Green Lane) level crossing is located to the south of the PR8. Yarnton Lane level crossing provide vehicular access to one property (located to the east of the railway) and is a public footpath. To the west of the railway line Yarnton Lane is public highway but to the east it becomes a single lane access track. No data on current usage has been provided by Network Rail. The Partial Review proposed to create parkland to the east of the rail way line, adjacent to the Oxford Canal. This may result in some increase in recreational use of Yarnton Level crossing by non-motorised users. Network Rail would prefer to close the level crossing, to do this would either require the provision of an over-bridge for pedestrians, or the diversion of the public footpath to Sandy Lane and provision of a consolidated crossing. With both these options the issue of access to the existing property east of the railway line would need to be resolved. It is proposed that the effects of PR8 and any potential mitigations should be explored as part of the development brief for PR8, Network Rail will need to be consulted through this process.

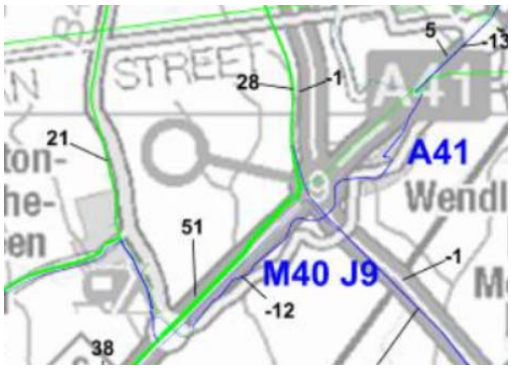
4. Potential impact on strategic road network

G: M40, Junction 9

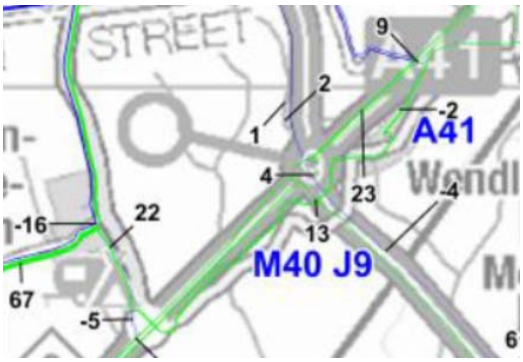
4.1 M40 J9 acts as a strategic link between the M40 motorway and A34, which links Oxford and Bicester. As a result of already allocated growth in the area, vehicle flows are forecast to increase through this junction (increases of +11% in the 2031 AM Peak Period and +24% in the PM Peak Period). In the Do Minimum scenario for 2031, this junction is forecast to operate between 85%-95% of its design capacity in the AM peak, with the M40 southbound approach to the junction operating over 95%. Delays of 134-151 PCUH are forecast as a result.

Potential impact of development

4.2 When the additional development proposals for accommodating Oxford's unmet housing need are considered without any associated transport improvements, the strategic transport model predicts a small increase in travel delay (+7 PCUH) in the PM peak, which equates to a 5% increase relative to the model's forecast for what could happen in 2031 based on already committed growth. Figure 45 shows how these relatively small changes in traffic volumes result in no change to volume:capacity ratio on the southbound approach to M40 J9 (which already exceeds 95% of its design capacity in the AM peak of the 'Do Minimum' scenario for 2031 – comprising already committed growth, without any additional development allocations). Overall, in both the AM peak and the PM peak the M40 junctions are forecast to operate similarly to how they would without the additional housing growth (~ 130 passenger carrying units per hour of delay in the AM and ~150 PCUH in the PM).



Development Package A4 – Do Minimum Flow Difference AM Peak (Figure 43)



Development Package A4 – Do Minimum Flow Difference PM Peak (Figure 44)

	
Development Package A4 AM peak hour volume to capacity forecast (Figure 45)	Development Package A4 PM peak hour volume to capacity forecast (Figure 46)

Options considered to address potential impact and main issues raised through plan preparation

4.3 The findings from this, and previous, work suggest that modelled improvements to add capacity at M40 J9 can accommodate most of the committed local growth allocations. However, this needs to be caveated by an understanding that suppressed demand could be unlocked as a result of any improvements. It is also possible that unrelated, localised trip generation arising from growth around Bicester and/or increasing freight and other business traffic volumes (not considered in Highways England's junction modelling) could have a similar effect.

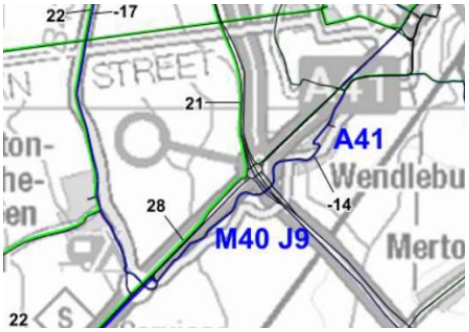
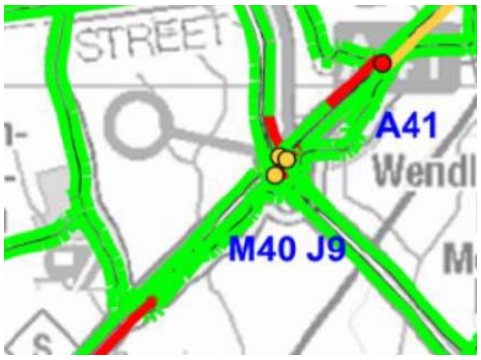
4.4 No specific mitigation options were proposed for M40 Junction 9, in view of its distance from the proposed growth sites and given the homes are intended to serve Oxford's growing economy. As such the transport modelling tested whether the cumulative impact of growth in the area, and specific local and strategic transport improvement packages, would impact on the M40 J9.

Forecast impact of mitigation

4.5 The forecast impact of transport improvements focused on Kidlington and North Oxford predicts a 1% reduction in delay (-1 PCUH) at M40 J9 in the AM peak and no change in the PM peak relative to what is otherwise predicted to occur in 2031. This is reflected in the marginally different vehicle flow estimates (Figures 47 and 48), and the near-identical volume to capacity ratio visuals in Figures 49 and 50. Residential development at the additional growth locations being considered is not therefore anticipated to have an appreciable impact on the operation of M40 J9.

4.6 Although Oxford-Bicester will be a key bus-based public transport corridor (running via M40 Junction 9) and a significant increase in public transport use is predicted to occur by 2031 (a 12-fold rise in bus and rail use in the AM Peak), the bulk of this increase focuses on the recently-opened East West Rail connection. These changes in travel patterns were captured in the 'Do Minimum' model tests which considered what might happen to as a result of already committed growth and transport improvements to 2031.

4.7 The additional inclusion of the Super Cycleway from Kidlington to Oxford City Centre, and public transport improvements serving the proposed growth locations were not found to have any direct impact on the operation of M40 J9. This reflects their relative distance from the junction and the fact that the growth is intended to cater for Oxford's growing economy.

	
Transport Improvement Package 2 – Do Minimum Flow Difference AM Peak (Figure 47)	Transport Improvement Package 2 – Do Minimum Flow Difference PM Peak (Figure 48)
	
Transport improvements package 2 AM Peak volume to capacity forecast (Figure 49)	Transport improvements package 2 PM Peak volume to capacity forecast (Figure 50)

Residual issues for consideration

4.8 The strategic transport model predicts that M40 J9 will continue operating at a high level of its design capacity in the AM and PM peak periods for a 2031 scenario that contains both additional development and complementary transport improvements. This is consistent with the 'Do Minimum' scenario for 2031, also tested in the model, which contains only already committed Local Plan growth (i.e. no additional development or transport improvements) from across Oxfordshire.

4.9 So, while residual capacity issues do appear to exist on the southbound slip-road of the M40 at J9, and on the roundabout itself, the contribution to this from trips associated with additional development being considered around Kidlington, Begbroke and Yarnton is considered to be negligible.

H: A34/A41 (between Bicester and Oxford)

4.10 The A34 and A41 serve as a strategic link between Oxford and Bicester. They intersect the M40 motorway at Junction 9 (see above) and carry considerable flows of both local and national (notably to/from Newbury, Winchester and Southampton) vehicle traffic, as well as bus and coach services.

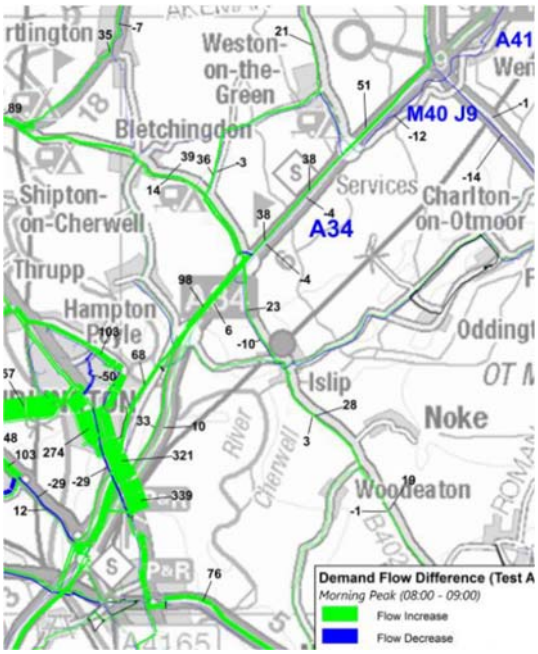
4.11 In the Do Minimum scenario for 2031, significant delays are forecast on the A34/A41 (227 PCUH in the AM peak and 333 PCUH in the PM peak). The Do Minimum scenario forecasts that, between the B430 and Pear Tree interchange, the southbound carriageway is operating at 85-95% or over 95% of its design capacity during the AM peak, with capacity issues also predicted northbound between the B4027 and B430. The model predicts a broadly inverse trend in the PM peak, with congestion northbound between Pear Tree interchange and the B430. The southbound carriageway between the B4027 and Oxford Road is also predicted to be operating at 85-95% of its design capacity in the PM peak.

Potential impact of development

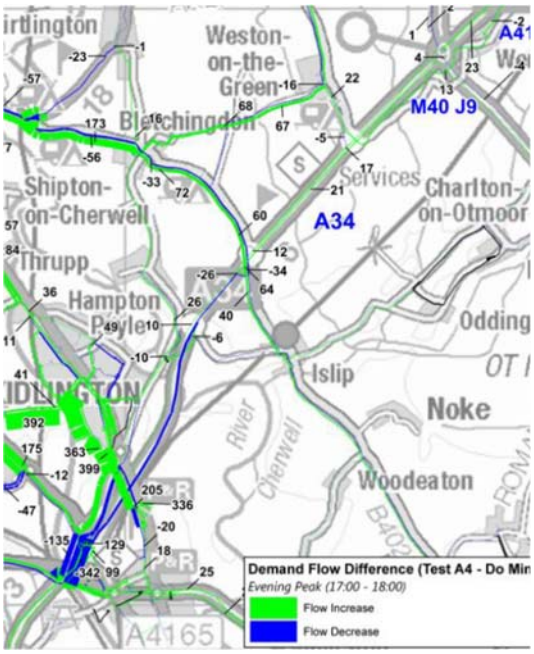
4.12 When additional development proposals to accommodate Oxford's unmet housing need are considered without any associated transport improvements, the strategic transport model predicts a small increase in travel delay in the AM peak (+3 PCUH, a 2% increase) and in the PM peak (+8 PCUH, a 5% increase) relative to the model's forecast for 2031 based on already committed growth. Figure 51 and Figure 52 show how these forecast changes in vehicle trips are predicted to have a relatively minor impact on traffic volumes along the A34/A41 corridor, between Bicester and Oxford. The largest increase in vehicle flows (+98 vehicles) appears on the northbound section

of the A34, between the Oxford Road and B4027 junctions between 8am and 9am in the AM peak.

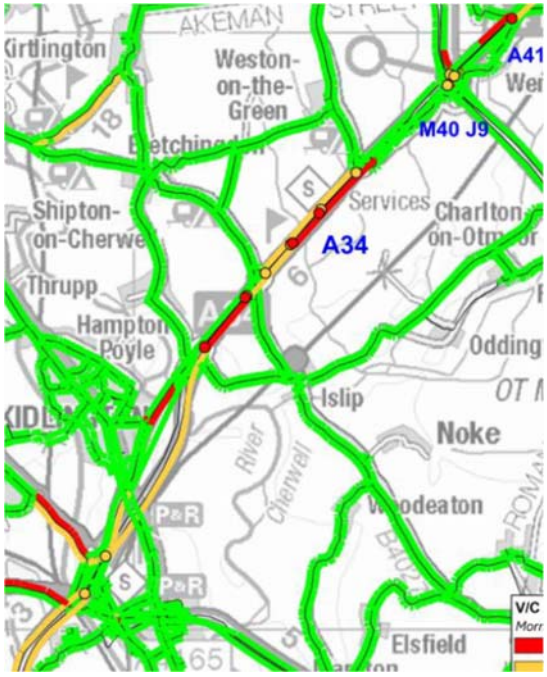
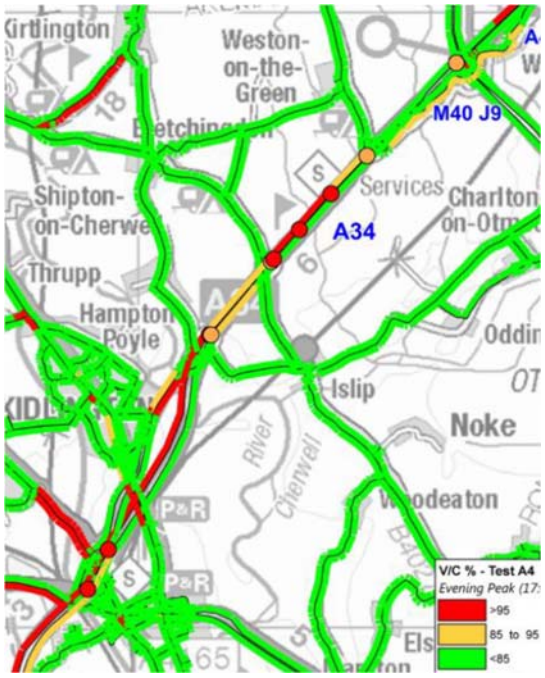
4.13 Figure 53 shows that, in the AM peak, much of the A34 southbound (and its junctions – see following sections) is forecast to operate at or beyond 95% of its design capacity from the M40 down to the Kidlington junctions. Heading south beyond the Kidlington Rd/Bicester Rd junction with the A34, the strategic transport model predicts the A34 will operate between 85% and 95% of its design capacity in a southbound direction through and beyond the Pear Tree interchange. The AM peak's northbound flow along the A34 is forecast to be less-severely congested. The section immediately to the south of Pear Tree interchange is predicted to operate between 85% and 95% of its design capacity, along with the section between the B4027 and B430 junctions. Figure 54 shows the model predicts a broadly inverse trend in the PM peak, with Pear Tree interchange and northbound sections of the A34 adjacent to it predicted to operate beyond 95% of their design capacity.



Development Package A4 – Do Minimum Flow Difference AM Peak (Figure 51)



Development Package A4 – Do Minimum Flow Difference PM Peak (Figure 52)

	
Development Package A4 AM peak hour volume to capacity forecast (Figure 53)	Development Package A4 PM peak hour volume to capacity forecast (Figure 54)

Options considered to address potential impact and main issues raised through plan preparation

4.14 No specific A34 highway or junction capacity improvements are included in the packages of transport measures proposed to help accommodate the additional development being considered around north Oxford and Kidlington. This is based on the principles set out in the Connecting Oxfordshire Local Transport Plan 4, which observes the need for a step-change in transport funding and delivery given that continuing to add highway capacity simply unlocks greater demand for private car trips with considerable social and environmental costs. Instead, the proposed improvements focus on:

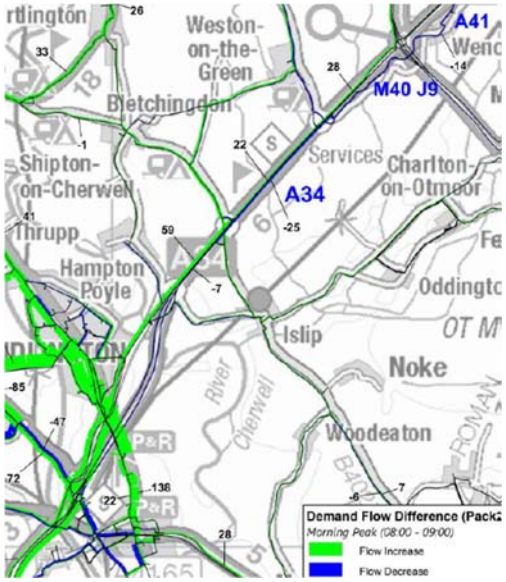
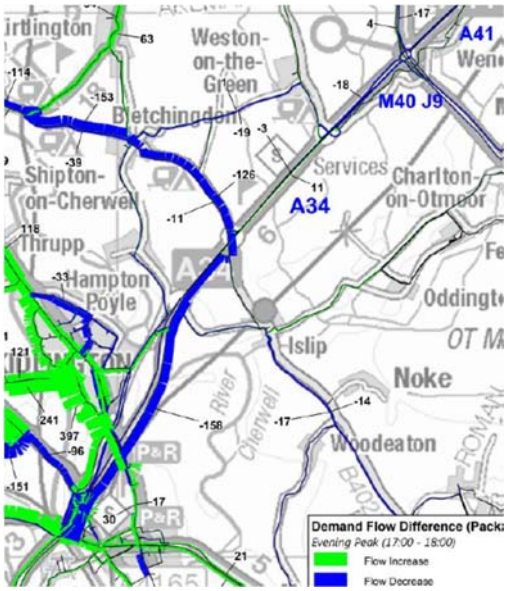
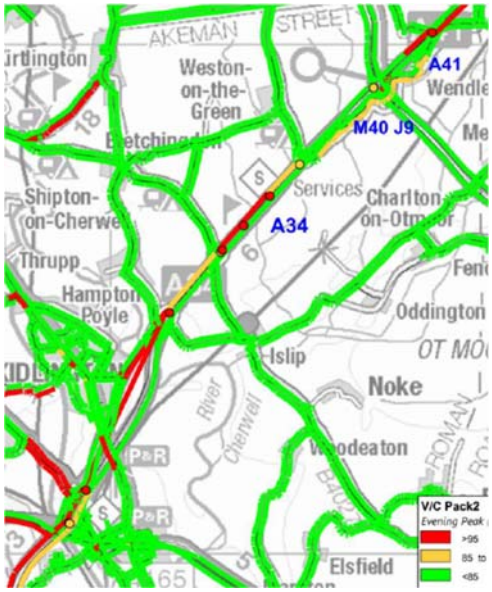
- Maximising the capacity and priority given to public transport services operating into the centre of Oxford, so as to provide a rapid and reliable alternative to private car travel for people accessing jobs and other opportunities.
- Delivering a high-quality, segregated Super Cycleway that connects proposed additional development locations with Kidlington, north Oxford employment and residential sites, Summertown, High Town and Oxford city centre.

4.15 While not everyone will be able to cycle, or use enhanced public transport services to reach their destinations, such improvements are expected to make it easier for both new and existing residents and visitors to switch from private car travel on their journeys. As such they should free-up roadspace and peak hour capacity for everyone, and reduce pressure on the A34 from local trips.

Forecast impact of mitigation

4.16 The strategic transport model forecasts the additional transport improvements in Kidlington and North Oxford will result in a 1% reduction in delay (-4 PCUH) in the PM peak and no change in the AM peak, compared with a 2031 scenario in which neither the additional growth, or transport improvements, are delivered. This is reflected in Figure 55 and Figure 56, which show decreases in AM peak southbound movements along the A34, the largest of which is -25 vehicle trips between the B430 and B4027 junctions with the A34. In the PM peak a more significant reduction (-158 vehicles) is predicted on the A34 southbound between Islip and Pear Tree Interchange.

4.17 Figure 57 and Figure 58 show that, while the A34 is predicted to continue operating beyond 85%, or 95%, of its design capacity in places (notably, southbound in the AM peak and northbound in the PM peak) there are some areas where the reduction in vehicle trips is forecast to have a positive impact. In the AM peak the southbound section of the A34, between the B4027 junction and Pear Tree interchange, is predicted to become less congested, along with the A34's junction with Islip Rd /Kidlington Rd. A similar pattern is evident in the PM peak, with some reduction in congestion evident between Pear Tree interchange and the Islip Rd/Kidlington Rd junction with the A34.

	
Transport Improvement Package 2 – Do Minimum Flow Difference AM peak (Figure 55)	Transport Improvement Package 2 – Do Minimum Flow Difference PM peak (Figure 56)
	
Transport improvements package 2 AM peak volume to capacity forecast (Figure 57)	Transport improvements package 2 PM peak volume to capacity forecast (Figure 58)

Residual issues for consideration

4.18 The strategic transport model predicts that, in the AM peak, the southbound sections of the A34 from M40 J9 towards Oxford will continue to operate with limited spare capacity if the additional development and transport improvements are implemented.

The same is true (in the opposite direction) in the PM peak, while the A34 is forecast to continuing operating at more than 85% or 95% of its design capacity south of Pear Tree interchange in both AM and PM periods.

4.19 This is consistent with projections for 2031 that do not contain any additional development or associated transport improvements. It suggests the additional development around north Oxford, Kidlington, Begbroke and Yarnton is effectively being mitigated by the package of complementary transport improvements proposed to accompany this growth, while improving public transport and cycling options for new and existing residents travelling into Oxford from these areas.

4.20 This work highlights that delivering viable alternative travel options to private car use in order to better connect settlements north of Oxford with employment and other opportunities in the city's urban area should be a priority irrespective of whether or not Oxford's unmet housing need is met in south Cherwell. Targeted junction capacity improvements and widening of the A34 north of Oxford are likely to have limited positive impact, due to a lack of highway capacity to the south of Pear Tree interchange (which is challenging to resolve, e.g. around Botley interchange and North Hinksey). It is also unclear what longer-term impact the Oxford – Cambridge Expressway might have on traffic congestion along the A34 to the north of Oxford.

4.21 The strategic nature of the Pear Tree interchange, and the fact it is projected to operate over its design capacity in 2031 with or without transport improvements, suggests that a more significant package of improvements may be required here. Monitoring the impact of nearer-term proposals to improve the Pear Tree interchange (announced in 2014) and Highways England's work to forecast the impact of the Oxford – Cambridge Expressway (announced in 2017), could help to inform the extent of further improvements.

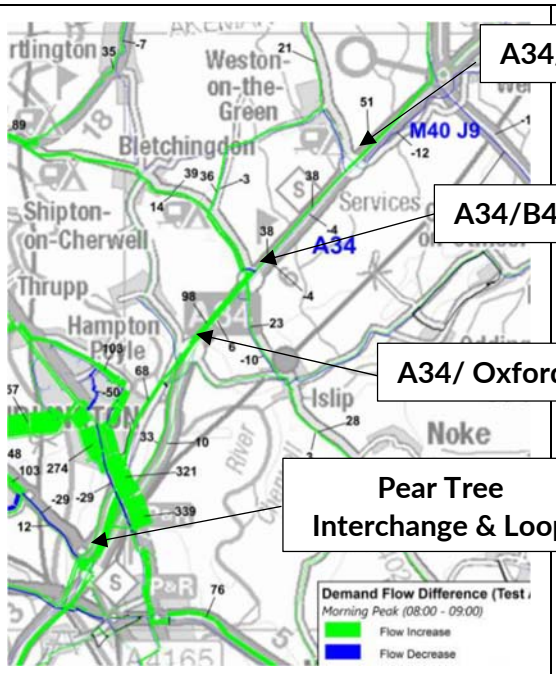
I: A34 Junctions north of Oxford

4.22 The A34 and A41 serve as a strategic link between Oxford and Bicester, with the junctions between Pear Tree Interchange and M40 Junction 9 providing access onto the strategic network for the villages and residential areas lying to the north and south of the A34 corridor. The Do Minimum modelling scenario for 2031 indicates that these junctions are expected to operate at 85-95% or over 95% of their design capacity in both peak hours.

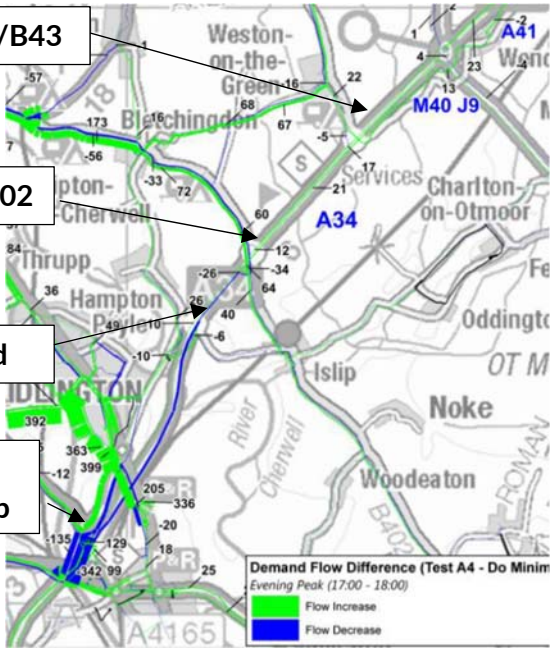
Potential impact of development

4.23 Figure 61 and Figure 61 shows that all of the junctions along the A4 corridor (A34/B430, A34/B4027, A34/Oxford Road and Pear Tree Interchange/Loop Farm Roundabout) are forecast to be operating at or over capacity in both the AM peak and PM peak. Overall congestion appears to be worse in the PM peak than the AM peak. However, as noted above the Do Minimum forecasts show that the A34 is already likely to be over capacity at junctions between Kidlington and the M40 Junction 9.

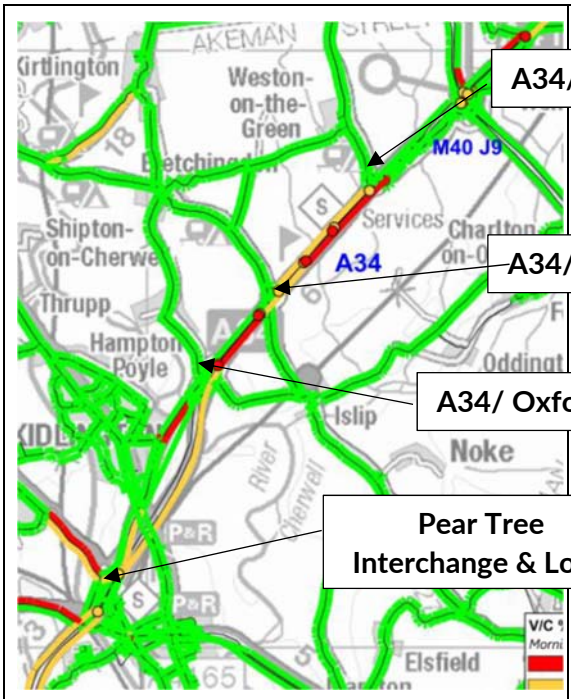
4.24 Figure 59 and Figure 60 show how the additional dwellings are predicted to have a relatively minor impact on traffic volumes on the links feeding into these junctions. More significant impacts are observed around the Pear Tree Interchange & Loop Farm Roundabout during the PM peak, with increased flows of up 129 vehicles on some links and decreases of up to 342 vehicles on others.



Development Package A4 – Do Minimum Flow Difference AM Peak (Figure 59)



Development Package A4 – Do Minimum Flow Difference PM Peak (Figure 60)



Development Package A4 AM peak hour volume to capacity forecast (Figure 61)	Development Package A4 PM peak hour volume to capacity forecast (Figure 62)

Options considered to address potential impact and main issues raised through plan preparation

4.25 As noted above, in relation to links along the A34, no specific A34 highway or junction capacity improvements are included in the packages of transport measures proposed to help accommodate the additional development being considered around north Oxford and Kidlington. Instead, the proposed improvements focus on:

- Maximising the capacity and priority given to public transport services operating into the centre of Oxford, so as to provide a rapid and reliable alternative to private car travel for people accessing jobs and other opportunities.
- Delivering a high-quality, segregated Super Cycleway that connects proposed additional development locations with Kidlington, north Oxford employment and residential sites, Summertown, High Town and Oxford city centre.

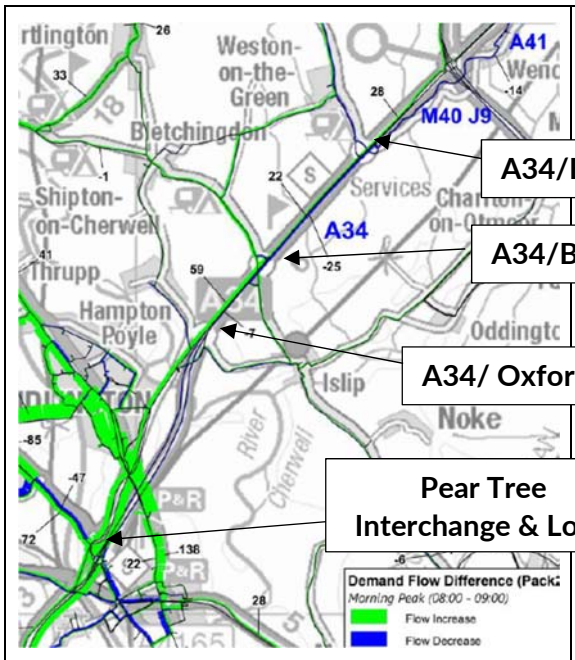
Forecast impact of mitigation

4.26 The strategic transport model forecasts the additional transport improvements in Kidlington and North Oxford will result in a reduction in PM peak southbound movements along the A34, the largest of which is -158 vehicle trips between the

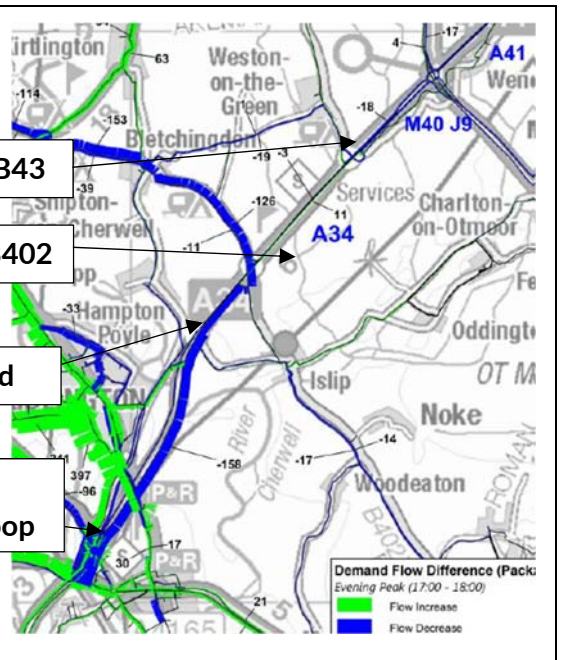
A34/B4027 junctions and Pear Tree Interchange (see Figure 64). Reduced traffic flows are also predicted on the B4027 towards Bletchingdon (-137 vehicles). Smaller reductions in vehicle flows (-25) are predicted on the A34 in the AM peak (Figure 63). These reduced traffic volumes may help ease the operation of these junctions and the A34/Oxford Road junction.

4.27 Figure 65 shows while several of the junctions along the A34 are predicted to continue operating beyond 85%, or 95%, of their design capacity (notably, southbound in the AM peak and northbound in the PM peak) there are some areas where the reduction in vehicle trips is predicted to positively effect congestion levels. In the AM peak, the A34/B430 and Loop Farm Roundabout are forecast to operate within free-flow capacity (volume:capacity ratio below 85%), and congestion levels are expected to reduce at the A34/Oxford Road junction (operating at 85%-95%). While conditions are forecast to improve at Loop Farm, the neighbouring Pear Tree Interchange is predicted to remain over capacity in the AM peak (as noted elsewhere in this topic paper).

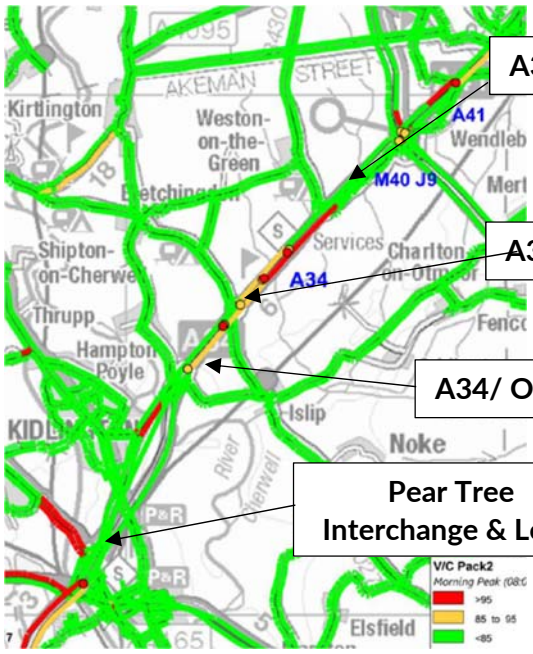
4.28 In the PM peak (Figure 66) the additional transport improvements are forecast to have a relatively minor impact on the operation of the A34 junctions being, with the exception of Pear Tree Interchange which is expected to improve slightly (volume:capacity ratio decreases from over 95% to 85-95%) and the A34/Oxford Road junction, where congestion is predicted to worsen slightly.



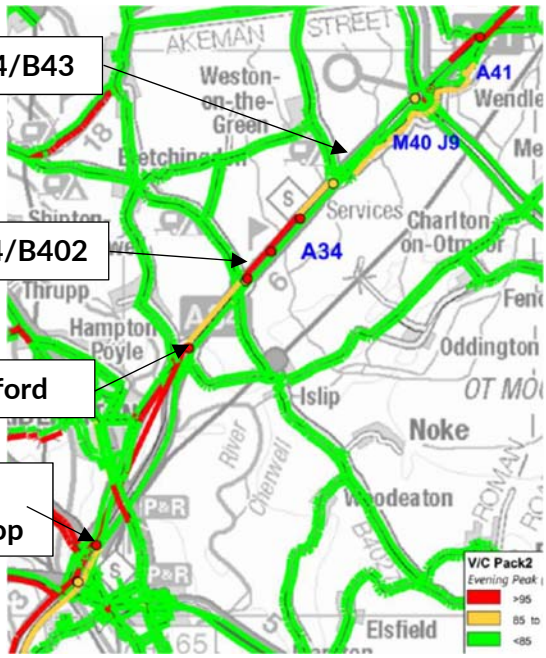
Transport Improvement Package 2 – Do Minimum Flow Difference AM peak (Figure 63)



Transport Improvement Package 2 – Do Minimum Flow Difference PM peak (Figure 64)



Transport improvements package 2 AM peak volume to capacity forecast (Figure 65)



Transport improvements package 2 PM peak volume to capacity forecast (Figure 66)

Residual issues for consideration

4.29 The strategic nature of the Pear Tree interchange, and the fact it is projected to operate over its design capacity in 2031 with or without the proposed transport improvements, suggests that a more significant package of improvements may be required here. Monitoring the impact of nearer-term proposals to improve the Pear Tree interchange (announced in 2014) and the potential impact of the Oxford – Cambridge Expressway (announced in 2017), could help to inform the extent of further improvements.

4.30 Other than at the Pear Tree interchange, the junctions along the A34 to the north of Oxford are forecast to function similarly with the proposed additional development and associated transport improvements as they are predicted to in 2031 without them (the Do Minimum scenario). This suggests the bulk of additional trips arising from the additional development being considered will be accommodated through capacity created by the proposed packages of strategic transport improvements.

5. Forecast impact of the A40/A44 link road from a Cherwell additional growth perspective

5.1 The A40/A44 link road is included in the Do Minimum scenario for 2031. OCC's modelling consultants also tested a scenario that included the additional growth in Cherwell and associated transport improvements, but with the A40/A44 link road removed (scenario 5).

5.2 Table 5-1 compares the delays forecast in 2031 with the A40/A44 link (scenario 3) and without the link (scenario 5). It presents a mixed picture overall, with eight links forecast to experience a worsening of delay in either the AM or PM peak period and five links predicted to yield some improvement in delay during these periods. In aggregate delay terms (summing changes in PCUH delay across all of these key links/junctions, but not across the whole network), the A40/A44 link road is forecast to achieve:

- A gross reduction in delay of -51 PCUH across the AM and PM peak hours.
- A gross increase in delay of +24 PCUH across the AM and PM peak hours.
- A net reduction in delay of -27 PCUH across the AM and PM peak hours

Table 5-1: Impact of A40/A44 Link Road

		Delay (PCUH)				
Link	Peak Period	Do Minimum	Scenario 3 (with link)	Scenario 5 (without link)	Difference (S3-S5) in delay	% difference in delay
A34/A41	AM	227	228	229	-1	-0.4%
	PM	333	329	325	4	1.2%
A44 Woodstock - Oxford	AM	189	231	220	11	4.8%
	PM	316	332	366	-34	-10.2%
A4095 Kirklington - Bladon	AM	46	55	52	3	5.5%
	PM	56	74	78	-4	-5.4%
A4260 Shipton - Oxford	AM	70	73	71	2	2.7%
	PM	115	125	131	-6	-4.8%
M40 Junction 9	AM	134	133	132	1	0.8%
	PM	151	151	150	1	0.7%
Sandy Lane	AM	2	3	3	0	0%
	PM	3	14	20	-6	-42.9%
Langford Lane	AM	6	7	6	1	14.3%
	PM	31	16	15	1	6.3%

Green = reduced delay with A40/A44 link; Red = increased delay with A40/144 link.

5.3 Comparing Volume:Capacity maps for the scenarios with and without the A40/A44 link road, also suggests it will have a negligible impact on the performance of the links and junctions reviewed in this note. This direct comparison includes the additional growth being considered in Cherwell and the associated transport improvements. As such it indicates that, with the proposed package of transport improvements and spatial allocation of growth around North Oxford, Kidlington and Begbroke; the A40/A44 link road is not a critical requirement for Cherwell to accommodate this additional growth.

Appendix B

Local Plan Partial Review response to national policy and guidance

Transport Topic Paper: Evidence for Cherwell Local Plan (Part 1) Partial Review

NPPF/NPPG	Influence on plan making
NPPF Paragraph 14 **Presumption in favour of sustainable development**	Cherwell District Council has sought to meet positively Oxford's unmet housing needs. The Local Plan Partial Review plans for the 4,400 homes apportioned to Cherwell by the Oxfordshire Growth Board and identifies the infrastructure and means to deliver the plan's growth.
NPPF Paragraph 17 Patterns of growth **NPPF Section 4 Promoting sustainable transport**	The Submission Plan directs development to areas with good accessibility by sustainable transport modes or where these can be provided. It makes the fullest possible use of public transport, walking and cycling, and focuses development in locations which are, or can be, made sustainable. Cherwell District Council, with advice from ITP and working with Oxfordshire County Council (in its role as the local transport authority), has identified infrastructure projects supporting the overall transport strategy in the Submission Plan and area strategies in the Local Transport Plan (LTP4). Details are included in the main body of this Topic Paper. The following policies have been informed by and will help deliver sustainable patterns of growth and transport and sustainable: Submission Plan Policies PR4a: Sustainable Transport, PR4b: Kidlington Centre, PR5: Green Infrastructure, PR11: Infrastructure Delivery and all site-specific Submission Plan's policies. Other relevant adopted Local Plan polices such as SLE4: Improved Transport and Connections will also promote sustainable transport aims.
NPPF Paragraph 31 **Working with neighbouring authorities and transport providers**	The District Council has, and continues to, work with neighbouring authorities and transport providers on the provision of viable infrastructure to deliver growth. Refer to the main body of this Topic Paper and the Duty to Cooperate Topic Paper (evidence document PR 90). Differences in long term planning for Local Plans and DfT/Highways England Road Investment Strategies (RIS) will mean that engagement with Highways England and Oxfordshire County Council as the local transport authority will be necessary on an ongoing basis. This should ensure that planned growth is considered in the 5-year RIS, and incorporated in the Council's Infrastructure Delivery Plan throughout the lifetime of the Submission Plan. Such matters will include Government's progress on RIS2 (Consultation ended in February 2018) and the progression of Oxford to Cambridge Expressway to more detailed stages.
NPPF paragraph 157 **Plan positively for development and infrastructure**	Cherwell District Council has planned positively for the development and infrastructure required to address Oxford's unmet housing need in Cherwell with an infrastructure schedule supporting 4,400 new homes and working jointly with the six Oxfordshire local authorities through the Oxfordshire Growth Board to identify and plan for County wide infrastructure. Refer to the main body of this Topic Paper and the Duty to Cooperate Topic Paper (evidence document PR90)
NPPF paragraphs 162	The Council has paid due attention to the assessment of transport infrastructure and taken into account strategic infrastructure needs in the

NPPF/NPPG	Influence on plan making
Assessing infrastructure	North Oxford/ South Cherwell Area. This is detailed in the body of this Topic Paper and the Council's Transport Assessment (evidence document PR52). The Council has worked with other local authorities and infrastructure providers on the preparation of its Infrastructure Schedule and cross boundary spatial planning matters including the identification of Countywide infrastructure in the Oxfordshire Infrastructure Strategy November 2017 (evidence document PR82) and Duty to Cooperate meetings with Highways England throughout the plan preparation. Refer to Duty to Cooperate Topic Paper (Evidence document 90).
NPPF paragraphs 173 and 177 **Using a proportionate evidence base: Ensuring viability and deliverability**	The Council has paid due attention to the development viability and costs in plan-making and has worked with other local authorities and infrastructure to identify the plan's infrastructure needs and the funding sources to deliver them (see Section 5 of the Transport Topic Paper for details). The Submission Plan proposals have been informed by a viability assessment considering development viability in relation to the Submission Plan's proposals (evidence document PR49). The viability assessment results indicate site specific infrastructure can be supported by the development proposed in the Submission Plan. The Council and its consultant have used a proportionate evidence base to inform the plan preparation and followed guidance in the NPPG for Transport evidence bases (Table 2-1 of this Topic Paper). The transport scheme proposals were devised alongside the Submission Plan preparation and the Plan's Infrastructure Schedule indicates estimated costs known to date. The Council has, and continues to, work with Oxfordshire County Council as the local transport authority, in conjunction with other partners (such as Network Rail, Highways England, and local public transport operators), to secure the delivery of infrastructure. This collaborative work has resulted in a Countywide infrastructure strategy, which incorporates the Submission Plan's infrastructure schemes (OxIS November 2017, evidence document PR82). The Oxfordshire Infrastructure Strategy (OxIS) secured approval on 15 March 2018 from the Ministry of Housing, Communities and Local Government as part of the Oxfordshire Housing and Growth Deal (confirmation letter included on the next page). The Deal provides a 5 year (2018-2023), £215 million funding package for addressing affordable housing and transport infrastructure in the county. The Submission Plan's transport schemes are included in this Deal, and the necessary private and public funding mechanisms (Table 5-1 and paragraphs 5.1-5.16 in the Topic Paper) have been identified to help deliver the Plan from 2021. As such there is a strong public funding commitment from the District Council, its partners and Central Government to ensure infrastructure is delivered.
NPPG: Transport evidence bases in plan making and decision taking	The potential transport impacts associated with the Submission Plan proposals have been considered at each stage of the plan review process. This is detailed in Table 2-1 'Transport evidence in this Local Plan Review process' in the main body of the Transport Topic Paper.

Ministry of Housing, Communities & Local Government

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Leader, Oxfordshire County Council
Leader, West Oxfordshire District Council
Leader, Cherwell District Council
Leader, Vale of White Horse District Council
Leader, South Oxfordshire District Council
Leader, Oxford City Council
Chair, Oxfordshire Local Enterprise Partnership

15 March 2018

Dear Leaders,

A housing and growth deal for Oxfordshire

Thank you for your letter of 28 February 2018, to the Secretary of State concerning Oxfordshire's Housing and Growth Deal, I am replying as the Minister for Housing. I am pleased to note that the deal has been approved by all six Oxfordshire councils and the Oxfordshire Local Enterprise Partnership.

I welcome your plans to deliver 100,000 homes by 2031 – well in excess of the published figures in our draft NPPF published last week - and your commitment to adopting a joint statutory spatial plan by 2021. I have been impressed with the collaborative approach you have taken to develop the deal. It will be of benefit to local people across Oxfordshire, whilst setting an ambition for housing delivery which other areas should seek to replicate.

It will be essential to ensure that the homes committed through the deal get delivered. You have committed to bring forward for adoption a joint statutory spatial plan by 2021 to deliver 100,000 homes by 2031 and to deliver 14,000 homes directly from the infrastructure funding provided by the deal and a further 1322 affordable homes from the affordable homes grant. I am therefore pleased to approve the delivery plan. My officials and Homes England will continue to work with you to track implementation of the deal and funding will be contingent on the milestones in the delivery plan being met. I hope to be able to visit Oxfordshire in the coming weeks, to publically sign off the deal.

I would like to thank you for the significant amount of work done to get to this stage and for the collaborative approach your councils have demonstrated when working with my officials. I look forward to a productive and on-going relationship between Oxfordshire and Government, as we continue to work together to build the homes this country needs.

Yours sincerely,

[redacted]

Appendix C

Post Submission OSM model test: Sandy Lane reclassification

Transport Topic Paper: Evidence for Cherwell Local Plan (Part 1) Partial Review

Post Submission OSM Model Test: Sandy Lane Reclassification

Project:	Begbroke - Local Plan Allocation		
Subject:	Post Submission OSM Model Test: Sandy Lane Reclassification		
Author:	Yan Zhu/Wei Wang	Atkins No.:	Version 5
Date:	18/01/2019	Icepac No.:	
		Project No.:	5167454
Distribution:	OCC	Representing:	

1. Introduction

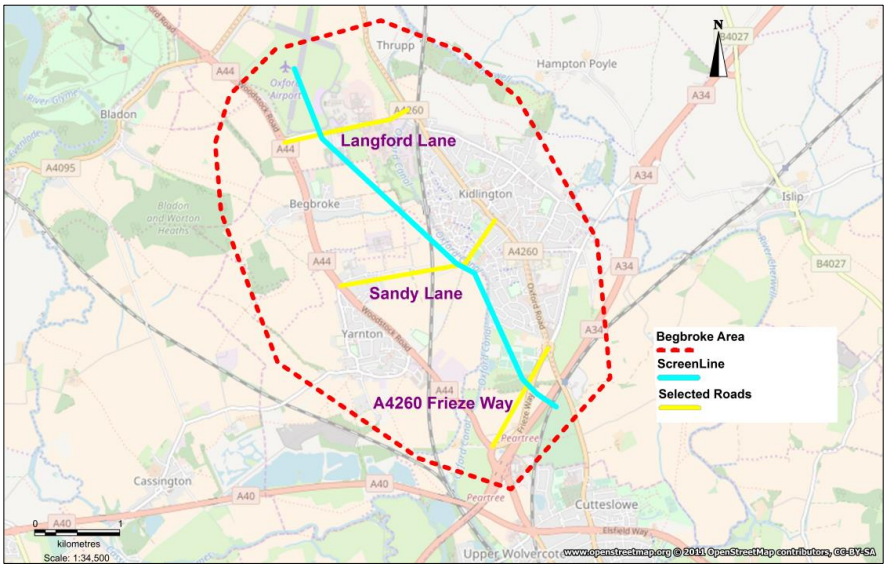
Oxfordshire County Council (OCC) has requested Atkins to assess the impacts of model enhancement for Sandy Lane and its surrounding area in both base (2013) and forecasting year (2031). The results from a refreshed Oxfordshire Strategic Model (OSM) demand model run have been compared with the previous 2031 Cherwell Local Plan Stage 2 (Scenario 3) model run, which was carried out in May 2018.

This technical note summaries the work undertaken for the model named as Post Submission with Sandy Lane flow reduced, including following aspects:

- A review of the OSM base year (2013) highway model to interrogate the model behaviour in the surrounding area of Begbroke, including journey time, local traffic routings, network condition along Sandy Lane and parallel competing routes including Langford Lane in the north and A4260 Frieze Way in the south (see Figure 1-1);
- A network update on Sandy lane and a series of key junctions in the region to have a more realistic network representation of physical constraint on Sandy Lane itself, local traffic access and routings;
- Demand adjustments by select link analysis to have a close match of traffic flow with observed traffic counts on Langford Lane, with highway demand increased marginally in the base year;
- A rebuild of the base year demand model databank including demand matrices and a cost inputs update;
- A forecasting year network and trip ends update and the relocation of zone 8535 specifically for Begbroke development; and
- A rerun of the OSM demand model for future year 2031 and extraction of results for comparison.

Figure 1-1 shows the proposed study area contained in the red dotted cordon. A North-South screenline is also formed, which cuts through three competing routes including Langford Lane, Sandy Lane, and A4260 Frieze Way. The screenline is the focus for detailed examination and model comparison for this commission.

Figure 1-1 Begbroke area and North-South screenline crossing three key roads



2. Issues Identified

2.1. Sandy Lane – Yarnton Road narrow bridge

During the model review process, it was recognised that the current highway network coding doesn't capture the impact of the narrow bridge crossing between Sandy Lane and Yarnton Road. The travel time along Sandy Lane and Yarnton Road in the existing base year model appeared overly optimistic, when compared to what Google map provided. This has now been fully addressed by introducing a one-way signal traffic management at a related node, which then helps to model both travel time and link capacity sensibly. It was also noted that although there is a railway level crossing in the middle of Sandy Lane, it would be difficult to measure traffic delays at that point and so the impact of the level crossing is not explicitly captured and assessed in the model. However, a sensitivity assignment run shows that travel time along Sandy Lane is modelled in line with observed data.

2.2. Access to the residential area of Begbroke along A44

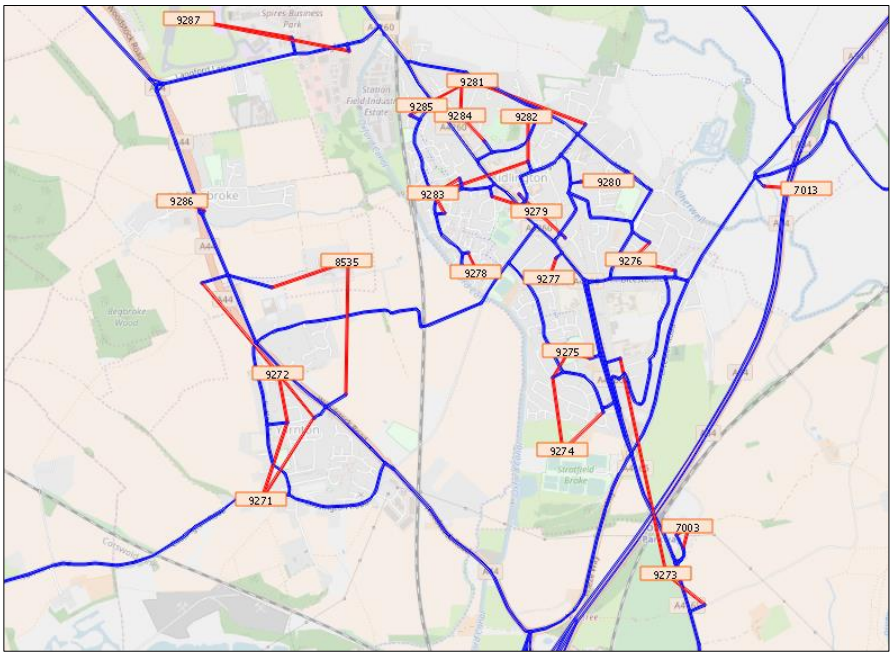
A series of selected link analysis (SLA) were carried out to have a better understanding of demand distribution in the region and routing sense checks. It was revealed that there is unexpected traffic routing from the A34/A44 northbound off-slip road to Begbroke, with a large proportion of traffic travelling along A4260 then following Langford Lane westbound, rather than going directly along A44 northbound. The issue is now solved with a network change at A44/Fernhill Road roundabout to allow all turnings together with other minor changes elsewhere. Inevitably, these network changes have a noteworthy impact on the traffic flow assigned on these three key roads. When comparing to the traffic counts received from OCC recently for the ongoing North Oxford model update, it was found that Langford Lane has a great shortfall in flows for both directions, with westbound traffic reduced significantly following the network changes. Some demand adjustments were then undertaken for all three modelled time periods to achieve a reasonable screenline and individual link flows in the base year, which are then be brought into the revised forecasting model.

2.3. Begbroke development zone representation

In the original demand model, the proposed Begbroke development was attached to an existing zone (9286), which was close to its location. The traffic generated by the proposed development was then extracted following a full demand model run and a post demand process with the development trips being allocated to a new zone, followed by a fixed assignment. This is an awkward and error prone process.

This procedure now has been revised by directly allocating a new zone (8535) in Begbroke to the north of Sandy Lane and connecting it to the network in both base and future year to have new developments physically represented by this new zone. This reduces the complexity of post processing and reflects the traffic assignment in a more straightforward way. As OCC intends to close Sandy Lane for car traffic and proposes a cycling/pedestrian route, zone 8535 is only connected to the A44 instead of Sandy Lane. Figure 2-1 illustrates the network changes in the forecasting year (2031).

Figure 2-1 Highway network structure around Sandy Lane



3. Base year traffic validation

The two tables in Appendix A (**Appendix A**

Table A-1 and

Table A-1) present comparisons between modelled flow and observed traffic counts in vehicles before and after undertaking the proposed enhancements specified in section 2 to tackle the identified issues.

Table A-1 provides a set of much improved and satisfactory GEH values meeting the standard (<=5) in the Web Transport Appraisal Guide (WebTAG) for the total modelled flows crossing the screenline by direction when compared against the observed count data. Along individual routes, both Langford Lane and Frieze Way generate much closer traffic flows compared to the observed data with improved GEH values; whilst Sandy Lane sees improvement in northbound traffic flows, though southbound traffic has deteriorated to a certain extent after the enhancements. All in all, the traffic flows generated around the Begbroke area are more reasonably close to observed counts in base year after the model enhancement.

4. Demand model inputs

4.1. Begbroke development trip ends

Under this commission, the future year (2031) scenario to be re-tested is the Cherwell Local Plan Stage 2 Scenario 3, as defined in the report "TN - 5155363 - Cherwell Local Plan S2_Issued15062017.pdf" issued by Atkins and signed off by Oxfordshire County Council, as shown in the Table 4-1 below.

The Begbroke development, represented as zone 8535 in the OSM zoning system, consists of a total of 1950 houses and 45000 sqm office space. The derived personal trip ends in association with the Begbroke development by origin and destination for car, bus and rail in each modelling AM, IP and PM period are shown in Table 4-2, based on the agreed trip rates in the OSM demand model. In general, private car is the dominant mode for Begbroke motorised development trips, which has a share of more than 90% across all three modelled time periods.

Figure 4-1 shows an example of the mode share in the AM peak for departure and arrival trips for the development.

Table 4-1 Summary of 2031 Cherwell Local Plan Stage 2 Scenario 3 assumptions

Scenario description	Scenarios	Land Use Assumptions	Transport intervention
New Land Use scenario + transport mitigation	3	Combined housing scenario (Do Minimum + 4400 households in Cherwell)	Transport Improvement Package 2

Table 4-2 – Begbroke development trip ends (persons) inputs in 2031

Time Period	Car		Bus		Rail	
	Destination	Origin	Destination	Origin	Destination	Origin
AM period (7-10)	1519	1840	46	111	36	94
IP period (10-16)	2869	2756	85	86	63	61
PM period (16-19)	1893	1846	88	42	79	35

Figure 4-1 Begbroke mode share in 2031 (reference case) in AM peak period (7-10)

4.2. Demand model run

The demand model settings in the revised Cherwell Local Plan Stage 2 (Scenario 3) model are almost identical to the previous model, except for the following key changes:

- Network changes on Sandy Lane and adjacent junctions plus the Begbroke zone 8535 centroid connect coding. The base year highway demand has also been increased marginally, approximately 0.66%, 0.40% and 0.72% for the total hourly vehicular trips in AM, IP and PM respectively.
- Base year EMME databank rebuilt;
- Trip ends update to cater for reallocation of zone 8535 to Begbroke development;
- Connect a direct rail access for zone 8535 to/from Oxford Parkway railway station;

The demand model converged after 18 iterations with a gap value of 0.1987%, which is in line with the WebTAG recommended value (<0.2%).

5. Model output check and comparison

5.1. Highway model comparison

Figures 5-1, 5-2 and 5-3 show the total actual flow differences of highway assignment between previous and revised model runs (run code reference:M42) for AM, IP and PM respectively, with a blue band for flow decrease and green band for flow increase from the previous model run (run code reference:M40). The flow comparison on the screenline is shown in Table 5-1.

The model comparison reveals following findings:

- Overall, the total assigned flows on Sandy Lane are reduced significantly. The updated network coding of a one-way signal control between Sandy Lane and Yarnton Road is operated as a bottleneck with substantially reduced link capacity to deter rat run traffic. The total flow EB in the AM peak decreases from 457 to 258 vehicles, approximately a 44% reduction. Similarly, in the PM peak the WB traffic reduces from 720 to 316 vehicles, approximately a 56% reduction. The flows in the inter peak in both directions along Sandy Lane also reduce by approximately 20%.
- There are some mixed pictures for the flow changes on adjacent links/corridors. In the AM peak, it is noticed that demand increases significantly on A4060 NB in the revised model. This is likely related to the demand adjustment on Langford Lane, which results in increased demand for a number of relevant zones in the area, including the one representing London Oxford Airport just to the north of Langford Lane. Flows on the A44 and Langford Lane increase proportionately, except for the A44 NB traffic between Yarnton and A44/A34 roundabout in the PM peak, likely due to traffic reassignment in the region in response to link capacity reduction on Sandy Lane.
- Further investigation of the previous model run found that there is a significant amount of Park & Ride traffic from/to existing zone 9286 in Begbroke for rail passengers to access the Oxford Parkway station by car. For instance, in the AM peak, the select link analysis on Sandy Lane EB reveals that there is a total of 260 pcus traveling from zone 9286 to Water Eaton, which doesn't look realistic. In the revised demand model run in the AM peak, the total trips from existing zone 9286 and Begbroke new development zone 8535 to Water Eaton are reduced to 31 and 33 pcus respectively.

As there are some key changes, such as the zone reallocation for Begbroke new development and base year demand adjustment, it is difficult to explain the flow changes before and after at a link by link basis. The trip distribution method embedded in the demand model for new development zones also introduces more uncertainties in traffic routing and flow assigned in the study area.

Figure 5-5 shows the actual flow bandwidth plot in the study area for the AM peak hour in 2031. As can be seen from the figure, the flows are reasonably distributed in the area with major key corridors such as A40, A34, A44 attracting more traffic than other roads. The banded speed plot in the study area for the AM peak in 2031 is illustrated in Figure 5-6. The links with lower travel speed are found at Kidlington village centre and A44 northbound from Peartree interchange to Yarnton.

Figure 5-1 Total hourly actual flow(PCUs) difference AM Peak 2031

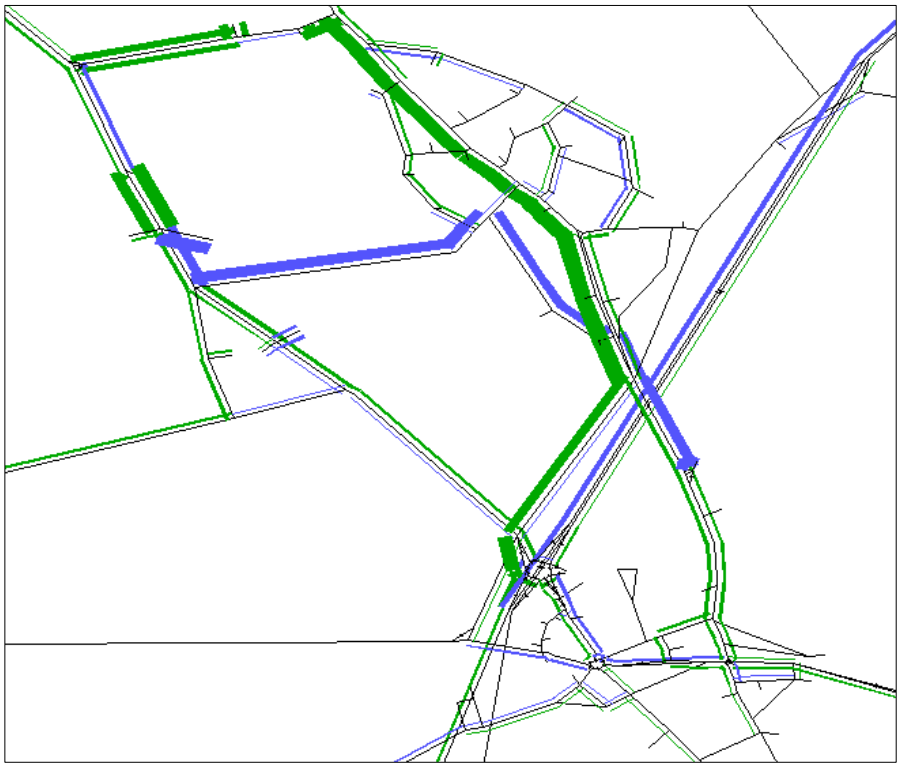


Figure 5-2 Total hourly actual flow(PCUs) difference Inter Peak 2031

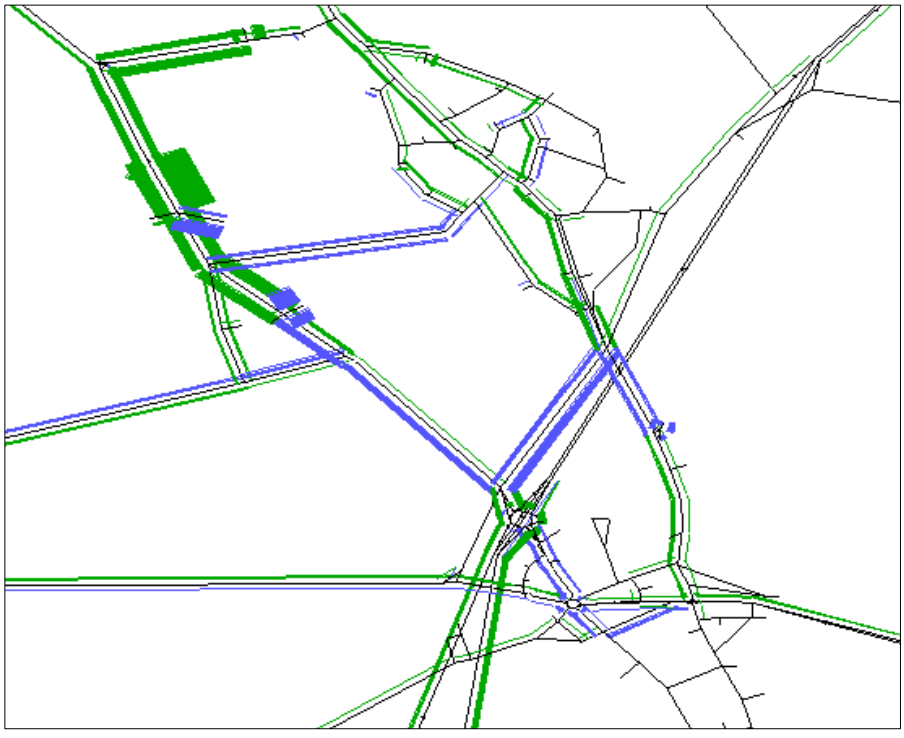
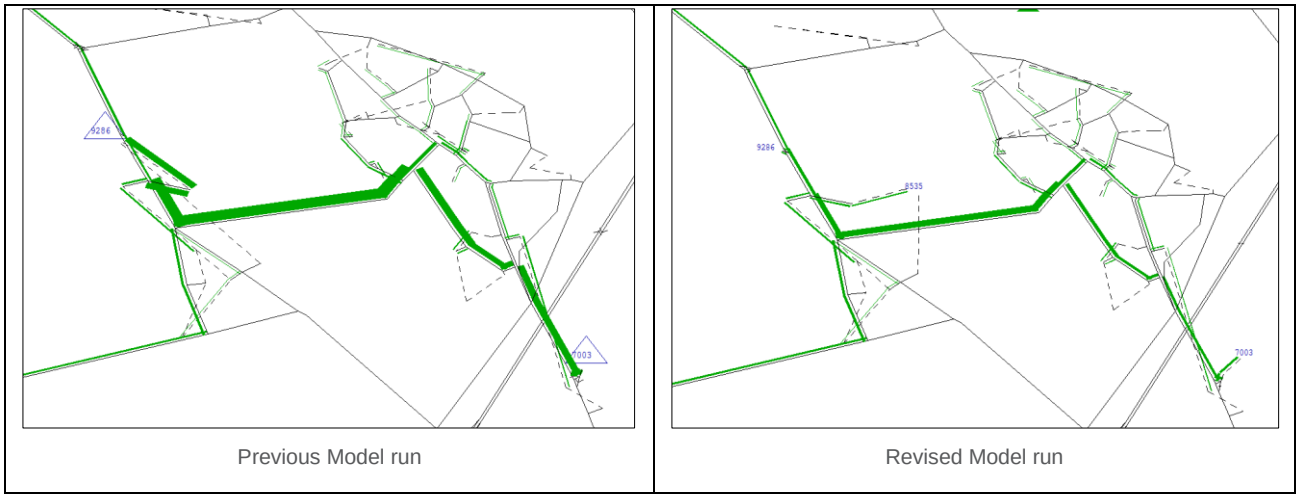


Figure 5-3 Total hourly actual flow(PCUs) difference PM Peak 2031

Table 5-1 Total hourly actual flow(PCUs) difference on screenline in 2031

Roads	Direction	2031 AM Peak - Vehicles			2031 Inter Peak - Vehicles			2031 PM Peak - Vehicles		
		Existing	Revised	% Diff.	Existing	Revised	% Diff.	Existing	Revised	% Diff.
Langford Lane	WB	273	368	**35%**	384	550	**43%**	490	851	**74%**
	EB	590	725	**23%**	286	394	**38%**	133	229	**73%**
Sandy Lane	WB	154	145	**-5%**	177	142	**-20%**	720	316	**-56%**
	EB	457	258	**-44%**	193	154	**-20%**	340	296	**-13%**
A4260 Frieze Way	SB	668	657	**-2%**	650	534	**-18%**	405	429	**6%**
	NB	335	492	**47%**	610	539	**-12%**	695	643	**-7%**
Total screen line	WB	1094	1170	**7%**	1212	1226	**1%**	1614	1596	**-1%**
	EB	1382	1475	**7%**	1089	1086	**0%**	1168	1168	**0%**

Figure 5-4 Selected Link Analysis on Sandy Lane EB in AM Peak in 2031

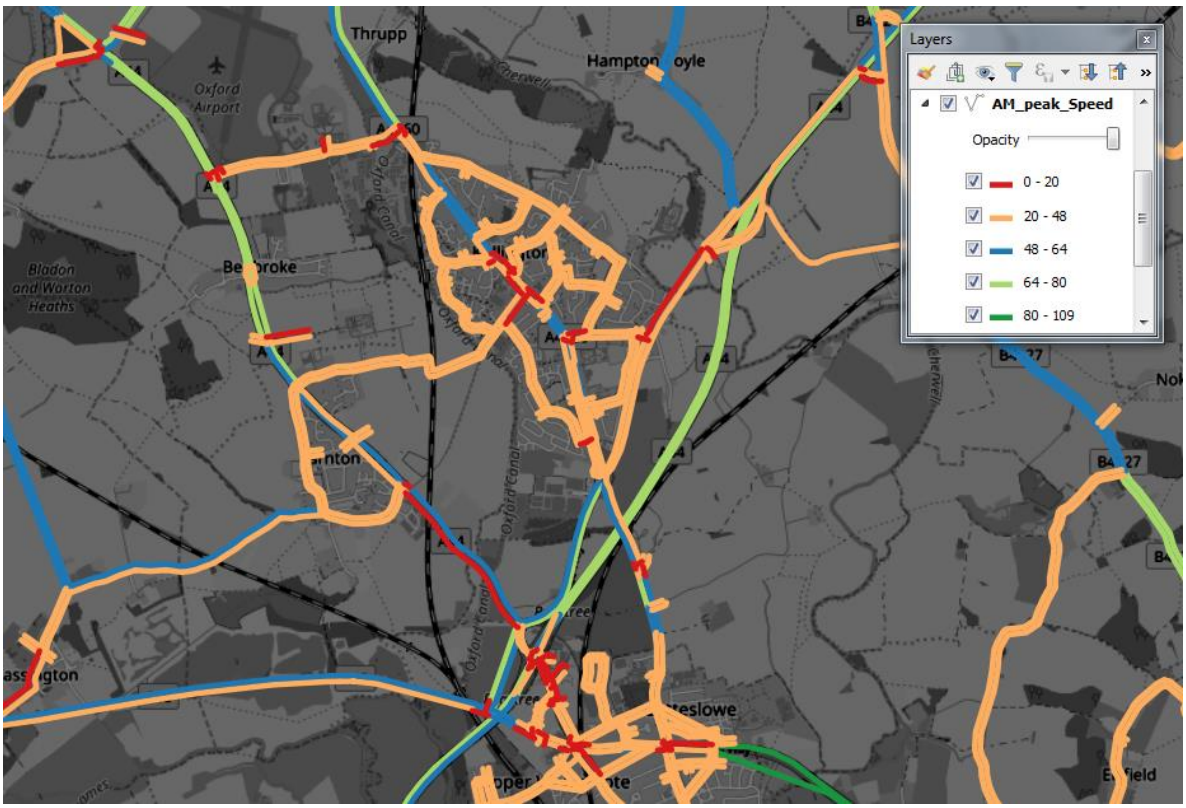


Previous Model run

Revised Model run

Figure 5-5 Actual flow bandwidth plot in the study area in AM peak in 2031

Figure 5-6 travel speed plot by band in the study area in AM peak in 2031



5.2. Bus line loadings

The bus line loadings are shown in Figures 5-7, 5-8 and 5-9 for AM, IP ad PM peak hour respectively. In general, the major bus corridors are along the A40 between Oxford and Witney, and the A4165/A4260 between Oxford and Kidlington. These plots are consistent with previous demand model runs.

Figure 5-7 Bus line loading in AM peak in 2031

Figure 5-8 Bus line loading in Inter peak in 2031

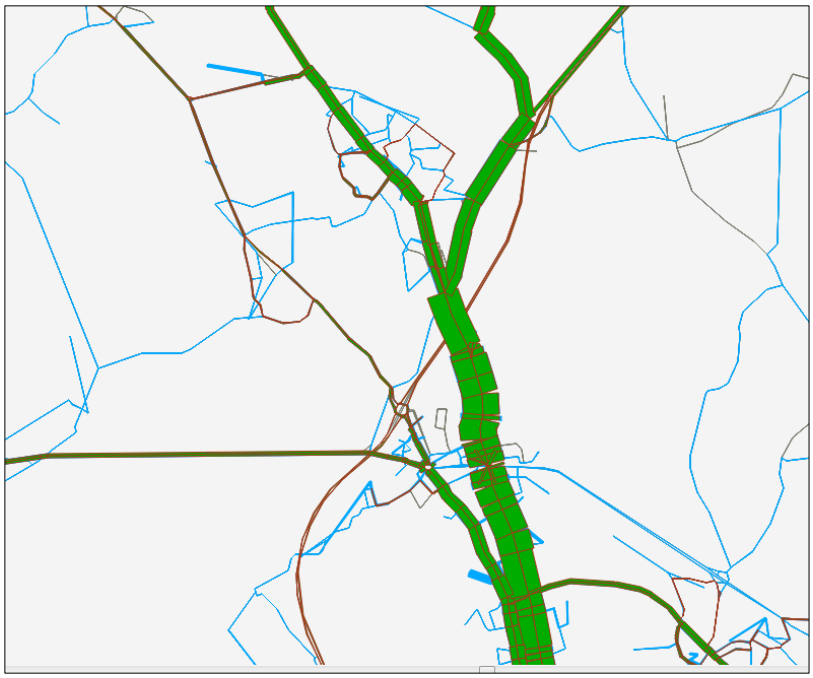


Figure 5-9 Bus line loading in PM peak in 2031

5.3. Mode share inspection

This relates to the mode share after the demand model has been checked in the study area. Figures 5-10 and 5-11 show the mode share pie chart for the origin trip ends for zones in the study area in the AM peak hour. In general, comparing to the reference case demand inputs given in Table 4-2, the demand model performs sensibly in terms of demand response to the level of service changes.

Figure 5-10 AM peak hour (8-9) mode share by origin (not in scale)

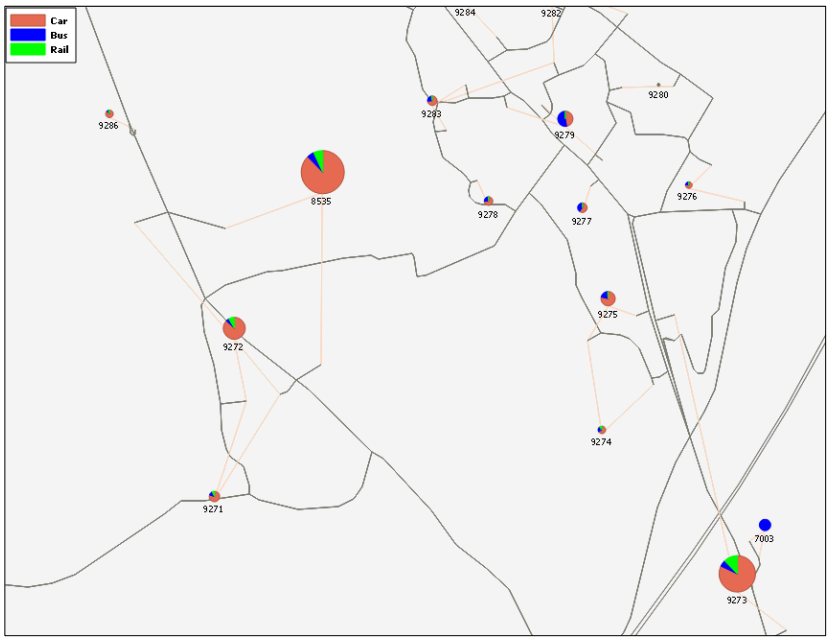
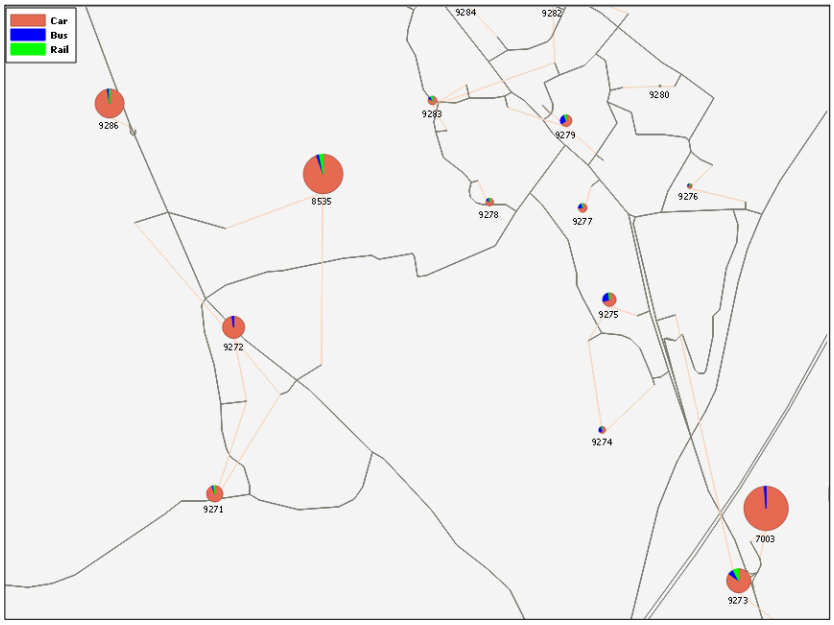


Figure 5-11 AM peak hour (8-9) mode share by destination (not in scale)



6. Summary

This technical note summarises the modelling work requested by OCC to assess the likely impacts of changes for Sandy Lane and the surrounding area in both base (2013) and forecasting year (2031). Following our investigation, network enhancement was undertaken on Sandy Lane and its surrounding area in the base year (2013) and forecasting year (2031). Traffic routing in the area was checked and a few illogical movements were fixed by the changing the traffic access to the residential area in Begbroke to along the A44. Meanwhile, the base year highway demand has been increased to address the shortfall of flows on Langford Lane.

The OSM demand model was rerun following the changes of highway network, trip ends, and the reallocation of the Begbroke development zone. The highway model comparisons show that the network changes result in substantial flow reduction on Sandy lane, along with an expected trip reassignment taking place on other roads in the study area. It was found that the previous model produces too much rail demand between the existing Begbroke zone and Water Eaton P&R. This is now fully addressed by the revised OSM model. Highway assignment, bus service line loading and mode shares in the study area were checked and the results look logical and robust. Overall the changes to the existing model are as expected and the highway assignment and demand respond sensibly.

During this commission, several observations were brought to our attention:

- There is still some traffic travelling along Sandy Lane and then following local residential roads (e.g. Morton Avenue) in Kidlington to Oxford Parkway Station.
- Traffic on Langford Lane is predominately used by traffic accessing the Oxford Spires Business Park and Oxford Airport. There aren't many through movements on this road which doesn't seem sensible.
- There isn't much traffic using the A40/A44 link road.

We will review these issues during an ongoing North Oxford model update task and address them accordingly, if necessary.

Appendix A

Table A-1- North South Screenline, observed counts v.s. original modelled flows before enhancement (vehicles)

Roads	Year of observed count data	Source of count data	Direction	2013 AM Peak - Vehicles				2013 Inter Peak - Vehicles				2013 PM Peak - Vehicles			
				Observed	Modelled	% Diff.	GEH	Observed	Modelled	% Diff.	GEH	Observed	Modelled	% Diff.	GEH
Langford Lane	2018	MCC_13	WB	350	334	-5%	1	339	315	-7%	1	768	348	-55%	18
	2018		EB	923	507	-45%	16	317	179	-44%	9	363	211	-42%	9
Sandy Lane	2014	Local count	WB	107	154	44%	4	84	125	48%	4	95	152	61%	5
	2014		EB	135	162	20%	2	98	187	92%	8	128	242	89%	8
A4260 Frieze Way	2018	MCC_04 &19	SB	450	413	-8%	2	413	335	-19%	4	613	478	-22%	6
	2018		NB	528	387	-27%	7	426	341	-20%	4	623	500	-20%	5
The screen line total			WB	906	901	-1%	0	836	775	-7%	2	1475	978	-34%	14
			EB	1586	1055	-33%	15	841	707	-16%	5	1114	953	-14%	5

Table A-1- North South Screenline, observed counts v.s. revised modelled flows after enhancement (vehicles)

Roads	Year of observed count data	Source of count data	Direction	2013 AM Peak - Vehicles				2013 Inter Peak - Vehicles				2013 PM Peak - Vehicles			
				Observed	Modelled	% Diff.	GEH	Observed	Modelled	% Diff.	GEH	Observed	Modelled	% Diff.	GEH
Langford Lane	2018	MCC_13	WB	350	345	-1%	0	339	346	2%	0	768	625	-19%	5
	2018		EB	923	731	-21%	7	317	283	-11%	2	363	286	-21%	4
Sandy Lane	2014	Local count	WB	107	186	74%	7	84	144	71%	6	95	244	158%	11
	2014		EB	135	140	4%	0	98	144	47%	4	128	131	2%	0
A4260 Frieze Way	2018	MCC_04 &19	SB	450	482	7%	1	413	346	-16%	3	613	516	-16%	4
	2018		NB	528	619	17%	4	426	302	-29%	6	623	537	-14%	4
The screen line total			WB	906	1013	12%	3	836	836	0%	0	1475	1386	-6%	2
			EB	1586	1491	-6%	2	841	729	-13%	4	1114	954	-14%	5

Appendix D

Post Submission OSM model test: Sandy Lane closure Scenario 3 testing

Transport Topic Paper: Evidence for Cherwell Local Plan (Part 1) Partial Review

Post Submission OSM Model Test: Sandy Lane Closure Scenario 3 Testing

Project:	Begbroke - Local Plan Allocation		
Subject:	Post Submission OSM Model Test: Sandy Lane Closure Scenario 3 Testing		
Author:	Wei Wang	Atkins No.:	Version 6
Date:	18/01/2019	Icepac No.:	
		Project No.:	5167454
Distribution:	OCC	Representing:	

1. Introduction

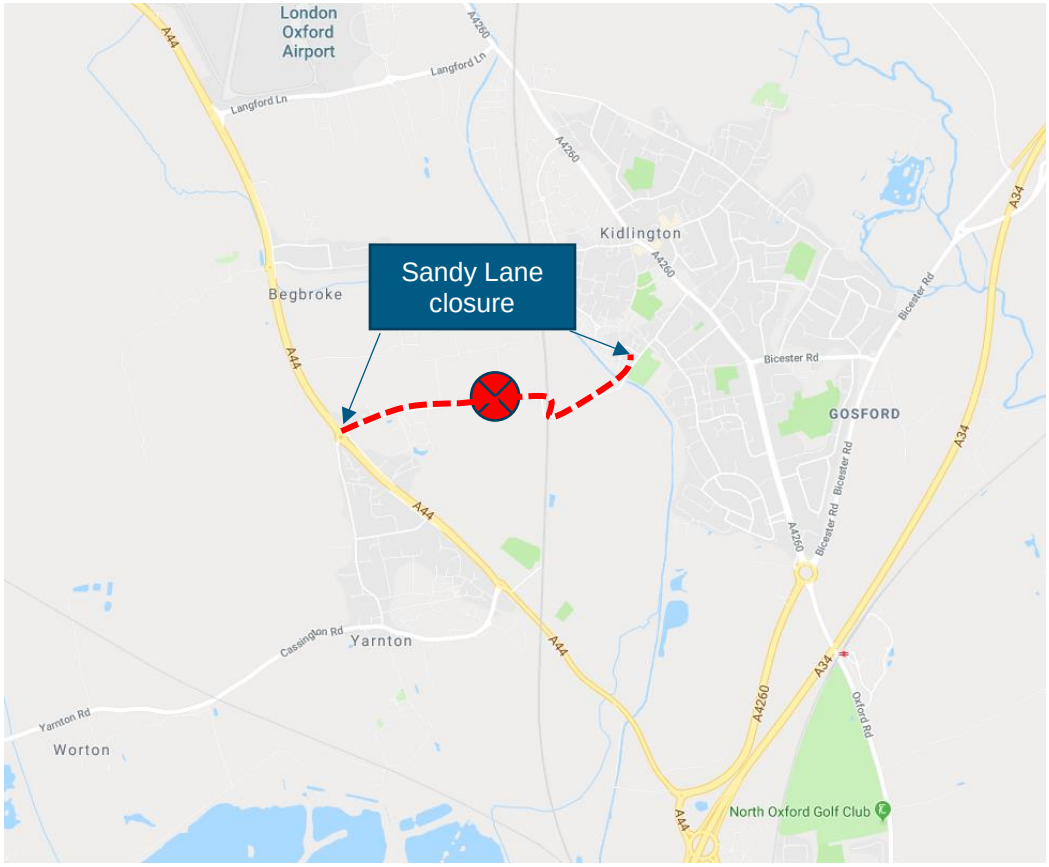
Built upon a previous model test, Post Submission OSM Model Test: Sandy Lane Reclassification, Oxfordshire County Council (OCC) has requested further modelling work to examine the impact of a proposal for Sandy Lane's closure to normal traffic in the forecasting year 2031. This technical note summarises the modelling methodology and key findings, which has a special focus on the model comparison against previous model runs.

The model test was carried out for comparative purposes relating to the Post Submission Scenario 3 model, which was refined with reduced Sandy Lane flows since the original submitted evidence base model in the EIP. The comparison between the Post Submission Scenario 3 model and the original evidence submission model is detailed in another technical note[1].

The model settings for the Sandy Lane closure model were kept largely identical to the Scenario 3 model, except for the proposed Sandy Lane closure. Since there is no bus service currently operating on Sandy Lane, the test was therefore focused on highway network change, where the road section on Sandy Lane between the A44 and Grovelands in Kidlington is closed to all normal traffic (cars and goods vehicles), as shown in Figure 1 below.

[1] See TN_ Post Submission OSM Model Test: Sandy Lane Reclassification.docx

Figure 1 Sandy Lane closure



2. Impact of Sandy Lane closure on the overall demand changes

Table 1 shows the total car demand matrix changes by time period and user class between Sandy Lane closure and the Scenario 3 model. It is found that, compared to the Scenario 3 model, the OD demand totals for car business and car other trips in AM and PM peak following Sandy Lane closure reduce marginally, whereas in the inter peak the demand increases proportionally. This reflects the level of demand response, such as mode shift and time period choice to travel condition changes in the affected area.

Table 2 summaries the total person period demand (in production/attraction PA form, excluding external to external movement) changes before and after Sandy Lane closure for the main modes including regular car, P&R, bus and rail. As can be seen, the demand for both bus and rail mode increases slightly, a demand response of mode shift captured by the OSM demand model.

Table 1 – Highway assignment car matrix total changes

Time Period	User Class	Scenario 3	Scenario 3+Sandy Lane closure	Abs. Diff.
AM (8-9)	Car Business	18464	18462	-2
	Car Other	94002	93985	-17
IP (av, hour 10-16)	Car Business	24356	24360	4
	Car Other	79910	79924	14
PM (17-18)	Car Business	19511	19503	-8
	Car Other	121280	121226	-54

Table 2 – Total PA person period demand changes

Demand item	Time period	Scenario 3	Scenario 3+Sandy Lane closure	Abs. Diff.	Rel. Diff.
HY	AM (7-10)	370993	370980	-13	0.00%
	IP (10-16)	547681	547821	140	0.03%
	PM (16-19)	217761	217595	-166	-0.08%
PR	AM (7-10)	3572	3523	-49	-1.37%
	IP (10-16)	1925	1901	-23	-1.20%
	PM (16-19)	868	860	-9	-0.99%
Bus	AM (7-10)	31088	31114	26	0.08%
	IP (10-16)	41062	41083	21	0.05%
	PM (16-19)	9828	9835	7	0.07%
Rail	AM (7-10)	14082	14097	15	0.11%
	IP (10-16)	12902	12914	12	0.09%

	PM (16-19)	5588	5592	3	0.06%

3. Impact of Sandy Lane closure on road network

The model output analysis for assessing the impact of Sandy Lane closure is focused on the following three link-based metrices:

- Total actual flow on links (in pcus);
- Congested travel speed on links (in kph);
- V/C ratio on links;

Tables A-1, A-2, A-3 in Appendix A show the comparison of model outputs in terms of these metrices between Scenario 3 and Sandy Lane closure for AM, IP and PM peak respectively.

Figure 2 below illustrates the total flow changes before and after Sandy Lane closure for the modelled AM, IP and PM peak hour in forecast year 2031. The comparisons between the models in terms of link V/C ratio greater than 0.90, an indication of being close to link capacity, are presented in Appendix B.

Comparing the scenario of Sandy Lane closure to the Scenario 3, a summary of the model findings are as follows:

- The links with flow changes before and after Sandy Lane closure are primarily within Kidlington and its surrounding area. Traffic tends to follow the A4095 and Langford Lane from Woodstock in the north to access Kidlington;
- Similarly, it is observed that between Eynsham/Witney and Kidlington there are a proportion of trips, previously following Cassington Road, that now start to follow A40 and A4260 Frieze Way to reach Kidlington, and vice versa.
- Across all three modelled time periods, the traffic flows for both directions on A4260 Frieze Way increase significantly. However, the road section copes with the increased traffic well since the flows are generally lower than the link capacity, with a maximum of V/C of 0.89 on the southbound direction link in the AM peak.
- It is noted that some of the road sections in the Scenario 3 model are already close to or over capacity. Demand has increased on the following sections, as a result of traffic rerouting after Sandy Lane closure:
  a) Woodstock A4095 SB in AM and PM peak;
  b) Langford Lane WB in PM peak;
  c) A44 South of Yarnton for all three-time periods (already over capacity in Scenario 3 model);
  d) A40 EB in AM and WB in PM peak (already over capacity in the Scenario 3 model);
  e) Woodstock A4095 SB in AM and PM peak;

Figure 3 shows the total flow changes after Sandy Lane closure, comparing to model outputs from the original Scenario 3 evidence submission (with Sandy Lane open) in the EIP evidence base. As the Sandy Lane closure model was based on the refined Scenario 3 model, which has some major changes at and around Begbroke existing zones and future development zones, the figure doesn't

present like-for-like comparisons across modelled time periods and the flow changes are as a result of combined factors including traffic rerouting, demand and network changes. Tables C-1, C-2 and C3 details the model comparisons in terms of total flow, speed and V/C ratio between the two models.

Figure 2 Total flow changes (pcus) for Sandy Lane closure vs. Scenario 3 in FY 2031

AM Peak | Inter Peak | PM Peak

Figure 3 Total flow changes (pcus) for Sandy Lane closure vs. Original Evidence Submission in FY 2031

AM Peak | Inter Peak | PM Peak

Note: the red bandwidth represents flow decrease, whereas green is for flow increase following Sandy Lane closure. Links with changes less than 5 pcus are excluded.

4. Begbroke development trip ends changes in FY 2031

Table 3 below shows comparison of the total highway demand (in pcus) for three selected zones between Sandy Lane closure and the Scenario 3 model. As can be seen, the overall demand changes are relatively small for all three-time periods. This indicates that demand response to the proposed Sandy Lane closure is largely related to traffic rerouting or reassignment, which is very sensitive to the cost changes and route choices available in congested areas.

Table 3 – Total highway demand (pcus) for selected zones comparison

Time Period	OSM Zone	Direction	Scenario 3	Sandy Lane closure	Diff
AM	Bebroke Development	in	451	448	-3
		out	615	612	-3
	Oxford Airport P&R	in	110	108	-2
		out	1	1	0
	Oxford Airport zone	in	1662	1642	-20
		out	711	709	-2
IP	Bebroke Development	in	503	502	-1
		out	473	473	0
	Oxford Airport P&R	in	16	16	0
		out	20	20	0
	Oxford Airport zone	in	821	821	0
		out	850	850	0
PM	Bebroke Development	in	627	619	-8
		out	523	520	-3
	Oxford Airport P&R	in	6	6	0
		out	81	80	-1
	Oxford Airport zone	in	594	594	0
		out	1215	1210	-5

5. Bus journey time comparisons

Figure 4 illustrates proposed bus lane schemes in 2031 along the A4260, A44 and A40 corridors. Note that the bus lane sections vary by travel direction along each corridor. Table 3 shows the travel time comparisons between car and bus on bus lanes for each corridor across three modelled time periods. For bus journey times along dedicated bus lanes, free flow car travel time is assumed,

which also includes the time for boarding and alighting the bus and bus priority measures at junctions. Meanwhile, some adjustment factors, derived from a comparison to base line models (e.g. a do-minimum scenario without bus lanes) were applied to reduce the bus travel time on related bus lane links. These factors vary by time period, section and travel direction.

Overall, it is found that during the peak hour for corridors with relatively long dedicated bus lanes, for example, for inbound travel on A4260, A40 and A44, the bus travel time saving is around 4 to 7 minutes in the AM and 2-4 minutes in the PM peak. As expected; however, the bus journey time saving over cars in the uncongested inter peak is less significant, with a 2.5 minutes reduction on the bus lane section for the A4260 inbound direction.

Figure 3 bus lanes in 2031 Sandy Lane closure network

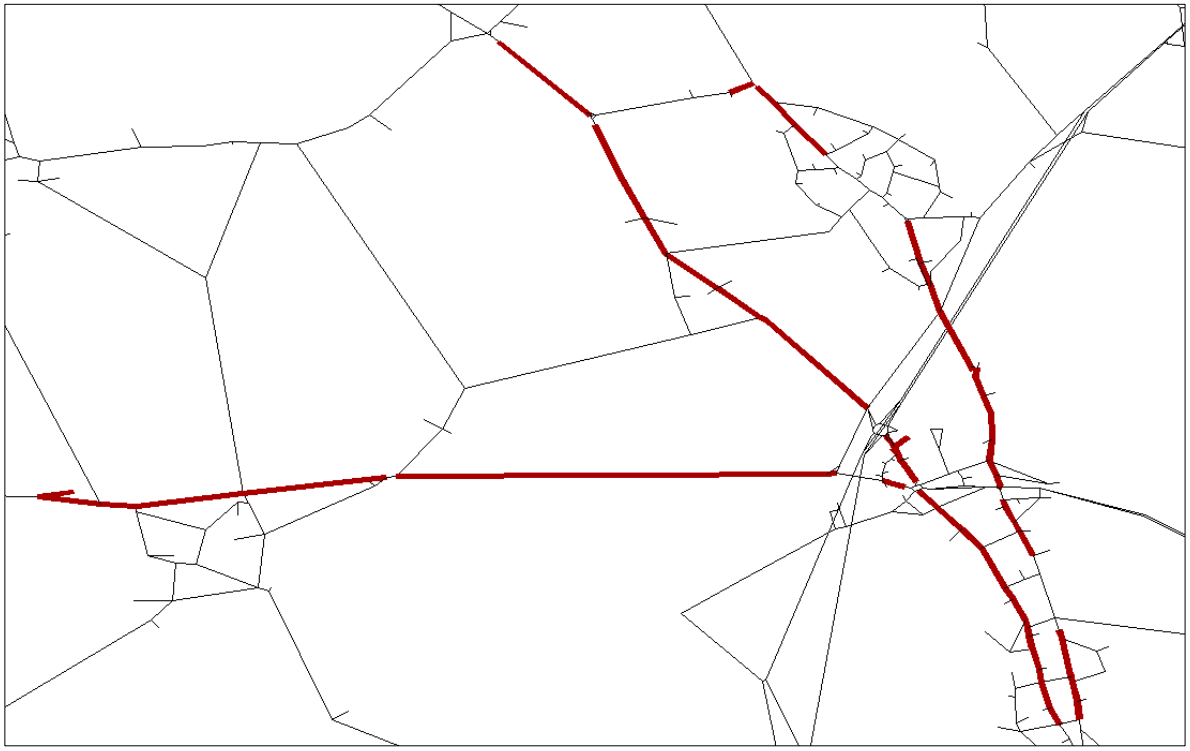


Table 3 travel time (minutes) comparison along bus lane sections between bus and car

Time Period	Corridor	Section	Selected bus service	Car	Bus	Abs diff	% diff
AM	A4260 Inbound	Woodstock to Oxford Centre	P500I	12.7	13.3	0.7	5.1%
	A4260 Outbound	Oxford Centre to Woodstock	P500O	4.0	6.8	2.9	72.1%
	A40 Eastbound	Brize Norton-Oxford Centre	S2I	20.8	13.1	-7.7	-36.9%

	A40 Westbound	Oxford Centre to Brize Norton	S2O	2.0	3.5	1.4	70.5%
	A44 Inbound	Chipping Norton to Oxford Centre	S3I	15.8	11.7	-4.1	-25.8%
	A44 Outbound	Chipping Norton to Oxford Centre	S3O	3.5	6.5	3.0	85.5%
IP	A4260 Inbound	Woodstock to Oxford Centre	P500I	14.6	12.1	-2.5	-17.0%
	A4260 Outbound	Oxford Centre to Woodstock	P500O	3.9	7.0	3.1	81.0%
	A40 Eastbound	Brize Norton-Oxford Centre	S2I	11.5	12.8	1.3	11.2%
	A40 Westbound	Oxford Centre to Brize Norton	S2O	2.0	3.5	1.5	77.6%
	A44 Inbound	Chipping Norton to Oxford Centre	S3I	9.9	12.3	2.3	23.5%
	A44 Outbound	Chipping Norton to Oxford Centre	S3O	3.4	6.4	3.0	89.3%
PM	A4260 Inbound	Woodstock to Oxford Centre	P500I	14.4	12.6	-1.8	-12.6%
	A4260 Outbound	Oxford Centre to Woodstock	P500O	4.1	7.5	3.4	82.8%
	A40 Eastbound	Brize Norton-Oxford Centre	S2I	15.4	13.4	-2.0	-13.0%
	A40 Westbound	Oxford Centre to Brize Norton	S2O	2.0	3.7	1.7	84.6%
	A44 Inbound	Chipping Norton to Oxford Centre	S3I	15.1	11.2	-3.9	-25.7%
	A44 Outbound	Chipping Norton to Oxford Centre	S3O	3.6	7.0	3.5	96.5%

6. Demand model statistics

The demand model statistics and highway assignment model network performance outputs are shown in Appendix D and Appendix E respectively, along with the model scenarios for the original Cherwell Local Plan Partial Review Stage 2 models and Post Submission with Sandy Lane flow reduced model. The table references Appendix 7 of the Evidence for Cherwell Local Plan (Part 1) Partial Review[2] report.

[2] Transport Assessment: Evidence for Cherwell Local Plan (Part 1) Partial Review - Oxford's Unmet Housing Need-OSM Stage 2 modelling report (transport improvement scenario testing)-Appendix 7

7. Summary

This technical note summarises the model outputs and findings for the modelling work requested by OCC to assess the impacts of Sandy Lane closure, based on a fully converged OSM demand model.

The model comparisons show that, following the Sandy Lane closure, some of the traffic flows follow alternative routes to reach their destinations, with most trips started or ended in Kidlington area. As a result, demand on a number of roads has increased accordingly around Kidlington, including Woodstock A4095 and the A44 South of Yarnton. The scheme has no major impacts on other areas, such as the key corridors along Banbury road, A4165 and A4144 in and out of Oxford City centre.

Overall, the OSM model performs sensibly and captures routing changes in the scheme influence area. The demand response in terms of retiming and mode shift from car to PT is less obvious. However, the model does show there is a small amount of total demand increase for both bus and rail mode, as well as demand shifting for car demand in the inter peak.

Appendix A

Figure A- 1 Link site location reference for comparison tables

Table A- 1 Model output comparison (Scenario 3 vs. Sandy Lane closure) in AM peak

Link ID_ref	Road section	Direction	Actual flows (pcus)				Speed (kph)				V/C(%)		
			S3	closure	Abs.Diff	Rel. Diff.	S3	closure	Abs. Diff	Rel. Diff.	S3	closure	Abs. Dff
1	Woodstock Oxford Rd	SB	1298	1216	-81	-6%	75	76	1	1%	42	39	-3
		NB	1133	1158	24	2%	73	73	0	0%	38	39	1
2	Woodstock A4095	NB	907	995	88	10%	70	69	-2	-2%	65	71	6
		SB	949	978	28	3%	70	70	-1	-1%	90	92	3
3	A44 North of Langford Ln	NB	1133	1158	24	2%	73	73	0	0%	38	39	1
		SB	1298	1216	-81	-6%	75	76	1	1%	42	39	-3
4	Langford Ln	EB	729	726	-3	0%	32	32	0	0%	83	82	0
		WB	376	413	36	10%	44	43	-1	-2%	43	47	4
5	A4260 North of Langford Ln	SB	976	1107	131	13%	49	47	-2	-4%	72	81	10
		NB	366	389	22	6%	78	78	0	0%	26	28	2
6	A44 South of Langford Ln	SB	1065	975	-90	-8%	75	75	0	0%	35	32	-3
		NB	1509	1485	-23	-2%	66	66	0	0%	49	48	-1
7	Sandy Lane	EB	260	0	-260	-100%	35	0	-35	-100%	82	0	-82
		WB	146	0	-146	-100%	42	0	-42	-100%	22	0	-22
8	A2260 Kidlington	SB	583	592	9	2%	50	50	0	0%	29	30	0
		NB	705	716	10	1%	50	50	0	0%	35	36	1
9	A44 North of Cassington Rd	SB	1122	1139	16	1%	47	47	0	0%	61	62	1
		NB	1268	1281	12	1%	54	54	0	0%	43	44	0
10	A4260 North of Bicester Rd	SB	905	895	-9	-1%	50	50	0	0%	45	45	0
		NB	913	904	-8	-1%	50	50	0	0%	32	31	0
11	Cassington Rd	EB	707	655	-52	-7%	37	40	2	6%	69	64	-5
		WB	253	234	-19	-7%	55	55	1	1%	25	23	-2
12	A40	EB	1047	1047	1	0%	43	45	3	6%	102	101	-1

		WB	849	868	19	2%	54	53	-1	-1%	70	72	1
13	A44 South of Yarnton	SB	1455	1476	21	1%	17	15	-2	-10%	107	109	2
		NB	1401	1411	11	1%	61	56	-6	-9%	100	100	1
14	A4260	SB	696	764	68	10%	58	59	1	1%	89	89	0
		NB	502	601	99	20%	69	69	-1	-1%	22	26	4
15	A4260 Oxford Rd	SB	577	584	7	1%	26	26	0	-1%	38	39	1
		NB	778	795	18	2%	40	40	0	0%	40	41	1
16	A34 Western By-Pass	SB	3640	3649	9	0%	65	65	0	0%	91	91	0
		NB	3819	3828	9	0%	64	64	0	0%	95	96	0
17	Oxford Rd South of Parkway Station	SB	474	484	9	2%	65	65	0	0%	31	31	1
		NB	730	716	-14	-2%	60	61	0	1%	47	46	-1
18	A44 South of Pear Tree P&R	SB	1837	1810	-27	-1%	48	48	0	0%	46	45	-1
		NB	1284	1292	8	1%	48	48	0	0%	32	32	0

Table A- 2 Model output comparison (Scenario 3 vs. Sandy Lane closure) in Inter peak

Link ID_ref	Road section	Direction	Actual flows (pcus)				Speed (kph)				V/C(%)		
			S3	closure	Abs.Diff	Rel. Diff.	S3	closure	Abs. Diff	Rel. Diff.	S3	closure	Abs. Dff
1	Woodstock Oxford Rd	SB	979	940	-40	-4%	77	77	0	0%	32	30	-1
		NB	890	898	8	1%	74	74	0	0%	30	30	0
2	Woodstock A4095	NB	647	685	38	6%	75	74	-1	-1%	46	49	3
		SB	828	827	-2	0%	73	73	0	0%	76	75	0
3	A44 North of Langford Ln	NB	890	898	8	1%	74	74	0	0%	30	30	0
		SB	979	940	-40	-4%	77	77	0	0%	32	30	-1
4	Langford Ln	EB	417	444	27	6%	39	39	-1	-1%	47	50	3
		WB	566	644	78	14%	40	37	-2	-6%	64	73	9
5	A4260 North of Langford Ln	SB	492	540	47	10%	67	67	0	0%	36	40	3
		NB	488	492	4	1%	77	77	0	0%	35	35	0
6	A44 South of Langford Ln	SB	1398	1365	-33	-2%	73	73	0	0%	45	44	-1
		NB	1197	1159	-38	-3%	68	68	0	0%	39	38	-1
7	Sandy Lane	EB	154	0	-154	-100%	40	0	-40	-100%	49	0	-49
		WB	144	0	-144	-100%	42	0	-42	-100%	28	0	-28
8	A2260 Kidlington	SB	372	375	3	1%	50	50	0	0%	19	19	0
		NB	570	600	30	5%	50	50	0	0%	28	30	1
9	A44 North of Cassington Rd	SB	1423	1460	37	3%	45	45	0	-1%	65	67	1
		NB	1283	1308	25	2%	54	53	0	0%	45	46	1
10	A4260 North of Bicester Rd	SB	687	686	-1	0%	50	50	0	0%	34	34	0
		NB	862	909	47	5%	50	50	0	0%	30	32	2
11	Cassington Rd	EB	189	148	-41	-22%	56	57	1	1%	18	14	-4
		WB	176	161	-15	-9%	56	57	0	0%	17	16	-1
12	A40	EB	785	799	14	2%	59	58	0	-1%	51	52	1

		WB	877	888	11	1%	53	53	0	-1%	73	74	1
13	A44 South of Yarnton	SB	1419	1439	21	1%	40	33	-7	-17%	101	102	1
		NB	1306	1333	27	2%	63	62	-1	-1%	93	95	2
14	A4260	SB	558	639	81	15%	65	64	-1	-1%	68	74	5
		NB	552	642	90	16%	68	68	0	0%	25	29	4
15	A4260 Oxford Rd	SB	334	367	33	10%	26	26	0	-1%	23	26	2
		NB	802	885	83	10%	40	40	0	0%	41	45	4
16	A34 Western By-Pass	SB	3443	3434	-9	0%	66	66	0	0%	86	86	0
		NB	3820	3825	4	0%	64	64	0	0%	96	96	0
17	Oxford Rd South of Parkway Station	SB	185	180	-5	-3%	66	66	0	0%	12	12	0
		NB	594	595	1	0%	63	63	0	0%	39	39	0
18	A44 South of Pear Tree P&R	SB	1349	1343	-6	0%	48	48	0	0%	34	34	0
		NB	1284	1292	8	1%	48	48	0	0%	32	32	0

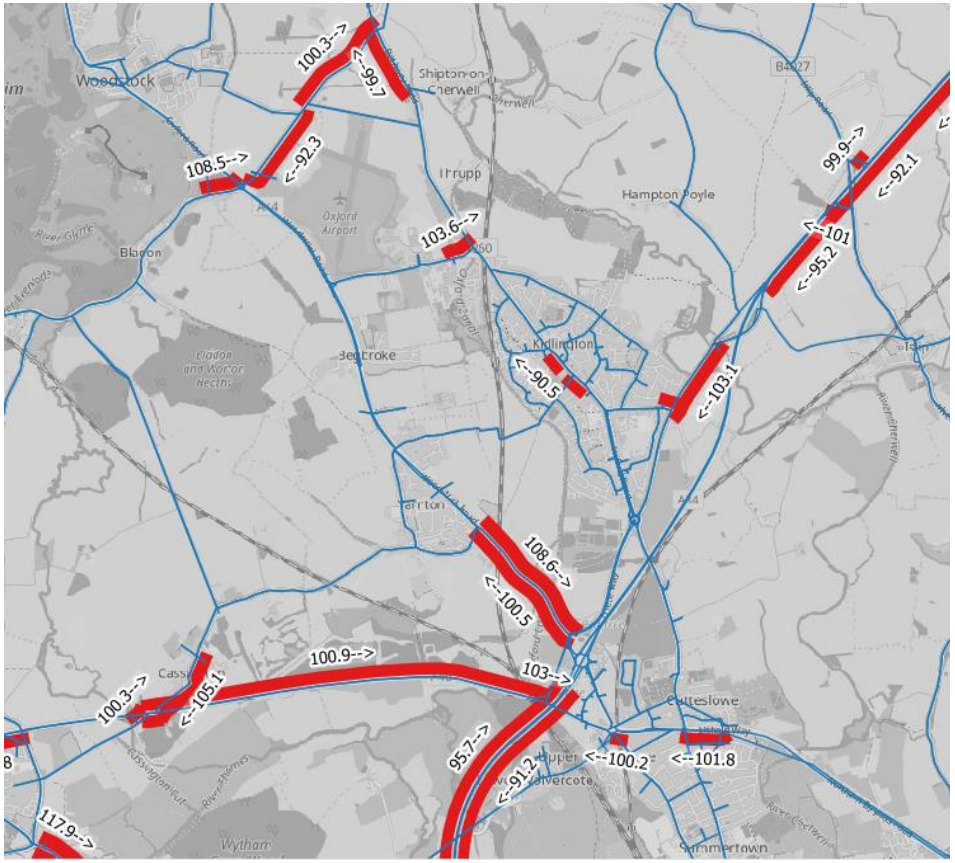
Table A- 3 Model output comparison (Scenario 3 vs. Sandy Lane closure) in PM peak

Link ID_ref	Road section	Direction	Actual flows (pcus)				Speed (kph)				V/C(%)		
			S3	closure	Abs.Diff	Rel. Diff.	S3	closure	Abs. Diff	Rel. Diff.	S3	closure	Abs. Dff
1	Woodstock Oxford Rd	SB	930	935	5	1%	78	78	0	0%	30	30	0
		NB	1604	1579	-25	-2%	70	70	0	0%	53	53	-1
2	Woodstock A4095	NB	1090	1110	20	2%	67	67	0	-1%	78	79	1
		SB	912	1024	111	12%	73	73	0	0%	83	93	10
3	A44 North of Langford Ln	NB	1604	1579	-25	-2%	70	70	0	0%	53	53	-1
		SB	930	935	5	1%	78	78	0	0%	30	30	0
4	Langford Ln	EB	235	247	12	5%	42	42	0	0%	27	28	1
		WB	861	898	37	4%	31	22	-8	-27%	98	102	4
5	A4260 North of Langford Ln	SB	585	672	86	15%	66	65	-1	-2%	50	58	7
		NB	929	930	1	0%	70	70	0	0%	66	66	0
6	A44 South of Langford Ln	SB	1627	1522	-105	-6%	70	71	1	1%	54	50	-4
		NB	1575	1438	-137	-9%	65	66	1	1%	51	47	-4
7	Sandy Lane	EB	296	0	-296	-100%	33	0	-33	-100%	94	0	-94
		WB	317	0	-317	-100%	39	0	-39	-100%	60	0	-60
8	A2260 Kidlington	SB	549	605	56	10%	50	50	0	0%	27	30	3
		NB	744	811	67	9%	50	50	0	0%	37	41	3
9	A44 North of Cassington Rd	SB	1274	1229	-45	-3%	46	47	0	1%	59	58	-1
		NB	1291	1321	30	2%	54	53	0	0%	44	45	1
10	A4260 North of Bicester Rd	SB	932	909	-23	-2%	50	50	0	0%	47	45	-1
		NB	1245	1235	-10	-1%	50	50	0	0%	48	48	0
11	Cassington Rd	EB	338	297	-42	-12%	53	54	1	2%	33	29	-4
		WB	363	365	2	1%	51	51	0	0%	35	35	0
12	A40	EB	902	911	9	1%	54	54	0	-1%	59	59	1

		WB	875	865	-10	-1%	20	18	-2	-12%	112	115	3
13	A44 South of Yarnton	SB	1295	1285	-10	-1%	19	18	-2	-9%	104	104	1
		NB	1448	1463	15	1%	11	9	-2	-15%	112	115	3
14	A4260	SB	442	588	146	33%	68	67	-1	-2%	54	63	10
		NB	652	775	123	19%	69	69	-1	-1%	35	39	5
15	A4260 Oxford Rd	SB	271	291	20	7%	27	27	0	0%	18	20	2
		NB	1470	1412	-58	-4%	40	40	0	0%	77	74	-4
16	A34 Western By-Pass	SB	4026	3984	-41	-1%	57	63	5	9%	101	100	-1
		NB	3856	3854	-2	0%	64	64	0	0%	96	96	0
17	Oxford Rd South of Parkway Station	SB	491	489	-2	0%	65	65	0	0%	32	32	0
		NB	759	707	-53	-7%	59	61	1	2%	49	46	-3
18	A44 South of Pear Tree P&R	SB	1550	1557	7	0%	48	48	0	0%	39	39	0
		NB	1540	1542	3	0%	48	48	0	0%	38	39	0

Appendix B Link V/C comparison between Scenario 3 and Sandy Lane closure

Scenario 3-AM peak

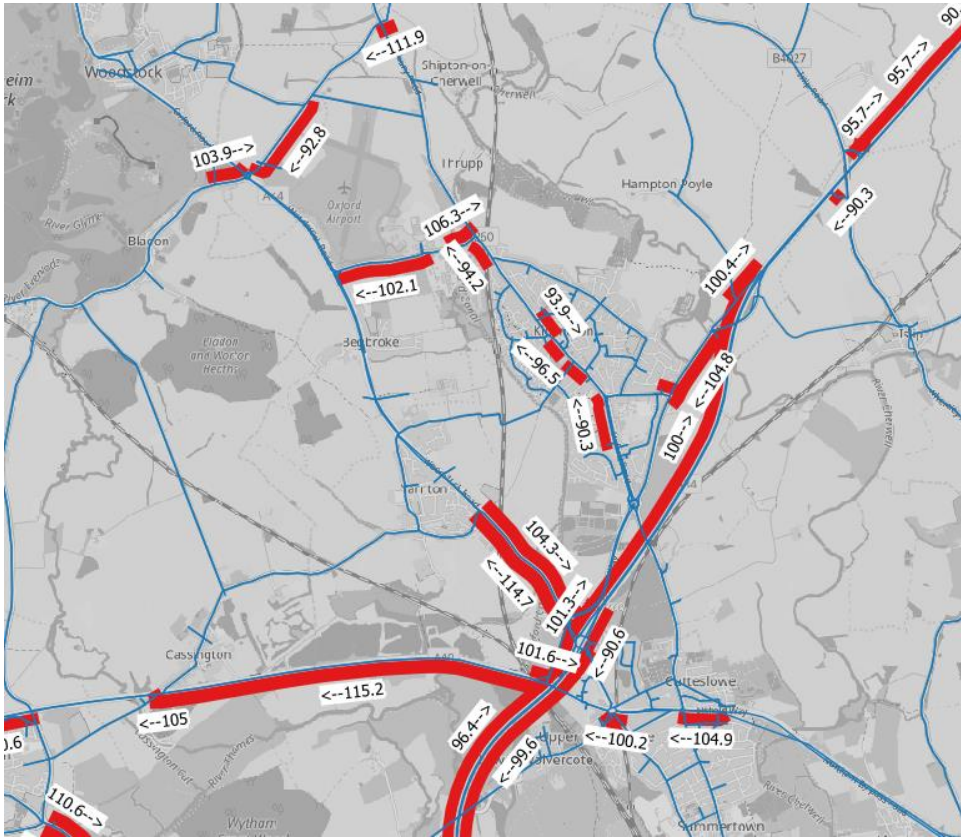


Scenario 3 +Sandy Lane closure-AM peak

Scenario 3-Inter peak

Scenario 3 +Sandy Lane closure -Inter peak

Scenario 3-PM peak



Scenario 3+Sandy Lane closure -PM peak

Appendix C

Table C- 1 Model output comparison (original evidence submission for Sandy Lane vs. Sandy Lane closure) in AM peak

Link ID_ref	Road section	Direction	Actual flows (pcus)				Speed (kph)				V/C(%)		
			evidence base	closure	Abs. Diff	Rel. Diff.	evidence base	closure	Abs. Diff	Rel. Diff.	evidence base	closure	Abs. Dff
1	Woodstock Oxford Rd	SB	1280	1216	-63	-5%	76	76	0	1%	41	39	-2
		NB	1083	1158	75	7%	73	73	0	-1%	36	39	2
2	Woodstock A4095	NB	907	995	88	10%	70	69	-2	-2%	65	71	6
		SB	958	978	20	2%	70	70	0	0%	91	92	2
3	A44 North of Langford Ln	NB	1083	1158	75	7%	73	73	0	-1%	36	39	2
		SB	1280	1216	-63	-5%	76	76	0	1%	41	39	-2
4	Langford Ln	EB	594	726	132	22%	36	32	-3	-10%	67	82	15
		WB	283	413	130	46%	45	43	-2	-5%	32	47	15
5	A4260 North of Langford Ln	SB	937	1107	170	18%	47	47	0	0%	69	81	12
		NB	364	389	25	7%	78	78	0	0%	26	28	2
6	A44 South of Langford Ln	SB	841	975	134	16%	76	75	-1	-1%	27	32	4
		NB	1336	1485	149	11%	75	66	-9	-12%	43	48	5
7	Sandy Lane	EB	459	0	-459	-100%	42	0	-42	-100%	52	0	-52
		WB	155	0	-155	-100%	42	0	-42	-100%	22	0	-22
8	A2260 Kidlington	SB	582	592	9	2%	50	50	0	0%	29	30	0
		NB	469	716	247	53%	50	50	0	0%	24	36	12
9	A44 North of Cassington Rd	SB	1075	1139	63	6%	47	47	0	-1%	59	62	3
		NB	1282	1281	-2	0%	54	54	0	0%	44	44	0
10	A4260 North of Bicester Rd	SB	905	895	-9	-1%	50	50	0	0%	45	45	0
		NB	633	904	272	43%	50	50	0	0%	20	31	11

11	Cassington Rd	EB	675	655	-20	-3%	39	40	1	2%	66	64	-2
		WB	247	234	-13	-5%	55	55	0	1%	24	23	-1
12	A40	EB	1046	1047	1	0%	42	45	3	8%	102	101	-1
		WB	854	868	14	2%	54	53	-1	-1%	71	72	1
13	A44 South of Yarnton	SB	1426	1476	50	3%	19	15	-4	-19%	105	109	3
		NB	1411	1411	0	0%	56	56	0	0%	100	100	0
14	A4260	SB	707	764	57	8%	60	59	-2	-3%	85	89	4
		NB	345	601	256	74%	67	69	1	2%	15	26	11
15	A4260 Oxford Rd	SB	708	584	-123	-17%	27	26	0	-1%	47	39	-8
		NB	506	795	289	57%	40	40	0	0%	26	41	15
16	A34 Western By-Pass	SB	3638	3649	11	0%	65	65	0	0%	91	91	0
		NB	3794	3828	34	1%	64	64	0	0%	95	96	1
17	Oxford Rd South of Parkway Station	SB	440	484	44	10%	65	65	0	-1%	29	31	3
		NB	680	716	35	5%	61	61	-1	-1%	44	46	2
18	A44 South of Pear Tree P&R	SB	1868	1810	-58	-3%	48	48	0	0%	47	45	-1
		NB	1263	1292	28	2%	48	48	0	0%	32	32	1

Table C- 2 Model output comparison (original evidence submission for Sandy Lane vs. Sandy Lane closure) in Inter peak

Link ID_ref	Road section	Direction	Actual flows (pcus)				Speed (kph)				V/C(%)		
			evidence base	closure	Abs. Diff	Rel. Diff.	evidence base	closure	Abs. Diff	Rel. Diff.	evidence base	closure	Abs. Dff
1	Woodstock Oxford Rd	SB	984	940	-45	-5%	77	77	0	0%	32	30	-1
		NB	857	898	41	5%	75	74	0	0%	29	30	1
2	Woodstock A4095	NB	596	685	89	15%	75	74	-1	-2%	42	49	6
		SB	795	827	32	4%	73	73	0	0%	72	75	3
3	A44 North of Langford Ln	NB	857	898	41	5%	75	74	0	0%	29	30	1
		SB	984	940	-45	-5%	77	77	0	0%	32	30	-1
4	Langford Ln	EB	307	444	138	45%	41	39	-2	-6%	35	50	16
		WB	400	644	244	61%	44	37	-6	-14%	45	73	28
5	A4260 North of Langford Ln	SB	474	540	66	14%	67	67	0	1%	35	40	5
		NB	463	492	29	6%	77	77	0	0%	33	35	2
6	A44 South of Langford Ln	SB	929	1365	436	47%	76	73	-3	-4%	30	44	14
		NB	992	1159	167	17%	77	68	-9	-12%	32	38	5
7	Sandy Lane	EB	194	0	-194	-100%	46	0	-46	-100%	22	0	-22
		WB	179	0	-179	-100%	42	0	-42	-100%	29	0	-29
8	A2260 Kidlington	SB	354	375	21	6%	50	50	0	0%	18	19	1
		NB	536	600	64	12%	50	50	0	0%	27	30	3
9	A44 North of Cassington Rd	SB	1364	1460	96	7%	46	45	-1	-2%	64	67	3
		NB	1395	1308	-86	-6%	51	53	3	5%	50	46	-4
10	A4260 North of Bicester Rd	SB	674	686	12	2%	50	50	0	0%	34	34	1
		NB	791	909	118	15%	50	50	0	0%	27	32	5
11	Cassington Rd	EB	221	148	-73	-33%	56	57	1	2%	22	14	-7
		WB	144	161	17	12%	57	57	0	0%	14	16	2
12	A40	EB	751	799	48	6%	60	58	-2	-3%	49	52	3

		WB	888	888	-1	0%	53	53	0	0%	74	74	0
13	A44 South of Yarnton	SB	1407	1439	32	2%	45	33	-12	-27%	100	102	2
		NB	1394	1333	-61	-4%	61	62	1	2%	99	95	-4
14	A4260	SB	675	639	-35	-5%	63	64	0	1%	75	74	-1
		NB	625	642	18	3%	67	68	1	2%	28	29	1
15	A4260 Oxford Rd	SB	290	367	78	27%	26	26	0	-1%	21	26	5
		NB	735	885	150	20%	40	40	0	0%	38	45	8
16	A34 Western By-Pass	SB	3366	3434	69	2%	67	66	0	-1%	84	86	2
		NB	3787	3825	38	1%	64	64	0	0%	95	96	1
17	Oxford Rd South of Parkway Station	SB	173	180	8	4%	66	66	0	0%	11	12	0
		NB	554	595	41	7%	64	63	-1	-1%	36	39	3
18	A44 South of Pear Tree P&R	SB	1374	1343	-31	-2%	48	48	0	0%	34	34	-1
		NB	1199	1160	-40	-3%	48	48	0	0%	30	29	-1

Table C- 3 Model output comparison (original evidence submission for Sandy Lane vs. Sandy Lane closure) in PM peak

Link ID_ref	Road section	Direction	Actual flows (pcus)				Speed (kph)				V/C(%)		
			evidence base	closure	Abs. Diff	Rel. Diff.	evidence base	closure	Abs. Diff	Rel. Diff.	evidence base	closure	Abs. Dff
1	Woodstock Oxford Rd	SB	876	935	59	7%	78	78	0	0%	28	30	2
		NB	1516	1579	63	4%	70	70	0	-1%	51	53	2
2	Woodstock A4095	NB	921	1110	190	21%	70	67	-3	-5%	66	79	14
		SB	827	1024	197	24%	73	73	0	0%	75	93	18
3	A44 North of Langford Ln	NB	1516	1579	63	4%	70	70	0	-1%	51	53	2
		SB	876	935	59	7%	78	78	0	0%	28	30	2
4	Langford Ln	EB	139	247	109	79%	42	42	-1	-1%	16	28	12
		WB	499	898	399	80%	41	22	-19	-46%	57	102	45
5	A4260 North of Langford Ln	SB	536	672	136	25%	66	65	-1	-2%	46	58	12
		NB	926	930	4	0%	70	70	0	0%	66	66	0
6	A44 South of Langford Ln	SB	953	1522	569	60%	75	71	-4	-5%	31	50	19
		NB	1434	1438	4	0%	75	66	-8	-11%	46	47	0
7	Sandy Lane	EB	340	0	-340	-100%	45	0	-45	-100%	39	0	-39
		WB	721	0	-721	-100%	29	0	-29	-100%	98	0	-98
8	A2260 Kidlington	SB	437	605	168	38%	50	50	0	0%	22	30	8
		NB	655	811	156	24%	50	50	0	0%	33	41	8
9	A44 North of Cassington Rd	SB	1245	1229	-16	-1%	47	47	0	0%	57	58	1
		NB	1287	1321	34	3%	53	53	1	1%	45	45	0
10	A4260 North of Bicester Rd	SB	914	909	-5	-1%	50	50	0	0%	46	45	0
		NB	1313	1235	-78	-6%	50	50	0	0%	52	48	-4
11	Cassington Rd	EB	284	297	12	4%	54	54	0	-1%	28	29	1
		WB	354	365	11	3%	51	51	0	0%	34	35	1
12	A40	EB	893	911	18	2%	55	54	-1	-1%	58	59	1

		WB	893	865	-28	-3%	23	18	-5	-21%	109	115	6
13	A44 South of Yarnton	SB	1219	1285	67	5%	18	18	0	0%	103	104	1
		NB	1390	1463	73	5%	13	9	-4	-27%	108	115	7
14	A4260	SB	417	588	171	41%	69	67	-2	-3%	48	63	15
		NB	703	775	71	10%	69	69	0	0%	40	39	0
15	A4260 Oxford Rd	SB	219	291	72	33%	27	27	0	-1%	15	20	5
		NB	1696	1412	-284	-17%	40	40	0	0%	91	74	-18
16	A34 Western By-Pass	SB	3795	3984	190	5%	64	63	-1	-2%	95	100	5
		NB	3853	3854	1	0%	64	64	0	0%	96	96	0
17	Oxford Rd South of Parkway Station	SB	431	489	57	13%	65	65	-1	-1%	28	32	4
		NB	762	707	-55	-7%	59	61	2	3%	49	46	-4
18	A44 South of Pear Tree P&R	SB	1588	1557	-31	-2%	48	48	0	0%	40	39	-1
		NB	1495	1542	47	3%	48	48	0	0%	37	39	1

Appendix D – demand model statistics

Table 12 Demand Model results for all scenarios 2031

Entire model	Do Minimum	Scenario 1 (LU only)	Scenario 2 (Pack 1)	Scenario 3 (Pack 2)	Scenario 5 (without A40-A44 link)	Scenario 3 reduced flow	Scenario 3 Sandy Lane closure
Morning peak period (07:00 – 10:00)							
Reg car (veh.)	328,380	332,584	332,416	332,290	332,269	333,531	333,535
P&R (veh.)	3,078	3,093	3,094	3,239	3,239	3,226	3,271
Bus only (pax)	33,999	34,049	34,141	34,182	34,178	34,352	34,323
Rail (pax)	15,120	16,435	16,042	16,007	16,013	15,508	15,492
TOTAL (persons)	470,025	476,568	476,084	476,083	476,058	477,411	477,421
Inter-peak period (10:00 – 16:00)							
Reg car (veh.)	616,784	622,309	622,083	621,855	621,859	623,167	623,025
P&R (veh.)	2,448	2,472	2,473	2,549	2,549	2,543	2,573
Bus only (pax)	67,868	67,837	67,854	67,875	67,863	67,969	67,936
Rail (pax)	22,501	23,347	23,017	22,981	22,994	22,163	22,142
TOTAL (persons)	898,120	905,989	905,451	905,220	905,224	906,373	906,168
Evening peak period (16:00 – 19:00)							
Reg car (veh.)	412,729	416,469	417,037	417,068	417,076	418,973	419,122
P&R (veh.)	2,600	2,605	2,582	2,665	2,663	2,658	2,689
Bus only (pax)	33,704	33,722	33,812	33,842	33,837	33,915	33,892
Rail (pax)	16,989	18,092	17,825	17,790	17,799	17,265	17,252
TOTAL (persons)	573,123	578,791	579,393	579,531	579,542	581,559	581,758

12-hour period (07:00 – 19:00)							
Reg car (veh.)	1,357,893	1,371,363	1,371,535	1,371,213	1,371,204	1,375,671	1,375,682
P&R (veh.)	8,127	8,170	8,149	8,453	8,450	8,427	8,533
Bus only (pax)	135,571	135,609	135,807	135,900	135,877	136,236	136,151
Rail (pax)	54,610	57,873	56,884	56,778	56,806	54,937	54,887
TOTAL (persons)	1,941,268	1,961,348	1,960,928	1,960,833	1,960,823	1,965,343	1,965,348

Table 13 Mode share – 12 hour period

Entire model	Do Minimum	Scenario 1 (LU only)	Scenario 2 (Pack 1)	Scenario 3 (Pack 2)	Scenario 5 (without A40-A44 link)	Scenario 3 reduced flow	Scenario 3 Sandy Lane closure
Car mode share	90.20%	90.10%	90.20%	90.20%	90.20%	90.27%	90.28%
PT mode share	9.80%	9.90%	9.80%	9.80%	9.80%	9.73%	9.72%

Table 14 Demand Model results for all scenarios–Cherwell as Origin

Cherwell	Do Minimum	Scenario 1 (LU only)	Scenario 2 (Pack 1)	Scenario 3 (Pack 2)	Scenario 5 (without A40-A44 link)	Scenario 3 reduced flow	Scenario 3 Sandy Lane closure
Morning peak period (07:00 – 10:00)							
Reg car (veh.)	70,489	74,401	74,301	74,270	74,274	72,426	72,462
P&R (veh.)	459	476	486	509	510	486	492
Bus only (pax)	4,421	4,505	4,552	4,571	4,572	4,592	4,576
Rail (pax)	4,411	5,450	5,180	5,167	5,169	4,579	4,572
TOTAL (persons)	98,776	104,724	104,441	104,430	104,439	101,572	101,603
Inter-peak period (10:00 – 16:00)							

Reg car (veh.)	136,688	141,443	141,620	141,537	141,514	139,081	139,090
P&R (veh.)	198	217	216	224	224	212.4255	214.7936
Bus only (pax)	8,422	8,500	8,517	8,523	8,525	8,586	8,572
Rail (pax)	8,058	8,543	8,346	8,331	8,335	7,719	7,708
TOTAL (persons)	194,865	201,469	201,614	201,507	201,480	197,869	197,865
Evening peak period (16:00 – 19:00)							
Reg car (veh.)	86,519	89,459	90,003	90,047	90,045	89,520	89,603
P&R (veh.)	33	34	36	39	39	34.15179	34.4927
Bus only (pax)	2,796	2,856	2,856	2,858	2,859	2,865	2,856
Rail (pax)	4,066	4,434	4,291	4,285	4,287	4,003	3,995
TOTAL (persons)	115,747	119,709	120,358	120,422	120,421	119,524	119,623
12-hour period (07:00 – 19:00)							
Reg car (veh.)	293,696	305,303	305,924	305,855	305,832	301,028	301155
P&R (veh.)	690	727	739	772	773	733.02139	741
Bus only (pax)	15,638	15,861	15,925	15,952	15,956	16,043	16,004
Rail (pax)	16,535	18,427	17,818	17,783	17,790	16,301	16,274
TOTAL (persons)	409,387	425,902	426,413	426,360	426,339	418,965	419,091

Table 15 Demand Model results for all scenarios–Cherwell as Destination

Cherwell	Do Minimum	Scenario 1 (LU only)	Scenario 2 (Pack 1)	Scenario 3 (Pack 2)	Scenario 5 (without A40-A44 link)	Scenario 3 reduced flow	Scenario 3 Sandy Lane closure
Morning peak period (07:00 – 10:00)							
Reg car (veh.)	68,998	71,870	72,123	72,104	72,102	71,229	71,330
P&R (veh.)	16	15	16	17	17	16.43814	16.68367

Bus only (pax)	3,556	3,637	3,648	3,658	3,659	3,658	3,648
Rail (pax)	4,340	4,713	4,558	4,551	4,553	4,345	4,336
TOTAL (persons)	94,773	98,654	98,940	98,920	98,919	97,637	97,758
Inter-peak period (10:00 – 16:00)							
Reg car (veh.)	133,434	138,189	139,166	139,028	138,982	135,599	135,633
P&R (veh.)	232	240	242	248	248	239.6523	241.936
Bus only (pax)	9,220	9,304	9,342	9,333	9,334	9,368	9,352
Rail (pax)	7,567	8,211	8,034	8,023	8,026	7,338	7,328
TOTAL (persons)	190,849	197,607	198,864	198,672	198,614	193,644	193,672
Evening peak period (16:00 – 19:00)							
Reg car (veh.)	85,999	89,595	90,265	90,320	90,290	88,984	89,102
P&R (veh.)	388	395	400	417	417	406.5476	410.1324
Bus only (pax)	4,163	4,249	4,297	4,314	4,313	4,307	4,292
Rail (pax)	4,661	5,567	5,420	5,411	5,413	4,786	4,780
TOTAL (persons)	117,439	122,814	123,697	123,800	123,762	121,492	121,636
12-hour period (07:00 – 19:00)							
Reg car (veh.)	288,431	299,654	301,554	301,452	301,374	295,812	296065
P&R (veh.)	636	651	657	682	682	662.63804	669
Bus only (pax)	16,940	17,190	17,287	17,305	17,307	17,333	17,293
Rail (pax)	16,568	18,492	18,012	17,985	17,991	16,469	16,444
TOTAL (persons)	403,061	419,075	421,501	421,393	421,295	412,772	413,067

Appendix E – Highway Assignment model statistics

Table 18 Cherwell District modelled network performance – 2031 Do-Minimum and Development Plan Scenarios - Morning peak

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (S4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff % Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff % Diff (S3 closure-DM)
Delay (pcuh)	1,706	1,789	5%	1785	5%	1769	4%	1,770	4%	1,727	1%	1,797	5%	1,823	7%
Total Time (pcuh)	9,719	9,911	2%	9908	2%	9906	2%	9,905	2%	9,842	1%	9,927	2%	9,945	2%
Total Distance (pcukm)	564,340	569,288	1%	569486	1%	570414	1%	570,479	1%	569,470	1%	569,792	1%	569,610	1%
Average Speed (km/h)	58.1	57	-2%	58	0%	58	0%	58	0%	58	0%	57	-2%	57	-2%

Table 17 Cherwell District modelled network performance – 2031 Do-Minimum and Development Plan Scenarios - Evening peak

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff % Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff % Diff (S3 closure-DM)
Delay (pcuh)	3,105	3,174	2%	3,181	2%	3157	2%	3,163	2%	3,153	2%	3,255	5%	3,295	6%
Total Time (pcuh)	12,182	12,347	1%	12,366	2%	12344	1%	12,345	1%	12,339	1%	12,430	2%	12,456	2%
Total Distance (pcukm)	618,204	621,919	1%	622,558	1%	623377	1%	623,188	1%	622,920	1%	622,957	1%	622,587	1%

Average Speed (km/h)	50.7	50	-1%	50	-1%	51	1%	51	1%	51	1%	50	-1%	50	-1%

Table 18 A34/A41 Bicester – Oxford corridor performance in the morning peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	227	230	1%	230	1%	228	0%	228	0%	229	1%	229	1%	229	1%
Total Time (pcuh)	1,484	1,496	1%	1494	1%	1487	0%	1,488	0%	1,488	0%	1,481	0%	1,481	0%
Total Distance (pcukm)	82,664	83,124	1%	83017	0%	82741	0%	82,832	0%	82,759	0%	82,286	0%	82,319	0%
Average Speed (km/h)	55.7	56	1%	56	1%	56	1%	56	1%	56	1%	56	1%	56	1%

Table 19 A34/A41 Bicester – Oxford corridor performance in the evening peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	333	341	2%	345	4%	329	-1%	331	-1%	325	-2%	324	-3%	326	-2%
Total Time (pcuh)	1,573	1,580	0%	1,581	1%	1557	-1%	1,558	-1%	1,553	-1%	1560	-1%	1558	-1%
Total Distance (pcukm)	82,024	81,853	0%	81,780	0%	81187	-1%	81,160	-1%	81,238	-1%	81,373	-1%	81,251	-1%

Average Speed (km/h)	52.1	52	0%	52	0%	52	0%	52	0%	52	0%	52	0%	52	0%

Table 20 A44 Woodstock – Oxford corridor performance in the morning peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	189	223	18%	220	16%	231	22%	230	22%	220	16%	260	38%	279	48%
Total Time (pcuh)	542	584	8%	597	10%	607	12%	606	12%	595	10%	640	18%	653	20%
Total Distance (pcukm)	21,039	21,484	2%	22038	5%	22256	6%	22,274	6%	22,222	6%	22,433	7%	22,042	5%
Average Speed (km/h)	38.8	37	-5%	37	-5%	37	-5%	37	-5%	37	-5%	35	-10%	34	-12%

Table 21 A44 Woodstock – Oxford corridor performance in the evening peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	316	338	7%	348	10%	332	5%	333	5%	366	16%	386	22%	432	37%
Total Time (pcuh)	673	720	7%	732	9%	731	9%	733	9%	772	15%	798	19%	829	23%

Total Distance (pcukm)	20,617	22,175	8%	22,041	7%	23306	13%	23,332	13%	23,575	14%	24,098	17%	23,331	13%
Average Speed (km/h)	30.6	31	1%	30	-2%	32	5%	32	5%	31	1%	30	-2%	28	-8%

Table 22 A4095 Kirtlington – Bladon corridor performance in the morning peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff % Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff % Diff (S3 closure-DM)
Delay (pcuh)	46	57	24%	58	26%	55	20%	55	20%	52	13%	64	39%	69	50%
Total Time (pcuh)	294	310	5%	307	4%	318	8%	318	8%	315	7%	332	13%	338	15%
Total Distance (pcukm)	13,495	13,739	2%	13561	0%	14461	7%	14,443	7%	14,458	7%	14,615	8%	14,675	9%
Average Speed (km/h)	46	44	-4%	44	-4%	46	0%	45	-2%	46	0%	44	-4%	44	-4%

Table 23 A4095 Kirtlington – Bladon corridor performance in the evening peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff % Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff % Diff (S3 closure-DM)
Delay (pcuh)	56	57	2%	56	0%	74	32%	73	30%	78	39%	131	134%	110	96%
Total Time (pcuh)	339	354	4%	357	5%	369	9%	369	9%	374	10%	426	26%	403	19%

Total Distance (pcukm)	14,399	14,751	2%	14,936	4%	15095	5%	15,112	5%	15,140	5%	15,189	5%	15,240	6%
Average Speed (km/h)	42.4	42	-1%	42	-1%	41	-3%	41	-3%	40	-6%	36	-15%	38	-10%

Table 24 A4260 Shipton – Oxford corridor performance in the morning peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	70	81	16%	81	16%	73	4%	73	4%	71	1%	86	23%	92	21%
Total Time (pcuh)	242	264	9%	263	9%	265	10%	263	9%	259	7%	291	20%	304	12%
Total Distance (pcukm)	9,467	9,965	5%	9888	4%	10376	10%	10,322	9%	10,200	8%	10,946	16%	11,255	6%
Average Speed (km/h)	39.1	38	-3%	38	-3%	39	0%	39	0%	39	0%	38	-3%	37	-5%

Table 25 A4260 Shipton – Oxford corridor performance in the evening peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)

Delay (pcuh)	115	112	-3%	117	2%	125	9%	124	8%	131	14%	184	60%	169	47%
Total Time (pcuh)	308	317	3%	323	5%	353	15%	351	14%	358	16%	410	33%	403	31%
Total Distance (pcukm)	10,179	10,793	6%	10,817	6%	11963	18%	11,924	17%	11,922	17%	11,953	17%	12,170	20%
Average Speed (km/h)	33	34	3%	34	3%	34	3%	34	3%	33	0%	29	-12%	30	-9%

Table 26 M40 J9 performance in the morning peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff % Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff % Diff (S3 closure-DM)
Delay (pcuh)	134	132	-1%	133	-1%	133	-1%	133	-1%	132	-1%	132	-1%	132	-1%
Total Time (pcuh)	285	284	0%	285	0%	284	0%	285	0%	283	-1%	283	-1%	283	-1%
Total Distance (pcukm)	12,101	12,120	0%	12129	0%	12120	0%	12,126	0%	12,116	0%	12,116	0%	12,122	0%
Average Speed (km/h)	42.4	43	1%	43	1%	43	1%	43	1%	43	1%	43	1%	43	1%

Table 27 M40 J9 performance in the evening peak hour in 2031

	Do Minimum	Scenario 1	% Diff	Scenario 2	% Diff	Scenario 3	% Diff	Scenario 4 (cycle route)	% Diff	Scenario 5	% Diff	Scenario 3	% Diff	Scenario 3	% Diff

		(LU only)	(S1-DM)	(Pack 1)	(S2-DM)	(Pack 2)	(S3-DM)		(Scen.4-DM)	(without A40-A44 link)	(S5-DM)	(Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	(Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	151	158	5%	158	5%	151	0%	151	0%	150	-1%	156	3%	154	2%
Total Time (pcuh)	304	311	2%	311	2%	304	0%	304	0%	302	-1%	308	1%	306	1%
Total Distance (pcukm)	12,734	12,723	0%	12,732	0%	12684	0%	12,683	0%	12,691	0%	12,652	-1%	12,660	-1%
Average Speed (km/h)	41.9	41	-2%	41	-2%	42	0%	42	0%	42	0%	41	-2%	41	-2%

Table 28 Sandy Lane corridor performance in the morning peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	2	3	50%	3	50%	3	50%	3	50%	3	50%	5	150%	1	-50%
Total Time (pcuh)	20	36	80%	30	50%	34	70%	34	70%	31	55%	27	35%	3	-85%
Total Distance (pcukm)	794	1,348	70%	1179	48%	1284	62%	1,287	62%	1,208	52%	913	15%	89	-89%
Average Speed (km/h)	39.9	37	-7%	39	-2%	38	-5%	38	-5%	39	-2%	34	-15%	29	-27%

Table 29 Sandy Lane corridor performance in the evening peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	3	4	33%	10	233%	14	367%	16	433%	20	567%	20	567%	1	-67%
Total Time (pcuh)	29	50	72%	54	86%	60	107%	61	110%	63	117%	53	83%	3	-90%
Total Distance (pcukm)	1,165	1,833	57%	1,792	54%	1907	64%	1,883	62%	1,799	54%	1,339	15%	98	-92%
Average Speed (km/h)	39.7	37	-7%	33	-17%	32	-19%	31	-22%	29	-27%	25	-37%	29	-27%

Table 30 Langford Lane corridor performance in the morning peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	6	7	17%	7	17%	7	17%	6	0%	6	0%	10	67%	12	100%
Total Time (pcuh)	44	43	-2%	42	-5%	40	-9%	40	-9%	40	-9%	46	5%	50	14%
Total Distance (pcukm)	1,458	1,429	-2%	1384	-5%	1349	-7%	1,350	-7%	1,350	-7%	1,382	-5%	1,424	-2%
Average Speed (km/h)	33.5	33	-1%	33	-1%	34	1%	34	1%	34	1%	30	-10%	28	-16%

Table 31 Langford Lane corridor performance in the evening peak hour in 2031

	Do Minimum	Scenario 1 (LU only)	% Diff (S1-DM)	Scenario 2 (Pack 1)	% Diff (S2-DM)	Scenario 3 (Pack 2)	% Diff (S3-DM)	Scenario 4 (cycle route)	% Diff (Scen.4-DM)	Scenario 5 (without A40-A44 link)	% Diff (S5-DM)	Scenario 3 (Sandy Lane reduced flow)	% Diff (S3 reduced-DM)	Scenario 3 (Sandy Lane closure)	% Diff (S3 closure-DM)
Delay (pcuh)	31	22	-29%	27	-13%	16	-48%	13	-58%	15	-52%	24	-23%	45	45%
Total Time (pcuh)	55	47	-15%	55	0%	45	-18%	43	-22%	46	-16%	63	15%	88	60%
Total Distance (pcukm)	1,035	1,061	3%	1,119	8%	1172	13%	1,182	14%	1,211	17%	1,377	33%	1,505	45%
Average Speed (km/h)	18.7	23	23%	20	7%	26	39%	28	50%	26	39%	22	18%	17	-9%